

RIDGE

ANCOATS DISPENSARY POST CONSTRUCITION SUSTAINABILITY REVIEW

June 2024

5014121 – ANCOATS DISPENSARY
POST CONSTRUCTION SUSTAINABILITY REVIEW

June 2024

Prepared for

Great Places Housing Group

2A Derwent Avenue

Manchester

M21 7QP

Prepared by

Ridge and Partners LLP
2nd Floor 100 Embankment
Cathedral Approach
Manchester
M3 7FB
Tel: 0161 833 9579

Contact

Susie Sidley
Partner
ssidley@ridge.co.uk

VERSION CONTROL

VERSION	DATE	DESCRIPTION	CREATED BY	REVIEWED BY
1.0	19.06.24	First Issue – Draft	BC	SS

CONTENTS

1. INTRODUCTION 4
2. THE DEVELOPMENT 4
2.1. Site Overview 4
2.2. Ancoats Dispensary 5
3. RESPONSE TO CLIMATE CHANGE INTRODUCTION 5
3.1. Construction-Related Carbon Emissions 5
3.2. Operational Carbon and Energy 6
3.3. Transport 8
3.4. Water 8
4. OTHER AREAS OF ENVIRONMENTAL & SUSTAINABILITY PERFORMANCE 9
4.1. Introduction 9
4.2. Materials and Waste 9
4.3. Construction Management 10
4.4. Biodiversity 11
5. CONCLUSION 12
6. APPENDICES 13
6.1. Appendix A – Ridge Site Inspection Report 14
6.2. Appendix B – Sustainable Procurement Plan 15
6.3. Appendix C – Home User Guide 16
6.4. Appendix D – MVHR Units Specification 17
6.5. Appendix E – PV Array 18
6.6. Appendix F – SAP Calculations 19
6.7. Appendix G – Water Meter Product Literature 20
6.8. Appendix H – Waste Dashboard Final 21
6.9. Appendix I – Eric Wright ISO 14001 Certificate 22
6.10. Appendix J – Considerate Constructors Scheme Certificate 23
6.11. Appendix K– Commissioning Schedule 24
6.12. Appendix L – Bat and Bird Survey 25

1. INTRODUCTION

Ridge and Partners LLP have been appointed by Great Places Housing Group to complete a Post Construction Sustainability Review for the newly constructed residential development at Ancoats Dispensary, Manchester.

This Post Construction Sustainability Review has been produced to close out the planning condition:

'The development hereby approved shall be carried out in accordance with the Energy Strategy prepared by Ridge, Environmental Standards Statement) prepared by Ridge stamped as received by the City Council, as Local Planning Authority, on the 11 May 2021. The development shall achieve a minimum of 11% in carbon on Part L 2013 Building Regulations. A post construction review certificate/statement shall be submitted for approval in writing by the City Council as Local Planning Authority, within 3 months of first occupation of the development hereby approved.'

In order to effectively complete this review, Ridge and Partners visited the occupied Ancoats Dispensary in May 2024 (see Appendix A) and were provided with other necessary information required to complete the report from Great Places Housing Group.

2. THE DEVELOPMENT

2.1. Site Overview

The former Ardwick and Ancoats Dispensary is a Grade II listed building located to the south of Old Mill Street, adjacent to Lampwick Lane in New Islington, Manchester. It is within the City Centre Fringe, to the east of Manchester City Centre. The area of New Islington has been considered a regeneration priority for Manchester City Council and has been subject to significant investment to facilitate the delivery of residential development and community infrastructure over the years. Old Mill Street provides an important route from Great Ancoats Street through, New Islington, connecting the neighbourhood with Manchester City Centre and the surrounding neighbourhood of Miles Platting, which mostly comprises of two storey residential terraces. The site location is shown in Figure 1.1, below.

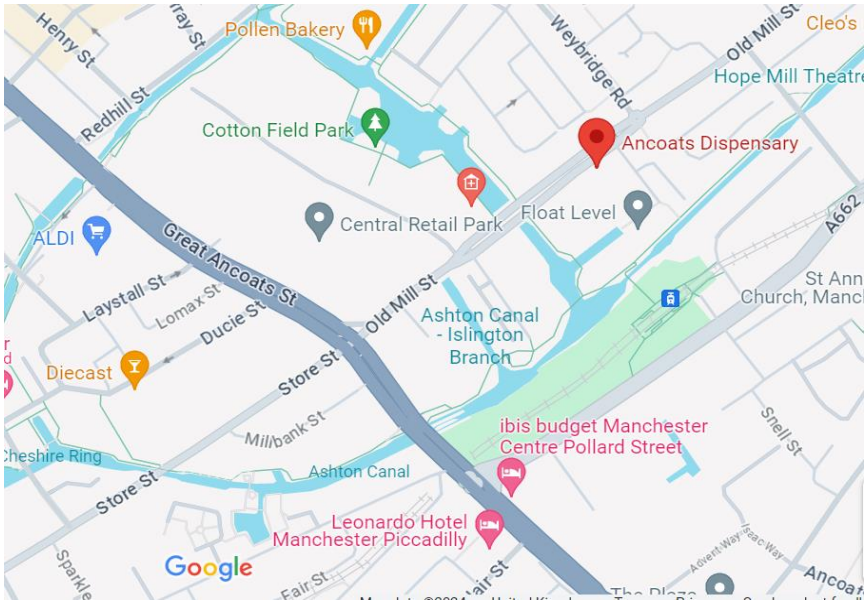


Figure 1.1: Location Plan (Google Map Data @2024)

2.2. Ancoats Dispensary

The newly refurbished Ancoats Dispensary redevelopment comprised the retention and refurbishment of the former dispensary building's two principal facades, facilitated by: partial demolition works; extension of the building's footprint southwards; and, extension to its height by 1.5 storeys, together with the removal of the entrance steps and lowering of the ground floor level, and the re-instatement of a central tower, to provide affordable housing units (Use Class C3), with creation of an external secure cycle store, bin store, boundary treatments and associated works. The residential development shown in Figure 1.2 below, comprises 39 apartments.



Figure 1.2: Newly Refurbished Ancoats Dispensary

3. RESPONSE TO CLIMATE CHANGE INTRODUCTION

This section of the Post Construction Sustainability Review Report will explore how the Ancoats Dispensary redevelopment has addressed the issues of climate change. In particular, this section will address Energy, Transport, and Water.

3.1. Construction-Related Carbon Emissions

As the development at Ancoats Dispensary comprised of the re-use of an existing building, a significant amount of embodied carbon was saved, in comparison to a new-build scheme. To further manage and reduce carbon emissions associated with the construction of the development were possible, materials were sourced locally where possible, and emissions of material deliveries to the site, and waste transported away from the site was monitored and recorded. A sustainable procurement plan produced by Eric Wright Construction, emphasised the importance of designing and specifying local materials, in-keeping with the local environment, and minimising travel distance from source, to processing, to site through the supply chain to keep construction-related carbon emissions minimal. This sustainable procurement plan (see appendix B) was implemented throughout the construction and refurbishment of Ancoats Dispensary.

3.2. Operational Carbon and Energy

During construction and refurbishment, the Ancoats Dispensary development sought to minimise operational CO2 emissions and the associated impact upon climate change by adhering to the energy hierarchy below:

- Lean – Use advanced building modelling and passive construction techniques as far as it is cost effective.
- Mean – Incorporate high efficiency systems and effective controls throughout the design.
- Green – Incorporate renewable and low carbon energy sources where necessary and economically viable to achieve targets or provide desirable benefits.

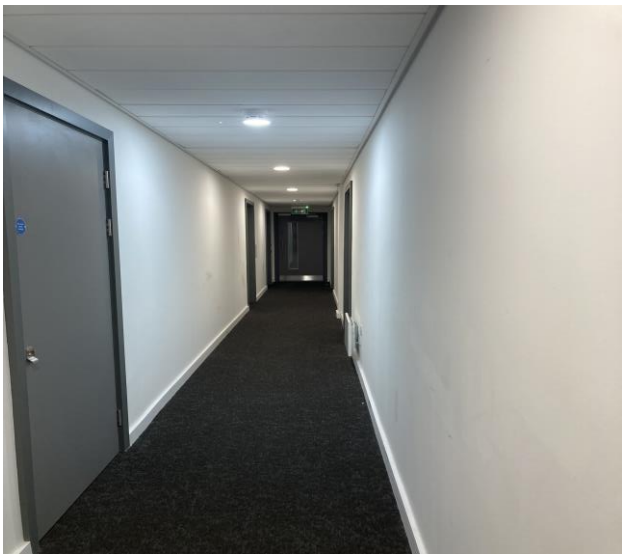
Passive Measures – Lean

Due to the building having a listed status, there was limited scope for improving the passive measures beyond upgrading the existing insulation. In the new elements of the building, the team have maximised passive measures to reduce the initial load of the building in terms of heating and anticipated lighting loads by improving glazing specification. High performance glazing has been installed to the apartments, and this was rated 'Very Good' within the breakdown of the property's energy performance within the Home User Guide (see appendix C). By improving the glazing specification, overheating and unwanted solar gain can be avoided now within the new development, enhancing the thermal comfort, and overall health and well-being of residents.

Energy Efficiency Measures - Mean

A range of energy efficiency measures have been installed into the development as per recommended in the Energy Strategy Report produced prior to planning. Hatherton LED Multi Bulkhead lights and high efficiency LED lighting (Figure 2 & 3) has been installed throughout the development. have been installed within corridors on ceilings providing energy efficient lighting. Additionally, Ultra-slim profile LED polycarbonate bulkheads have also been installed to enhance energy efficiency. Furthermore, demand operated lighting with the use of PIRs and photocells have been installed to the development's entrance, corridors, and external areas such as the waste storage area. Additionally, heat recovery ventilation systems have been provided to each apartment. Lo-Carbon Sentinel Kinetic Plus (see appendix D) have been recognised as ideal for multiple occupancy units, as the BMS capability means building performance and maintenance can be monitored at all times.





Figures 2 & 3: Internal & External Lighting Installed at Ancoats Dispensary

Renewable & Low Carbon Technologies – Green

As advised prior to planning in the Energy Strategy Report, rooftop photovoltaic panels were deemed a suitable low carbon technology to be adopted within the development. Hi-Mo 5m Rooftop photovoltaic panels (see appendix E) have been provided to the roof of the new building to generate zero carbon electricity for the new development. These panels have been selected given their excellent outdoor power generation performance and long term-reliability.

Energy Related Carbon Emissions

Regulated CO2 emissions are those associated with heating, lighting and ventilation. Given the building's status as a listed building, it was acknowledged prior to planning that there was a limited scope to improve the existing fabric beyond upgrading the existing ventilation. Furthermore, the apartments which fall within the refurbished area of the building are not assessed under Part L of the Building Regulations 2013.

As-built SAP calculations have been completed under the Building Regulations 2013 Part L for apartments 30-39 within the newly constructed part of the building. Theses confirm that there is an average 12.7% improvement of the Dwelling Emission Rate (DER) over the Target Emissions Rate (TER) (see appendix F), therefore achieving the requirement in the planning condition.

Regarding unregulated carbon emissions, residents have been encouraged within their Home User Guide to minimise their unregulated energy use through provision of information and guidance. Additionally, the Home User Guide explores energy efficient white goods and encourages residents to purchase these by discussing both money saving benefits and reducing CO_2 emissions (see appendix C).

3.3. Transport

Ancoats Dispensary is located in Manchester City Centre, in an area of high public transport accessibility with New Islington tram stop 300m away, plus several bus stops within 100m. Additionally, Manchester Piccadilly train station is approximately a 15-minute walk away. The residential development is within walking distance of a plethora of local amenities and services, including schools, a health centre and food shop within a 10-minute walk. A list of local amenities is provided by residents within the Home User Guides (see appendix C). Furthermore, the development has good access to cycle routes, including the Rochdale Canal Towpath. Prior to planning, it was agreed the site would not provide car parking spaces, but would provide secure, covered cycle storage for each apartment. This was planned with the intention of encouraging residents to utilise sustainable modes of transport. Given the city centre location, and lack of car parking, the new development at Ancoats Dispensary has not resulted in an increase in vehicle use.





Figures 4 & 5: Secure, Sheltered Cycle Store provided for residents.

3.4. Water

As the Ancoats Dispensary scheme progressed throughout planning, refurbishment and construction, the team ensured that the effects of climate change on the development were mitigated wherever possible. To mitigate against the effects of low summer rainfall, which in turn could lead to water shortages, it was agreed that sanitary fittings which reduce flow rates would be prioritised to optimise the developments water use. Additionally, water meters have been installed to the development so occupiers are able to monitor their consumption. Diehl Altair (Piston) water meters (see appendix G) have been installed to each apartment, and these are accurate at low flows, low maintenance, and supplied with an AMR unit attached and paired to the meter.

4. OTHER AREAS OF ENVIRONMENTAL & SUSTAINABILITY PERFORMANCE

4.1. Introduction

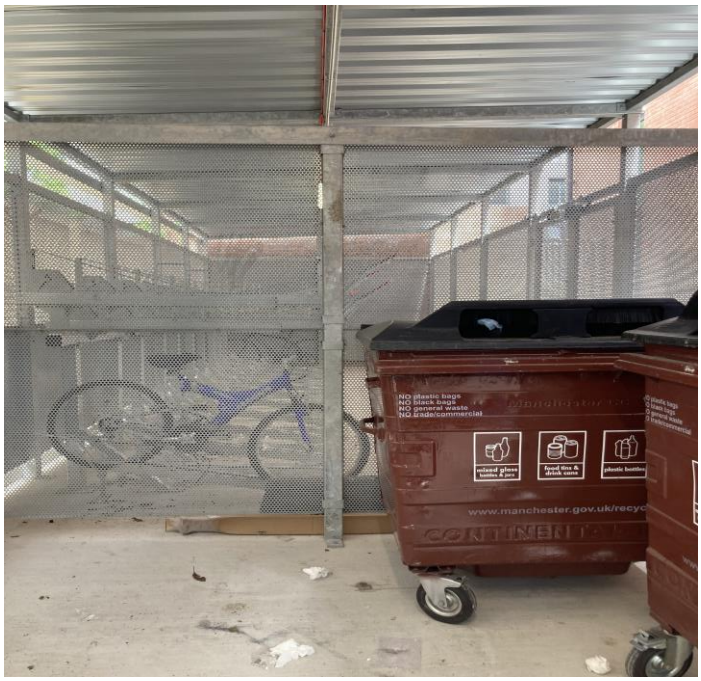
Sustainability measures which consider the site as a whole have been integrated into the final design of the newly refurbished Ancoats Dispensary, in line with national, regional, and local planning policies. This section of the Post Construction Sustainability Review will explore in greater depth how the development placed a focus on sustainability, in relation to materials and waste, construction management, and biodiversity.

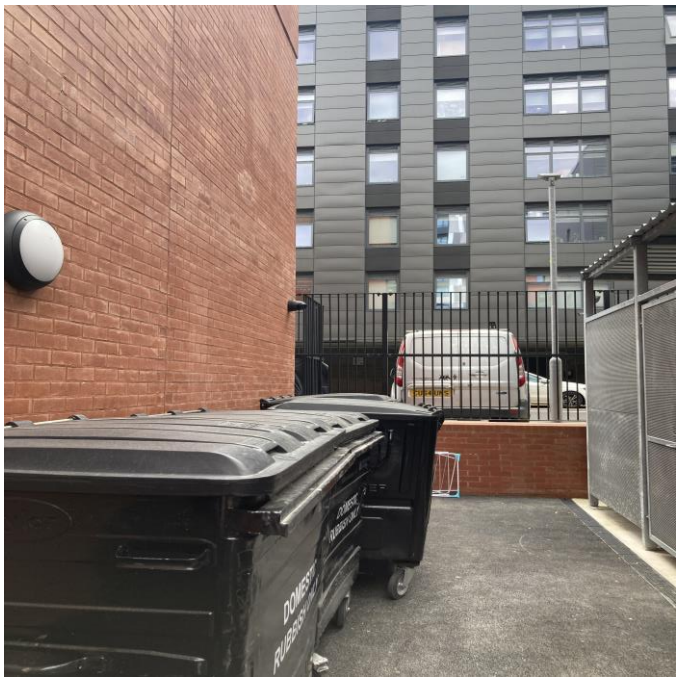
4.2. Materials and Waste

Sustainable use of resources includes both efficient use of materials and minimisation of waste. As the development involved the re-use of the existing building, it made excellent use of existing resources and reduced the need for the use of new materials. As acknowledged in the sustainable procurement plan produced by Eric Wright, the development was designed to be durable and resilient, and when required materials were specified with a 25+ year guarantee from the manufacturer. This has helped to reduce the need to repair and replace materials resulting from damage due to exposed elements of the building and landscape. A whole life approach was taken to the refurbishment of Ancoats Dispensary, with consideration taken over the need to reduce unnecessary material use and demolition. The sustainable procurement plan stated prioritising reusing materials wherever feasible. Options to retain material on site were widely followed, and where demolition material was produced this was crushed and reused where possible. Throughout the construction, Eric Wright Construction committed to specifying timber from sustainable and legal sources, and ensuring the supplier was FSC accredited. Additionally, the sustainable procurement plan committed to specifying materials which were extracted, processed, and supplied from a responsible source, preferably those with environmental credentials.

Regarding waste, the construction of Ancoats Dispensary sought to minimise waste as far as possible, in line with best practice efficiency benchmarks, and set a commitment to ensure at least 80% of waste volume was diverted from landfill. A Resource Management Plan was produced during construction which covered, targets for site construction waste and off-site manufacturing waste, whilst recording waste arising and waste management practices. In December 2023, at building handover the developments final waste reporting figures were reported. The headline results summarised, 99.72% of waste was recycled, with only 0.28% being sent to landfill. Furthermore, 1.13 tonnes of waste removed was sent to landfill, significantly exceeding the best practice benchmark (see appendix H).

The new Ancoats Dispensary Development actively encourages residents to recycle through the provision of space for the storage of recyclable waste. This is a dedicated bin store, located externally beside the bike store. Manchester City Council makes collections for the recyclable waste every two weeks, currently on a Tuesday. Each apartment has been provided with a food waste bin to encourage food waste recycling. Additionally, each resident is provided a 'Home User Guide' with information on WRAP hierarchy, and the nearest waste centre where items can be takes to be recycled (see appendix C).





Figures 6 & 7: Dedicated Bin Store provided for residents.

4.3. Construction Management

Eric Wright Construction have an Environmental Management System (EMS) certified under ISO14001 (see appendix I). Once appointed on the project, Eric Wright registered with the Considerate Constructors Scheme (CCS) with the intention of minimising the construction impact on local residents. The Contractor scored 45/45 on both visits, demonstrating excellent environmental procedures and strong social value with high community engagement (see appendix J). Within the CCS Monitor's Report, Eric Wright was praised for wellbeing in the workforce, and the corporate progress towards the net zero objective. Prior to handover, a schedule of commissioning was conducted on all relevant building services, meeting building standards such as CIBSE and BSRIA. Additionally, client demonstration and end-user training formed the final stage of the commissioning process, and this was caried out in December 2023 (see appendix K). This schedule of commissioning ensured that the project was completed to the highest quality standards, whilst meeting the occupiers' expectations and needs.

4.4. Biodiversity

Prior to planning, a bat and bird survey were undertaken of the existing site. This survey concluded that the restoration and redevelopment proposals at Ancoats Dispensary can be achieved with no adverse effect on designated sites for nature conservation, ecologically valuable habitats, roosting bats, and other relevant protected species. The survey report included several recommendations for best practice measures to be applied during renovation and construction works. This included toolbox talks in relation to bats, and advice for commencing the demolition works so areas could be re-checked for bats prior to stacking or discarding. As the site was limited in ecological value, there were no further recommendations proposed by the ecologist (see appendix L). Externally to the site, planters have been installed which may encourage some form of biodiversity onto the site.



Figures 8: Planters installed around the building.

5. CONCLUSION

This Post Construction Sustainability Review has assessed the newly refurbished Ancoats Dispensary, to ensure it has complied with the climate change and sustainability considerations proposed prior to planning, and throughout refurbishment, construction, and handover.

As the development at Ancoats Dispensary comprised of the re-use of an existing building, a significant amount of embodied carbon was saved, in comparison to a new-build scheme. **Furthermore, the new build apartments have achieved an average 12.7% improvement in CO2 emissions over the Building Regulations 2013 Part L requirement.**

The development has minimised operational energy and carbon through adoption of the Energy Hierarchy by:

- Implementing several passive design measures, optimising the thermal performance of the building envelope.
- Installing energy efficient building services systems to the building. These include; LED lighting, photocell/ occupancy sensing controls and low energy mechanical ventilation systems.
- Installing the recommended PV Panels to the roof.

The development encourages the provision of sustainable transport measures, through the installation of a secure bike store, and the close distances to local amenities, as well as bus, rail and Metrolink services.

Wider sustainability aspects incorporated into the development were also explored, these include materials and waste, construction management, and biodiversity. It was particularly noted that the development significantly exceeded best practice benchmarks with 99.72% of waste being recycled, and Eric Wright was awarded the highest possible score in the Considerate Constructors Scheme. Overall, the Post Construction Sustainability Review conducted for Ancoats Dispensary has confirmed that the development has addressed issues of climate change, whilst integrating effective sustainability measures in line with national, regional, and local planning policies.

6. APPENDICES

6.1. Appendix A – Ridge Site Inspection Report

Sustainability Review Checklist using the ESS/ Energy Strategy
Project: Ancoats Dispenary
Date of Site Visit: 21.05.24

RIDGE

Criteria	Evidence/ (photo no.)	Confirmed	Additional Information Required
Energy			
LED Fittings have been utilised.	2,3, 20	Internal LED light fittings confirmed.	Product literature/ datasheets/ as built electrical drawings also received - no further information required.
Internal lighting is controlled through presence detection in communal areas to ensure the lighting is used efficiently.	2,3	Presence detection in communal areas confirmed to ensure efficent use of internal lighting.	Product literature/ datasheets/ as built electrical drawings also received - no further information required.
External space lighitng and security lighting includes energy efficient fittings with PIR/ Timeclocks, Daylight Sensors or Timers.	4, 19	External space lighting confirmed to include energy efficient fittings with PIR/ Timeclock.	Product literature/ datasheets/ as built electrical drawings also received - no further information required.
Energy metering ensures that each apartment can be separately monitored and billed.	15, 16	EDMI meters confirmed to ensure apartments can be monitored.	No further information required.
Water			
Waste Management			
Waste storage areas are easily accessible.	4, 5, 6, 7, 13	Accessible waste storage areas on site.	Drawing of waste area with dimensions
Appropriate provision of space for the storage of recyclable waste.	4, 5, 6, 7, 13	Appropriate provision of space for the storage of recyclable waste.	Drawing of waste area with dimensions
Construction Management			
Photos of material labels where feasible to compare against specifications - local suppliers prioritised	24, 25, 26, 27, 28, 29	Part refurb - so buiding uses local materials	No further information required.
Biodiversity			
Native planting has been incorporated to increase the ecological value of the site.	8, 9, 23	Native planting incorporated around the site.	Got drawings of planters - no further information required.
Transport			
Secure, covered cycle storage has been provided.	7, 11, 12	Appropriate secure and covered cycle storage has been provided.	Any external drawings with the storage.
Public transport services are within walking distance of the site (e.g. New Islington tram stop, Bus stops)	1	New Islington Tram Stop Photographed as close to the site.	No further information required.
Local amenities close by include a food shop, health centre and a primary school.	10	School confirmed as being a local amenity to the development	No further information required.

6.2. Appendix B – Sustainable Procurement Plan

Procurement Policy

The Group is committed to ensuring its supply chain understands the principles in meeting the objectives of the Group and thus minimising the impact of the Group's activities on the environment.

The Group has developed a strategic process for achieving this.

Materials and Supply chain

Using local materials wherever possible

- Developing a network of local suppliers and manufacturers.
- Designing and specifying local materials in-keeping with the local environment.
- Minimising travel distance from source, to processing, to site through the supply chain.

Specifying and using responsibly sourced materials

- Wherever possible our supplier/manufacturers will be selected preferentially where they operate an ISO 14001 or equivalent accredited Environmental Management System.
- Specifying timber from sustainable and legal sources and ensuring the supplier is FSC. Accredited.
- Designing and specifying materials which are extracted/processed/supplied from a responsible source.
- Maintaining relevant records to confirm that suppliers and materials meet these objectives.

Reusing materials wherever feasible

- Exploring options for the reuse of demolition materials through increasing the use of pre-demolition audits and looking for options to retain material on site, where feasible.
- Where demolition material is produced, crushing and reuse of the inert material will be promoted on-site or off-site if this is not possible.
- Developing agreements with the supply chain to ensure that all materials not used can be returned for restocking/resale.

Using recycled materials and those with recycled content

- Designing and specifying recycled materials and those with a recycled content.
- Crushing inert demolition material for reuse on site or off site. Promoting cut and fill earthworks where possible.
- Specifying recycled aggregates for high grade, sub-base material and filling where possible.

Using non-toxic materials and refrigerants with low global warming potential (GWP) and ozone depleting properties (ODP)

- Designing, specifying and procuring materials which have low or zero ODP and GWP.
- Maintaining records which confirms the content of materials used by the Eric Wright Group and their supply chain.
- Using and specifying natural and non-toxic materials where possible, and using materials with the highest possible Green Guide to Specification rating, Ecopoint or other sustainability metric.

Using materials with a low embodied energy

- Reviewing the embodied energy of materials as part of the design and specification process and specifying those with the highest possible Green Guide to Specification rating in this regard.

Using durable materials

- Using materials and systems which are designed to provide a durable solution to minimise maintenance and repairs.
- Where required specifying materials with a 25+ year guarantee from the manufacturer.
- Following recognised best practice guidelines in specifying materials and constructing the works.

Supply chain

To ensure that the supply chain is competent to achieve the objectives set out by the Group in minimising its impact on the environment, a rigorous pre-qualification process has been established.

Supply selection takes into consideration performance in the following areas;

- An environmental policy statement is in place.
- An environmental management system is in place (ISO 14001 certified)

6.3. Appendix C – Home User Guide

Flat 1
Dispensary Mansions
80 Old Mill Street
Manchester
M4 6ND

Home User Guide



great places HOUSING GROUP

ERIC WRIGHT CONSTRUCTION
PART OF THE ERIC WRIGHT GROUP

Contents

Section 1 - Introduction 4

1. About This Guide 4
2. Alternative Formats 4
3. Building Guarantee 5
4. What to Do If You Have a Problem 5
5. Important Contact Details 5

Section 2 - Emergency Information 7

1. Fire Safety 7
2. Emergency Service Contact Information 8

Section 3 - Using Your Home 9

1. “Running-In” Your New Home 9
2. Looking After Your Property 11
3. Your Heating System 12
4. Your Hot Water System 13
5. Heat Recovery Ventilation 14
6. The Electrical Supply in Your Home 15
7. Energy Use in the Home 18
8. Water Usage 19
9. The Environmental Features of Your Property 20
10. Recycling and Waste 21
11. Sustainable DIY 21
12. Specification and Manufacturer Details 23

Section 4 - Site and Surroundings 29

1. Recycling and waste 29
2. Public Transport 30
3. Local amenities 31

4. Responsible purchasing 32
Section 5 – Cleaning Schedule 36
Section 6 – Further Links, references and further information 39
Appendices 40
Appendix A - Panel Heaters 1
Appendix B - Towel Rails 7
Appendix C – EPC Certificate 15
Appendix D – Electrical Test Certificate 16
Appendix E - Floor Plan 17

Section 1 - Introduction

1. About This Guide

This Home User Guide has been prepared to provide you will all the information you need about your home and the facilities and services at your disposal.
Please take a little time now to read through this guide. You can refer to it in the first instance, but feel free to contact us at any time.

Please note personal safety always comes first. If you are uncomfortable or unsure how to undertake any of the routine jobs within the home please contact an appropriate professional or Great Places Customer Access Team for assistance on 0300 123 1966 or at www.greatplaces.org.uk

Within this guide you will find details about your home, advice on how best to maintain it and relevant instruction manuals for your fitted appliances and heating and hot water systems.

The address of your property is:
Flat 1, Dispensary Mansions
80 Old Mill Street
Manchester
M4 6ND

2. Alternative Formats

This home user guide can also be provided in alternative formats including Braille, large print or audio cassette or CD. For further information please contact:

Customer Care Services
Great Places Housing Group
2a Derwent Avenue
West Didsbury
Manchester
M21 7QP

0300 123 1966
customercare@greatplaces.org.uk

3. Building Guarantee

Eric Wright Construction, as the developer, will guarantee your property for the initial period of PERIOD after legal completion. Throughout this time your property will have a warranty against defects in the materials or construction of the property, with one year's appliance cover. While Eric Wright Construction will remedy defects in your home within the 12 month period, general wear and tear, decorating or normal routine maintenance is not covered.

Your property is guaranteed by Eric Wright Construction until: 29th January 2025

4. What to Do If You Have a Problem

To report a repair or discuss anything to do with your tenancy then please contact our Customer Access Team on 0300 123 1966.

You can also report repairs, pay rent, or find additional information through the My Great Place website. Simply visit www.greatplaces.org.uk and following the "My Great Place" link.

5. Important Contact Details

Utilities

Your services are currently supplied by the following companies. Any queries with regard to supply, tariffs and alternative options should be addressed to them.

Please make sure you keep records of the meter readings taken on the day you moved in to the property; your bills will be calculated from these readings and you must give them to the service providers.

For your own safety no-one should have to gain access to your property to any sort of meter reading as all your meters are external.

Electricity: Electricity North West
105

Meter number: 2500223198502
Your electricity meter is located within the Ground floor plant room.



Water: United Utilities
0845 746 2222

Meter number: C23LU340706
Your water meter is located within your utility Cupboard.



Local Authority

Your local authority is . Their contact details are as follows:

Manchester City Council
Town Hall
Albert Square
Manchester
M60 2LA

0161 234 5000
https://www.manchester.gov.uk/contactus

Section 2 - Emergency Information

1. Fire Safety

Your property is fitted with mains-powered smoke detectors in the hall way, bedroom, lounge and utility cupboard with a heat detector located in the kitchen. All detectors are fitted with a battery back-up to ensure safe operation in the event of a power failure. The detectors within the property and looks like this:


Smoke detector

It is imperative that you check that the detector is working weekly by pressing the "test" button on the face of the unit.

In addition to sounding in the event of a fire, your detector may give various audible indications of a malfunction. Please refer to the instruction leaflet at the back of this guide for details of how the detector functions and full clear instructions for the maintenance of this importance piece of equipment. IT MAY SAVE YOUR LIFE.

Advice on Fire Precautions

- Test smoke and heat detectors in your property regularly.
- Do not store anything in hallways, landings, stairs or corridors, especially anything that may burn easily, as this may block an escape route.
- Use only the fixed heating system in your home. If required, use a small convector heater. Do not use gas or paraffin heaters, which have a named flame, or electric bar heaters.
- Use your rooms only for their intended purpose; do not use them as a workshop or storeroom. Do not store things in the cupboard where the fuse board is fitted.
- Doors in communal areas are self closing fire doors and should not be wedged open.

What to Do if a Fire Breaks Out

You must leave your home if it is affected by smoke or heat. If you can do so safely, close all doors and windows before leaving, but to not delay leaving the property and raising the alarm.

- Do not stay behind to try to put out the fire
- Do not use the lift
- Do not delay by collecting any possessions
- CALL THE FIRE BRIGADE by dialling 999, regardless of how small the fire is.

The local fire authority provides a fire action plan service. For further information please contact

Manchester Central Community Fire Station
Thompson Street
Manchester
M4 5FP
0161 608 5303

2. Emergency Service Contact Information

The nearest Accident and Emergency department is located at the following address:
North Manchester General Hospital
151 Delaunays Road
Crumpsall
Manchester
M8 5XL
0161 795 4567

Your local police station is:
Greater Manchester Police
Town Hall
Lloyd Street
Manchester
M60 2LA
0161 856 3129

The local fire station is located at:
Manchester Central Community Fire Station
Thompson Street
Manchester
M4 5FP
0161 608 5303

In the event of an emergency dial 999.

Section 3 - Using Your Home

1. "Running-In" Your New Home

Moisture from Construction

Your newly constructed home needs to be acclimatised gently for at least six months so that it can dry out gradually. When you move in to your new home there is moisture present that will have been absorbed by the building materials during construction. You may not feel it and it will certainly not do you any harm, but it does need to evaporate slowly and be ventilated away.

Slow evaporation helps to minimise shrinkage cracking. This can be achieved by keeping your home at a reasonably even temperature at all times during the drying out period. The heating should be used sparing at first so that the underlying building structure warms up and dries out gradually. We recommend that the central heating thermostat should be set at no higher than 20°C or at 4 on the radiator valve, unless extreme weather conditions are experienced.

At the same time the evaporating moisture needs to be ventilated away in order to avoid problems with dampness and condensation, which will otherwise cause a black mould to grow on the walls, appearing as a dark stain. You can help this drying process by leaving windows open for as long as you can each day and ensure that trickle vents in the window frames are left open. Internal doors should be left open, where possible, to allow appropriate air circulation and wardrobe and cupboard doors should be left open.

Moisture from Occupation

Once the building materials have dried out, modern standards of insulation should ensure you no longer experience harmful condensation. Even then, however, some normal daily activities product a great deal of water vapour which can cause condensation around the home. Condensation is steam or water vapour which reverts to water on contact with a cold surface. As with moisture from construction, it can sometimes cause mould on walls and ceilings, especially in unventilated corners behind cupboards and wardrobes. If allowed to persist, condensation and mould can damage clothes, bedding, floor coverings, decorations and the home itself. Next to shrinkage, condensation is the most common problem in newly constructed homes.

The following guidelines will help reduce these risks, particularly during the drying out period:

- A low level of heating should be maintained at all times during the drying out period. Even when this period is over it is advisable to maintain the temperature at a low level, or set the time clock so that your home has preheated before you return. A house which is continually occupied or maintained at a warm temperature is less conducive to generating condensation.

- Do not use portable gas heaters instead of the installed heating system. These supplementary heaters create a great deal of water vapour when burning.
- Tumble dryers should be self condensing or vented externally.
- Keep ventilators open and try to safety leave windows ajar.
- In the kitchen and bathroom you will need much more ventilation as more steam is produced in these areas. Your home is provided with an extractor fan or hood and ductwork from the kitchen and bathroom will operate when required. You need to ensure that the isolator switches for these systems are left on at all times. Additionally, the fans should be left running until any noticeable vapour has cleared.
- Cover pans when cooking to reduce steam.
- Avoid drying clothes indoors over radiators.

Movement and Shrinkage

As drying out progresses and the home is lived in and heated the building materials shrink, which may cause small cracks to appear. These are not structural defects and can be filled and covered in the normal process of periodic redecoration. Some may recur to a reduced extent. Such minor cracks are inevitable.

If you plan to redecorate we recommend that you wait until the drying out process is complete, as paint applied too soon may crack as the moisture from construction evaporates. We cannot be held responsible for damage to decorations which have been applied too soon.

Efflorescence

A consequence of drying out may be the appearance of a white deposit on walls, called “efflorescence”. This is caused by natural salts coming out of the wall materials and is quite normal. It is not harmful and usually disappears over time. If efflorescence occurs on internal walls it can be wiped or brushed away.

2. Looking After Your Property

Cleaning Sanitary-Ware

It is important that, when cleaning sanitary-ware, the appropriate product is used to avoid any damage. In general, abrasive cleaning materials should not be used with acrylic products in any circumstances. The use of abrasive cleaners should also be avoided on taps, as the surface material is likely to be scratches, eventually leading to the full removal of the surface material and subsequent corrosion.

Security

You should remember to lock all windows and remove window keys whenever you are out, and we recommend the following additional measures to keep your home safe:

- Try and make your home look occupied.
- Remember to cancel papers, milk and other regular deliveries before going on holiday. Ask a neighbour to remove free papers and parcels.
- Leave lights on in the evening (not just in the hall and landing) and use an automatic time switch. Another good idea is to have a radio playing, on a talk station, on a similar time switch. Alternatively, ask a neighbour to come in to switch these items on.
- Pack away easily stolen items
- Never leave valuable and easily transportable items, like video recorders or car keys, on view where they can be easily seen.
- Photograph valuable items and use marker pens to add your post code and house number, so that your property can be traced if recovered after a theft. Similarly, make a note of all serial numbers.
- Make sure that the contents of your home are fully insured against fire and theft.

3. Your Heating System

This guide contains instructions on how to operate your central heating system. These instructions should have been explained to you during your handover.



Water Heater:
Your hot water is supplied from a pressurised hot water cylinder located in the utility cupboard. The water is heated by an electrical immersion heater. The immersion heater is controlled by a time clock located adjacent to the cylinder.

Should you have any queries / difficulties please contact Great Places Housing Association



The space heating within the apartments is provided by electrical panel heaters throughout and towel rails within the bathroom.
The heaters can be manually switched on and off or programmed with three different scheduled on/off periods per day. Each period can be set with individual temperatures
The towel rails within the bathroom can also be programmed for 24/7 control. It can also be manually overridden for 2 or 4 hour boost.

4. Your Hot Water System

Your hot water is supplied from a pressurised hot water cylinder located in the utility cupboard. The water is heated by an electrical immersion heater. The immersion heater is controlled by a time clock located adjacent to the cylinder; The time clock provides 24hr timed control that can be programmed with numerous individual timing schedules. The time clock can also be set manually on/off if required.
Full operators guide for the cylinder and time clock can be found in the operator's manual.



Setting the clock

- Turn the dial in the direction of the arrow (clockwise) until the correct time of day is exactly opposite time set marker on the clock face. (24 hour clock).
- For the "ON " period push the switching riders out towards the outside edge of the face. The timer will operate for the duration set (each segment is approximately 15 minutes duration). i.e. If it is required to switch on between 16.00 and 18.00, all the segments between these times should be moved to the outer edge.

By moving the switch located centre right of the dock face the following operations can be achieved.

I = Permanently ON.
= Switching programme as set on dial.
0 = Permanently OFF.

5. *Heat Recovery Ventilation*



The supply and extract ventilation within the apartment is supplied by a mechanical ventilation heat recovery (MVHR) unit installed within the utility cupboard which extracts stale air from the kitchen & bathrooms and supply's fresh air to the living area and bedrooms. The heat within the extracted air is recovered within the MVHR unit and transferred to the supply air to reduce heat loss.

The MVHR unit is programmed to run continuously on low speed (trickle). The extract ventilation rate is boosted if the manual override switch in the kitchen is operated or when the light in the bathroom is operated. The unit will also boost if the humidity level in the bathroom increases.

The unit can be manually increased to full ventilation rate (purge) by pressing the lower button on the unit for 5 seconds. Purge mode runs the fans at full speed for 2 hours (120 minutes). The Purge screen displays a countdown of the time remaining. If the purge needs top be manually stopped at any time this can be done by pressing the lower button once.

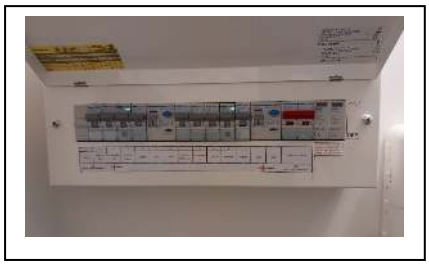
The unit is fitted with a Summer Bypass and will provide energy-free cooling when the house temperature and ambient temperature allows. From the Normal Airflow screen, press the down arrow button twice to access the Summer Bypass screen.
If the unit is a summer bypass model, the Summer Bypass screen enables you to switch the summer bypass control on or off

6. The Electrical Supply in Your Home

The electrical supply enters your home through the electricity meter located in the meter box in the Plant Room, access to the meter can be granted by request from the Neighbourhood Services Manager.

The wires leading from the meter go to the consumer unit which is located in the utility cupboard of your apartment. This unit contains the main on/off switches and a number of MCB (milliamp circuit breaker) trip switches which protect individual circuits. They are like small fuse that do not need rewiring, MCBs automatically switch off the electricity supply, should there be a fault, for example due to loose wiring or faulty appliances being connected to it. Written alongside each MCB is a description of the circuit it protects – power, lighting, water heater, etc. MCBs have different current ratings suitable for their type of circuit; a cooker circuit will require 30 amps, but lighting only 5 amps, etc.

Consumer Unit & MCBs



To reset, please switch the ON button/switch, should take approximately one minute

What to Do if a Circuit Fails

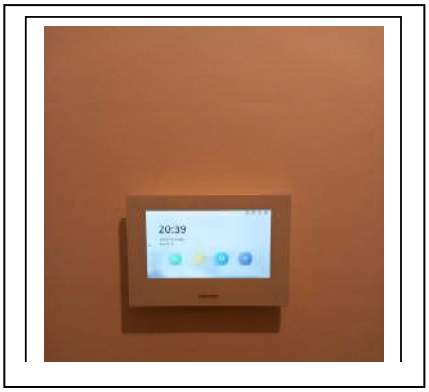
If a circuit fails you should disconnect (rather than just switch off) any appliance that you think may have caused the problem. It will be obvious which circuit has been affected by checking the consumer unit, where the switch on the relevant MCB will be in the “off” position. Switching the MCB back on should restore the circuit. To be sure that you have identified the faulty appliance reconnect all other appliances and see if the MCB fuses again. If it does, it means there is still a faulty appliance somewhere, which you should try to locate by disconnecting all appliances and reconnecting them in turn, switching them on as you do so.

Telephones
There are connections for telephones and appliances in the living room and bedroom.



You must make arrangements directly with a Supplier for telecommunications service.

Intercom



In the event someone presses your apartment number on the external door entry intercom unit located at the entrance to the building this will call to your wall mounted intercom receiver located at the entrance to your apartment, you will be able to see the person on the screen, the intercom will continue to ring until you accept or cancel the call by either pressing the accept or reject button, if you accept the call you will be able to speak with the person who is external to the building, in the event you want to grant access you can press the unlock button which will disengage the magnets on the front door and allow access into the building

Television
There are sockets for TV aerials in the living room and bedroom which are connected to the mains aerial located on the roof of the property.



You are responsible for obtaining a television licence before using a tv in the property.

Shaver Point



A shaver socket is located in the bathroom

Light fittings

The lighting within your apartment is controlled by the light switches located on the walls of the rooms that they serve or on entry to those rooms. The lighting is isolated at the local consumer unit located within the utility cupboard, it is from here where the lighting circuitry eminates from wiring round all the switches with switch wires going from the switches to the lights. In the event a light is not working please check that the lamp within the light is in a fit state first by trying a new lamp in the light and the existing lamp in a proved working light fitting. If the lamp is proved as fit please check if the MCB serving the light has tripped, if it hasn't please contact an electrician to review the fault.

7. Energy Use in the Home

This section contains advice and tips about how to reduce the amount of energy that you use in your home – and keep your utility bills down at the same time!

Heating

- Turn down the thermostat to 19°C and set the timer so it comes on no more than 30 minutes before you get up and switches off half an hour before you get up and leave in the morning.
- Move furniture away from radiators or heaters to let the heat into the room.

Water

- Turn down the temperature of your hot water at the central heating boiler. A maximum of 60° C is normally sufficient.
- If the water is heated by an electric immersion turn it on half an hour before you need it and turn it off once finished.
- Don't leave hot taps running - always used the plug. If you've got a leaking hot tap now is the time to fix it!

Lighting

- Switch the lights off if the room is bright or no one is in it.
- Use natural light where possible – eg remove books/ornaments from windowsills.
- Make sure that all your light fittings have energy-efficient bulbs. Your home is fitted with a number of 3-prong fittings which will only accept special energy efficient bulbs. These fittings are located…

Gadgets

- Turn off the chargers for mobile phones and laptops. Turn off the TV's, radios (DABs are particularly energy hungry) and computers!

8. Water Usage

Water Shut off point (stoptap)



The water within the apartments can be isolated by a manual lever valve which is located at high level within the utility cupboard. this valve will isolate both the hot and cold water system.. Should there be an emergency (ie leak) please use the stoptap to turn off the water.

Please familiarise yourself and test whether you are able to turn off the water or not. Should you be unable to turn it off please contact Great Places Housing Association.

All cold water is fed directly from the mains supply is drinkable.

- General water savings systems installed in the home for example toilets/taps.

9. The Environmental Features of Your Property

Showersave units-

A Showersave waste water heat recovery unit has been installed within the bathroom, these units are designed to take the warm waste water from the bath drain and use it to indirectly preheat the water going to the shower. This reduces the energy required to heat the water at source.

There is a wall mounted access panel located above the toilet that provides maintenance access to the main components.

Maintenance & cleaning

Generally, no maintenance or cleaning is required. The wastewater from the shower flows at a high speed of over 1 m/s along the inner pipe's wall. The water flows through the pipe in 2 seconds and so no dirt can accumulate.

If, for whatever reason dirt does accumulates, then a soap-based cleaning agent can be used to flush the pipe (do not use corrosive drain cleaners). Cleaning agents based on scouring or polishing agents are not recommended as these can stick to the wall of the pipe, reducing its efficiency.

10. Recycling and Waste

Your home is provided with recycling bins, which are located in the bin store. Your local authority makes collections for recyclable waste every two weeks, currently on a Tuesday.

Materials which will be collected by the local authority at your home for recycling are limited to:

- Tins and cans
- Glass bottles and jars
- Paper

For specific queries regarding recycling and waste collections by your local council please see www.manchester.gov.uk/bins or ring 0161 234 5004

Your property has also been provided with a compost bin.

11. Sustainable DIY

Making home improvements, even simply touching up on scratched paint work, can make a difference to the local and global environment. DIY can be better for the environment and your health if undertaken in a sustainable manner as outlined below:

Timber

Seek to source wood from sustainable sources for your home and garden. Check that any wood you buy has the Forestry Stewardship Council Logo, this ensures any timber you purchase comes from sustainably managed sources.

Paints

Standard paints can contain a toxic mix of chemicals such as high levels of Volatile Organic Compounds (VOCs) and petrochemicals which can be released into the air as the paint dries. These are neither good for your health nor the environment. There are numerous companies which provide water based paints made from natural ingredients.

Always take waste solvents such as paint stripper to the nearest local council refuse site for proper disposal.

Floors

Vinyl contains PVC which is harmful to the environment. You can choose linoleum, wool or timber as a more sustainable alternative. If you are re-doing any part of the floor make sure you insulate the floor to reduce draughts and keep the heat in.

Wallpaper

When purchasing wallpaper, check for the Forestry Stewardship Council logo to make sure your paper has come from sustainable sources.

Reclaimed Materials

Rather than buying new things consider using reclaimed materials as part of your DIY project. Old flagstones which have been worn and weathered can give a garden much more character than new paving from a high street brand. Just make sure your reclaimed items have been legally acquired. Check out www.salvo.co.uk if you have any concerns. Additionally, locally sourced stone will support local plant species better than stone imported from the other side of the world.

12. Specification and Manufacturer Details

The details provided below are for information only:

Description	Company	Contact
White tiles 150x150 - AA043YPRG1044	HR Johnson Johnson Tiles Harewood Street Tunstall Stoke On Trent ST6 5JZ United Kingdom	Tel: 01782 524000 www.johnson-tiles.com Email: info@johnson-tiles.com
Doors	Central Doorset Manufacturing Ltd Haypark Business Centre Marchmont Avenue Polmont FK2 0NZ	Tel: 01324879370 www.centraldoors.co.uk Email: enquiries@central-manufacturing.co.uk
Aluminium Curtain Wall Screen - Seniors SF52	LDG Contracts Ltd Havelock Street Preston PR1 7NL	Tel: 01772 20002 www.ldgcontracts.co.uk
Aluminium Window - Seniors SPW600		
Doors - SENIORS SPW 600e		
Door - Technal ST11		
Paint - AM201	Armstead Trade ICI Paints Akzonobel, Wexham Road, Slough, Berkshire, S12 5DS	Tel: +44 (0) 33 222 70 70 armsteadtrade.co.uk Email: armstead.advice@akzonobel.com
Paint - AM204		
Vanity Top - INP	Inscape Interiors Ltd Lower Healey Business Park, Froom Street, Chorley. Lancashire PR6 9AR	Tel: 0845 2308560 www.inscapepeople.com Email: web@inscapepeople.co.uk

Description	Company	Contact
Taps - 521502B Sink - BL230792	Blanco Uk Limited 1 Victor Way Colney Street St. Albans AL2 2FL	Tel: 01923 635200 www.blanco.com/gb-en/ Email: info@blanco.co.uk
Blind Fabric – Obscura Blinds System - Astralux 3000	Pentel Contracts Limited Dyer Street Salford Manchester M5 4TH	Tel: 0161 872 7642 Fax: 0161 872 7636 www.pentel-contracts.com Email: info@pentel-contracts.com
Supacord Carpet Tile - Supacord	Heckmondwike Fb Wellington Mills Liversedge West Yorkshire WF15 7FH	Tel: 01924 406161 www.heckmondwike-fb.co.uk Email: technical@heckmondwike-fb.co.uk
Polysafe Wood FX 3357 Polysafe Standard PUR - 4020	Polyflor Ltd Po Box 3 Radcliffe New Road Whitefield Manchester M45 7NR	Tel: 0161 767 1111 Fax: 0161 767 1188 www.polyflor.com Email: info@polyflor.com
Worktops - PF40 Splashback - STSBACK600 Cabinets - Hacienda Platinum Cabinets - Medford White	Symphony Group Penhill Estate Park Spring Road Grimethorpe Barnsley S72 7EX	Tel: 01226 446000 www.symphony-group.co.uk Email: enquiries@symphony-group.co.uk

Description	Company	Contact
Door Closer - 06.0053.R.SNP	Franchi 278 Holloway Road London N7 6NE	Tel: 0800176176 www.franchi.co.uk/ Email: contracts@franchi.co.uk
Scissor Door Closer - 06.9999.00001		
Mortice Latch - 09.9999.00002		
Lever Handle - 13.9999.00001		
Pull Handle - 15.9999.00001		
Escutcheons - 16.9999.00001		
Turn and Release - 16.9999.00002		
Blank Escutcheon - 16.9999.00003		
Cylinder Pull - 16.9999.00004		
Cylinder Escutcheon - 16.9999.00005		
Flush Bolt - 19.9999.00001		
Socket - 19.9999.00002		
Door Stop - 22.0099.SNP		
Door Viewer - 22.9999.00001		
Panel Heater	Adax-Solaire New Row Eppleby DL11 7AW	01325 717 899 adax-solaire.co.uk info@solairehp.co.uk

Description	Company	Contact
White tiles 150x150 - AA043YPRG1044	HR Johnson Johnson Tiles Harewood Street Tunstall Stoke On Trent ST6 5JZ United Kingdom	Tel: 01782 524000 www.johnson-tiles.com Email: info@johnson-tiles.com
Doors	Central Doorset Manufacturing Ltd	Tel: 01324879370 www.centraldoors.co.uk Email: enquiries@central-manufacturing.co.uk
Aluminium Curtain Wall Screen - Seniors SF52	LDG Contracts Ltd Havelock Street Preston PR1 7NL	Tel: 01772 20002 www.ldgcontracts.co.uk
Aluminium Window - Seniors SPW600		
Doors - SENIORS SPW 600e		
Door - Technal ST11		
Paint - AM201	Armstead Trade ICI Paints Akzonobel, Wexham Road, Slough, Berkshire, S12 5DS	Tel: +44 (0) 33 222 70 70 armsteadtrade.co.uk Email: armstead.advice@akzonobel.com
Paint - AM204		
Vanity Top - INP	Inscape Interiors Ltd Lower Healey Business Park, Froom Street, Chorley. Lancashire PR6 9AR	Tel: 0845 2308560 www.inscapepeople.com Email: web@inscapepeople.co.uk

Description	Company	Contact
Taps - 521502B Sink - BL230792	Blanco Uk Limited 1 Victor Way Colney Street St. Albans AL2 2FL	Tel: 01923 635200 www.blanco.com/gb-en/ Email: info@blanco.co.uk
Blind Fabric – Obscura Blinds System - Astralux 3000	Pentel Contracts Limited Dyer Street Salford Manchester M5 4TH	Tel: 0161 872 7642 Fax: 0161 872 7636 www.pentel-contracts.com Email: info@pentel-contracts.com
Supacord Carpet Tile - Supacord	Heckmondwike Fb Wellington Mills Liversedge West Yorkshire WF15 7FH	Tel: 01924 406161 www.heckmondwike-fb.co.uk Email: technical@heckmondwike-fb.co.uk
Polysafe Wood FX 3357 Polysafe Standard PUR - 4020	Polyflor Ltd Po Box 3 Radcliffe New Road Whitefield Manchester M45 7NR	Tel: 0161 767 1111 Fax: 0161 767 1188 www.polyflor.com Email: info@polyflor.com
Worktops - PF40 Splashback - STSBACK600 Cabinets - Hacienda Platinum Cabinets - Medford White	Symphony Group Penhill Estate Park Spring Road Grimethorpe Barnsley S72 7EX	Tel: 01226 446000 www.symphony-group.co.uk Email: enquiries@symphony-group.co.uk
Consumer Unit	Hager Ltd 50 Hortonwood Telford Shropshire TF1 7FT	0870 2402400 0870 2400400 www.hager.co.uk sales@hager.co.uk

Description	Company	Contact
Door Closer - 06.0053.R.SNP	Franchi 278 Holloway Road London N7 6NE	Tel: 0800176176 www.franchi.co.uk/ Email: contracts@franchi.co.uk
Scissor Door Closer - 06.9999.00001		
Mortice Latch - 09.9999.00002		
Lever Handle - 13.9999.00001		
Pull Handle - 15.9999.00001		
Escutcheons - 16.9999.00001		
Turn and Release - 16.9999.00002		
Blank Escutcheon - 16.9999.00003		
Cylinder Pull - 16.9999.00004		
Cylinder Escutcheon - 16.9999.00005		
Flush Bolt - 19.9999.00001		
Socket - 19.9999.00002		
Door Stop - 22.0099.SNP		
Door Viewer - 22.9999.00001		

Section 4 - Site and Surroundings

1. *Recycling and waste*

If the items are in a good condition you could donate them to charity.

Manchester City Council will collect large unwanted items from outside the property if you arrange a collection with them.

As of January 2024 they will make one collection of three items per year for free. If you have already had a free collection it will cost £27 for up to three items and £54 for up to six items.

You can also take items to your nearest recycling and waste centre which is located at Reliance Street, Manchester, M40 3EZ.

In 2019/2020 local authorities sent 2.2 million tonnes of household waste to landfill. When rubbish is put in a landfill site is becomes compacted and the materials break down anaerobically (without oxygen) resulting in the formation of a toxic sludge which can enter water courses. This process also produces methane gas, a significant greenhouse gas. Landfill sites across the UK are filling up rapidly and no-one wants to live next to a landfill site therefore we must start taking action.

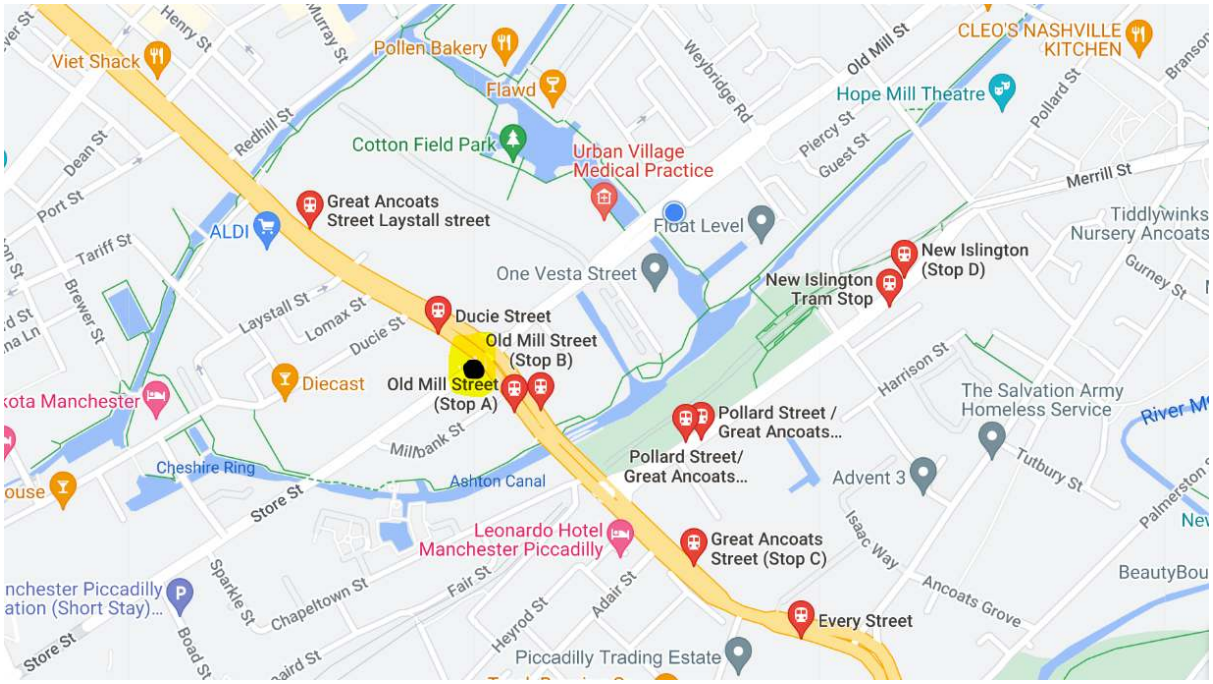
When it comes to waste from homes it is advised to use the WRAP hierarchy:
Prevent
Reduce
Reuse
Recycle
Landfill

Furniture:
There a numerous Furniture Reuse Charities across the North West that will accept second hand furniture in good condition. Some will even collect it for free! Check out the furniture reuse network (www.frn.org.uk) for your local charities.

Batteries:
Batteries contain a toxic mix of chemicals and must always be taken to waste depots for appropriate disposal. Check www.recyclemore.com to find out where you can recycle batteries.

2. *Public Transport*

The nearest bus stop is shown below – for all bus routes visit https://tfgm.com/bus/timetables



The nearest tram stop is New Islington, M4 7EQ – for all tram stops visit https://tfgm.com/public-transport/tram/stops

For details of car sharing please visit:
https://liftshare.com/uk/search/from/manchester-united-kingdom

For cycle paths please visit:
https://www.manchester.gov.uk/info/500356/active_travel/6850/cycling

3. Local amenities

Ancoats General Store, 57 Ancoats Street, Blossom Street – 0161 236 7897

Co-op, 45-49 Blossom Street, Ancoats – 0161 235 8435

There is a post Box located on Mill Street - Last Collection Times are Mon - Fri: 17:30, Saturday: 12:00

Pharmacy – K's Chemist, Ancoats Primary Care Centre, Old Mill Street, Ancoats, M4 6EE – 0161 273 5721

East Manchester Leisure Centre, 189 Grey Mare Lane, Beswick, Manchester, M11 3ND – 0161 641 1200

St Georges Community Centre, Bothwell Road, Collyhurst, Manchester, M40 7ny – 0161 834 9368

Places of Worship

Halle at St Michaels', 36 – 38 Leigh Street, Ancoats, Manchester, M4 5DG – 0161 312 2068

Trinity Methodist Church, Ancoats, Manchester, M40 7FZ

City Church, Central Building, Oldham Street, Manchester, M1 1JQ -

Church of The Resurrection and St Barnabas, 1a Albert Street, Beswick, Manchester, M11 3AS – 07880 984236

Shahjalal Mosque & Islamic Centre, 1a Eileen Grove, Manchester, M14 5SW – 0161

Your nearest farmers market is held every Sunday 11am to 5pm at Stevenson Square, Manchester, M1 1DS

Alternatively there are a number of organic box schemes available in your area. You can find your local scheme by viewing:
www.boxscheme.org
www.freerangereview.com

4. Responsible purchasing

Everyone, as a consumer, must make decisions on everyday purchases. Being responsible for a home requires consideration for yet more products. Responsible purchasing is having consideration for the impact of the products we buy on both people and the environment.

The products you purchase for your home can make a significant difference to the overall fuel bills for your property. With energy prices, both gas and electric, predicted to rise in the future now is the time to consider the long-term use and energy consumption of essential home products. We have outlined a few key products below:

White goods

White goods are electrical items such as fridges, freezers, washing machines, and dishwashers, items that are regularly used in the home. White goods are now sold with energy efficiency ratings A to G with A (or in the case of fridges and freezers A++) been the lowest energy user and therefore best for your money saving and reducing your CO2 emissions.

The Energy Saving Trust advises that through responsible purchasing of low energy fridge freezers alone can result in savings of up to £34 per year.

In addition when purchasing a washing machine or a dishwasher check the water usage and look for machines that are water efficient. Your clothes will still be clean but your annual bills will be reduced through having to heat and pump less water during every cycle.

The Energy Saving Trust advises that through responsible purchasing of low energy fridge freezers alone can result in savings of up to £34 per year.

Electrical equipment

Increasingly electrical equipment such as TV's, set top boxes and radios are being sold with energy efficiency labels. These demonstrate the potential savings that can be made. The Energy Saving Trust recommended digital radios can use approximately 75% less electricity annually than a standard digital radio.

Responsible purchasing also considers the food we purchase. The Soil Association and Fairtrade are two nationally recognised certification schemes that ensure the environment is considered during production of food.

Many people purchase organic food because they believe it is healthier. Organic farming is crucially less harmful to the environment as biodiversity is encouraged and less herbicides and pesticides are used enabling wildlife to flourish.

Climate Change

Climate Change is one of the most important and urgent problems facing us today, It is widely accepted that without action to reduce greenhouse gas emissions, the direct impacts of a changing climate will have major impacts on society, the economy and the environment. The greatest change is the increase in extreme weather for example very heavy rainfall in short periods of time and drought caused by the higher temperatures and less even rainfall.

In the North West the greatest increased risks are flooding and heatwave. Steps to minimise the impact of climate change for you and your family are outlined below:

Dealing with a heatwave:

We all hope for a warm summer and the opportunity to enjoy the sunshine. We should make sure we do it safely and certain groups of people, such as young children and older people, are more vulnerable than others to the effects of heat. If we get too hot it can make the body go into overdrive as it tries to stay cool through perspiration and evaporation. Overexposure to sun is equally dangerous, with effects ranging from mild sunburn to skin cancer. It doesn't have to be hot for the UV index to be high.

Before a heatwave

- Ensure you have plenty of cold fluids available.

During a heatwave

- Try to keep your house cool, closing blinds or curtains can help.
- At night, keep your sleeping area well ventilated. Night cooling is important as it allows the body to recuperate.
- Try to stay cool by taking cool showers or baths and/or sprinkle yourself several times a day with cold water.
- Avoid too much exercise, which can cause heat exhaustion or heat stroke, and can even be fatal. Watch for signs of heat stress — an early sign is fatigue.
- Drink plenty of fluids, but not alcohol, which dehydrates the body.
- Try to eat as you normally would. Not eating properly may exacerbate health-related problems.
- If driving, keep your vehicle well ventilated to avoid drowsiness. Take plenty of water with you and have regular rest breaks.
- If you have elderly neighbours who may be at risk during a heatwave, try to visit them daily.
- If you do go out, try and avoid the hottest part of the day (11 a.m. to 3 p.m.) and seek shade where possible. Avoid being in the sun for long stretches.

Before going out in the sun

- Check you have appropriate sun cream for your particular type of skin.

During sunny weather

- The UV index (the strength of the sun) can be high at many times of the year — it doesn't have to be hot. The UV index can be strong through cloud even when the sun isn't directly shining.
- If you go out, wear lightweight, light-coloured clothing, high factor sunscreen and a wide-brimmed hat.
- Avoid being in the sun for long stretches.
- Reapply an appropriate factor sun cream at regular intervals during the day.

Do not leave children or animals in parked cars. Even on cool days, strong sunshine can make car interiors very hot.

Dealing with a flood:

Forecasting where and when floods will occur is a difficult task. Whether a flood occurs is subject to a large number of factors coming together at the same time. For example short periods of very heavy rainfall can cause flash flooding; while longer periods of heavy rain can cause rivers to overflow.

A number of organisations work together; including the Met office and Environment Agency to try to predict where flooding will occur. The Environment Agency and your local Council share responsibility for providing advice and information to the public during flood emergencies and can be contacted 24 hours a day via a dedicated Floodline number: Floodline 0845 988 1188

Make sure you know what to do if a flood is predicted in your area:

Before the flood:

- Move valuable items, including important documents, to high levels.
- Bring indoors items which may cause damage or be damaged.
- Ensure you have bottles of drinking water in case the water supply becomes contaminated.
-

During the flood:

- Never try to drive through flood water — 80% of flood deaths occur in vehicles.
- Avoid walking through flood water, streams or rivers in full flow — just six inches of rapidly moving water can knock a person over.
- If you have to evacuate your home or workplace turn off those utilities you can access.
- Avoid driving unless your journey is absolutely necessary.

After the flood:

- Check structural damage to buildings.
- If it is dark, use a torch, not candles.
- Throw away all foods, including canned goods, which have come into contact with flood water.

Information sourced with kind permission of the Met Office.

Section 5 – Cleaning Schedule

System / Type	1D	1W	1M	3M	6M	1Y	3Y	4Y	5Y	10Y	A/R
Clean: Curtain walling			✓	✓	✓	✓					
We recommend frequent cleaning of the aluminium profile and glazing with warm soapy water using a soft sponge/cloth. All cleaned areas should be thoroughly rinsed and dried after. Gaskets may be cleaned using warm soapy water or a mild detergent using a soft cloth or sponge. Ensure no gaskets become dislodged when cleaning.											
Clean: Window frames			✓		✓	✓					
Generally, cleaning with water only is recommended. Where this is inadequate to remove urban grime, a neutral soap powder or liquid detergent may be added to the water. Deposits which cannot be removed with water should be brushed away using a nylon brush											
Clean: Curtain wall, doors and windows			✓	✓	✓	✓					
Clean: White tiles 150x150											✓
Occasionally foreign matter may cause surface marks on tiles. If the surface mark cannot be removed with the normal cleaning procedures detailed above, other cleaning materials should be considered. It is advisable to try a small inconspicuous area first. Paint Paint remover Organic stains Bleach or a one-off treatment with washing soda Rust Masonry cleaner Rubber Abrasive powder or liquid but not on glazed tiles Oil, fat, grease Detergent or degreasers Mould growth Household bleach or proprietary cleaner Tea, coffee, ink Household bleach or proprietary cleaner Abrasive powders or cleaners should never be used on ceramic tiles											

System / Type	1D	1W	1M	3M	6M	1Y	3Y	4Y	5Y	10Y	A/R
Clean: Tile Trim											✓
Cleaned periodically using an neutral detergent to maintain the appearance											
Clean: Blinds											✓
All fabrics are coated to ensure that they will always hang flat, repel dust and not fray. General care of the fabric is minimal, requiring occasional vacuuming or dusting. Dirty marks may be removed by wiping with a damp cloth or using a mild detergent											
Clean: Obscura fabric											✓
Wipe clean											
Clean: Supacord carpet	✓					✓					
Daily vacuum cleaning with a twin motored upright vacuum. Periodically deep cleaned by hot water extraction using a good quality carpet detergent. Stains can be dealt with by a multi-purpose stain remover or solvent based cleaner.											
Clean: Polysafe PUR Vinyl	✓										✓
Sweep or vacuum. Apply a solution of neutral cleanser – pick up solution with a clean microfibre mop. Rinse with clean, warm water and wet vacuum, Leave to dry.											
Clean: Square Edge Vanity Top											✓
Never used as cutting or chopping surface. Laminate surfaces are best kept clean by water and mild detergent (non-scratch liquids, creams or pastes such as jif, flash or ajax). Scouring pads should not be used. Wash thoroughly with clean water and polished dry with a soft cloth. Window cleaning agents are excellent at removing and avoiding smears. Furniture polish should not be used. Cumulative staining over a long period can be removed by a dilute solution of bleach.											

System / Type	1D	1W	1M	3M	6M	1Y	3Y	4Y	5Y	10Y	A/R
Clean: Worktops, units and frontals											✓
Clean with warm water and a mild detergent using a damp cloth. Once dean, wipe again with a clean, dry cloth. Avoid the use of abrasive cleaners or strong chemicals. Frontals - Do not allow water to stand on timber surfaces, always wipe off immediately with a soft cloth. Clean and protect with furniture polish											
Clean: Splashback											✓
If spillage occurs rinse thoroughly with plenty of fresh water and dry with a soft cloth. Only use cleaners suitable for stainless steel. Only use cloths or non-scratch pads.											

Section 6 – Further Links, references and further information
(In addition to those found in Section 4.3 of this booklet)

See *www.sustrans.org.uk*, this organisation "We work for and with communities, helping them come to life by walking, wheeling and cycling to create healthier places and happier lives for everyone."

The local authority link is https://www.manchester.gov.uk/

You can easily navigate from the home page for info on recycling and waste tips
Local transport providers eg bus and train companies - https://tfgm.com/public-transport.

Local amenities

- Ancoats General Store is situated on the corner of 57 Ancoats Street, Blossom Street – 0161 236 7897

- Co-op, 45-49 Blossom Street, Ancoats – 0161 235 8435

- Other useful links:

    - www.est.org.uk/myhome
    - www.water.org.uk
    - www.wrap.org.uk
    - www.recyclenow.com
    - www.lovefoodhatewaste.com
    - www.transportdirect.info
    - www.thetrainline.com
    - www.seat61.com
    - www.freecycle.com
    - www.upmystreet.com

Appendices

Appendix A – Panel Heaters

Appendix B – Towel Rails

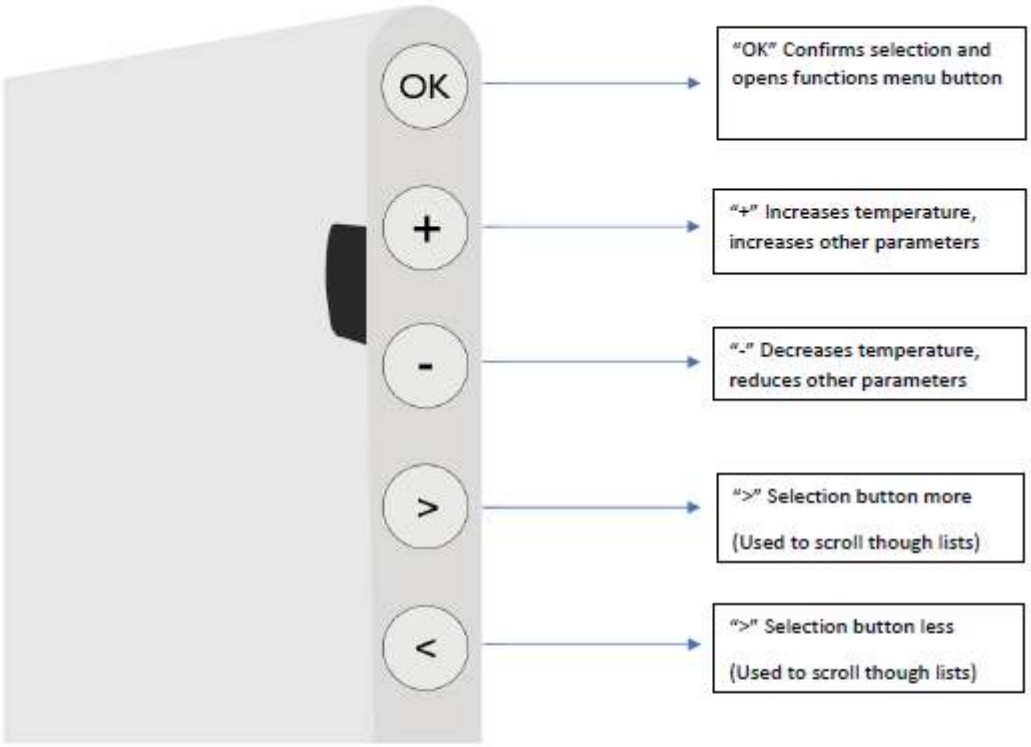
Appendix C – EPC Certificate

Appendix D – Electrical Test Certificate

Appendix E – Floor Plan

Appendix A - Panel Heaters

Control Panel



Menu Functions

Press and hold OK for 5 seconds to open and close the menu.

td	Setting the time and day
Pr	The weekly program menu
Co	"Comfort" temperature
rd	"Reduced" temperature
OP	Open window detection function
C	Temperature calibration
AS	Adaptive start function
rE	Reset the heater to factory default settings
Use ">" button to cycle through list	



1. Initial Set Up.

When the heater is switched on for the first time, it begins operating at the default "comfort" temperature of 22°C. This is the home screen.

The screen will blink indicating that the time and day has not been set.

2. Pre-Set programmes.

The heater has 3 programme modes: "Office" (P2) "Home" (P3) and P1(the user's programme). *See section 4 for details on how to set P1.* The heater will operate at the default temperature settings comfort = 22°C, reduced = 17°C).

(Times of "comfort" temperature)

	P1	P2	P3
Monday	User Programmed	07-17	06-08, 15-23
Tuesday	User Programmed	07-17	06-08, 15-23
Wednesday	User Programmed	07-17	06-08, 15-23
Thursday	User Programmed	07-17	06-08, 15-23
Friday	User Programmed	07-17	06-08, 15-23
Saturday	User Programmed	OFF	07-23
Sunday	User Programmed	OFF	07-23

3. Setting the time and day.

Start from the Below home Screen :



Hold the OK button until Td is present



Press OK To enter the day menu



1. Select the current day of the week using + and – . hours (eg 1 -Monday, 2 Tuesday ect) Press OK to confirm and move on to setting the hours
2. Set the current hour; press OK once to confirm
3. Set the minutes; press OK once confirm
4. Td will show on the display
5. Hold OK to return to the home screen

The time and day must be set before you can access the programmes and functions.

4. Setting the heater's timer.

Start at the home screen, as shown below.



Hold OK



Press OK



Press

OK



Press OK to Select P1

Press OK



Now select which days you wish to programme

Press >

7d Programme Monday - Sunday
5d Programme Monday - Friday
2d Programme Saturday – Sunday
d1 Monday
d2 Tuesday
d3 Wednesday
d4 Thursday
d5 Friday
d6 Saturday
d7 Sunday

Then press Ok to confirm

The Time programmer will now be open.

0 indicates midnight



Pressing the + button will set the heater to “comfort” mode.

Indicated by a green light at the top



Pressing the - button will set the heater to “reduced” mode.

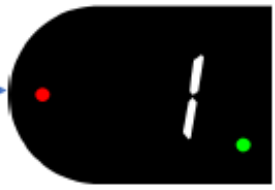
Indicated by a green light at the bottom



Using the + or – select either comfort or reduced mode



Use the > button to progress onto the next hour.



Continue through each hour using +/- and > until you arrive back at 0.

Make sure each hour is programmed to comfort or reduced.

Then press OK once to return to the programme day screen.

Hold OK until you return to the initial home screen.

5. Setting comfort and reduced mode

Start at the home screen, as shown below.



Press and Hold OK until the menu is opened.



Press the > button until Co is displayed.



Press OK once; a number is displayed. Use + or – to change the comfort temp



Press OK once return to the menu screen below screen.

Then press > once. RD will display



Press OK once; a number is displayed. Use + or – to change the reduced temp. Then press OK to return to the menu



Then, press and hold OK to return to the home screen.

To activate the programme, select P1

See section 6 on how to activate the timer

6. Changing / Activating programme mode

Start at the home screen, as shown below.



Press the ">" button to open the menu list



Keep pressing the > button until the desired programme is displayed.

Press OK to confirm your selection.

See the key below for details

Option	Description
P1	The user's own program. See section 5 to set
P2	Pre set programme 2 "Office"
P3	Pre set programme 3 "Home"
OF	Heater is OFF but the clock setting are maintained.
nP	No programme / manual mode

To indicate that the heater is in a programmed mode (P1, 2 or 3) a green light will display.

Appendix B - Towel Rails

Schematic depiction



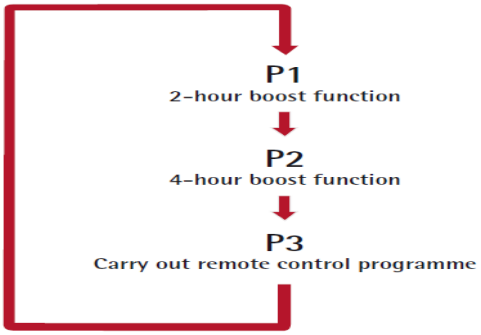
Description of the control unit

Description of the infrared operation

Button functions

Control unit button functions

Symbol	Function
	"On – Standby – On" button (with acoustic signal and Braille character)
— +	Adjusting the target temperature
	Fixed programme functions (press keys multiple times)
	Infra-red receiver on the control unit receives the transmission of remote control programmes



Infra-red remote control button functions

Symbol	Function
	Transmission button (for sending input information to the control unit)
	Basic settings (date, time etc.)
	Operating settings (e.g. switching times)
—	Reduce displayed values
+	Increase displayed values
	Check programme, enter password etc.
	Confirmations, corrections etc.

Working with the control unit

Once the power supply for the control unit has been established as outlined above, a dot will appear at the bottom of the controller display. This indicates that the controller is being supplied with current and is ready for operation. It is now in standby mode.



Pressing the button on the controller puts it into operating mode, and the previously used temperature setting will appear on the display together with the symbol for radiator temperature measurements. If the current radiator temperature is below the displayed target temperature, a flashing flame symbol will appear. This is always an indication that the actual temperature differs from the target temperature. If the device is heating up in order to adjust the temperature, the flame will flash slowly. If the actual temperature is falling in order to reach the target temperature, the flame will flash quickly. When the selected target temperature has been reached, the flame symbol will disappear. If no flame is shown on the display, this means that the actual temperature is the same as the target temperature on the display.



The target temperature for the radiator can be adjusted in 5°C intervals using these buttons on the controller.



This button on the controller is an input button with 3 functions: P1, P2, and P3. The required level can be selected by pressing the button repeatedly. The levels are as follows:

P1 = The device operates at maximum power for 2 hours and then returns to the previous operating mode.
P2 = Same as P1, but for 4 hours. These two functions are known as "booster" functions.
Once the boost period for P1 or P2 has come to an end, the device will return to manual mode with the previously selected temperature.
P3 = The programme entered via remote control is carried out at the corresponding times.

Switching between the three P functions

Press the ⇦ button on the controller. The current temperature flashes. Press the button again, and P1 will appear briefly on the display. Then 2H will appear (for 2-hour booster). This function is now running. To select the 4-hour booster function, press the ⇦ button again. P1 will flash on the display. If P1 is flashing on the display, press the ⇦ button again. P2 will appear, followed briefly by 4H (for the 4-hour booster). If no further selection is made, this function will start to run.

If you wish to carry out the entered remote control programme, you can now switch to P3 in the same way as before. The symbols "." and ⧖ will appear on the control unit display either if no programme has been saved or if no programme is currently being carried out. If a temperature and other symbols are shown on the display, this means that a preset programme is currently running automatically.

If the controller is in the P3 position and a saved programme is running, the +/- buttons on the control unit can be used to change the defined temperature for the programme. The change will also be shown on the controller display. This change only applies to the current cycle, and will not be permanently adopted for the programme.

If no programme has been entered in P3, it is possible to switch between the individual P positions. However, it will not be possible to simply switch between the positions if a programme is detected - even if it is not currently running. If you wish to switch from P3 to P1 or P2 in this case, you will firstly need to press the standby button ⏻ on the controller to end the current operation, and then press the button again to go to manual mode. The P1 and P2 functions can now be selected again by pressing the ⇦ button. Press P3 to go back to automatic mode. If a programme is currently active there, this will be carried out even if there is only residual cycle time remaining.

Data input from the remote control

In order to receive data sent to the controller from the remote control, the controller must always be in position **P3** (see above). Otherwise, data will not be received and will therefore not be saved, meaning that it will not be carried out.

Starting up and using the remote control



Batteries (2 x AAA 1.5V) are not included.

General information on using the remote control

When you put the remote control into operation for the first time, please firstly enter the basic settings before entering operating programmes or additional data. The procedure is explained in detail in the following sections.

To enter programmes or other data, you do not need to be in the vicinity of the radiator with the control unit. You can make entries in the remote control from any location.

If you wish to send entered data to the control unit on the radiator, however, you will need to be close to the control unit and you will need to hold the remote control with one of the short narrow ends pointing towards the controller. There is an infra-red transmitter for remote control on both of the short narrow ends. There must not be any objects impairing the optical connection between the remote control and the controller. Once unimpaired optical connection is guaranteed, send the data to the controller by pressing the transmission button . Transmission is confirmed on the remote control display.

In order that the transmitted data can be received and saved by the controller, the controller must be in position P3. It does not matter if data has already been saved or whether a programme is currently being carried out. Once the transmission button is pressed on the remote control and the control unit is in P3 mode, the controller adopts the new entry immediately and changes any programme currently running. See also the section entitled "Working with the control unit" in this manual.

Data entry in the remote control

Basic settings (summertime/ wintertime, time, day)

Briefly press ◷ - S or W (summertime/wintertime) will flash.
+ Briefly press to select S or W, and then briefly press ◷ again to confirm the selection. You will then be taken to the time setting. The hour flashes: Use the — or + buttons to set the current time, and then press ◷ to confirm.
The minutes flash: set in the same way as the hour, and then press ◷ to confirm. The days (1-7: Monday-Sunday) are now displayed. Use the — or + buttons to select the current day, and then press ◷ to confirm.

The current settings have now been made and will be permanently shown on the display.

Operating settings (operating hours, operating temperatures, operating modes)

Briefly press ⟐ - the days 1-7 will be displayed. A cursor will flash under the 1st day of the week (Monday). If you wish to set a weekly repeating entry for this day, briefly press the + button. The cursor will flash more quickly, indicating that entries can now be made for this day. Now briefly press the ⟐ button to confirm the day for subsequent data entry. The cursor moves to the next day of the week. To select this day as well, proceed in the same way as for the first day. If you do not wish to confirm a day for data entry, you can skip it by pressing the ⟐ button again immediately after confirming the previous day. After pressing the ⟐ button for the last day of the week, the system will go to the data entry screen for the selected days. The selected days will appear on the display. "01" at the top left-hand side of the display indicates that this is the first of a maximum of 4 programmes. At the bottom part of the display, the word "Start" will appear, with a time flashing underneath, which can be adjusted to the required start time by pressing the + or – buttons. Once the time has been selected, press the ⟐ button and the word "Stop" will appear. Now enter the required end time for the programme in the same way, and press the ⟐ button again. On the top edge of the display, the symbol for the temperature of the heated towel rail ≡ is displayed on the left, and the symbol for the room temperature ⌂ on the right.

Press the — or + buttons to switch between the two symbols. The symbol shown on the display represents the selected option. Confirm the selection by pressing the ⟐ button. The selected symbol is then displayed, with the currently selected room or radiator temperature (depending on the selected symbol) flashing underneath.
Use the — or + buttons to select the desired temperature, and then press the ⟐ button to confirm. Available temperatures are 30-70°C (in 5°C increments) for the

radiator temperature, and 15-35°C (in 1°C increments) for the room temperature.

Once the desired temperature has been confirmed, the start time prompt will appear at the bottom edge of the display. A large "02" is shown as the caption, indicating the 2nd work sequence. A total of 4 different work sequences (01–04) can be set for each day.

If you do not wish to enter 4 work programmes for selected days press the ⇦ button for the last entered programme and then press the ⊃ button as soon as the new number for the next programme appears. This ends the programme entry, the word "good" appears on the display and the device switches to the standard display.

Please note that if you have selected multiple days for the aforementioned entries, all of these days will work with the same programmes. If you want to have different times or temperatures for one or more days, you will need to select these days separately, either individually or as a group.

Example:

If you want Monday, Tuesday and Wednesday to work with the same programmes... ...select these days and enter the data. If you want to specify a different entry for Friday... ...go to the data entry again, enter the required data and then confirm. If you want to specify different times for Saturday and Sunday... ...select these days and enter common programmes. In this example on Thursday should be no heating at all... ...select Thursday and make sure that not start/stop time is set.

Temporarily switching off certain work sequences and resetting

If certain work sequences are not going to be carried out for a certain period of time on individual days, e.g. due to absence, but the entire control system is not going to be switched off, e.g. due to frost protection, proceed as follows:

Press the ⇦ button on the remote control. Select the day to be deleted by pressing the ⇦ button again. Then press the + button to activate the selected day.
Then press the ⇦ button until you get to the end of the week. Programme "01" appears. Press the ◷ button to delete the entire day. The word "good" appears on the remote control display, and the entries for this day are deleted.

The entries for multiple days can also be deleted in this way by proceeding as follows when selecting the days:

Press the ⇦ button repeatedly until you reach the day you wish to delete. Activate the day by pressing the + button (flashes quickly). Press the ⇦ button again to move to the next day to be deleted, and activate by pressing the + button. Proceed in the same way for any additional days you wish to delete. Then press the ⇦ button until you get to the end of the week. Programme "01" appears on the display. Press the ◷ button; all selected days are deleted.

Other settings & data entries

Entering the maximum temperature for the radiator

The adjustable maximum temperature for the radiator is 70°C. Some applications require a lower temperature of the radiator surface, e.g. in nurseries, care homes etc. To enter a maximum temperature for the radiator, proceed as follows:

Press and hold the — button to open the input screen for the maximum temperature. The most recently set maximum temperature appears at the top of the display. Use the — or + buttons to set the desired maximum temperature, then press the ⊃ button to confirm and activate the setting. The active maximum temperature will now be displayed permanently at the top of the display. This maximum temperature cannot be exceeded by the radiator, regardless of any higher values that might have been entered in the work programmes.

If you wish to deactivate the maximum temperature control, **press and hold** the + button. The word "OFF" will appear, and there will no longer be a maximum temperature shown on the standard display.

Deleting entries during data collection

If you make a mistake when entering the day, time, temperature etc., the entry can be cancelled by briefly pressing the ⊃ button. The display will then return to the last step.

Delay in entering data

If no data is entered for 10 seconds, the system will return to the previous menu.

Simple switching between summer and wintertime

Press and hold the ⊃ button. Each time the button is pressed, the S – W – S information changes. When the required time is displayed, there is no need to press a button to confirm. All times are adjusted automatically.

Displaying all saved programmes

Briefly pressing the 👁 button gradually brings up on the display all saved programmes that have been sent to the control unit or that are ready to be sent by pressing the transmission button. Once data has been entered, all entries can also be checked here. If you are not sure if you have already sent all entries to the controller just send them again. Watch the prescribed correct procedures.

For more advanced settings refer to the user manual

Appendix C – EPC Certificate

Energy performance certificate (EPC)

Flat 1 Dispensary Mansions 80 Old Mill Street MANCHESTER M4 6ND	Energy rating **C**	Valid until: **10 January 2034** Certificate number: **9496-3033-7309-5044-3204**

Property type	Ground-floor flat
Total floor area	84 square metres

Rules on letting this property

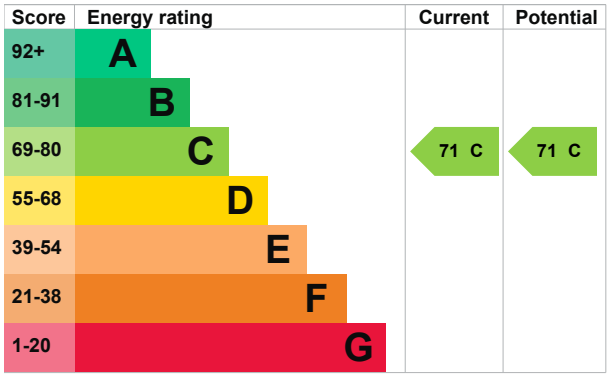
Properties can be let if they have an energy rating from A to E.

You can read guidance for landlords on the regulations and exemptions (https://www.gov.uk/guidance/domestic-private-rented-property-minimum-energy-efficiency-standard-landlord-guidance).

Energy rating and score

This property's energy rating is C. It has the potential to be C.

See how to improve this property's energy efficiency.



The graph shows this property's current and potential energy rating.

Properties get a rating from A (best) to G (worst) and a score. The better the rating and score, the lower your energy bills are likely to be.

For properties in England and Wales:

the average energy rating is D
the average energy score is 60

Breakdown of property’s energy performance

Features in this property

Features get a rating from very good to very poor, based on how energy efficient they are. Ratings are not based on how well features work or their condition.

Assumed ratings are based on the property's age and type. They are used for features the assessor could not inspect.

Feature	Description	Rating
Walls	Average thermal transmittance 0.25 W/m²K	Very good
Floor	Average thermal transmittance 0.30 W/m²K	Good
Windows	High performance glazing	Very good
Main heating	Room heaters, electric	Very poor
Main heating control	Programmer and appliance thermostats	Good
Hot water	Electric immersion, standard tariff, waste water heat recovery	Poor
Lighting	Low energy lighting in all fixed outlets	Very good
Air tightness	Air permeability 6.4 m³/h.m² (as tested)	Good
Roof	(other premises above)	N/A
Secondary heating	None	N/A

Primary energy use

The primary energy use for this property per year is 167 kilowatt hours per square metre (kWh/m2).

How this affects your energy bills

An average household would need to spend **£1,413 per year on heating, hot water and lighting** in this property. These costs usually make up the majority of your energy bills.

You could **save £0 per year** if you complete the suggested steps for improving this property’s energy rating.

This is **based on average costs in 2024** when this EPC was created. People living at the property may use different amounts of energy for heating, hot water and lighting.

Heating this property

Estimated energy needed in this property is:

- 2,690 kWh per year for heating
- 1,690 kWh per year for hot water

Impact on the environment

This property's environmental impact rating is C. It has the potential to be C.

Properties get a rating from A (best) to G (worst) on how much carbon dioxide (CO2) they produce each year.

Carbon emissions

An average household produces	6 tonnes of CO2
This property produces	2.4 tonnes of CO2
This property's potential production	2.4 tonnes of CO2

You could improve this property's CO2 emissions by making the suggested changes. This will help to protect the environment.

These ratings are based on assumptions about average occupancy and energy use. People living at the property may use different amounts of energy.

Changes you could make

The assessor did not make any recommendations for this property.

Help paying for energy improvements

You might be able to get a grant from the Boiler Upgrade Scheme (https://www.gov.uk/apply-boiler-upgrade-scheme). This will help you buy a more efficient, low carbon heating system for this property.

More ways to save energy

Find ways to save energy in your home by visiting www.gov.uk/improve-energy-efficiency.

Who to contact about this certificate

Contacting the assessor

If you're unhappy about your property's energy assessment or certificate, you can complain to the assessor who created it.

Assessor's name	Adam Lindley
Telephone	01617060298
Email	office@completesustainability.co.uk

Contacting the accreditation scheme

If you're still unhappy after contacting the assessor, you should contact the assessor's accreditation scheme.

Accreditation scheme	Elmhurst Energy Systems Ltd
Assessor's ID	EES/022683
Telephone	01455 883 250
Email	enquiries@elmhurstenergy.co.uk

About this assessment

Assessor's declaration	No related party
Date of assessment	11 January 2024
Date of certificate	11 January 2024
Type of assessment	SAP

Appendix D – Electrical Test Certificate

ELECTRICAL INSTALLATION CERTIFICATE
Requirements For Electrical Installations - BS 7671

WEST LANCASHIRE GROUP
Electrical • Mechanical • ELV • Facilities Maintenance

Certificate Number:	WLG-225-01

1. DETAILS OF THE CLIENT

Client:	Eric Wright Group
Address:	Sceptre House, Sceptre Way , Bamber Bridge, Preston, PR5 6AW

2. DETAILS AND EXTENT OF THE INSTALLATION

Installation Address:	Apartment 1, Dispensary, Old Mill Street, Ancoats , Greater Manchester, M4 6EB
Extent of the installation covered by this certificate:	As Schedules Attached

The installation is:	New installation	✓	Addition to an existing installation	N/A	Alteration to an existing installation	N/A

3. COMMENTS ON EXISTING INSTALLATION

Comments on existing installation (In the case of an addition or alteration see Regulation 644.1.2):

N/A

4. NEXT INSPECTION

I RECOMMEND that this installation is further inspected and tested after an interval of not more than: 10 Years

5. DESIGN, CONSTRUCTION, INSPECTION AND TESTING

I/We being the person(s) responsible for the design, construction, inspection and testing of the electrical installation (as indicated by my/our signatures below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design, construction, inspection and testing, hereby CERTIFY that the design work for which I/we have been reponsible is to the best of my/our knowledge and belief in accordance with BS 7671:2018, amended to 2022 except for the departures, if any, detailed as follows.

Details of departures from BS 7671, as amended (Regulations 120.3, 133.5):

None

Details of permitted exceptions (Regulations 411.3.3): Risk assessment attached: N/A

N/A

The extent of liability of the signatory/signatories is limited to the work described above as the subject of this certificate.

For the DESIGN, the CONSTRUCTION, and the INSPECTION AND TESTING of the installation:

Name:	Ben Smith	Position:	Contracts Manager	Signature:		Date:	15/11/2023

Report reviewed and confirmed by:

Name:	Dave Millard	Position:	Qualified Supervisor	Signature:		Date:	15/11/2023

6. DETAILS OF THE ELECTRICAL CONTRACTOR

Trading Title:	West Lancs Group
Address:	West Lancs House Wyrefields, Poulton-Le-Fylde Lancashire Postcode: FY6 8JX
Registration Number (if applicable):	603587
Telephone Number:	01253 884501

7. SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS

Earthing Arrangements

TN-S:	N/A
TN-C-S:	✓
TT:	N/A

Number and Type of Live Conductors

1-phase (2-wire):	✓	2-phase (3-wire):	N/A
3-phase (3-wire):	N/A	3-phase (4-wire):	N/A
Other:	N/A		
Confirmation of supply polarity:	✓		

Nature of Supply Parameters

Nominal voltage, U/Uo:	230 V
Nominal frequency, f:	50 Hz
Prospective fault current, Ipf:	1.55 kA
External earth fault loop impedance, Ze:	0.15 Ω

Supply Protective Device

BS (EN):	88-2
Type:	gG
Rated current:	80 A

8. PARTICULARS OF INSTALLATION REFERRED TO IN THE REPORT

Means of Earthing

Distributor's facility:	✓
Installation earth electrode:	N/A

Details of Installation Earth Electrode (where applicable)

Type:	N/A	Location:	N/A
Resistance to Earth:	N/A Ω	Method of measurement:	N/A

Maximum Demand (Load): 80 Amps

Main Switch / Switch-Fuse / Circuit-Breaker / RCD

Location:	Electrical Switchroom	BS (EN):	BS EN 60947-3 Isolator	Number of poles:	2
Current rating:	100 A	Fuse/device rating or setting:	100 A	Voltage rating:	240 V

If RCD main switch:

RCD Type:	N/A	Rated residual operating current ($I_{\Delta n}$):	N/A mA	Rated time delay:	N/A ms	Measured operating time:	N/A ms

Earthing and Protective Bonding Conductors

Earthing conductor

Conductor material:	Copper	csa:	16 mm^2	Connection/ continuity verified:	✓

Main protective bonding conductors

Conductor material:	N/A	csa:	N/A mm^2	Connection/ continuity verified:	N/A

Bonding of extraneous-conductive parts

To water installation pipes:	N/A	To gas installation pipes:	N/A
To oil installation pipes:	N/A	To lightning protection:	N/A
To structural steel:	N/A	To other service(s):	N/A

9. SCHEDULE OF INSPECTIONS

Item No	Description	Outcome
1.0	Condition of consumer's intake equipment (visual inspection only)	Pass
2.0	Parallel or switched alternative sources of supply	N/A
3.0	Protective measure: Automatic disconnection of supply	Pass
4.0	Basic protection	Pass
5.0	Protective measures other than ADS	N/A
6.0	Additional protection	Pass
7.0	Distribution equipment	Pass
8.0	Circuits (Distribution and Final)	Pass
9.0	Isolation and switching	Pass
10.0	Current-using equipment (permanently connected)	Pass
11.0	Identification and notices	Pass
12.0	Location(s) containing a bath or shower	Pass
13.0	Other special installations or locations	N/A
14.0	Prosumer's low voltage electrical installation(s)	N/A

All boxes must be completed. 'Pass' indicates that an inspection or test was carried out and that the result was satisfactory. 'Fail' indicates than an inspection or test was carried out and the result is not satisfactory. 'N/A' indicates that an inspection or test was not applicable to the particular installation. 'LIM' indicates that, exceptionally, a limitation agreed with the person ordering the work prevented the inspection or test being carried out.

DISTRIBUTION BOARD DETAILS

DB reference:	Origin Isolator	Location:	Electrical Switchroom	Supplied from:	Origin		
Distribution circuit OCPD: BS (EN):	88-2	Type:	gG	Rating/Setting:	80 A	No of phases:	1
SPD Details: Types:	T1 N/A	T2 N/A	T3 N/A	N/A N/A	Status indicator checked (where functionality indicator present)	N/A	
Confirmation of supply polarity	✓	Confirmation of phase sequence	N/A	Zs at DB:	0.15 Ω	Ipf at DB:	1.55 kA

SCHEDULE OF CIRCUIT DETAILS AND TEST RESULTS

CIRCUIT DETAILS																TEST RESULT DETAILS														
		Conductor details						Overcurrent protective device					RCD				Continuity (Ω)					Insulation resistance				Zs	RCD		AFDD
					Number and size												Ring final circuit			R_1+R_2 or R_2										
Circuit number	Circuit description	Type of wiring	Reference method	Number of points served	Live (mm^2)	cpc (mm^2)	Max disconnect time permitted by BS7671 (s)	BS (EN)	Type	Rating (A)	Breaking capacity (kA)	Maximum permitted Zs (Ω)	BS (EN)	Type	Rated operating current (mA)	Rating (A)	r_1 (line)	r_n (neutral)	r_2 (cpc)	R_1+R_2	R_2	Test voltage (V)	Live - Live (MΩ)	Live - Earth (MΩ)	Polarity (tick)	Maximum measured (Ω)	Disconnection time (ms)	Test button operation (tick)	Manual test button operation (tick)
1	Sub Main (Supply to DB 1)	G	E	1	16	16	5	88-2	gG	80	5	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.06	N/A	500	> 200	> 200	✓	0.22	N/A	N/A	N/A

CODES FOR TYPE OF WIRING	A Thermoplastic insulated/sheathed cables	B Thermoplastic cables in metallic conduit	C Thermoplastic cables in nonmetallic conduit	D Thermoplastic cables in metallic trunking	E Thermoplastic cables in nonmetallic trunking	F Thermoplastic /SWA cables	G Thermosetting /SWA cables	H Mineral insulated cables	O - Other
									N/A

DETAILS OF TEST INSTRUMENTS

Details of test instruments used (serial and/or asset numbers):

Multi-functional:	101906744	Insulation resistance:	N/A	Continuity:	N/A
Earth electrode resistance:	N/A	Earth fault loop impedance:	N/A	RCD:	N/A

TESTED BY

Name:	Daniel Lyons	Position:	Test Electrician	Signature:	D.R.L	Date:	15/11/2023

DISTRIBUTION BOARD DETAILS

DB reference:	DB 1	Location:	Utility Cupboard	Supplied from:	Origin Isolator - 1		
Distribution circuit OCPD: BS (EN):	88-2	Type:	gG	Rating/Setting:	80 A	No of phases:	1
SPD Details: Types: T1	N/A	T2	✓	T3	N/A	N/A	N/A
Status indicator checked (where functionality indicator present)	✓						
Confirmation of supply polarity	✓	Confirmation of phase sequence	N/A	Zs at DB:	0.22 Ω	Ipf at DB:	1.07 kA

SCHEDULE OF CIRCUIT DETAILS AND TEST RESULTS

CIRCUIT DETAILS																	TEST RESULT DETAILS																
		Conductor details						Overcurrent protective device					RCD				Continuity (Ω)					Insulation resistance				Zs	RCD		AFDD				
					Number and size												Ring final circuit			R_1+R_2 or R_2												
Circuit number	Circuit description	Type of wiring	Reference method	Number of points served	Live (mm^2)	cpc (mm^2)	Max disconnect time permitted by BS7671 (s)	BS (EN)	Type	Rating (A)	Breaking capacity (kA)	Maximum permitted Zs (Ω)	BS (EN)	Type	Rated operating current (mA)	Rating (A)	r_1 (line)	r_n (neutral)	r_2 (cpc)	R_1+R_2	R_2	Test voltage (V)	Live - Live (MΩ)	Live - Earth (MΩ)	Polarity (tick)	Maximum measured (Ω)	Disconnection time (ms)	Test button operation (tick)	Manual test button operation (tick)				
1	Lights Ground Floor,Bathroom & Utility	A	C	6	1.5	1.0	0.4	60898	C	6	10	3.64	61008	A	30	100	N/A	N/A	N/A	0.99	N/A	500	> 200	> 200	✓	1.21	124	✓	N/A				
2	General Sockets & Media	A	C	10	2.5	1.5	0.4	60898	B	32	10	1.37	61008	A	30	100	0.86	0.86	0.33	0.40	N/A	500	> 200	> 200	✓	0.27	124	✓	✓				
3	Cooker	A	C	1	6	2.5	0.4	60898	C	32	10	0.68	61008	A	30	100	N/A	N/A	N/A	0.16	N/A	500	> 200	> 200	✓	0.46	124	✓	N/A				
4	Immersion 1	A	C	1	2.5	1.5	0.4	60898	C	20	10	1.09	61008	A	30	100	N/A	N/A	N/A	0.10	N/A	500	> 200	> 200	✓	0.41	124	✓	N/A				
5	Smoke Detectors	A	C	6	1.5	1.0	0.4	60898	C	10	10	2.19	61008	A	30	100	N/A	N/A	N/A	1.00	N/A	500	> 200	> 200	✓	1.02	124	✓	N/A				
6	RCD Module																																
7	RCD Module																																
8	Lights First Floor,Stairs & Shaver Skt	A	C	7	1.5	1.0	0.4	60898	C	6	10	3.64	61008	A	30	100	N/A	N/A	N/A	1.02	N/A	500	> 200	> 200	✓	1.52	134	✓	N/A				
9	Kitchen & Utility Power	A	C	7	2.5	1.5	0.4	60898	B	32	10	1.37	61008	A	30	100	0.27	0.27	0.27	0.27	N/A	500	> 200	> 200	✓	0.29	134	✓	✓				
10	Immersion 2 Via Timeclock	A	C	2	2.5	1.5	0.4	60898	C	20	10	1.09	61008	A	30	100	N/A	N/A	N/A	0.12	N/A	500	> 200	> 200	✓	0.49	134	✓	N/A				

CODES FOR TYPE OF WIRING	A	B	C	D	E	F	G	H	O - Other
	Thermoplastic insulated/sheathed cables	Thermoplastic cables in metallic conduit	Thermoplastic cables in nonmetallic conduit	Thermoplastic cables in metallic trunking	Thermoplastic cables in nonmetallic trunking	Thermoplastic /SWA cables	Thermosetting /SWA cables	Mineral insulated cables	N/A

DETAILS OF TEST INSTRUMENTS

Details of test instruments used (serial and/or asset numbers):

Multi-functional:	101906744	Insulation resistance:	N/A	Continuity:	N/A
Earth electrode resistance:	N/A	Earth fault loop impedance:	N/A	RCD:	N/A

TESTED BY

Name:	Daniel Lyons	Position:	Test Electrician	Signature:	D.R.L	Date:	15/11/2023

SCHEDULE OF CIRCUIT DETAILS AND TEST RESULTS

DB reference: **DB 1** Location: Utility Cupboard Supplied from: Origin Isolator - 1

CIRCUIT DETAILS																	TEST RESULT DETAILS														
		Conductor details						Overcurrent protective device					RCD				Continuity (Ω)					Insulation resistance				Zs	RCD		AFDD
					Number and size												Ring final circuit			R_1+R_2 or R_2										
Circuit number	Circuit description	Type of wiring	Reference method	Number of points served	Live (mm²)	cpc (mm²)	Max disconnect time permitted by BS7671 (s)	BS (EN)	Type	Rating (A)	Breaking capacity (kA)	Maximum permitted Zs (Ω)	BS (EN)	Type	Rated operating current (mA)	Rating (A)	r_1 (line)	r_n (neutral)	r_2 (cpc)	R_1+R_2	R_2	Test voltage (V)	Live - Live (MΩ)	Live - Earth (MΩ)	Polarity (tick)	Maximum measured (Ω)	Disconnection time (ms)	Test button operation (tick)	Manual test button operation (tick)
11	Heating Ring & Water Saver	A	C	6	2.5	1.5	0.4	60898	B	32	10	1.37	61008	A	30	100	0.54	0.54	0.57	0.46	N/A	500	> 200	> 200	✓	0.56	134	✓	N/A
12	Spare	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

CODES FOR TYPE OF WIRING	A	B	C	D	E	F	G	H	O - Other
	Thermoplastic insulated/sheathed cables	Thermoplastic cables in metallic conduit	Thermoplastic cables in nonmetallic conduit	Thermoplastic cables in metallic trunking	Thermoplastic cables in nonmetallic trunking	Thermoplastic /SWA cables	Thermosetting /SWA cables	Mineral insulated cables	N/A

ELECTRICAL INSTALLATION CERTIFICATE
GUIDANCE FOR RECIPIENTS

(to be appended to the Certificate)

This safety Certificate has been issued to confirm that the electrical installation work to which it relates has been designed, constructed and inspected and tested in accordance with BS 7671.

You should have received an 'original' Certificate and the person that issued the certificate should have retained a duplicate. If you were the person ordering the work, but not the owner of the installation, you should pass this Certificate, or a full copy of it including the schedules, immediately to the owner.

The 'original' Certificate should be retained in a safe place and be shown to any person inspecting or undertaking further work on the electrical installation in the future. If you later vacate the property, this Certificate will demonstrate to the new owner that the electrical installation complied with the requirements of BS 7671 at the time the Certificate was issued. The Construction (Design and Management) Regulations require that for a project covered by those Regulations, a copy of this Certificate, together with schedules is included in the project health and safety documentation.

For safety reasons, the electrical installation will need to be inspected at appropriate intervals by a skilled person or persons, competent in such work. The maximum time interval recommended before the next inspection is stated on Page 1 under 'NEXT INSPECTION'.

This Certificate is intended to be issued only for a new electrical installation or for new work associated with an alteration or addition to an existing installation. It should not have been issued for a periodic inspection of an existing electrical installation. An 'Electrical Installation Condition Report' should be issued for such an inspection.

This certificate is only valid if accompanied by the Schedule(s) of Inspections and the Schedule(s) of Test Results.

Where the installation includes a residual current device (RCD) it should be tested six-monthly by pressing the button marked 'T' or Test. The device should switch off the supply and should then be switched on to restore the supply. If the device does not switch off the supply when the button is pressed, seek expert advice. For safety reasons it is important that this instruction is followed.

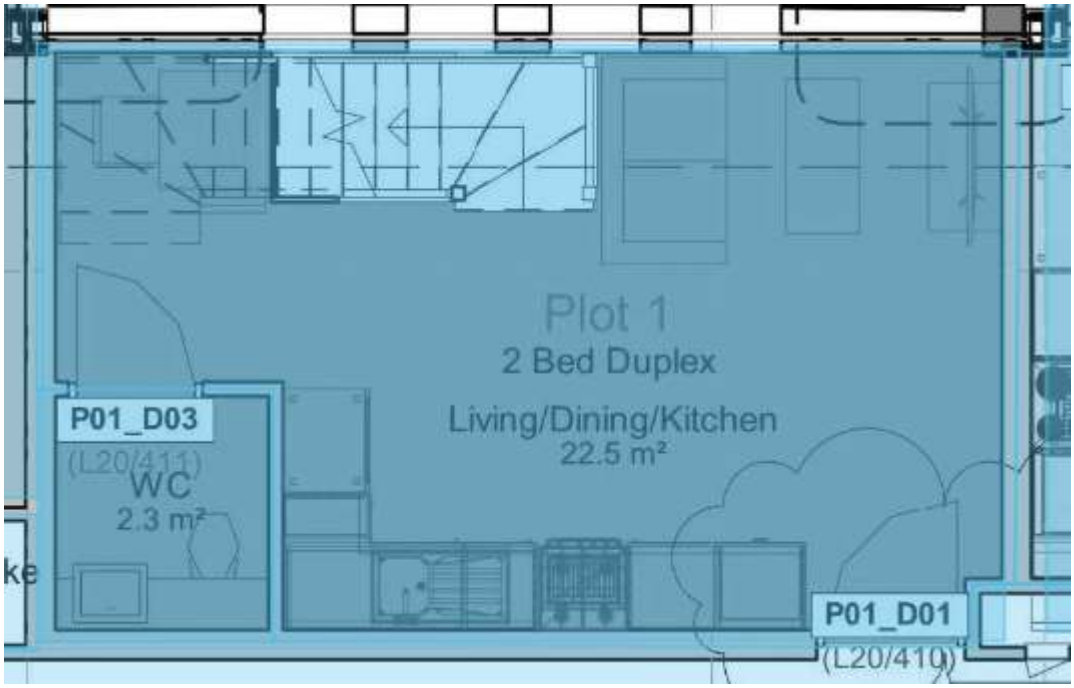
Where the installation includes an arc fault detection device (AFDD) having a manual test facility it should be tested six-monthly by pressing the test button. Where an AFDD has both a test button and automatic test function, manufacturer's instructions shall be followed with respect to test button operation.

Where the installation includes a surge protective device (SFD) the status indicator should be checked to confirm it is in operational condition in accordance with manufacturer's information. If the indication shows that the device is not operational, seek expert advice. For safety reasons it is important that this instruction is followed.

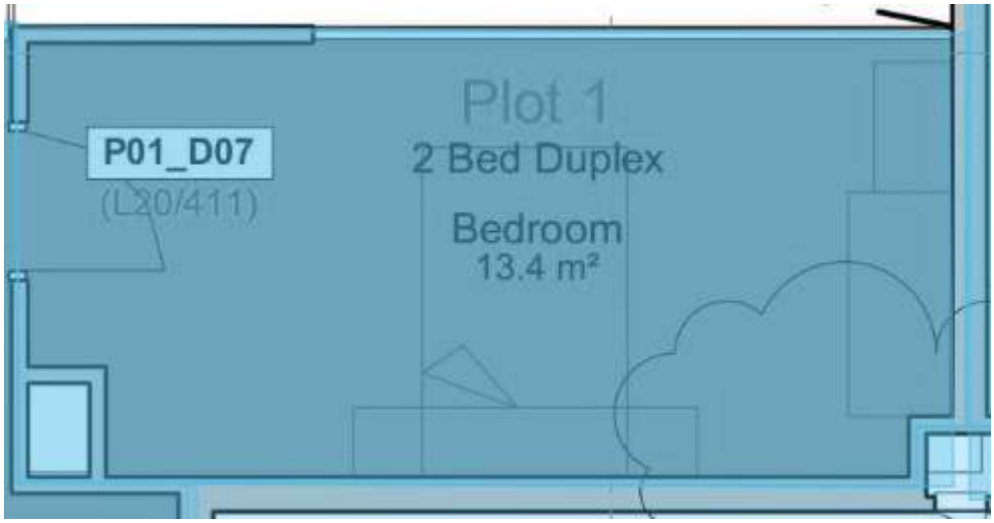
Where the installation includes alternative or additional sources of supply, warning notices should be found at the origin or meter position or, if remote from the origin, at the consumer unit or distribution board and at all points of isolation of all sources of supply.

Appendix E - Floor Plan

Flat 1 – Ground Floor Plan



Flat 1 – 1st Floor Plan



6.4. Appendix D – MVHR Units Specification

Lo-Carbon Sentinel Kinetic Plus

- Acoustic Enclosure option for reduced breakout noise
- Acoustic Top Box option for reduced in-duct noise
- Recognised in SAP PCDB
- Horizontal duct option for space-saving installations
- High airflow, ideal for student accommodation clusters
- Unique folding filter for removal when access is restricted
- Integrated digital controller for simple and accurate commissioning
- Lightweight for easy installation
- Plug and play controls; Humidistat, Wireless Remote
- BMS connectivity
- LS inputs (Light Switch)
- Volt-free inputs
- Self diagnosis for simplified fault finding
- Adjustable delay On/delay Off timer



Increased Performance

The Sentinel Kinetic Plus benefits from the latest high efficiency, backward curved impeller design, ensuring the lowest possible energy consumption, ultra quiet operation and an exceptional performance range covering small one bed apartments to the largest of houses.

For scenarios where noise is a critical issue, an Acoustic Enclosure is available to reduce breakout noise and the Acoustic Top Box will reduce in-duct noise at key frequencies.

Care Homes & Student Accommodation

The Sentinel Kinetic Plus is ideal for larger homes and multiple occupancy units such as care homes and student accommodation. Capable of 400m^3/hr at 150Pa, the unit can extract from up to ten bathrooms and a communal kitchen while still achieving almost 90% heat recovery. The fully automatic capability of the Kinetic range means that adequate ventilation is always achieved.

The Kinetic's BMS capability is also ideal for those commercial applications where landlords or property managers want to monitor and optimise building performance and maintenance. The Kinetic BMS can provide status information and its self diagnostics can report if any fault is found.

Spigot Options

Spigots may be re-positioned to give horizontal connection or a combination of vertical and horizontal connection.

Optional 180mm/200mm spigots can simplify connection in commercial installations where larger diameter duct work has been used.

Quick Change Filter

As many systems are placed within cupboards the unique filter design folds as you remove it to ensure easy access in restricted spaces.

Integral Humidity Sensor

The integral humidity sensor increases speed in proportion to relative humidity levels, saving energy and reducing noise. The sensor also reacts to small but rapid increases in humidity, even if the normal trigger threshold is not reached. This unique feature ensures adequate ventilation, even for the smallest wet room. The night time relative humidity setback feature suppresses nuisance tripping as humidity gradually increases with falling temperature.

Models

Model	Stock Ref
Sentinel Kinetic Plus Right	443028
Sentinel Kinetic Plus Right with Acoustic Top Box & Enclosure	479538
Sentinel Kinetic Plus Right with Acoustic Top Box	479537
Sentinel Kinetic Plus Right with Acoustic Enclosure	479536
Sentinel Kinetic Plus Left	443028L
Sentinel Kinetic Plus Left with Acoustic Top Box & Enclosure	479541
Sentinel Kinetic Plus Left with Acoustic Top Box	479540
Sentinel Kinetic Plus Left with Acoustic Enclosure	479539

Accessories

Model	Stock Ref
Wired Remote Controller	443283
Wireless Enable Kit	441865
Wireless Transmitter Controller	437827
LED Alarm with 15m cable	448356
Opto-coupler for volt-free bms connection	447340
ISO 45% Coarse (G3) Filter 2pk	443351
ISO ePM10 50% (M5) Filter 2pk	444201
180mm/200mm Spigot Kit (One per pack)	446523
Anti Vibration Mounts	68MP033G
Acoustic Purge Fan	477988
Acoustic Purge Fan XL	479829

SAP PCDB Test Results

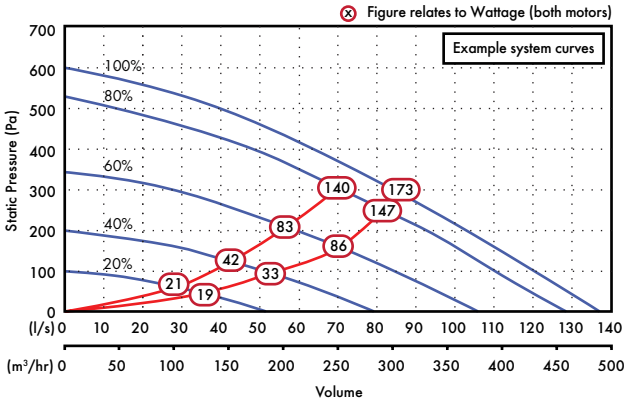
	SAP 2009		SAP 2012	
	Thermal Efficiency %	SFP (W/l/s)	Thermal Efficiency %	SFP (W/l/s)
K+1	91	0.51	91	0.42
K+2	91	0.40	91	0.44
K+3	90	0.41	90	0.52
K+4	90	0.45	90	0.63
K+5	90	0.53	90	0.76
K+6	90	0.60	91	0.90
K+7	90	0.70	91	1.05

SEC Class

Model	SEC Class
Kinetic Plus B	A+

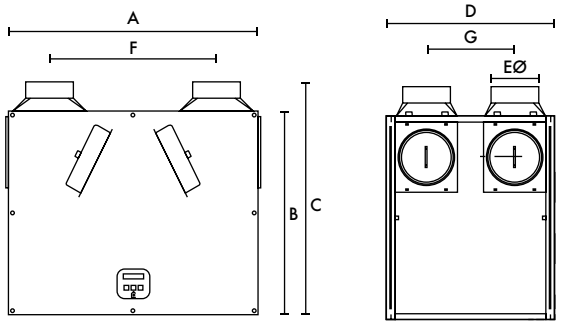
Performance

Fan speeds are fully adjustable within the performance range.



Dimensions (mm)

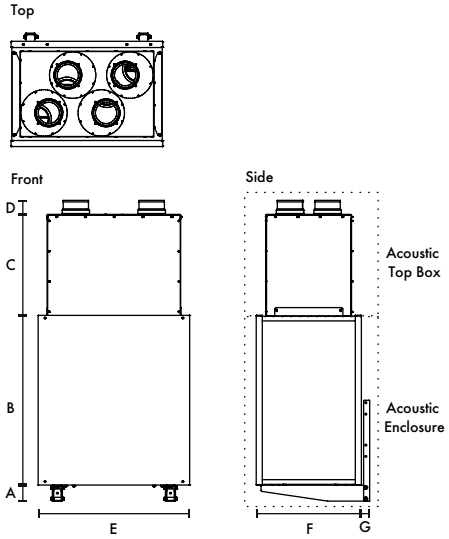
Unit



A	B	C	D	EØ	F	G
785	635	722	550	150	520	275

Weight: 24kg

Acoustic Solution



A	B	C	D	E	F	G	Acoustic Top Box kg	Acoustic Enclosure kg	Spigot
80	750	501	71	844	583	40	17	33	150

Sound Data (Unit only)

Unit setting	Test mode	Octave band, Hz, dB SWL 63	125	250	500	1k	2k	4k	8k	LwA	SPL dB(A) at 3m
20%	Supply	54.4	60.9	50.6	45.9	34.3	23.6	19.1	24.5	51.3	30.8
	Extract	48.4	56.7	43.7	35.9	21.4	16	18.7	24.5	42.3	24.8
	Breakout	42.6	40.2	39.6	38	31.1	24.3	19.4	24.6	35.1	17.6
40%	Supply	61.6	64.6	58.4	55.5	45.9	37.2	24.7	25.1	58.8	38.3
	Extract	54.9	62.2	51.5	44.8	32.1	24.1	19.7	24.6	48.8	31.3
	Breakout	51.1	49.3	48.9	45.9	41.3	35.7	26.7	25.6	44.0	26.5
60%	Supply	67.5	67.5	73.2	62.4	53.4	47.5	33.5	28.3	69.2	48.7
	Extract	62.5	61.7	60.1	51.1	39.2	32.1	23.2	24.8	54.0	36.5
	Breakout	54.9	53	58.4	55.1	49.7	43.9	35.4	31.9	52.8	35.3
80%	Supply	70.5	71.1	73.8	66.5	58.3	53.2	39.7	33.3	71.3	50.8
	Extract	68.4	65.9	71.8	55.6	43.6	37.1	27.3	25.5	63.8	46.3
	Breakout	59.2	56.8	63.6	57.3	54.2	49	41	37.5	56.8	39.3
100%	Supply	72.8	73.1	75.2	70.4	61.6	56.6	44.2	37.6	73.9	53.4
	Extract	71.7	69	71.8	57.4	45.7	39.9	30.9	26.6	64.1	46.6
	Breakout	61.2	58.8	67.9	59.6	56.7	52.2	44.4	41.2	60.1	42.6

Sound Data (Unit with Acoustic Solution)

Unit setting	Test mode	Octave band, Hz, dB SWL 63	125	250	500	1k	2k	4k	8k	LwA	SPL dB(A) at 3m
20%	Supply	55.7	49.2	36.6	23.6	17.4	14.9	17.8	23.3	36.1	18.6
	Extract	51.4	42.4	30.3	20.9	16.8	14.9	17.8	23.3	30.8	13.3
	Breakout	37.4	39.7	30.0	22.7	15.6	14.0	17.9	23.3	28.4	7.9
40%	Supply	59.7	59.7	45.5	32.2	22.2	15.2	17.9	23.3	45.1	27.6
	Extract	54.8	55.0	38.0	26.8	18.1	14.9	17.8	23.3	40.2	22.7
	Breakout	45.7	48.5	39.9	32.8	24.2	17.5	18.0	23.4	36.8	16.3
60%	Supply	66.1	61.9	53.6	41.0	29.8	18.3	18.0	23.3	49.5	32.0
	Extract	60.6	55.9	48.4	34.9	23.8	16.3	17.9	23.3	43.8	26.3
	Breakout	51.1	51.0	52.4	40.9	33.2	26.1	19.7	23.4	44.5	24.0
80%	Supply	70.0	67.6	68.5	48.1	37.9	25.3	19.4	23.6	60.7	43.2
	Extract	65.4	59.7	57.2	41.6	31.3	21.8	19.2	23.4	50.4	32.9
	Breakout	55.6	55.6	57.9	47.9	40.4	34.3	26.1	23.7	51.3	30.8
100%	Supply	72.1	70.1	66.4	51.6	41.9	29.7	21.7	24.0	60.0	42.5
	Extract	68.2	62.4	60.6	45.5	36.0	26.6	21.7	23.6	53.8	36.3
	Breakout	57.6	58.8	63.3	51.0	44.2	38.5	31.0	24.9	56.3	35.8

Tested according to BS EN 13141-7:2010. Breakout quoted spherical. Supply and Extract quoted hemispherical. For in-duct data, end reflections are added based on the spigot size of the unit.

Vent-Axia

Consultant's Specification

Operation

The supply and extract ventilation unit shall be as Sentinel Kinetic Plus as manufactured by Vent-Axia and shall be sized as indicated on the drawings and shall be in accordance with the particular specification.

Supply air to the room shall be pre-heated by the extract air via the integrated composite plastic counterflow heat recovery cell. The Sentinel Kinetic Plus shall automatically vary the ventilation rate via EC/DC motors, as it receives signals from one of the optional interconnected sensors.

When a signal is received, the fans shall either vary their speed proportionally or on a trickle and boost principle.

The unit shall have the facility to commission the supply and extract fans individually via in-built minimum and maximum speed adjustment, or alternative wired remote control unit. The fans themselves shall have independent, infinitely variable speed control.

Unit Specification

The unit shall be manufactured with an ABS outer case construction, and incorporate a reversible core to allow for left or right hand mounting.

The unit shall have a high efficiency composite plastic counterflow heat exchanger, supply and extract filters, automatic summer bypass, integral minimum and maximum infinitely variable speed controls with facia mounted failure indication.

The unit shall have low energy, high efficiency EC/DC fan/motor assemblies with sealed for life bearings. The impellers shall be high efficiency backward curved centrifugal type.

The unit shall have a heat exchanger cell with a thermal efficiency of up to 92% when tested to EN 308. This shall be protected by ISO 45% Coarse (G3) grade synthetic filters on supply and extract. Complete with a condensate drip tray and drain connection.

To reduce breakout noise, the MVHR unit shall be provided with an Acoustic Enclosure of steel construction lined with class '0' acoustic foam. To reduce in-duct noise, the top of the MVHR shall be fitted with an Acoustic Top Box to provide attenuation to the 4 ducts of the unit. This Acoustic Top Box shall be of steel construction lined with acoustic class '0' foam with the MVHR spigots linked to the Top Box via 4 separate attenuated ducts. The acoustic enclosure and top box shall each be independently tested for noise to BS EN 13141-*7*.

The unit shall be constructed with a removable Core allowing full maintenance access. The removable Core shall provide access to the following:

- ✓ Supply and extract filter
- ✓ Heat exchanger
- ✓ Access to the electrical connections

Access shall be provided for wiring termination and setup/commissioning. The backlit LCD user interface therein may be duplicated for remote mounting if required. Units shall be as manufactured by Vent-Axia Ltd.

Sound tested to BS EN 13141-*7*:2010

Standard Controls

All Sentinel Kinetic units shall incorporate the following functions integrally mounted, pre-wired and factory fitted by the manufacturer:

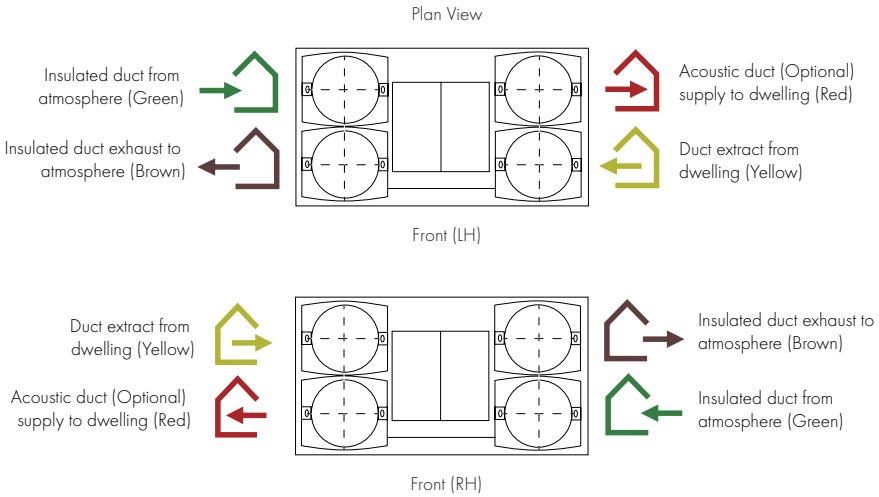
- ✓ Integral infinitely variable fan speed control on supply and extract
- ✓ Integral min/max ventilation control/set point
- ✓ Integral BMS input/output interfaces – control and status indication
- ✓ Heating interlocks
- ✓ 0-10V proportional speed adjustment
- ✓ Volt free contacts
- ✓ 24V sensor supply
- ✓ Integral on/off or trickle boost function from remote switch, e.g. PIR occupancy detector
- ✓ Fully automatic summer bypass
- ✓ Switched Live input with adjustable 'delay-on' feature
- ✓ Fan failure or component failure indicated via individual fault code display
- ✓ Running time counter
- ✓ Control panel PIN number lock
- ✓ Automatic frost protection effective to -20°C
- ✓ The unit shall incorporate an integral humidity sensor with the following features:
  - Ambient Response; Raises the humidity trigger point as dwelling temperature reduces
  - Rapid Response: Monitors the rate of change in humidity and triggers increased airflow even if the humidity trigger threshold is not reached
  - Proportional Response; Incrementally increases the fan speed to reduce noise and reduce energy consumption
- ✓ The unit shall be controlled by the 'Sentinel' control devices (enablers and sensors) as detailed in the schedule or on the drawings.
- ✓ Tool free filter access

Mounting Option



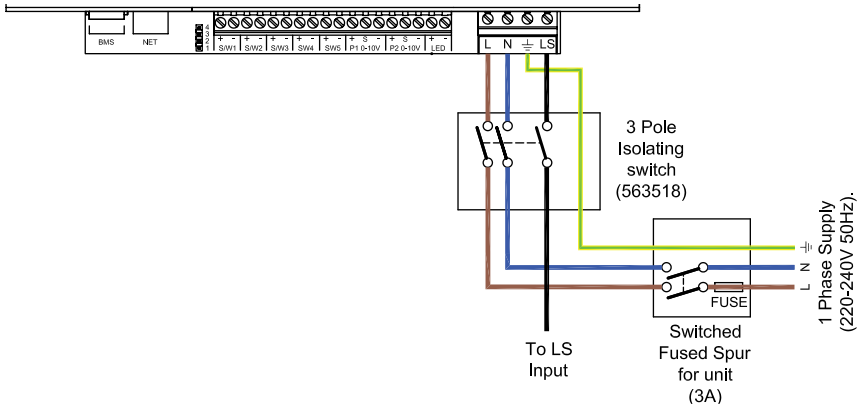
Wall Surface

Airflow Direction

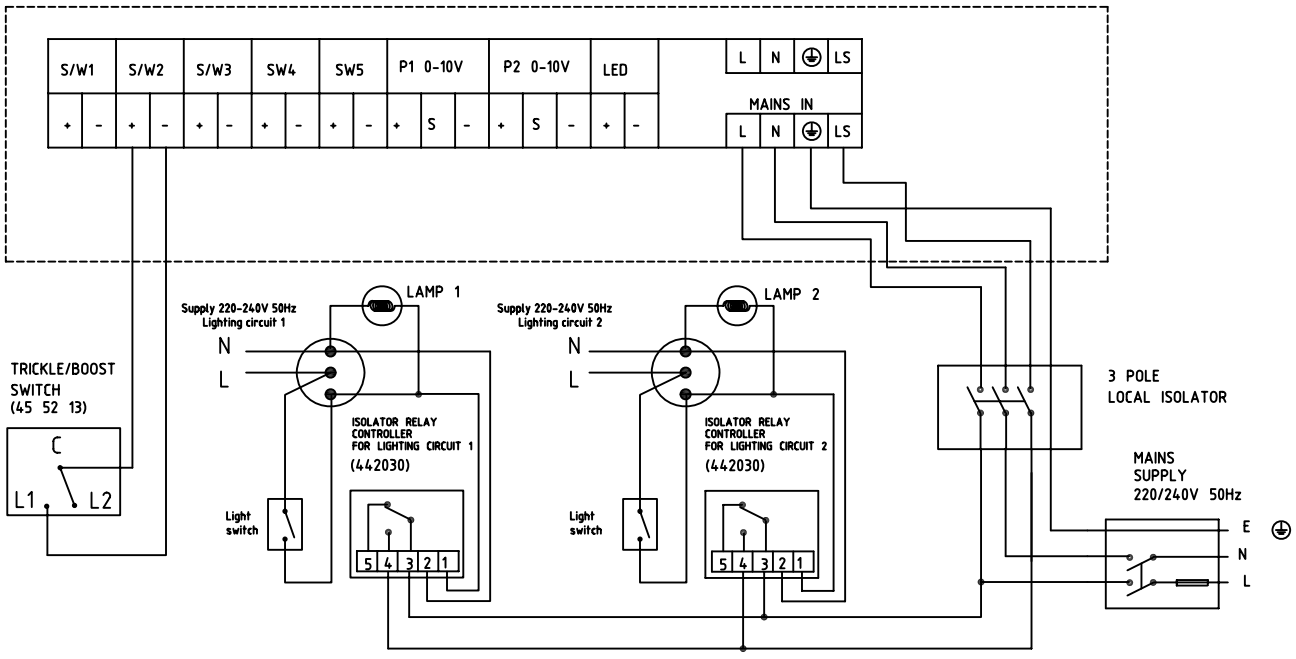


Electrical Connection

Please note: Electrical connection should be carried out by an appropriately qualified person and in accordance with current wiring regulations.



Trickle to Boost by two lighting circuits or Trickle/Boost Switch



Vent-Axia

Lo-Carbon Sentinel Kinetic FH

- Acoustic Enclosure option for reduced breakout noise
- Acoustic Top Box option for reduced in-duct noise
- Lightweight for easier installation
- Horizontal duct option for space-saving installations
- Integrated digital controller for simple and accurate commissioning
- Plug and play controls; Humidistat, Wireless Remote
- BMS connectivity
- LS inputs (Light Switch)
- Volt-free inputs
- Self diagnosis for simplified fault finding
- Adjustable delay On/delay Off timer



Easy Installation

The Sentinel Kinetic models can be mounted vertically in a roof space or in an appropriate cupboard within the dwelling. When mounted in an unheated area the ducting and unit must be insulated in accordance with the Domestic Ventilation Compliance Guide. Ducting can be attached to the unit horizontally, vertically or both.

For scenarios where noise is a critical issue, an Acoustic Enclosure is available to reduce breakout noise and the Acoustic Top Box will reduce in-duct noise at key frequencies.

Left (L) or right (R) hand installation. Left hand and right hand units are available.

Spigot Options

The combination of spigot options allows installation in confined locations. If vertical and horizontal connection is required on the same outlet/inlet, additional spigots can be supplied.

The condensate drain can be taken out through the back, side or bottom of the unit. Using the fittings supplied, the final condensate connection is made outside the unit and can be completed after installation.

Integral Humidity Sensor

The integral humidity sensor increases speed in proportion to relative humidity levels, saving energy and reducing noise. The sensor also reacts to small but rapid increases in humidity, even if the normal trigger threshold is not reached. This unique feature ensures adequate ventilation, even for the smallest wet room. The night time relative humidity setback feature suppresses nuisance tripping as humidity gradually increases with falling temperature.

Model

Model	Stock Ref
Sentinel Kinetic FH Right	408167
Sentinel Kinetic FH Right with Acoustic Top Box & Enclosure	479532
Sentinel Kinetic FH Right with Acoustic Top Box	479531
Sentinel Kinetic FH Right with Acoustic Enclosure	479530
Sentinel Kinetic FH Left	408169
Sentinel Kinetic FH Left with Acoustic Top Box & Enclosure	479535
Sentinel Kinetic FH Left with Acoustic Top Box	479534
Sentinel Kinetic FH Left with Acoustic Enclosure	479533

(FH comes with summer bypass & humidity sensor)

Accessories

Model	Stock Ref
Wired Remote Controller	443283
Wireless Enable Kit	441865
Wireless Transmitter Controller	437827
LED alarm with 15m cable	448356
ISO 45% Coarse (G3) Filter 2pk	409764
ISO ePM10 50% (M5) Filter 2pk	472153
Anti Vibration Mounts	68MP033G
Acoustic Purge Fan	477988
Acoustic Purge Fan XL	479829

SAP PCDB performance

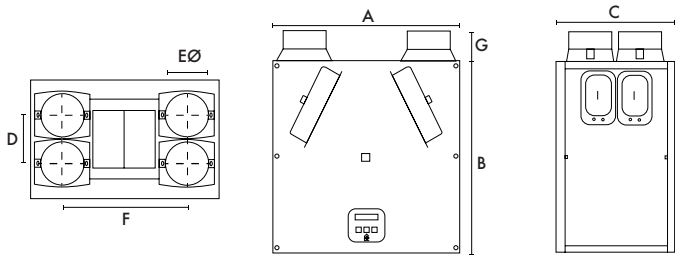
	SAP 2009		SAP 2012	
	Thermal Efficiency %	SFP (W/l/s)	Thermal Efficiency %	SFP (W/l/s)
K+1	90	0.53	89	0.53
K+2	89	0.51	88	0.60
K+3	88	0.56	86	0.71
K+4	87	0.65	84	0.88
K+5	85	0.75	84	1.07

SEC Class

Model	SEC Class
Kinetic FH/FHL	A+

Dimensions (mm)

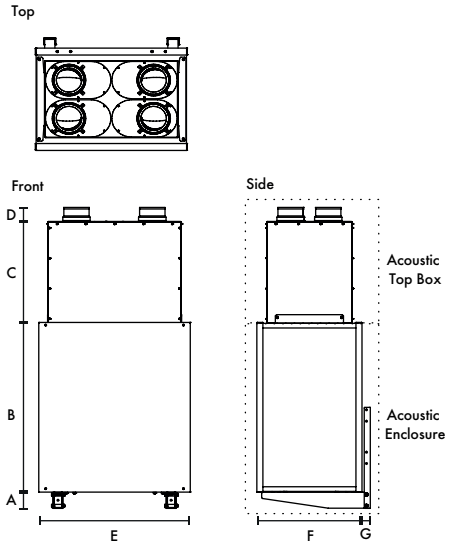
Unit



A	B	C	D	EØ	F	G
555	550	350	140	125	360	90

Weight: 18kg

Acoustic Solution



A	B	C	D	E	F	G	Acoustic Top Box kg	Acoustic Enclosure kg	Spigot
80	633	501	75	626	447	45	11	19	125

Sound Data (Unit only)

Speed	Test mode	Port 63	125	250	500	Octave band, Hz, dB SWL 1k	2k	4k	8k	LwA	SPL dB(A) @ 3m
20%	Supply	66.2	67.2	54.3	48.0	42.1	33.3	22.5	25.6	53.9	36.4
	Extract	57.7	56.6	47.2	43.5	35.3	24.1	19.6	25.7	45.7	28.2
	Breakout	41.2	47.0	41.7	39.5	34.6	30.4	22.5	25.7	41.0	20.5
40%	Supply	68.9	66.4	68.8	57.8	52.1	44.9	35.3	28.8	62.4	44.9
	Extract	66.8	56.1	56.9	52.1	44.7	34.6	23.8	25.8	53.2	35.7
	Breakout	47.3	47.5	56.4	48.0	44.0	39.6	32.8	29.1	51.0	30.5
60%	Supply	72.8	72.5	82.2	64.4	59.9	53.8	46.2	40.3	74.4	56.9
	Extract	67.3	61.9	66.5	58.9	52.2	42.7	32.6	27.6	61.1	43.6
	Breakout	53.9	53.2	65.9	55.8	52.2	48.2	42.5	39.3	61.0	40.5
80%	Supply	85.0	75.3	72.5	77.9	65.3	58.8	52.1	47.4	76.0	58.5
	Extract	83.5	65.2	65.0	65.5	57.0	47.7	37.9	31.3	65.5	48.0
	Breakout	56.4	56.4	60.4	69.8	56.7	53.2	47.8	42.0	66.5	46.0
100%	Supply	95.5	77.7	74.0	80.4	68.7	62.9	56.9	52.4	79.1	61.6
	Extract	83.3	68.3	66.9	71.2	60.7	51.4	42.4	36.1	69.7	52.2
	Breakout	62.1	59.7	62.9	70.0	61.0	57.3	52.3	46.9	68.0	47.5

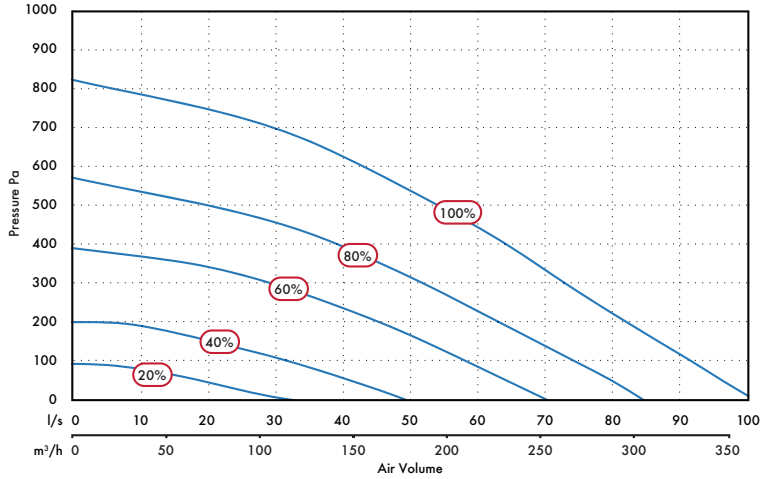
Sound Data (Unit with Acoustic Solution)

Speed	Test mode	Port 63	125	250	500	Octave band, Hz, dB SWL 1k	2k	4k	8k	LwA	SPL dB(A) @ 3m
20%	Supply	58.2	62.1	46.8	33.7	21.1	14.1	18.2	24.1	47.5	30.0
	Extract	55.9	48.3	37.1	26.8	17.7	14.5	18.0	23.7	36.2	18.7
	Breakout	41.8	45.1	38.7	29.1	18.4	13.7	17.8	23.5	34.7	14.2
40%	Supply	66.5	59.3	59.3	43.5	30.5	15.9	17.9	23.5	52.1	34.6
	Extract	57.4	49.7	50.9	36.2	23.5	15.0	18.1	23.7	43.5	26.0
	Breakout	47.1	47.6	49.8	38.4	30.2	21.0	18.5	23.6	42.6	22.1
60%	Supply	69.5	66.0	66.5	50.7	40.2	20.6	18.8	24.2	59.3	41.8
	Extract	62.4	57.1	53.7	43.2	32.5	19.5	18.5	23.8	48.0	30.5
	Breakout	51.8	54.5	54.4	45.2	38.9	32.1	24.4	24.0	49.0	28.5
80%	Supply	78.5	68.9	63.3	61.3	45.1	25.7	20.7	25.8	61.0	43.5
	Extract	74.2	59.8	55.8	49.9	37.8	24.4	20.5	23.9	52.4	34.9
	Breakout	57.6	57.6	56.4	52.0	43.7	38.0	31.6	25.6	52.2	31.7
100%	Supply	75.7	70.8	67.1	65.7	48.2	30.4	23.6	27.8	64.6	47.1
	Extract	75.6	62.9	59.5	53.1	42.2	29.4	24.3	24.7	55.7	38.2
	Breakout	64.3	59.8	60.3	56.8	47.1	42.2	36.9	28.8	56.4	35.9

Tested according to BS EN 13141-7:2010. Breakout quoted spherical. Supply and Extract quoted hemispherical. For in-duct data, end reflections are added based on the spigot size of the unit.

Performance

Fan speeds are fully adjustable within the performance range.



Vent-Axia

Consultant's Specification

Operation

The supply and extract ventilation unit shall be a Sentinel Kinetic as manufactured by Vent-Axia and shall be sized as indicated on the drawings and shall be in accordance with the particular specification.

Supply air to the room shall be pre-heated by the extract air via the integrated composite plastic counterflow heat recovery cell. The Sentinel Kinetic shall automatically vary the ventilation rate via EC/DC motors, as it receives signals from one of the optional interconnected sensors. When a signal is received, the fans shall either vary their speed proportionally or on a trickle and boost principle.

The unit shall have the facility to commission the supply and extract fans individually via in-built minimum and maximum speed adjustment, or alternative wired remote control unit. The fans themselves shall have independent, infinitely variable speed control.

Unit Specification

The unit shall be manufactured with an ABS outer case construction, and incorporate a reversible core to allow for left or right hand mounting.

The unit shall have a high efficiency composite plastic counterflow heat exchanger, supply and extract filters, automatic summer bypass, integral minimum and maximum infinitely variable speed controls with facia mounted failure indication. The unit shall have low energy, high efficiency EC/DC fan/motor assemblies with sealed for life bearings. The impellers shall be high efficiency backward curved centrifugal type.

The unit shall have a heat exchanger cell with a thermal efficiency of up to 90% when tested to EN 308. This shall be protected by ISO 45% Coarse (G3) grade synthetic filters on supply and extract. Complete with a condensate drip tray and drain connection.

To reduce breakout noise, the MVHR unit shall be provided with an Acoustic Enclosure of steel construction lined with class '0' acoustic foam. To reduce in-duct noise, the top of the MVHR shall be fitted with an Acoustic Top Box to provide attenuation to the 4 ducts of the unit. This Acoustic Top Box shall be of steel construction lined with acoustic class '0' foam with the MVHR spigots linked to the Top Box via 4 separate attenuated ducts. The acoustic enclosure and top box shall each be independently tested for noise to BS EN 13141-7.

The unit shall be constructed with a removable Core allowing full maintenance access. The removable Core shall provide access to the following:

- ✓ Supply and extract filter
- ✓ Heat exchanger
- ✓ Access to the electrical connections

Access shall be provided for wiring termination and setup/commissioning. The backlit LCD user interface therein shall be removable for remote mounting if required.

Units shall be as manufactured by Vent-Axia Ltd.

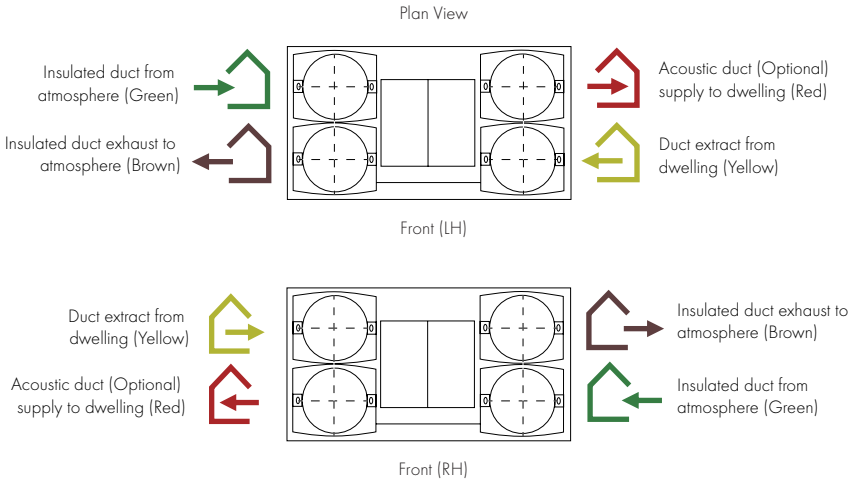
Acoustically tested to BS EN 13141-7

Standard Controls

All Sentinel Kinetic units shall incorporate the following functions integrally mounted, pre-wired and factory fitted by the manufacturer:

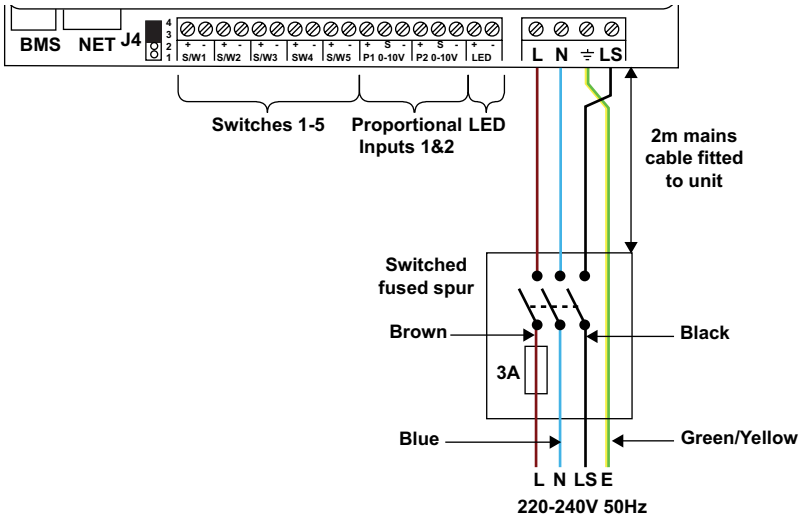
- ✓ Integral infinitely variable fan speed control on supply and extract
- ✓ Integral min/max ventilation control/set point
- ✓ Integral BMS interfaces – control and status indication
- ✓ Heating interlocks
- ✓ 0-10V proportional speed adjustment
- ✓ Volt free contacts
- ✓ 24V sensor supply
- ✓ Integral on/off or trickle boost function from remote switch e.g. PIR occupancy detector
- ✓ The unit shall be controlled by the 'Sentinel' control devices (enablers and sensors) as detailed in the schedule or on the drawings
- ✓ Fully automatic summer bypass
- ✓ Switched Live input with adjustable 'delay-on' feature
- ✓ Fan failure or component failure indicated via individual fault code display
- ✓ Running time counter
- ✓ Control panel PIN number lock
- ✓ Automatic frost protection effective to -20°C
- ✓ Tool free filter access
- ✓ The unit shall incorporate ('H' models) an integral humidity sensor with the following features:
  - Ambient Response; Raises the humidity trigger point as dwelling temperature reduces
  - Rapid Response; Monitors the rate of change in humidity and triggers increased airflow even if the humidity trigger threshold is not reached
  - Proportional Response; Incrementally increases the fan speed to reduce noise and reduce energy consumption

Airflow Direction

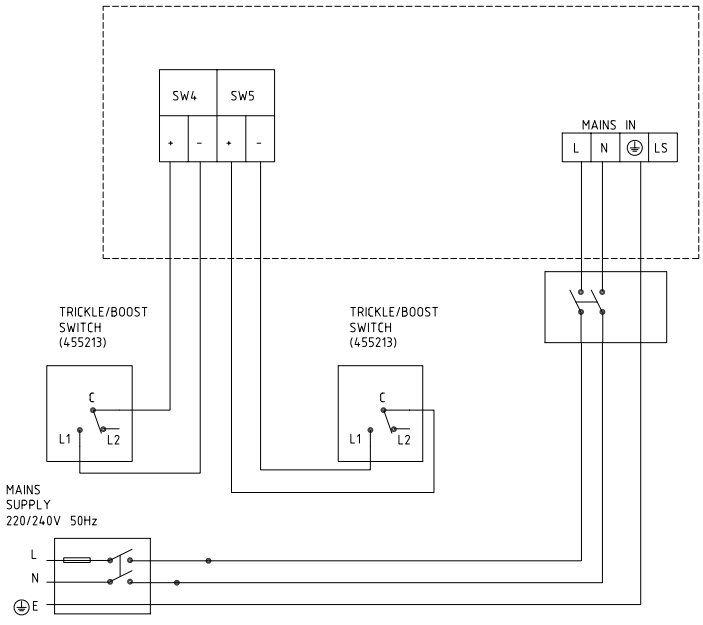


Electrical Connection

Please note: Electrical connection should be carried out by an appropriately qualified person and in accordance with current wiring regulations.



Trickle to Boost by Trickle/Boost Switch



6.5. Appendix E – PV Array

Project Overview

PV System

Grid-connected PV System

Climate Data	West Pennines Wales / West Pennines England (SAP 2012), GBR (-)	
Values source	SAP 2012	
PV Generator Output	5	kWp
PV Generator Surface	23.5	m²
Number of PV Modules	10	
Number of Inverters	1	

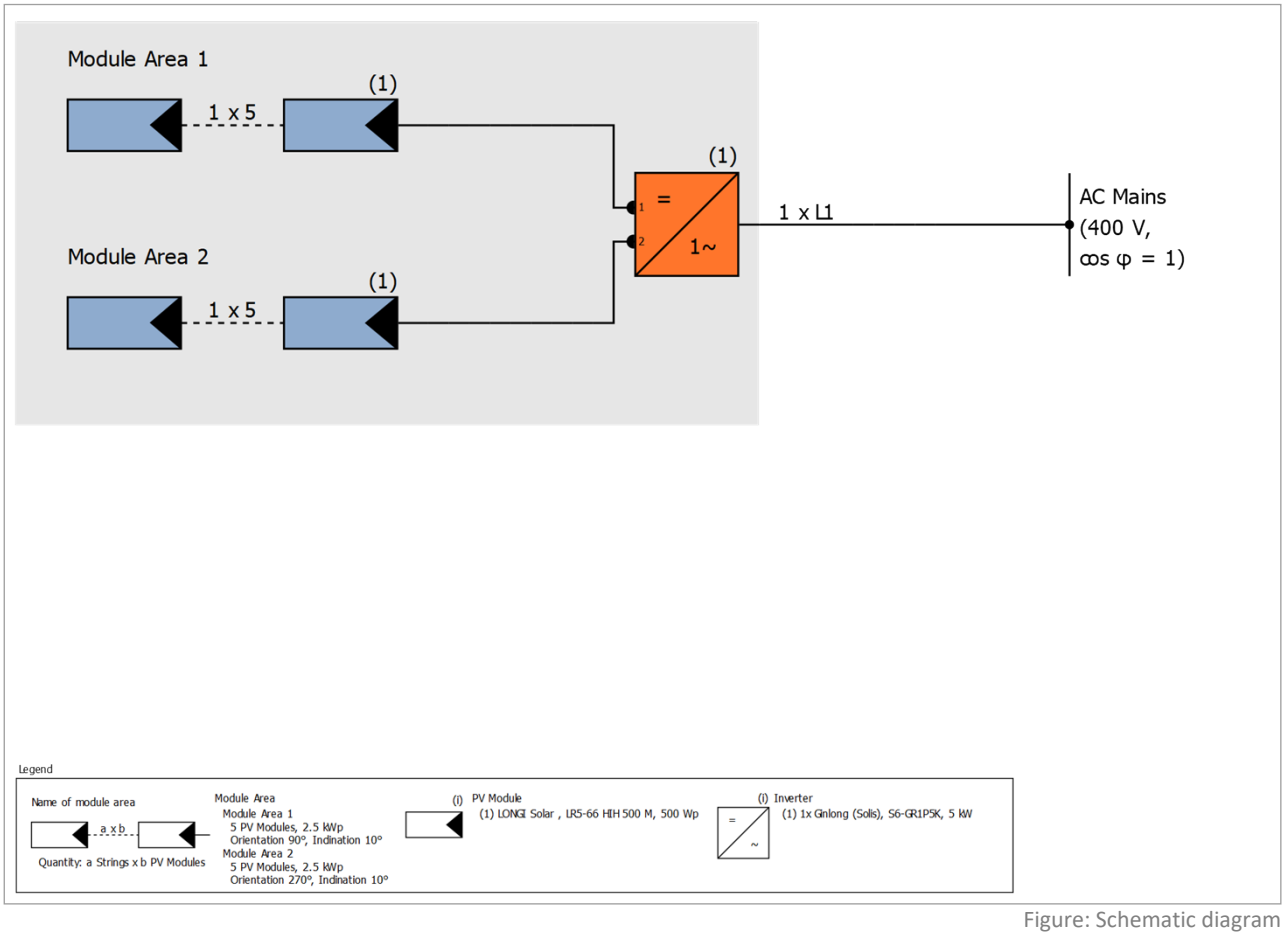


Figure: Schematic diagram

Production Forecast

Production Forecast		
PV Generator Output	5.00	kWp
Spec. Annual Yield	810.85	kWh/kWp
Performance Ratio (PR)	91.22	%
Grid Feed-in	4,059	kWh/Year
Grid Feed-in in the first year (incl. module degradation)	3,966	kWh/Year
Standby Consumption (Inverter)	5	kWh/Year
CO_2 Emissions avoided	1,905	kg / year

Financial Analysis

Your Gain		
Total investment costs	6,000.00	£
Internal Rate of Return (IRR)	0.00	%
Amortization Period	More than 25	Years
Electricity Production Costs	0.0945	£/kWh
Energy Balance/Feed-in Concept	Full Feed-in	

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the System

Overview

System Data

Type of System	Grid-connected PV System

Climate Data

Location	West Pennines Wales / West Pennines England (SAP 2012), GBR (-)
Values source	SAP 2012
Resolution of the data	1 h
Simulation models used:	
- Diffuse Irradiation onto Horizontal Plane	Hofmann
- Irradiance onto tilted surface	Hay & Davies

Module Areas

1. Module Area - Module Area 1

PV Generator, 1. Module Area - Module Area 1

Name	Module Area 1
PV Modules	5 x LR5-66 HIH 500 M (v1)
Manufacturer	LONGI Solar
Inclination	10 °
Orientation	East 90 °
Installation Type	Mounted - Roof
PV Generator Surface	11.7 m²

2. Module Area - Module Area 2

PV Generator, 2. Module Area - Module Area 2

Name	Module Area 2
PV Modules	5 x LR5-66 HIH 500 M (v1)
Manufacturer	LONGI Solar
Inclination	10 °
Orientation	West 270 °
Installation Type	Mounted - Roof
PV Generator Surface	11.7 m²

Inverter configuration

Configuration 1

Module Areas	Module Area 1 + Module Area 2
Inverter 1	
Model	S6-GR1P5K (v1)
Manufacturer	Ginlong (Solis)
Quantity	1
Sizing Factor	100 %
Configuration	MPP 1: 1 x 5
	MPP 2: 1 x 5

AC Mains

AC Mains

Number of Phases	3
Mains voltage between phase and neutral	400 V
Displacement Power Factor (cos phi)	+/- 1

Simulation Results

Results Total System

PV System

PV Generator Output	5.00	kWp
Spec. Annual Yield	810.85	kWh/kWp
Performance Ratio (PR)	91.22	%
Grid Feed-in	4,059	kWh/Year
Grid Feed-in in the first year (incl. module degradation)	3,966	kWh/Year
Standby Consumption (Inverter)	5	kWh/Year
CO_2 Emissions avoided	1,905	kg / year

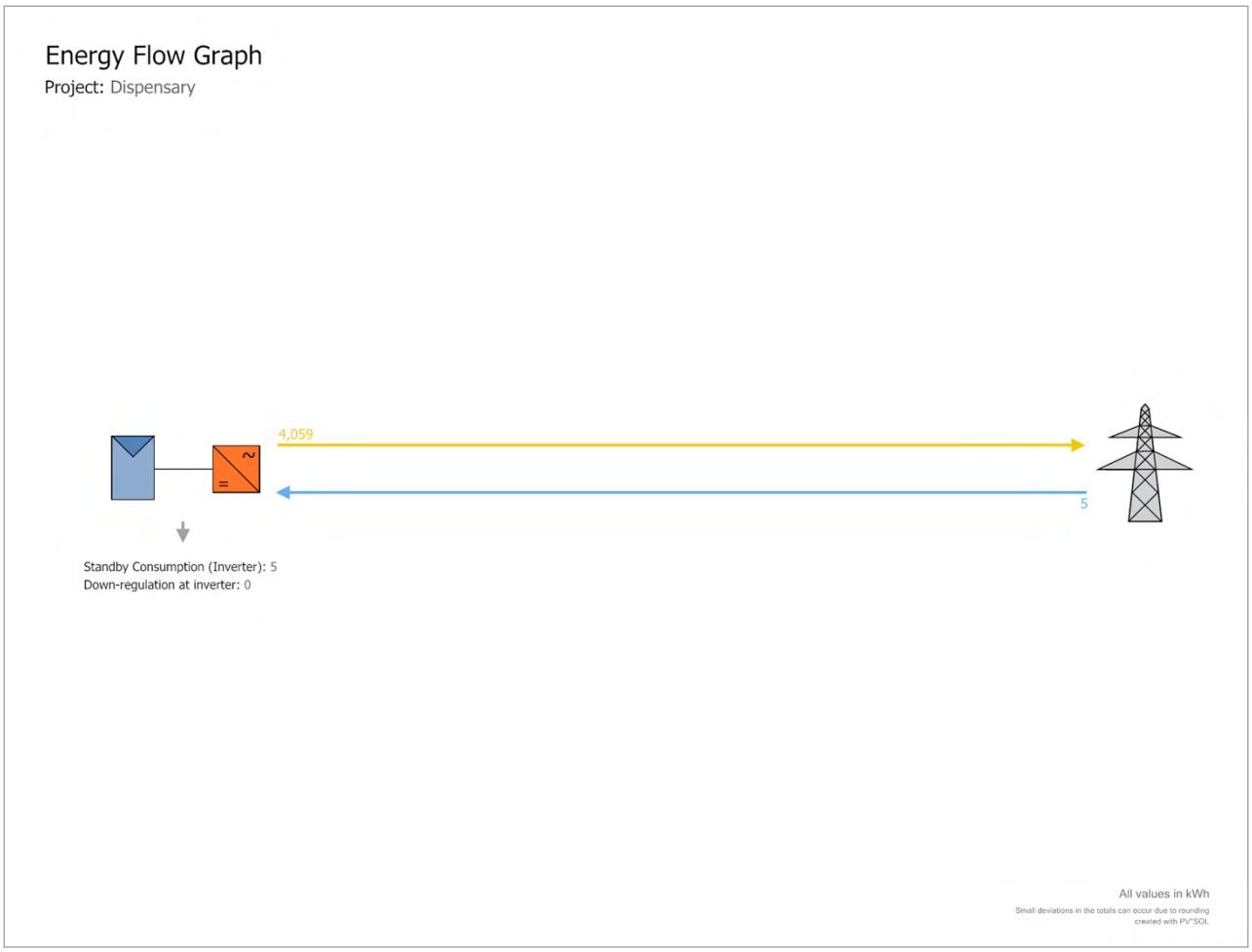


Figure: Energy flow

Dispensary

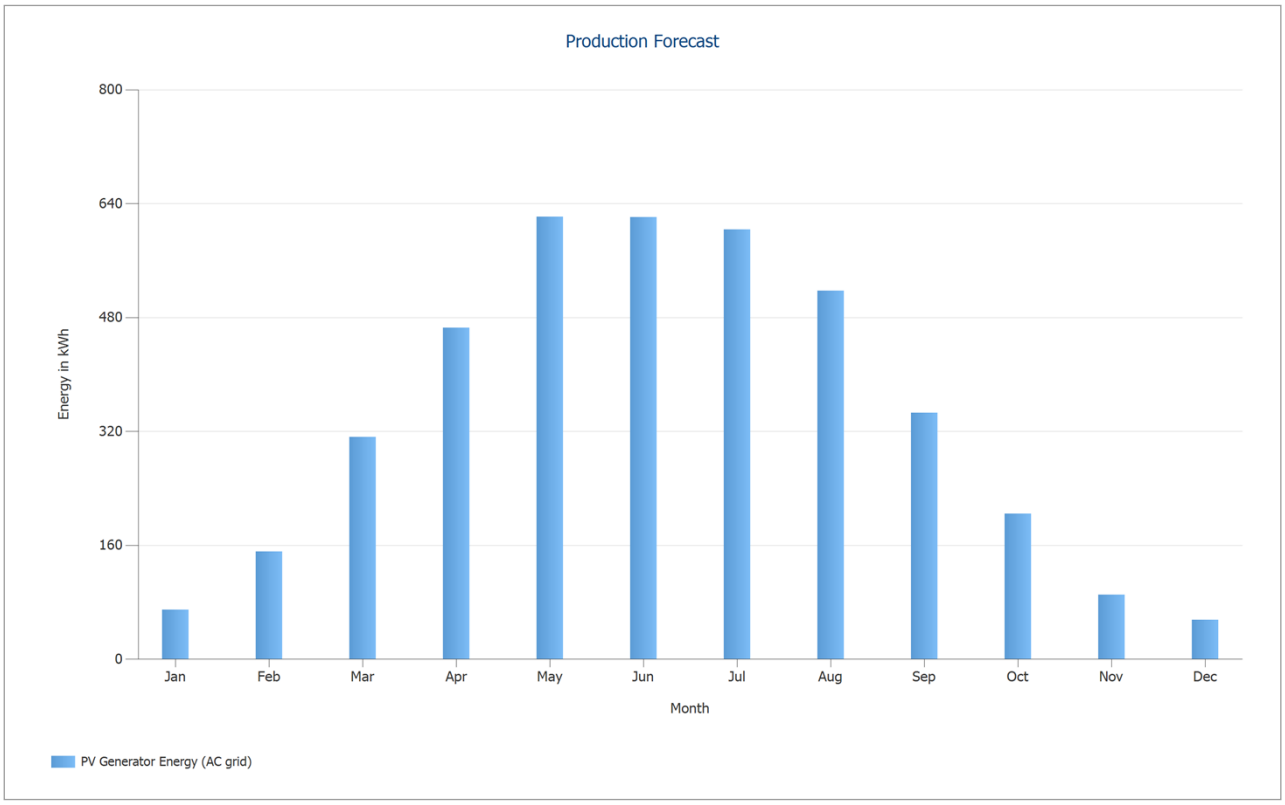


Figure: Production Forecast

Plans and parts list

Circuit Diagram

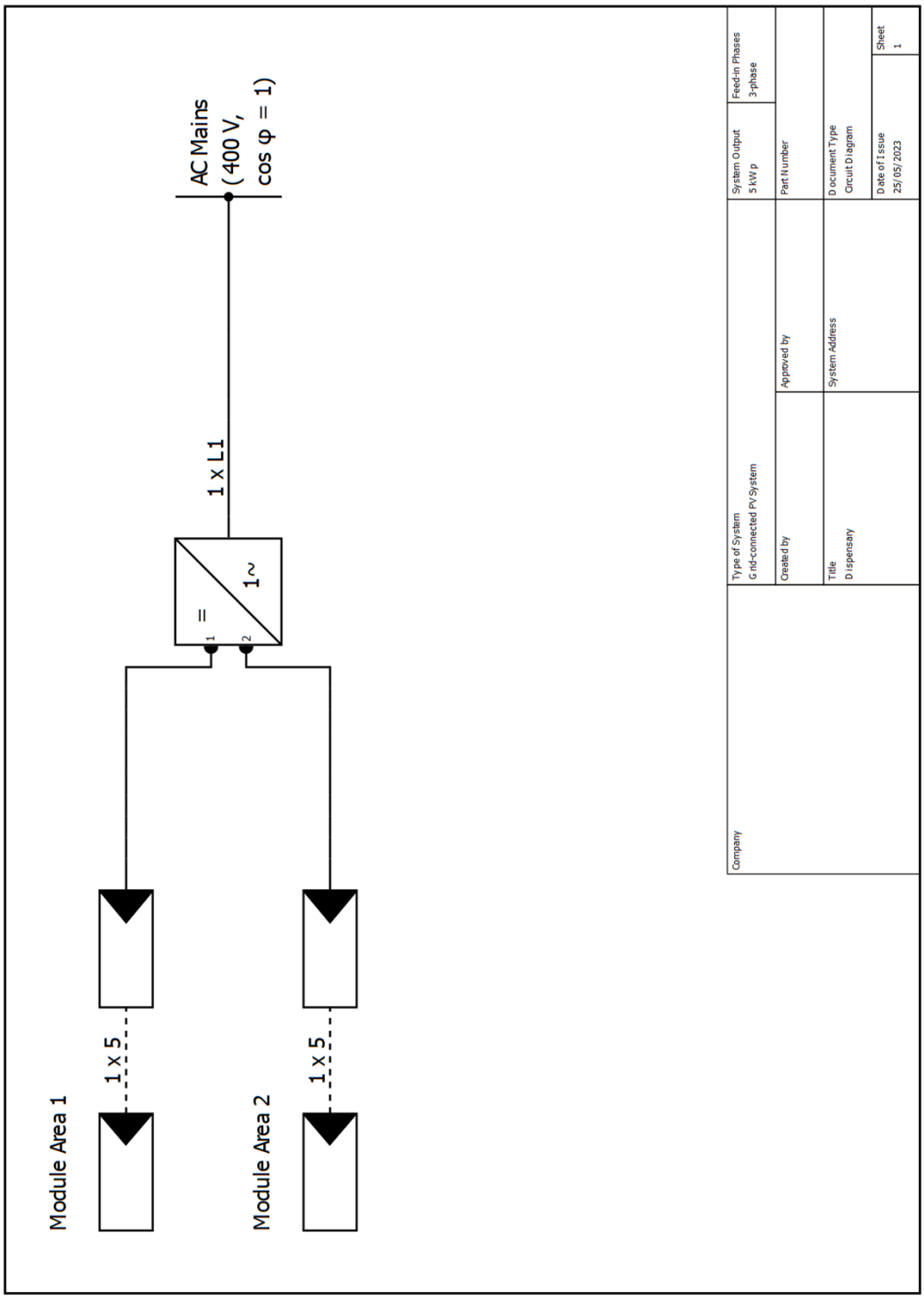


Figure: Circuit Diagram

Parts list

Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		LONGI Solar	LR5-66 HIH 500 M	10	Piece
2	Inverter		Ginlong (Solis)	S6-GR1P5K	1	Piece

6.6. Appendix F – SAP Calculations

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-30	**Issued on Date**	11/01/2024
Assessment Reference	7765-30	**Prop Type Ref**	
Property	Flat 30, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	77 C	**DER**	26.15	**TER**	29.19
Environmental	82 B	**% DER<TER**	10.41		
CO_2 Emissions (t/year)	1.40	**DFEE**	43.20	**TFEE**	55.30
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.88		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Top-floor flat, total floor area 66 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 29.19 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 26.15 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.2 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.73 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South West: 1.46 m², No overhang
Windows facing North West: 5.44 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.7 m³/m²h
Photovoltaic array 469.45 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7300	
Infiltration rate		0.1865	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1445	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1843	0.1807	0.1771	0.1590	0.1554	0.1373	0.1373	0.1337	0.1445	0.1554	0.1626	0.1698	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2848	0.2812	0.2776	0.2595	0.2559	0.2378	0.2378	0.2342	0.2450	0.2559	0.2631	0.2703	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			6.9000	1.4151	9.7642			(27)
New External	52.4300	6.9000	45.5300	0.1600	7.2848			(29a)
External Roof 1	65.7500		65.7500	0.1500	9.8625			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9115			(33)
Party Wall 1			16.6800	0.0000	0.0000			(32)
Corridor			40.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4681	(36)
Total fabric heat loss (33) + (36) =	39.3796	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4478	15.2518	15.0558	14.0758	13.8798	12.8997	12.8997	12.7037	13.2918	13.8798	14.2718	14.6638	(38)
Heat transfer coeff	54.8274	54.6314	54.4354	53.4553	53.2593	52.2793	52.2793	52.0833	52.6713	53.2593	53.6513	54.0433	(39)
Average = Sum(39)m / 12 =												53.4063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8339	0.8309	0.8279	0.8130	0.8100	0.7951	0.7951	0.7921	0.8011	0.8100	0.8160	0.8220	(40)
HLP (average)												0.8123	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1387 (42)
Average daily hot water use (litres/day)	84.9942 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	20.7972	18.1894	18.7698	16.3640	15.7016	13.5493	12.5554	14.4076	14.5796	16.9911	18.5472	20.1410	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(64)
								Total per year (kWh/year) = Sum(64)m =				1543.1494	(64)
Heat gains from water heating, kWh/month													
	60.0878	52.9534	55.5937	49.8095	48.7925	43.5703	41.8184	45.9239	45.8542	51.6509	54.6489	58.6331	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0730	16.9404	13.7769	10.4300	7.7965	6.5822	7.1123	9.2448	12.4083	15.7552	18.3887	19.6031	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	187.1821	189.1245	184.2298	173.8096	160.6559	148.2933	140.0343	138.0920	142.9867	153.4069	166.5606	178.9232	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	(71)
Water heating gains (Table 5)													
	80.7631	78.7998	74.7227	69.1799	65.5813	60.5144	56.2076	61.7257	63.6863	69.4233	75.9012	78.8080	(72)
Total internal gains													
	342.0987	339.9452	327.8099	308.5000	289.1143	270.4704	258.4347	264.1430	274.1619	293.6659	315.9310	332.4147	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	36.7938	0.3500	0.7000	0.7700	9.1207	(79)
Northwest	5.4400	11.2829	0.3500	0.7000	0.7700	10.4213	(81)

Solar gains	19.5419	36.7487	59.4756	89.1044	113.8710	119.2351	112.3804	92.9574	69.5868	43.0942	24.0371	16.3159	(83)
Total gains	361.6407	376.6939	387.2855	397.6044	402.9854	389.7054	370.8151	357.1004	343.7487	336.7601	339.9681	348.7307	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.3116	33.4311	33.5515	34.1666	34.2924	34.9352	34.9352	35.0667	34.6752	34.2924	34.0418	33.7949	
alpha	3.2208	3.2287	3.2368	3.2778	3.2862	3.3290	3.3290	3.3378	3.3117	3.2862	3.2695	3.2530	
util living area													
	0.9690	0.9620	0.9466	0.9107	0.8388	0.7073	0.5653	0.6001	0.7890	0.9133	0.9568	0.9721	(86)
MIT	19.2754	19.4199	19.7071	20.1241	20.5155	20.8174	20.9368	20.9216	20.7150	20.2413	19.7079	19.2559	(87)
Th 2	20.2241	20.2266	20.2292	20.2421	20.2447	20.2576	20.2576	20.2601	20.2524	20.2447	20.2395	20.2343	(88)
util rest of house													
	0.9649	0.9568	0.9388	0.8967	0.8110	0.6542	0.4865	0.5236	0.7449	0.8972	0.9501	0.9684	(89)
MIT 2	17.8815	18.0928	18.5101	19.1166	19.6660	20.0722	20.2084	20.1962	19.9446	19.2904	18.5204	17.8598	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	18.4005	18.5869	18.9558	19.4917	19.9823	20.3497	20.4796	20.4663	20.2314	19.6444	18.9626	18.3796	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4005	18.5869	18.9558	19.4917	19.9823	20.3497	20.4796	20.4663	20.2314	19.6444	18.9626	18.3796	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9520	0.9426	0.9228	0.8801	0.8001	0.6612	0.5111	0.5460	0.7436	0.8817	0.9356	0.9564	(94)
Useful gains	344.2785	355.0731	357.3938	349.9280	322.4187	257.6865	189.5184	194.9719	255.5954	296.9169	318.0772	333.5212	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	773.0933	747.7344	678.0336	566.1828	441.1085	300.5888	202.8236	211.7844	322.9499	481.6995	636.4427	766.3123	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	319.0382	263.8684	238.5560	155.7035	88.3052	0.0000	0.0000	0.0000	0.0000	137.4782	229.2231	321.9966	(98)
Space heating												1754.1692	(98)
Space heating per m2											(98) / (4) =	26.6794	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1754.1692	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	319.0382	263.8684	238.5560	155.7035	88.3052	0.0000	0.0000	0.0000	0.0000	137.4782	229.2231	321.9966	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	319.0382	263.8684	238.5560	155.7035	88.3052	0.0000	0.0000	0.0000	0.0000	137.4782	229.2231	321.9966	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(219)
Water heating fuel used												1543.1494	(219)
Annual totals kWh/year													
Space heating fuel - main system												1754.1692	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												147.8964	(230a)
Total electricity for the above, kWh/year												147.8964	(231)
Electricity for lighting (calculated in Appendix L)												336.8344	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3782.0494	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1754.1692	0.5190	910.4138	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1543.1494	0.5190	800.8945	(264)
Space and water heating			1711.3084	(265)
Pumps and fans	147.8964	0.5190	76.7582	(267)
Energy for lighting	336.8344	0.5190	174.8170	(268)
Energy saving/generation technologies				
PV Unit	-469.4500	0.5190	-243.6446	(269)
Total CO2, kg/year			1719.2391	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			26.1500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		26.1500	ZC1
Total Floor Area	TFA	65.7500	
Assumed number of occupants	N	2.1387	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.8700	ZC2
CO2 emissions from cooking, equation (L16)		2.5906	ZC3
Total CO2 emissions		45.6105	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		45.6105	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3717	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2880	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3673	0.3601	0.3529	0.3169	0.3097	0.2736	0.2736	0.2664	0.2880	0.3097	0.3241	0.3385	(22b)
Effective ac	0.5674	0.5648	0.5623	0.5502	0.5479	0.5374	0.5374	0.5355	0.5415	0.5479	0.5525	0.5573	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			6.9000	1.3258	9.1477			(27)
New External	52.4300	6.9000	45.5300	0.1800	8.1954			(29a)
External Roof 1	65.7500		65.7500	0.1300	8.5475			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.8906			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.3845	(36)
Total fabric heat loss					(33) + (36) =		43.2751	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7801	30.6380	30.4988	29.8448	29.7224	29.1528	29.1528	29.0473	29.3722	29.7224	29.9699	30.2287	(38)
Heat transfer coeff	74.0552	73.9131	73.7739	73.1199	72.9975	72.4279	72.4279	72.3224	72.6473	72.9975	73.2451	73.5039	(39)
Average = Sum(39)m / 12 =												73.1193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1263	1.1242	1.1220	1.1121	1.1102	1.1016	1.1016	1.1000	1.1049	1.1102	1.1140	1.1179	(40)
HLP (average)												1.1121	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1387 (42)
Average daily hot water use (litres/day)												84.9942 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	20.7972	18.1894	18.7698	16.3640	15.7016	13.5493	12.5554	14.4076	14.5796	16.9911	18.5472	20.1410	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	184.7854	162.9349	171.2693	153.7421	150.8147	134.9776	129.8400	142.1874	141.8463	159.4114	168.2966	180.4106	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	184.7854	162.9349	171.2693	153.7421	150.8147	134.9776	129.8400	142.1874	141.8463	159.4114	168.2966	180.4106	(64)
Total per year (kWh/year) = Sum(64)m =												1880.5163	(64)
Heat gains from water heating, kWh/month													
	83.0102	73.6576	78.5161	71.9926	71.7150	65.7534	64.7409	68.8464	68.0372	74.5734	76.8319	81.5556	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0730	16.9404	13.7769	10.4300	7.7965	6.5822	7.1123	9.2448	12.4083	15.7552	18.3887	19.6031	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	187.1821	189.1245	184.2298	173.8096	160.6559	148.2933	140.0343	138.0920	142.9867	153.4069	166.5606	178.9232	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	(71)
Water heating gains (Table 5)													
	111.5729	109.6095	105.5324	99.9897	96.3911	91.3241	87.0173	92.5355	94.4961	100.2330	106.7110	109.6177	(72)
Total internal gains													
	375.9085	373.7550	361.6197	342.3098	322.9241	304.2801	292.2445	297.9528	307.9716	327.4757	349.7408	366.2245	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	36.7938	0.6300	0.7000	0.7700	16.4172	(79)
Northwest	5.4400	11.2829	0.6300	0.7000	0.7700	18.7583	(81)

Solar gains	35.1755	66.1476	107.0561	160.3879	204.9679	214.6231	202.2847	167.3233	125.2562	77.5695	43.2668	29.3687	(83)
Total gains	411.0840	439.9026	468.6757	502.6977	527.8920	518.9032	494.5291	465.2761	433.2279	405.0452	393.0076	395.5932	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6563	61.7748	61.8914	62.4450	62.5497	63.0416	63.0416	63.1336	62.8512	62.5497	62.3383	62.1188	
alpha	5.1104	5.1183	5.1261	5.1630	5.1700	5.2028	5.2028	5.2089	5.1901	5.1700	5.1559	5.1413	
util living area	0.9976	0.9961	0.9918	0.9759	0.9231	0.7880	0.6195	0.6745	0.8929	0.9815	0.9955	0.9980	(86)
MIT	19.8141	19.9211	20.1315	20.4331	20.7244	20.9213	20.9822	20.9728	20.8352	20.4797	20.0987	19.7930	(87)
Th 2	19.9794	19.9812	19.9829	19.9910	19.9925	19.9996	19.9996	20.0009	19.9968	19.9925	19.9894	19.9862	(88)
util rest of house	0.9968	0.9948	0.9887	0.9660	0.8895	0.7021	0.4912	0.5474	0.8337	0.9720	0.9936	0.9974	(89)
MIT 2	18.4007	18.5579	18.8657	19.3056	19.7063	19.9431	19.9925	19.9888	19.8551	19.3773	18.8236	18.3747	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	18.9269	19.0655	19.3370	19.7254	20.0854	20.3073	20.3610	20.3551	20.2200	19.7877	19.2983	18.9028	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9269	19.0655	19.3370	19.7254	20.0854	20.3073	20.3610	20.3551	20.2200	19.7877	19.2983	18.9028	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9931	0.9861	0.9627	0.8931	0.7310	0.5394	0.5950	0.8491	0.9694	0.9918	0.9964	(94)
Useful gains	409.2748	436.8737	462.1572	483.9560	471.4644	379.2966	266.7651	276.8544	367.8605	392.6639	389.7978	394.1601	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1083.1998	1047.0135	947.0344	791.5509	612.1109	413.3672	272.4026	286.0448	444.6013	670.6821	893.4684	1080.7119	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	501.4002	410.0140	360.7487	221.4683	104.6410	0.0000	0.0000	0.0000	0.0000	206.8455	362.6428	510.7945	(98)
Space heating												2678.5550	(98)
Space heating per m2											(98) / (4) =	40.7385	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2864.7647	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	501.4002	410.0140	360.7487	221.4683	104.6410	0.0000	0.0000	0.0000	0.0000	206.8455	362.6428	510.7945	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	536.2569	438.5177	385.8274	236.8645	111.9155	0.0000	0.0000	0.0000	0.0000	221.2252	387.8533	546.3043	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	184.7854	162.9349	171.2693	153.7421	150.8147	134.9776	129.8400	142.1874	141.8463	159.4114	168.2966	180.4106	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.3461	87.1759	86.7552	85.7868	83.8615	79.8000	79.8000	79.8000	79.8000	85.5097	86.8104	87.4398	(217)
Fuel for water heating, kWh/month													
	211.5554	186.9036	197.4168	179.2142	179.8379	169.1449	162.7068	178.1797	177.7522	186.4250	193.8669	206.3254	(219)
Water heating fuel used												2229.3289	(219)
Annual totals kWh/year													
Space heating fuel - main system												2864.7647	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												336.8344	(232)
Total delivered energy for all uses												5505.9280	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2864.7647	0.2160	618.7892	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2229.3289	0.2160	481.5350	(264)
Space and water heating			1100.3242	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	336.8344	0.5190	174.8170	(268)
Total CO2, kg/m2/year			1314.0663	(272)
Emissions per m2 for space and water heating			16.7350	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.6588	(272b)
Emissions per m2 for pumps and fans			0.5920	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7350 * 1.55) + 2.6588 + 0.5920, rounded to 2 d.p.			29.1900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1217	(8)
Pressure test			Yes	
Measured/design AP50			3.7300	
Infiltration rate			0.3082	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2388	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3045	0.2985	0.2926	0.2627	0.2567	0.2269	0.2269	0.2209	0.2388	0.2567	0.2687	0.2806	(22b)
Effective ac	0.5464	0.5446	0.5428	0.5345	0.5330	0.5257	0.5257	0.5244	0.5285	0.5330	0.5361	0.5394	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			6.9000	1.4151	9.7642			(27)
New External	52.4300	6.9000	45.5300	0.1600	7.2848			(29a)
External Roof 1	65.7500		65.7500	0.1500	9.8625			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9115			(33)
Party Wall 1			16.6800	0.0000	0.0000			(32)
Corridor			40.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4681	(36)
Total fabric heat loss (33) + (36) =	39.3796	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6368	29.5392	29.4435	28.9938	28.9097	28.5181	28.5181	28.4456	28.6690	28.9097	29.0799	29.2578	(38)
Heat transfer coeff	69.0164	68.9187	68.8230	68.3734	68.2893	67.8977	67.8977	67.8251	68.0485	68.2893	68.4594	68.6374	(39)
Average = Sum(39)m / 12 =												68.3730	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0497	1.0482	1.0467	1.0399	1.0386	1.0327	1.0327	1.0316	1.0350	1.0386	1.0412	1.0439	(40)
HLP (average)												1.0399	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1387 (42)
Average daily hot water use (litres/day)	84.9942 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	29.4628	25.7683	26.5906	23.1823	22.2440	19.1949	17.7869	20.4107	20.6545	24.0708	26.2752	28.5331	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0730	16.9404	13.7769	10.4300	7.7965	6.5822	7.1123	9.2448	12.4083	15.7552	18.3887	19.6031	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	187.1821	189.1245	184.2298	173.8096	160.6559	148.2933	140.0343	138.0920	142.9867	153.4069	166.5606	178.9232	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	(71)
Water heating gains (Table 5)													
	39.6005	38.3457	35.7401	32.1977	29.8978	26.6596	23.9071	27.4337	28.6868	32.3532	36.4933	38.3510	(72)
Total internal gains													
	300.9361	299.4912	288.8273	271.5178	253.4308	236.6156	226.1342	229.8510	239.1623	256.5959	276.5231	291.9577	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	36.7938	0.3500	0.7000	0.7700	9.1207	(79)
Northwest	5.4400	11.2829	0.3500	0.7000	0.7700	10.4213	(81)

Solar gains	19.5419	36.7487	59.4756	89.1044	113.8710	119.2351	112.3804	92.9574	69.5868	43.0942	24.0371	16.3159	(83)
Total gains	320.4781	336.2399	348.3029	360.6222	367.3019	355.8506	338.5146	322.8084	308.7491	299.6901	300.5602	308.2736	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.4631	26.5006	26.5375	26.7120	26.7449	26.8991	26.8991	26.9279	26.8395	26.7449	26.6784	26.6093	
alpha	2.7642	2.7667	2.7692	2.7808	2.7830	2.7933	2.7933	2.7952	2.7893	2.7830	2.7786	2.7740	
util living area													
	0.9788	0.9741	0.9640	0.9414	0.8949	0.8049	0.6888	0.7238	0.8664	0.9455	0.9718	0.9810	(86)
MIT	18.6385	18.7973	19.1340	19.6219	20.1340	20.5805	20.8143	20.7780	20.4282	19.7936	19.1378	18.6003	(87)
Th 2	20.0421	20.0434	20.0446	20.0502	20.0513	20.0562	20.0562	20.0571	20.0543	20.0513	20.0491	20.0469	(88)
util rest of house													
	0.9756	0.9701	0.9580	0.9302	0.8710	0.7510	0.5915	0.6336	0.8266	0.9330	0.9667	0.9781	(89)
MIT 2	17.8638	18.0225	18.3579	18.8441	19.3436	19.7639	19.9586	19.9338	19.6299	19.0174	18.3664	17.8292	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	18.1523	18.3110	18.6469	19.1337	19.6379	20.0679	20.2772	20.2481	19.9271	19.3064	18.6536	18.1163	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1523	18.3110	18.6469	19.1337	19.6379	20.0679	20.2772	20.2481	19.9271	19.3064	18.6536	18.1163	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9671	0.9603	0.9464	0.9165	0.8584	0.7518	0.6168	0.6542	0.8202	0.9203	0.9567	0.9702	(94)
Useful gains	309.9212	322.9048	329.6277	330.4983	315.2819	267.5206	208.7919	211.1678	253.2249	275.8162	287.5559	299.0819	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	956.0329	924.2663	835.9840	699.7126	542.0720	371.2582	249.6731	260.9996	396.5252	594.5528	790.9542	955.1776	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	480.7071	404.1149	376.7291	265.8343	168.7318	0.0000	0.0000	0.0000	0.0000	237.1400	362.4468	488.1353	(98)
Space heating												2783.8393	(98)
Space heating per m2											(98) / (4) =	42.3398	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	638.2380	502.4427	515.4711	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6385	0.7152	0.6916	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	407.5235	359.3463	356.5145	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	496.5589	474.7929	458.0496	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	64.1055	85.8923	75.5421	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												225.5399	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	16.0264	21.4731	18.8855	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												56.3850 (107)
Space cooling per m2												0.8576 (108)
Energy for space heating												42.3398 (99)
Energy for space cooling												0.8576 (108)
Total												43.1973 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.2 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1217	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3717	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2880	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3673	0.3601	0.3529	0.3169	0.3097	0.2736	0.2736	0.2664	0.2880	0.3097	0.3241	0.3385	(22b)
Effective ac	0.5674	0.5648	0.5623	0.5502	0.5479	0.5374	0.5374	0.5355	0.5415	0.5479	0.5525	0.5573	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			6.9000	1.3258	9.1477			(27)
New External	52.4300	6.9000	45.5300	0.1800	8.1954			(29a)
External Roof 1	65.7500		65.7500	0.1300	8.5475			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.8906			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.3845	(36)
Total fabric heat loss					(33) + (36) =		43.2751	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7801	30.6380	30.4988	29.8448	29.7224	29.1528	29.1528	29.0473	29.3722	29.7224	29.9699	30.2287	(38)
Heat transfer coeff	74.0552	73.9131	73.7739	73.1199	72.9975	72.4279	72.4279	72.3224	72.6473	72.9975	73.2451	73.5039	(39)
Average = Sum(39)m / 12 =												73.1193	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1263	1.1242	1.1220	1.1121	1.1102	1.1016	1.1016	1.1000	1.1049	1.1102	1.1140	1.1179	(40)
HLP (average)												1.1121	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1387	(42)
Average daily hot water use (litres/day)	84.9942	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	29.4628	25.7683	26.5906	23.1823	22.2440	19.1949	17.7869	20.4107	20.6545	24.0708	26.2752	28.5331	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	106.9351	(66)

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

	19.0730	16.9404	13.7769	10.4300	7.7965	6.5822	7.1123	9.2448	12.4083	15.7552	18.3887	19.6031	(67)

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

	187.1821	189.1245	184.2298	173.8096	160.6559	148.2933	140.0343	138.0920	142.9867	153.4069	166.5606	178.9232	(68)

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

	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	33.6935	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	(71)

Water heating gains (Table 5)

	39.6005	38.3457	35.7401	32.1977	29.8978	26.6596	23.9071	27.4337	28.6868	32.3532	36.4933	38.3510	(72)

Total internal gains

	300.9361	299.4912	288.8273	271.5178	253.4308	236.6156	226.1342	229.8510	239.1623	256.5959	276.5231	291.9577	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	36.7938	0.6300	0.7000	0.7700	16.4172	(79)
Northwest	5.4400	11.2829	0.6300	0.7000	0.7700	18.7583	(81)

Solar gains	35.1755	66.1476	107.0561	160.3879	204.9679	214.6231	202.2847	167.3233	125.2562	77.5695	43.2668	29.3687	(83)
Total gains	336.1116	365.6388	395.8833	431.9057	458.3987	451.2387	428.4189	397.1743	364.4185	334.1654	319.7899	321.3264	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.6563	61.7748	61.8914	62.4450	62.5497	63.0416	63.0416	63.1336	62.8512	62.5497	62.3383	62.1188	
alpha	5.1104	5.1183	5.1261	5.1630	5.1700	5.2028	5.2028	5.2089	5.1901	5.1700	5.1559	5.1413	
util living area	0.9991	0.9983	0.9961	0.9872	0.9532	0.8498	0.6952	0.7566	0.9394	0.9919	0.9982	0.9993	(86)
MIT	19.7076	19.8161	20.0304	20.3407	20.6519	20.8846	20.9700	20.9536	20.7711	20.3846	19.9951	19.6871	(87)
Th 2	19.9794	19.9812	19.9829	19.9910	19.9925	19.9996	19.9996	20.0009	19.9968	19.9925	19.9894	19.9862	(88)
util rest of house	0.9987	0.9978	0.9946	0.9815	0.9297	0.7734	0.5606	0.6287	0.8980	0.9874	0.9975	0.9990	(89)
MIT 2	18.7952	18.9050	19.1201	19.4343	19.7347	19.9389	19.9908	19.9854	19.8512	19.4807	19.0907	18.7803	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	19.1349	19.2442	19.4590	19.7718	20.0762	20.2910	20.3554	20.3459	20.1937	19.8173	19.4274	19.1179	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1349	19.2442	19.4590	19.7718	20.0762	20.2910	20.3554	20.3459	20.1937	19.8173	19.4274	19.1179	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9972	0.9936	0.9800	0.9321	0.7986	0.6117	0.6770	0.9080	0.9863	0.9969	0.9987	(94)
Useful gains	335.5626	364.6070	393.3451	423.2497	427.2593	360.3432	262.0588	268.9038	330.8933	329.5919	318.8092	320.9134	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1098.6020	1060.2244	956.0383	794.9433	611.4423	412.1880	271.9942	285.3761	442.6898	672.8373	902.9224	1096.5241	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	567.7013	467.4549	418.6438	267.6194	137.0322	0.0000	0.0000	0.0000	0.0000	255.3745	420.5615	577.0544	(98)
Space heating												3111.4419	(98)
Space heating per m2											(98) / (4) =	47.3223	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	680.8224	535.9666	549.6505	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7879	0.8699	0.8353	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	536.4348	466.2405	459.1412	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	608.0514	579.8758	544.9708	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.5640	84.5447	63.8572	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												199.9659	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	12.8910	21.1362	15.9643	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												49.9915 (107)
Space cooling per m2												0.7603 (108)
Energy for space heating												47.3223 (99)
Energy for space cooling												0.7603 (108)
Total												48.0826 (109)
Target Fabric Energy Efficiency (TFEE)												55.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7300	
Infiltration rate		0.1865	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1445	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1590	0.1554	0.1554	0.1409	0.1445	0.1265	0.1192	0.1229	0.1229	0.1409	0.1409	0.1445	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2595	0.2559	0.2559	0.2414	0.2450	0.2270	0.2197	0.2234	0.2234	0.2414	0.2414	0.2450	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			6.9000	1.4151	9.7642			(27)
New External	52.4300	6.9000	45.5300	0.1600	7.2848			(29a)
External Roof 1	65.7500		65.7500	0.1500	9.8625			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9115			(33)
Party Wall 1			16.6800	0.0000	0.0000			(32)
Corridor			40.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4681	(36)
Total fabric heat loss (33) + (36) =	39.3796	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.0758	13.8798	13.8798	13.0957	13.2918	12.3117	11.9197	12.1157	12.1157	13.0957	13.0957	13.2918	(38)
Heat transfer coeff	53.4553	53.2593	53.2593	52.4753	52.6713	51.6913	51.2993	51.4953	51.4953	52.4753	52.4753	52.6713	(39)
Average = Sum(39)m / 12 =												52.3936	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8130	0.8100	0.8100	0.7981	0.8011	0.7862	0.7802	0.7832	0.7832	0.7981	0.7981	0.8011	(40)
HLP (average)												0.7969	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1387 (42)
Average daily hot water use (litres/day)	84.9942 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	20.7972	18.1894	18.7698	16.3640	15.7016	13.5493	12.5554	14.4076	14.5796	16.9911	18.5472	20.1410	(46)

Water storage loss:

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume 145.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (56)

If cylinder contains dedicated solar storage

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575 (64)

Total per year (kWh/year) = Sum(64)m = 1543.1494 (64)

RHI water heating demand 1543 (64)
Heat gains from water heating, kWh/month

	60.0878	52.9534	55.5937	49.8095	48.7925	43.5703	41.8184	45.9239	45.8542	51.6509	54.6489	58.6331 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	(66)

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

	47.6824	42.3511	34.4422	26.0750	19.4913	16.4554	17.7807	23.1120	31.0208	39.3881	45.9717	49.0076 (67)

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

	279.3763	282.2754	274.9699	259.4173	239.7849	221.3333	209.0065	206.1074	213.4129	228.9655	248.5979	267.0495 (68)

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

	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481 (71)

Water heating gains (Table 5)

	80.7631	78.7998	74.7227	69.1799	65.5813	60.5144	56.2076	61.7257	63.6863	69.4233	75.9012	78.8080 (72)

Total internal gains

	500.5668	496.1712	476.8797	447.4171	417.6026	391.0480	375.7397	383.6901	400.8651	430.5218	463.2158	487.6101 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	31.1332	0.3500	0.7000	0.7700	7.7175	(79)
Northwest	5.4400	9.5471	0.3500	0.7000	0.7700	8.8180	(81)

Solar gains	16.5355	32.6655	55.7584	86.1343	106.7541	113.8695	105.2451	85.8524	67.1664	41.1354	21.8519	14.7620 (83)
Total gains	517.1023	528.8367	532.6381	533.5514	524.3567	504.9175	480.9848	469.5425	468.0315	471.6572	485.0677	502.3721 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.1666	34.2924	34.2924	34.8047	34.6752	35.3326	35.6026	35.4671	35.4671	34.8047	34.8047	34.6752	
alpha	3.2778	3.2862	3.2862	3.3203	3.3117	3.3555	3.3735	3.3645	3.3645	3.3203	3.3203	3.3117	
util living area	0.9140	0.9009	0.8742	0.8073	0.6940	0.5318	0.4031	0.4323	0.6294	0.8042	0.8831	0.9196	(86)
MIT	19.8228	19.9412	20.1541	20.4980	20.7736	20.9348	20.9807	20.9747	20.8750	20.5661	20.1821	19.8068	(87)
Th 2	20.2421	20.2447	20.2447	20.2550	20.2524	20.2653	20.2705	20.2679	20.2679	20.2550	20.2550	20.2524	(88)
util rest of house	0.9040	0.8893	0.8589	0.7827	0.6533	0.4728	0.3323	0.3611	0.5764	0.7756	0.8677	0.9102	(89)
MIT 2	18.6770	18.8476	19.1502	19.6373	20.0023	20.2071	20.2577	20.2502	20.1437	19.7355	19.2004	18.6616	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	19.1036	19.2548	19.5239	19.9578	20.2894	20.4780	20.5269	20.5199	20.4160	20.0448	19.5659	19.0880	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1036	19.2548	19.5239	19.9578	20.2894	20.4780	20.5269	20.5199	20.4160	20.0448	19.5659	19.0880	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8860	0.8714	0.8421	0.7719	0.6554	0.4904	0.3576	0.3861	0.5876	0.7667	0.8514	0.8926	(94)
Useful gains	458.1536	460.8344	448.5250	411.8562	343.6608	247.5954	172.0116	181.2961	275.0171	361.6060	412.9723	448.4422	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	753.9141	727.2435	661.6907	538.2806	399.7459	262.4906	175.7976	186.4095	304.6447	469.3787	617.4190	747.3015	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	220.0458	179.0269	158.5953	91.0256	41.7274	0.0000	0.0000	0.0000	0.0000	80.1829	147.2016	222.3513	(98)

Space heating 1140.1568 (98)
RHI space heating demand 1140 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7300	
Infiltration rate		0.1865	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1445	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1843	0.1807	0.1771	0.1590	0.1554	0.1373	0.1373	0.1337	0.1445	0.1554	0.1626	0.1698	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2848	0.2812	0.2776	0.2595	0.2559	0.2378	0.2378	0.2342	0.2450	0.2559	0.2631	0.2703	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			6.9000	1.4151	9.7642			(27)
New External	52.4300	6.9000	45.5300	0.1600	7.2848			(29a)
External Roof 1	65.7500		65.7500	0.1500	9.8625			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9115			(33)
Party Wall 1			16.6800	0.0000	0.0000			(32)
Corridor			40.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4681	(36)
Total fabric heat loss (33) + (36) =	39.3796	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.4478	15.2518	15.0558	14.0758	13.8798	12.8997	12.8997	12.7037	13.2918	13.8798	14.2718	14.6638	(38)
Heat transfer coeff	54.8274	54.6314	54.4354	53.4553	53.2593	52.2793	52.2793	52.0833	52.6713	53.2593	53.6513	54.0433	(39)
Average = Sum(39)m / 12 =												53.4063	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8339	0.8309	0.8279	0.8130	0.8100	0.7951	0.7951	0.7921	0.8011	0.8100	0.8160	0.8220	(40)
HLP (average)												0.8123	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1387 (42)
Average daily hot water use (litres/day)	84.9942 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	20.7972	18.1894	18.7698	16.3640	15.7016	13.5493	12.5554	14.4076	14.5796	16.9911	18.5472	20.1410	(46)
Water storage loss:													

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(64)
								Total per year (kWh/year) = Sum(64)m =				1543.1494	(64)
Heat gains from water heating, kWh/month													
	60.0878	52.9534	55.5937	49.8095	48.7925	43.5703	41.8184	45.9239	45.8542	51.6509	54.6489	58.6331	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.6824	42.3511	34.4422	26.0750	19.4913	16.4554	17.7807	23.1120	31.0208	39.3881	45.9717	49.0076	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.3763	282.2754	274.9699	259.4173	239.7849	221.3333	209.0065	206.1074	213.4129	228.9655	248.5979	267.0495	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	(71)
Water heating gains (Table 5)													
	80.7631	78.7998	74.7227	69.1799	65.5813	60.5144	56.2076	61.7257	63.6863	69.4233	75.9012	78.8080	(72)
Total internal gains													
	500.5668	496.1712	476.8797	447.4171	417.6026	391.0480	375.7397	383.6901	400.8651	430.5218	463.2158	487.6101	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	36.7938	0.3500	0.7000	0.7700	9.1207	(79)
Northwest	5.4400	11.2829	0.3500	0.7000	0.7700	10.4213	(81)

Solar gains	19.5419	36.7487	59.4756	89.1044	113.8710	119.2351	112.3804	92.9574	69.5868	43.0942	24.0371	16.3159	(83)
Total gains	520.1087	532.9199	536.3553	536.5215	531.4736	510.2831	488.1200	476.6475	470.4519	473.6160	487.2529	503.9260	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.3116	33.4311	33.5515	34.1666	34.2924	34.9352	34.9352	35.0667	34.6752	34.2924	34.0418	33.7949	
alpha	3.2208	3.2287	3.2368	3.2778	3.2862	3.3290	3.3290	3.3378	3.3117	3.2862	3.2695	3.2530	
util living area													
	0.9230	0.9112	0.8861	0.8322	0.7390	0.5897	0.4501	0.4761	0.6612	0.8228	0.8971	0.9286	(86)
MIT	19.6710	19.7964	20.0394	20.3837	20.6841	20.8956	20.9680	20.9608	20.8381	20.4942	20.0516	19.6512	(87)
Th 2	20.2241	20.2266	20.2292	20.2421	20.2447	20.2576	20.2576	20.2601	20.2524	20.2447	20.2395	20.2343	(88)
util rest of house													
	0.9141	0.9008	0.8722	0.8107	0.7041	0.5358	0.3810	0.4078	0.6108	0.7968	0.8836	0.9203	(89)
MIT 2	18.4469	18.6281	18.9769	19.4701	19.8799	20.1562	20.2338	20.2298	20.0863	19.6298	19.0046	18.4258	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	18.9027	19.0630	19.3725	19.8103	20.1793	20.4315	20.5072	20.5020	20.3662	19.9516	19.3944	18.8820	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9027	19.0630	19.3725	19.8103	20.1793	20.4315	20.5072	20.5020	20.3662	19.9516	19.3944	18.8820	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8958	0.8823	0.8543	0.7971	0.7009	0.5489	0.4048	0.4307	0.6189	0.7856	0.8662	0.9025	(94)
Useful gains	465.9121	470.1943	458.2169	427.6786	372.5016	280.1126	197.5748	205.2927	291.1586	372.0732	422.0638	454.8087	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	800.6260	773.7463	700.7178	583.2115	451.6019	304.8664	204.2644	213.6448	330.0481	498.0621	659.6098	793.4656	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	249.0272	203.9869	180.4207	111.9837	58.8506	0.0000	0.0000	0.0000	0.0000	93.7358	171.0331	251.9607	(98)
Space heating												1320.9987	(98)
Space heating per m2											(98) / (4) =	20.0912	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1320.9987	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	249.0272	203.9869	180.4207	111.9837	58.8506	0.0000	0.0000	0.0000	0.0000	93.7358	171.0331	251.9607	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	249.0272	203.9869	180.4207	111.9837	58.8506	0.0000	0.0000	0.0000	0.0000	93.7358	171.0331	251.9607	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(219)
Water heating fuel used												1543.1494	(219)
Annual totals kWh/year													
Space heating fuel - main system												1320.9987	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												147.8964	(230a)
Total electricity for the above, kWh/year												147.8964	(231)
Electricity for lighting (calculated in Appendix L)												336.8344	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3348.8789	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1320.9987	13.1900	174.2397	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1543.1494	13.1900	203.5414	(247)
Mechanical ventilation fans	147.8964	13.1900	19.5075	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	336.8344	13.1900	44.4285	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			441.7171	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.6751	(257)
SAP value		76.6319	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1320.9987	0.5190	685.5984	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1543.1494	0.5190	800.8945	(264)
Space and water heating			1486.4929	(265)
Pumps and fans	147.8964	0.5190	76.7582	(267)
Energy for lighting	336.8344	0.5190	174.8170	(268)
Energy saving/generation technologies				
PV Unit	-469.4500	0.5190	-243.6446	(269)
Total kg/year			1494.4236	(272)
CO2 emissions per m2			22.7300	(273)
EI value			81.9185	
EI rating			82	(274)
EI band			B	

Calculation of stars for heating and DHW

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	65.7500 (1b)	x	2.5000 (2b)	=	164.3750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.7500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	164.3750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7300	
Infiltration rate		0.1865	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1445	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1590	0.1554	0.1554	0.1409	0.1445	0.1265	0.1192	0.1229	0.1229	0.1409	0.1409	0.1445	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2595	0.2559	0.2559	0.2414	0.2450	0.2270	0.2197	0.2234	0.2234	0.2414	0.2414	0.2450	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			6.9000	1.4151	9.7642			(27)
New External	52.4300	6.9000	45.5300	0.1600	7.2848			(29a)
External Roof 1	65.7500		65.7500	0.1500	9.8625			(30)
Total net area of external elements Aum(A, m2)			118.1800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9115			(33)
Party Wall 1			16.6800	0.0000	0.0000			(32)
Corridor			40.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4681	(36)
Total fabric heat loss (33) + (36) =	39.3796	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.0758	13.8798	13.8798	13.0957	13.2918	12.3117	11.9197	12.1157	12.1157	13.0957	13.0957	13.2918	(38)
Heat transfer coeff	53.4553	53.2593	53.2593	52.4753	52.6713	51.6913	51.2993	51.4953	51.4953	52.4753	52.4753	52.6713	(39)
Average = Sum(39)m / 12 =												52.3936	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8130	0.8100	0.8100	0.7981	0.8011	0.7862	0.7802	0.7832	0.7832	0.7981	0.7981	0.8011	(40)
HLP (average)												0.7969	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1387 (42)
Average daily hot water use (litres/day)	84.9942 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	93.4936	90.0938	86.6941	83.2943	79.8945	76.4948	76.4948	79.8945	83.2943	86.6941	90.0938	93.4936	(44)
Energy conte	138.6483	121.2627	125.1322	109.0933	104.6776	90.3288	83.7029	96.0504	97.1975	113.2743	123.6478	134.2735	(45)
Energy content (annual)										Total = Sum(45)m =		1337.2894	(45)
Distribution loss (46)m = 0.15 x (45)m	20.7972	18.1894	18.7698	16.3640	15.7016	13.5493	12.5554	14.4076	14.5796	16.9911	18.5472	20.1410	(46)
Water storage loss:													

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(64)
								Total per year (kWh/year) = Sum(64)m =				1543.1494	(64)
Heat gains from water heating, kWh/month													
	60.0878	52.9534	55.5937	49.8095	48.7925	43.5703	41.8184	45.9239	45.8542	51.6509	54.6489	58.6331	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	128.3221	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.6824	42.3511	34.4422	26.0750	19.4913	16.4554	17.7807	23.1120	31.0208	39.3881	45.9717	49.0076	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	279.3763	282.2754	274.9699	259.4173	239.7849	221.3333	209.0065	206.1074	213.4129	228.9655	248.5979	267.0495	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	49.9709	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	-85.5481	(71)
Water heating gains (Table 5)													
	80.7631	78.7998	74.7227	69.1799	65.5813	60.5144	56.2076	61.7257	63.6863	69.4233	75.9012	78.8080	(72)
Total internal gains													
	500.5668	496.1712	476.8797	447.4171	417.6026	391.0480	375.7397	383.6901	400.8651	430.5218	463.2158	487.6101	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	1.4600	31.1332	0.3500	0.7000	0.7700	7.7175	(79)
Northwest	5.4400	9.5471	0.3500	0.7000	0.7700	8.8180	(81)

Solar gains	16.5355	32.6655	55.7584	86.1343	106.7541	113.8695	105.2451	85.8524	67.1664	41.1354	21.8519	14.7620	(83)
Total gains	517.1023	528.8367	532.6381	533.5514	524.3567	504.9175	480.9848	469.5425	468.0315	471.6572	485.0677	502.3721	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.1666	34.2924	34.2924	34.8047	34.6752	35.3326	35.6026	35.4671	35.4671	34.8047	34.8047	34.6752	
alpha	3.2778	3.2862	3.2862	3.3203	3.3117	3.3555	3.3735	3.3645	3.3645	3.3203	3.3203	3.3117	
util living area													
	0.9140	0.9009	0.8742	0.8073	0.6940	0.5318	0.4031	0.4323	0.6294	0.8042	0.8831	0.9196	(86)
MIT	19.8228	19.9412	20.1541	20.4980	20.7736	20.9348	20.9807	20.9747	20.8750	20.5661	20.1821	19.8068	(87)
Th 2	20.2421	20.2447	20.2447	20.2550	20.2524	20.2653	20.2705	20.2679	20.2679	20.2550	20.2550	20.2524	(88)
util rest of house													
	0.9040	0.8893	0.8589	0.7827	0.6533	0.4728	0.3323	0.3611	0.5764	0.7756	0.8677	0.9102	(89)
MIT 2	18.6770	18.8476	19.1502	19.6373	20.0023	20.2071	20.2577	20.2502	20.1437	19.7355	19.2004	18.6616	(90)
Living area fraction									fLA = Living area / (4) =			0.3723	(91)
MIT	19.1036	19.2548	19.5239	19.9578	20.2894	20.4780	20.5269	20.5199	20.4160	20.0448	19.5659	19.0880	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1036	19.2548	19.5239	19.9578	20.2894	20.4780	20.5269	20.5199	20.4160	20.0448	19.5659	19.0880	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8860	0.8714	0.8421	0.7719	0.6554	0.4904	0.3576	0.3861	0.5876	0.7667	0.8514	0.8926	(94)
Useful gains	458.1536	460.8344	448.5250	411.8562	343.6608	247.5954	172.0116	181.2961	275.0171	361.6060	412.9723	448.4422	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	753.9141	727.2435	661.6907	538.2806	399.7459	262.4906	175.7976	186.4095	304.6447	469.3787	617.4190	747.3015	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	220.0458	179.0269	158.5953	91.0256	41.7274	0.0000	0.0000	0.0000	0.0000	80.1829	147.2016	222.3513	(98)
Space heating												1140.1568	(98)
Space heating per m2											(98) / (4) =	17.3408	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1140.1568	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	220.0458	179.0269	158.5953	91.0256	41.7274	0.0000	0.0000	0.0000	0.0000	80.1829	147.2016	222.3513	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	220.0458	179.0269	158.5953	91.0256	41.7274	0.0000	0.0000	0.0000	0.0000	80.1829	147.2016	222.3513	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	156.1323	137.0547	142.6162	126.0133	122.1616	107.2488	101.1869	113.5344	114.1175	130.7583	140.5678	151.7575	(219)
Water heating fuel used												1543.1494	(219)
Annual totals kWh/year													
Space heating fuel - main system												1140.1568	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												147.8964	(230a)
Total electricity for the above, kWh/year												147.8964	(231)
Electricity for lighting (calculated in Appendix L)												336.8344	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3168.0369	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1140.1568	31.0800	354.3607	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1543.1494	31.0800	479.6108	(247)
Mechanical ventilation fans	147.8964	31.0800	45.9662	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	336.8344	31.0800	104.6881	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			984.6259	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1140.1568	0.5190	591.7414	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1543.1494	0.5190	800.8945	(264)
Space and water heating			1392.6359	(265)
Pumps and fans	147.8964	0.5190	76.7582	(267)
Energy for lighting	336.8344	0.5190	174.8170	(268)
Energy saving/generation technologies				
PV Unit	-469.4500	0.5190	-243.6446	(269)
Total kg/year			1400.5666	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1140.1568	3.0700	3500.2812	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1543.1494	3.0700	4737.4687	(264)
Space and water heating			8237.7499	(265)
Pumps and fans	147.8964	3.0700	454.0420	(267)
Energy for lighting	336.8344	3.0700	1034.0815	(268)
Energy saving/generation technologies				
PV Unit	-469.4500	3.0700	-1441.2115	(269)
Primary energy kWh/year			8284.6619	(272)
Primary energy kWh/m2/year			126.0025	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 77
Current environmental impact rating: B 82

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 77
Potential environmental impact rating: B 82

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£985	£985	£0
Space heating	£400	£400	£0
Water heating	£480	£480	£0
Lighting	£105	£105	£0
Total cost of fuels	£985	£985	£0
Total cost of uses	£985	£985	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.4 tonnes	0.0 tonnes
CO2 emissions per m²	21 kg/m²	21 kg/m²	0 kg/m²
Primary energy	126 kWh/m²	126 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-31	**Issued on Date**	11/01/2024
Assessment Reference	7765-31	**Prop Type Ref**	
Property	Flat 31, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	77 C	**DER**	29.62	**TER**	33.39
Environmental	82 B	**% DER<TER**	11.30		
CO_2 Emissions (t/year)	1.20	**DFEE**	47.95	**TFEE**	62.19
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.90		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Top-floor flat, total floor area 49 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 33.39 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 29.62 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)62.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 2.76 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing North East: 1.39 m², No overhang
Windows facing North West: 5.94 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 2.8 m³/m²h
Photovoltaic array 347.21 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		2.7600	
Infiltration rate		0.1380	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1070	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1364	0.1337	0.1310	0.1176	0.1150	0.1016	0.1016	0.0989	0.1070	0.1150	0.1203	0.1257	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2369	0.2342	0.2315	0.2181	0.2155	0.2021	0.2021	0.1994	0.2075	0.2155	0.2208	0.2262	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.3300	1.4151	10.3726			(27)
New External	44.1800	7.3300	36.8500	0.1600	5.8960			(29a)
External Roof 1	48.6300		48.6300	0.1500	7.2945			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.5631			(33)
Party Wall 1			17.8800	0.0000	0.0000			(32)
Corridor			28.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8075	(36)
Total fabric heat loss (33) + (36) =	34.3706	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5028	9.3955	9.2883	8.7519	8.6447	8.1083	8.1083	8.0010	8.3228	8.6447	8.8592	9.0737	(38)
Heat transfer coeff	43.8735	43.7662	43.6589	43.1226	43.0153	42.4789	42.4789	42.3717	42.6935	43.0153	43.2298	43.4444	(39)
Average = Sum(39)m / 12 =												43.0957	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9022	0.9000	0.8978	0.8867	0.8845	0.8735	0.8735	0.8713	0.8779	0.8845	0.8890	0.8934	(40)
HLP (average)												0.8862	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498 (42)
Average daily hot water use (litres/day)	73.3839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	17.9563	15.7047	16.2059	14.1287	13.5568	11.6985	10.8404	12.4395	12.5880	14.6701	16.0136	17.3897	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Total per year (kWh/year) = Sum(64)m =												1360.4750	(64)
Heat gains from water heating, kWh/month													
	53.7904	47.4457	49.9102	44.8545	44.0381	39.4676	38.0167	41.5614	41.4395	46.5060	49.0328	52.5345	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5265	12.0141	9.7705	7.3969	5.5293	4.6680	5.0440	6.5564	8.7999	11.1735	13.0412	13.9024	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	143.6764	145.1673	141.4103	133.4119	123.3155	113.8263	107.4869	105.9960	109.7530	117.7514	127.8478	137.3370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)
Water heating gains (Table 5)													
	72.2989	70.6038	67.0836	62.2980	59.1910	54.8162	51.0977	55.8621	57.5548	62.5081	68.1012	70.6109	(72)
Total internal gains													
	277.2495	275.5329	266.0121	250.8546	235.7835	221.0582	211.3763	216.1622	223.8556	239.1807	256.7379	269.5980	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	11.2829	0.3500	0.7000	0.7700	2.6628	(75)
Northwest	5.9400	11.2829	0.3500	0.7000	0.7700	11.3791	(81)

Solar gains	14.0419	28.5827	51.4969	84.5727	113.6823	121.1974	113.3776	90.3860	62.7498	34.9303	17.6683	11.4673	(83)
Total gains	291.2914	304.1156	317.5090	335.4273	349.4658	342.2556	324.7540	306.5481	286.6053	274.1110	274.4062	281.0653	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.7893	30.8648	30.9406	31.3254	31.4036	31.8001	31.8001	31.8806	31.6403	31.4036	31.2477	31.0934	
alpha	3.0526	3.0577	3.0627	3.0884	3.0936	3.1200	3.1200	3.1254	3.1094	3.0936	3.0832	3.0729	
util living area													
	0.9631	0.9550	0.9359	0.8908	0.8042	0.6643	0.5270	0.5693	0.7669	0.9017	0.9495	0.9666	(86)
MIT	19.1828	19.3339	19.6478	20.0986	20.5185	20.8192	20.9359	20.9171	20.6967	20.1900	19.6253	19.1524	(87)
Th 2	20.1656	20.1675	20.1694	20.1788	20.1807	20.1901	20.1901	20.1920	20.1863	20.1807	20.1769	20.1731	(88)
util rest of house													
	0.9581	0.9488	0.9266	0.8739	0.7717	0.6066	0.4449	0.4885	0.7184	0.8831	0.9415	0.9620	(89)
MIT 2	17.7111	17.9309	18.3853	19.0346	19.6170	20.0124	20.1424	20.1270	19.8658	19.1730	18.3610	17.6717	(90)
Living area fraction									fLA = Living area / (4) =			0.4987	(91)
MIT	18.4450	18.6306	19.0149	19.5652	20.0665	20.4147	20.5381	20.5210	20.2801	19.6802	18.9914	18.4100	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4450	18.6306	19.0149	19.5652	20.0665	20.4147	20.5381	20.5210	20.2801	19.6802	18.9914	18.4100	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9447	0.9343	0.9107	0.8591	0.7667	0.6235	0.4814	0.5228	0.7245	0.8697	0.9271	0.9494	(94)
Useful gains	275.1796	284.1364	289.1585	288.1710	267.9364	213.3861	156.3360	160.2622	207.6470	238.3976	254.3962	266.8455	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	620.5890	600.9339	546.3857	459.9096	359.8885	247.0031	167.2868	174.6127	263.8512	390.5854	514.0646	617.3462	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	256.9846	212.8879	191.3770	123.6518	68.4124	0.0000	0.0000	0.0000	0.0000	113.2278	186.9613	260.7725	(98)
Space heating												1414.2751	(98)
Space heating per m2											(98) / (4) =	29.0824	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1414.2751	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	256.9846	212.8879	191.3770	123.6518	68.4124	0.0000	0.0000	0.0000	0.0000	113.2278	186.9613	260.7725	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	256.9846	212.8879	191.3770	123.6518	68.4124	0.0000	0.0000	0.0000	0.0000	113.2278	186.9613	260.7725	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(219)
Water heating fuel used												1360.4750	(219)
Annual totals kWh/year													
Space heating fuel - main system												1414.2751	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												109.3871	(230a)
Total electricity for the above, kWh/year												109.3871	(231)
Electricity for lighting (calculated in Appendix L)												238.8813	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3123.0186	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1414.2751	0.5190	734.0088	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1360.4750	0.5190	706.0865	(264)
Space and water heating			1440.0953	(265)
Pumps and fans	109.3871	0.5190	56.7719	(267)
Energy for lighting	238.8813	0.5190	123.9794	(268)
Energy saving/generation technologies				
PV Unit	-347.2100	0.5190	-180.2020	(269)
Total CO2, kg/year			1440.6446	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			29.6200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		29.6200	ZC1
Total Floor Area	TFA	48.6300	
Assumed number of occupants	N	1.6498	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.5076	ZC2
CO2 emissions from cooking, equation (L16)		3.2613	ZC3
Total CO2 emissions		50.3889	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		50.3889	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1645	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4145	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3212	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4096	0.4016	0.3935	0.3534	0.3453	0.3052	0.3052	0.2972	0.3212	0.3453	0.3614	0.3775	(22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			7.3300	1.3258	9.7178			(27)
New External	44.1800	7.3300	36.8500	0.1800	6.6330			(29a)
External Roof 1	48.6300		48.6300	0.1300	6.3219			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.6727			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8191	(36)
Total fabric heat loss					(33) + (36) =		37.4918	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4251	23.2944	23.1664	22.5647	22.4522	21.9282	21.9282	21.8311	22.1300	22.4522	22.6799	22.9179	(38)
Heat transfer coeff	60.9169	60.7862	60.6582	60.0565	59.9440	59.4200	59.4200	59.3229	59.6218	59.9440	60.1717	60.4097	(39)
Average = Sum(39)m / 12 =												60.0560	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2527	1.2500	1.2473	1.2350	1.2327	1.2219	1.2219	1.2199	1.2260	1.2327	1.2373	1.2422	(40)
HLP (average)												1.2350	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498	(42)
Average daily hot water use (litres/day)	73.3839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	17.9563	15.7047	16.2059	14.1287	13.5568	11.6985	10.8404	12.4395	12.5880	14.6701	16.0136	17.3897	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage													
	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	165.8459	146.3703	154.1762	138.8399	136.5157	122.6387	118.4062	129.0669	128.5691	143.9381	151.4062	162.0687	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	165.8459	146.3703	154.1762	138.8399	136.5157	122.6387	118.4062	129.0669	128.5691	143.9381	151.4062	162.0687	(64)
								Total per year (kWh/year) = Sum(64)m =				1697.8418	(64)
Heat gains from water heating, kWh/month													
	76.7129	68.1499	72.8327	67.0376	66.9605	61.6507	60.9391	64.4838	63.6225	69.4285	71.2159	75.4569	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5265	12.0141	9.7705	7.3969	5.5293	4.6680	5.0440	6.5564	8.7999	11.1735	13.0412	13.9024	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	143.6764	145.1673	141.4103	133.4119	123.3155	113.8263	107.4869	105.9960	109.7530	117.7514	127.8478	137.3370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)
Water heating gains (Table 5)													
	103.1087	101.4135	97.8934	93.1077	90.0007	85.6259	81.9074	86.6718	88.3646	93.3179	98.9109	101.4206	(72)
Total internal gains													
	311.0593	309.3427	299.8219	284.6643	269.5933	254.8680	245.1861	249.9719	257.6653	272.9905	290.5476	303.4078	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	11.2829	0.6300	0.7000	0.7700	4.7930	(75)
Northwest	5.9400	11.2829	0.6300	0.7000	0.7700	20.4824	(81)

Solar gains	25.2754	51.4488	92.6944	152.2308	204.6281	218.1552	204.0798	162.6947	112.9496	62.8745	31.8030	20.6412	(83)
Total gains	336.3347	360.7915	392.5163	436.8952	474.2214	473.0232	449.2658	412.6667	370.6149	335.8650	322.3506	324.0489	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4375	55.5567	55.6740	56.2317	56.3373	56.8342	56.8342	56.9271	56.6418	56.3373	56.1241	55.9030	
alpha	4.6958	4.7038	4.7116	4.7488	4.7558	4.7889	4.7889	4.7951	4.7761	4.7558	4.7416	4.7269	
util living area													
	0.9963	0.9942	0.9875	0.9624	0.8858	0.7267	0.5629	0.6274	0.8670	0.9749	0.9933	0.9969	(86)
MIT	19.7066	19.8241	20.0665	20.4176	20.7385	20.9303	20.9837	20.9733	20.8285	20.4369	20.0187	19.6860	(87)
Th 2	19.8781	19.8802	19.8823	19.8921	19.8940	19.9025	19.9025	19.9041	19.8992	19.8940	19.8902	19.8864	(88)
util rest of house													
	0.9950	0.9922	0.9829	0.9475	0.8405	0.6310	0.4321	0.4942	0.7970	0.9622	0.9906	0.9959	(89)
MIT 2	18.1724	18.3451	18.6985	19.2063	19.6359	19.8562	19.8966	19.8932	19.7587	19.2420	18.6365	18.1480	(90)
Living area fraction										fLA = Living area / (4) =		0.4987	(91)
MIT	18.9375	19.0826	19.3807	19.8104	20.1857	20.3918	20.4387	20.4318	20.2921	19.8378	19.3257	18.9149	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9375	19.0826	19.3807	19.8104	20.1857	20.3918	20.4387	20.4318	20.2921	19.8378	19.3257	18.9149	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9936	0.9903	0.9802	0.9461	0.8539	0.6762	0.4978	0.5610	0.8253	0.9613	0.9887	0.9946	(94)
Useful gains	334.1747	357.2810	384.7408	413.3620	404.9422	319.8542	223.6378	231.4983	305.8581	322.8786	318.6977	322.2972	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	891.6694	862.1084	781.3179	655.2386	508.6684	344.1487	228.0966	239.1779	369.1856	553.7533	735.6433	888.9249	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	414.7760	339.2440	295.0534	174.1511	77.1723	0.0000	0.0000	0.0000	0.0000	171.7708	300.2008	421.5710	(98)
Space heating												2193.9396	(98)
Space heating per m2											(98) / (4) =	45.1149	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2346.4594	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	414.7760	339.2440	295.0534	174.1511	77.1723	0.0000	0.0000	0.0000	0.0000	171.7708	300.2008	421.5710	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	443.6107	362.8278	315.5651	186.2579	82.5372	0.0000	0.0000	0.0000	0.0000	183.7121	321.0704	450.8781	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	165.8459	146.3703	154.1762	138.8399	136.5157	122.6387	118.4062	129.0669	128.5691	143.9381	151.4062	162.0687	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.1618	86.9845	86.5186	85.4193	83.3594	79.8000	79.8000	79.8000	79.8000	85.2863	86.6067	87.2513	(217)
Fuel for water heating, kWh/month													
	190.2738	168.2717	178.2001	162.5392	163.7677	153.6825	148.3786	161.7380	161.1141	168.7705	174.8204	185.7493	(219)
Water heating fuel used												2017.3059	(219)
Annual totals kWh/year													
Space heating fuel - main system												2346.4594	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												238.8813	(232)
Total delivered energy for all uses												4677.6466	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2346.4594	0.2160	506.8352	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2017.3059	0.2160	435.7381	(264)
Space and water heating			942.5733	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	238.8813	0.5190	123.9794	(268)
Total CO2, kg/m2/year			1105.4777	(272)
Emissions per m2 for space and water heating			19.3825	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.5494	(272b)
Emissions per m2 for pumps and fans			0.8004	(272c)
Target Carbon Dioxide Emission Rate (TER) = (19.3825 * 1.55) + 2.5494 + 0.8004, rounded to 2 d.p.			33.3900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1645	(8)
Pressure test		Yes	
Measured/design AP50		2.7600	
Infiltration rate		0.3025	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2344	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2989	0.2931	0.2872	0.2579	0.2520	0.2227	0.2227	0.2169	0.2344	0.2520	0.2637	0.2755	(22b)
Effective ac	0.5447	0.5429	0.5412	0.5333	0.5318	0.5248	0.5248	0.5235	0.5275	0.5318	0.5348	0.5379	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.3300	1.4151	10.3726			(27)
New External	44.1800	7.3300	36.8500	0.1600	5.8960			(29a)
External Roof 1	48.6300		48.6300	0.1500	7.2945			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.5631			(33)
Party Wall 1			17.8800	0.0000	0.0000			(32)
Corridor			28.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8075	(36)
Total fabric heat loss (33) + (36) =	34.3706	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.8522	21.7826	21.7144	21.3940	21.3340	21.0549	21.0549	21.0033	21.1624	21.3340	21.4553	21.5821	(38)
Heat transfer coeff	56.2229	56.1533	56.0851	55.7646	55.7047	55.4256	55.4256	55.3739	55.5331	55.7047	55.8259	55.9527	(39)
Average = Sum(39)m / 12 =												55.7643	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1561	1.1547	1.1533	1.1467	1.1455	1.1397	1.1397	1.1387	1.1420	1.1455	1.1480	1.1506	(40)
HLP (average)												1.1467	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498 (42)
Average daily hot water use (litres/day)	73.3839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	25.4381	22.2484	22.9583	20.0156	19.2055	16.5728	15.3572	17.6226	17.8331	20.7827	22.6860	24.6355	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.5265	12.0141	9.7705	7.3969	5.5293	4.6680	5.0440	6.5564	8.7999	11.1735	13.0412	13.9024	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	143.6764	145.1673	141.4103	133.4119	123.3155	113.8263	107.4869	105.9960	109.7530	117.7514	127.8478	137.3370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)
Water heating gains (Table 5)													
	34.1910	33.1077	30.8579	27.7995	25.8138	23.0178	20.6414	23.6863	24.7681	27.9337	31.5083	33.1122	(72)
Total internal gains													
	239.1416	238.0368	229.7864	216.3560	202.4063	189.2599	180.9200	183.9864	191.0689	204.6064	220.1450	232.0993	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	11.2829	0.3500	0.7000	0.7700	2.6628	(75)
Northwest	5.9400	11.2829	0.3500	0.7000	0.7700	11.3791	(81)

Solar gains	14.0419	28.5827	51.4969	84.5727	113.6823	121.1974	113.3776	90.3860	62.7498	34.9303	17.6683	11.4673	(83)
Total gains	253.1835	266.6195	281.2833	300.9287	316.0886	310.4573	294.2976	274.3723	253.8186	239.5367	237.8133	243.5667	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	24.0264	24.0562	24.0854	24.2238	24.2499	24.3720	24.3720	24.3948	24.3248	24.2499	24.1972	24.1424	
alpha	2.6018	2.6037	2.6057	2.6149	2.6167	2.6248	2.6248	2.6263	2.6217	2.6167	2.6131	2.6095	
util living area													
	0.9756	0.9703	0.9579	0.9291	0.8715	0.7705	0.6532	0.6968	0.8520	0.9393	0.9680	0.9780	(86)
MIT	18.4635	18.6329	19.0045	19.5466	20.1073	20.5741	20.8096	20.7657	20.3851	19.6963	18.9935	18.4222	(87)
Th 2	19.9553	19.9564	19.9575	19.9629	19.9639	19.9685	19.9685	19.9694	19.9667	19.9639	19.9618	19.9597	(88)
util rest of house													
	0.9718	0.9655	0.9507	0.9153	0.8424	0.7086	0.5474	0.5980	0.8071	0.9249	0.9620	0.9745	(89)
MIT 2	17.6305	17.7996	18.1691	18.7069	19.2497	19.6825	19.8742	19.8455	19.5211	18.8598	18.1632	17.5927	(90)
Living area fraction										fLA = Living area / (4) =		0.4987	(91)
MIT	18.0459	18.2151	18.5857	19.1256	19.6774	20.1271	20.3406	20.3044	19.9520	19.2769	18.5773	18.0064	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0459	18.2151	18.5857	19.1256	19.6774	20.1271	20.3406	20.3044	19.9520	19.2769	18.5773	18.0064	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9625	0.9550	0.9383	0.9014	0.8329	0.7193	0.5890	0.6335	0.8063	0.9128	0.9515	0.9658	(94)
Useful gains	243.6777	254.6233	263.9207	271.2694	263.2548	223.3041	173.3532	173.8265	204.6565	218.6389	226.2723	235.2334	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	772.8330	747.6884	677.8282	570.2289	444.3782	306.3427	207.3264	216.2004	324.9769	483.3438	640.7287	772.5035	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	393.6915	331.3397	307.9471	215.2508	134.7558	0.0000	0.0000	0.0000	0.0000	196.9404	298.4086	399.7290	(98)
Space heating												2278.0629	(98)
Space heating per m2											(98) / (4) =	46.8448	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	521.0005	410.1493	420.8416	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6478	0.7202	0.6898	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	337.4816	295.3905	290.2890	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	425.7831	405.7448	383.4720	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	63.5771	82.1036	69.3281	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												215.0088	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	15.8943	20.5259	17.3320	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												53.7522 (107)
Space cooling per m2												1.1053 (108)
Energy for space heating												46.8448 (99)
Energy for space cooling												1.1053 (108)
Total												47.9501 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.0 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1645	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4145	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3212	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4096	0.4016	0.3935	0.3534	0.3453	0.3052	0.3052	0.2972	0.3212	0.3453	0.3614	0.3775	(22b)
Effective ac	0.5839	0.5806	0.5774	0.5624	0.5596	0.5466	0.5466	0.5441	0.5516	0.5596	0.5653	0.5712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			7.3300	1.3258	9.7178			(27)
New External	44.1800	7.3300	36.8500	0.1800	6.6330			(29a)
External Roof 1	48.6300		48.6300	0.1300	6.3219			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.6727			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8191	(36)
Total fabric heat loss					(33) + (36) =		37.4918	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.4251	23.2944	23.1664	22.5647	22.4522	21.9282	21.9282	21.8311	22.1300	22.4522	22.6799	22.9179	(38)
Heat transfer coeff	60.9169	60.7862	60.6582	60.0565	59.9440	59.4200	59.4200	59.3229	59.6218	59.9440	60.1717	60.4097	(39)
Average = Sum(39)m / 12 =												60.0560	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2527	1.2500	1.2473	1.2350	1.2327	1.2219	1.2219	1.2199	1.2260	1.2327	1.2373	1.2422	(40)
HLP (average)												1.2350	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498	(42)
Average daily hot water use (litres/day)	73.3839	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	25.4381	22.2484	22.9583	20.0156	19.2055	16.5728	15.3572	17.6226	17.8331	20.7827	22.6860	24.6355 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	82.4925	(66)

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

	13.5265	12.0141	9.7705	7.3969	5.5293	4.6680	5.0440	6.5564	8.7999	11.1735	13.0412	13.9024	(67)

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

	143.6764	145.1673	141.4103	133.4119	123.3155	113.8263	107.4869	105.9960	109.7530	117.7514	127.8478	137.3370	(68)

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

	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	31.2492	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)

Water heating gains (Table 5)

	34.1910	33.1077	30.8579	27.7995	25.8138	23.0178	20.6414	23.6863	24.7681	27.9337	31.5083	33.1122	(72)
Total internal gains													
	239.1416	238.0368	229.7864	216.3560	202.4063	189.2599	180.9200	183.9864	191.0689	204.6064	220.1450	232.0993	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	11.2829	0.6300	0.7000	0.7700	4.7930	(75)
Northwest	5.9400	11.2829	0.6300	0.7000	0.7700	20.4824	(81)

Solar gains	25.2754	51.4488	92.6944	152.2308	204.6281	218.1552	204.0798	162.6947	112.9496	62.8745	31.8030	20.6412	(83)
Total gains	264.4170	289.4856	322.4809	368.5869	407.0344	407.4152	384.9998	346.6811	304.0184	267.4809	251.9480	252.7405	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.4375	55.5567	55.6740	56.2317	56.3373	56.8342	56.8342	56.9271	56.6418	56.3373	56.1241	55.9030	
alpha	4.6958	4.7038	4.7116	4.7488	4.7558	4.7889	4.7889	4.7951	4.7761	4.7558	4.7416	4.7269	
util living area													
	0.9987	0.9977	0.9944	0.9800	0.9277	0.7976	0.6409	0.7163	0.9254	0.9897	0.9976	0.9989	(86)
MIT	19.5720	19.6916	19.9395	20.3049	20.6578	20.8945	20.9720	20.9531	20.7523	20.3176	19.8879	19.5519	(87)
Th 2	19.8781	19.8802	19.8823	19.8921	19.8940	19.9025	19.9025	19.9041	19.8992	19.8940	19.8902	19.8864	(88)
util rest of house													
	0.9982	0.9969	0.9922	0.9712	0.8940	0.7072	0.4996	0.5778	0.8755	0.9839	0.9966	0.9986	(89)
MIT 2	18.5794	18.7005	18.9491	19.3175	19.6517	19.8512	19.8951	19.8897	19.7476	19.3347	18.9046	18.5659	(90)
Living area fraction									fLA = Living area / (4) =			0.4987	(91)
MIT	19.0744	19.1947	19.4430	19.8099	20.1534	20.3714	20.4321	20.4200	20.2486	19.8248	19.3949	19.0576	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0744	19.1947	19.4430	19.8099	20.1534	20.3714	20.4321	20.4200	20.2486	19.8248	19.3949	19.0576	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9962	0.9910	0.9704	0.9031	0.7493	0.5709	0.6476	0.8943	0.9834	0.9960	0.9982	(94)
Useful gains	263.8232	288.3863	319.5912	357.6917	367.6124	305.2559	219.8035	224.5022	271.8932	263.0465	250.9405	252.2858	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	900.0108	868.9214	785.0965	655.2099	506.7314	342.9391	227.7028	238.4788	366.5911	552.9725	739.8041	897.5437	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	473.3235	390.1196	346.3360	214.2131	103.5046	0.0000	0.0000	0.0000	0.0000	215.7050	351.9818	480.0719	(98)
Space heating												2575.2553	(98)
Space heating per m2											(98) / (4) =	52.9561	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	558.5477	439.7077	450.8543	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8123	0.8835	0.8425	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	453.7007	388.5036	379.8453	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	539.1105	511.7603	467.9888	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	61.4951	91.7029	65.5788	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												218.7768	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	15.3738	22.9257	16.3947	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												54.6942 (107)
Space cooling per m2												1.1247 (108)
Energy for space heating												52.9561 (99)
Energy for space cooling												1.1247 (108)
Total												54.0808 (109)
Target Fabric Energy Efficiency (TFEE)												62.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		2.7600	
Infiltration rate		0.1380	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1070	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1176	0.1150	0.1150	0.1043	0.1070	0.0936	0.0882	0.0909	0.0909	0.1043	0.1043	0.1070	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2181	0.2155	0.2155	0.2048	0.2075	0.1941	0.1887	0.1914	0.1914	0.2048	0.2048	0.2075	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.3300	1.4151	10.3726			(27)
New External	44.1800	7.3300	36.8500	0.1600	5.8960			(29a)
External Roof 1	48.6300		48.6300	0.1500	7.2945			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.5631			(33)
Party Wall 1			17.8800	0.0000	0.0000			(32)
Corridor			28.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8075	(36)
Total fabric heat loss (33) + (36) =	34.3706	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	8.7519	8.6447	8.6447	8.2156	8.3228	7.7865	7.5720	7.6792	7.6792	8.2156	8.2156	8.3228	(38)
Heat transfer coeff	43.1226	43.0153	43.0153	42.5862	42.6935	42.1571	41.9426	42.0499	42.0499	42.5862	42.5862	42.6935	(39)
Average = Sum(39)m / 12 =												42.5415	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8867	0.8845	0.8845	0.8757	0.8779	0.8669	0.8625	0.8647	0.8647	0.8757	0.8757	0.8779	(40)
HLP (average)												0.8748	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498 (42)
Average daily hot water use (litres/day)	73.3839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	17.9563	15.7047	16.2059	14.1287	13.5568	11.6985	10.8404	12.4395	12.5880	14.6701	16.0136	17.3897	(46)

Water storage loss:

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Total per year (kWh/year) = Sum(64)m =												1360.4750	(64)
RHI water heating demand												1360	(64)
Heat gains from water heating, kWh/month													
	53.7904	47.4457	49.9102	44.8545	44.0381	39.4676	38.0167	41.5614	41.4395	46.5060	49.0328	52.5345	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8161	30.0352	24.4263	18.4922	13.8232	11.6701	12.6100	16.3909	21.9998	27.9338	32.6029	34.7560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4424	216.6676	211.0601	199.1223	184.0530	169.8900	160.4282	158.2030	163.8105	175.7483	190.8176	204.9806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)
Water heating gains (Table 5)													
	72.2989	70.6038	67.0836	62.2980	59.1910	54.8162	51.0977	55.8621	57.5548	62.5081	68.1012	70.6109	(72)
Total internal gains													
	400.1034	396.8525	382.1159	359.4585	336.6131	315.9222	303.6818	310.0019	322.9111	345.7362	371.0676	389.8934	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	9.5471	0.3500	0.7000	0.7700	2.2531	(75)
Northwest	5.9400	9.5471	0.3500	0.7000	0.7700	9.6285	(81)

Solar gains	11.8816	25.4068	48.2783	81.7536	106.5771	115.7435	106.1791	83.4775	60.5672	33.3426	16.0621	10.3752	(83)
Total gains	411.9850	422.2593	430.3942	441.2121	443.1902	431.6657	409.8609	393.4794	383.4783	379.0787	387.1297	400.2686	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.3254	31.4036	31.4036	31.7200	31.6403	32.0428	32.2067	32.1246	32.1246	31.7200	31.7200	31.6403	
alpha	3.0884	3.0936	3.0936	3.1147	3.1094	3.1362	3.1471	3.1416	3.1416	3.1147	3.1147	3.1094	
util living area													
	0.9067	0.8930	0.8630	0.7888	0.6666	0.5062	0.3855	0.4191	0.6190	0.7956	0.8758	0.9128	(86)
MIT	19.7209	19.8455	20.0837	20.4592	20.7610	20.9285	20.9772	20.9694	20.8535	20.5128	20.0944	19.6939	(87)
Th 2	20.1788	20.1807	20.1807	20.1882	20.1863	20.1957	20.1995	20.1976	20.1976	20.1882	20.1882	20.1863	(88)
util rest of house													
	0.8956	0.8802	0.8460	0.7616	0.6227	0.4442	0.3113	0.3437	0.5624	0.7648	0.8590	0.9023	(89)
MIT 2	18.4878	18.6665	19.0040	19.5304	19.9270	20.1336	20.1851	20.1771	20.0548	19.6107	19.0287	18.4548	(90)
Living area fraction									fLA = Living area / (4) =			0.4987	(91)
MIT	19.1027	19.2544	19.5424	19.9935	20.3429	20.5300	20.5801	20.5722	20.4531	20.0605	19.5601	19.0727	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1027	19.2544	19.5424	19.9935	20.3429	20.5300	20.5801	20.5722	20.4531	20.0605	19.5601	19.0727	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8784	0.8633	0.8309	0.7545	0.6316	0.4706	0.3471	0.3795	0.5812	0.7595	0.8442	0.8854	(94)
Useful gains	361.8693	364.5519	357.6340	332.8987	279.8994	203.1620	142.2663	149.3441	222.8733	287.8972	326.8113	354.3830	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	608.1456	587.3488	535.2123	438.3632	326.3012	216.2650	145.9642	154.4161	250.3258	381.5954	500.8182	605.0829	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	183.2295	149.7195	132.1182	75.9345	34.5230	0.0000	0.0000	0.0000	0.0000	69.7115	125.2849	186.5207	(98)
Space heating												957.0418	(98)
RHI space heating demand												957	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		2.7600	
Infiltration rate		0.1380	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1070	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1364	0.1337	0.1310	0.1176	0.1150	0.1016	0.1016	0.0989	0.1070	0.1150	0.1203	0.1257	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2369	0.2342	0.2315	0.2181	0.2155	0.2021	0.2021	0.1994	0.2075	0.2155	0.2208	0.2262	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.3300	1.4151	10.3726			(27)
New External	44.1800	7.3300	36.8500	0.1600	5.8960			(29a)
External Roof 1	48.6300		48.6300	0.1500	7.2945			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.5631			(33)
Party Wall 1			17.8800	0.0000	0.0000			(32)
Corridor			28.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8075	(36)
Total fabric heat loss (33) + (36) =	34.3706	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5028	9.3955	9.2883	8.7519	8.6447	8.1083	8.1083	8.0010	8.3228	8.6447	8.8592	9.0737	(38)
Heat transfer coeff	43.8735	43.7662	43.6589	43.1226	43.0153	42.4789	42.4789	42.3717	42.6935	43.0153	43.2298	43.4444	(39)
Average = Sum(39)m / 12 =												43.0957	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9022	0.9000	0.8978	0.8867	0.8845	0.8735	0.8735	0.8713	0.8779	0.8845	0.8890	0.8934	(40)
HLP (average)												0.8862	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498 (42)
Average daily hot water use (litres/day)	73.3839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	17.9563	15.7047	16.2059	14.1287	13.5568	11.6985	10.8404	12.4395	12.5880	14.6701	16.0136	17.3897	(46)

Water storage loss:

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Total per year (kWh/year) = Sum(64)m =												1360.4750	(64)
Heat gains from water heating, kWh/month													
	53.7904	47.4457	49.9102	44.8545	44.0381	39.4676	38.0167	41.5614	41.4395	46.5060	49.0328	52.5345	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8161	30.0352	24.4263	18.4922	13.8232	11.6701	12.6100	16.3909	21.9998	27.9338	32.6029	34.7560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4424	216.6676	211.0601	199.1223	184.0530	169.8900	160.4282	158.2030	163.8105	175.7483	190.8176	204.9806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)
Water heating gains (Table 5)													
	72.2989	70.6038	67.0836	62.2980	59.1910	54.8162	51.0977	55.8621	57.5548	62.5081	68.1012	70.6109	(72)
Total internal gains													
	400.1034	396.8525	382.1159	359.4585	336.6131	315.9222	303.6818	310.0019	322.9111	345.7362	371.0676	389.8934	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	11.2829	0.3500	0.7000	0.7700	2.6628	(75)
Northwest	5.9400	11.2829	0.3500	0.7000	0.7700	11.3791	(81)

Solar gains	14.0419	28.5827	51.4969	84.5727	113.6823	121.1974	113.3776	90.3860	62.7498	34.9303	17.6683	11.4673	(83)
Total gains	414.1453	425.4352	433.6128	444.0312	450.2954	437.1195	417.0594	400.3878	385.6609	380.6665	388.7360	401.3607	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	30.7893	30.8648	30.9406	31.3254	31.4036	31.8001	31.8001	31.8806	31.6403	31.4036	31.2477	31.0934	
alpha	3.0526	3.0577	3.0627	3.0884	3.0936	3.1200	3.1200	3.1254	3.1094	3.0936	3.0832	3.0729	
util living area													
	0.9154	0.9027	0.8741	0.8126	0.7093	0.5597	0.4272	0.4590	0.6472	0.8129	0.8891	0.9215	(86)
MIT	19.5791	19.7106	19.9773	20.3492	20.6738	20.8895	20.9644	20.9548	20.8176	20.4420	19.9689	19.5483	(87)
Th 2	20.1656	20.1675	20.1694	20.1788	20.1807	20.1901	20.1901	20.1920	20.1863	20.1807	20.1769	20.1731	(88)
util rest of house													
	0.9055	0.8912	0.8586	0.7886	0.6713	0.5030	0.3554	0.3871	0.5935	0.7848	0.8743	0.9122	(89)
MIT 2	18.2757	18.4647	18.8457	19.3724	19.8102	20.0854	20.1647	20.1582	20.0025	19.5089	18.8432	18.2370	(90)
Living area fraction									fLA = Living area / (4) =			0.4987	(91)
MIT	18.9256	19.0860	19.4100	19.8595	20.2408	20.4864	20.5635	20.5554	20.4090	19.9742	19.4045	18.8909	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9256	19.0860	19.4100	19.8595	20.2408	20.4864	20.5635	20.5554	20.4090	19.9742	19.4045	18.8909	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8878	0.8737	0.8424	0.7784	0.6743	0.5244	0.3891	0.4202	0.6090	0.7770	0.8582	0.8949	(94)
Useful gains	367.6856	371.6829	365.2589	345.6440	303.6206	229.2307	162.2973	168.2400	234.8496	295.7863	333.6294	359.1675	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	641.6763	620.8657	563.6357	472.6026	367.3868	250.0473	168.3659	176.0720	269.3515	403.2351	531.9236	638.2350	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	203.8491	167.4508	147.5923	91.4102	47.4420	0.0000	0.0000	0.0000	0.0000	79.9419	142.7718	207.6262	(98)
Space heating												1088.0843	(98)
Space heating per m2											(98) / (4) =	22.3748	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1088.0843	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	203.8491	167.4508	147.5923	91.4102	47.4420	0.0000	0.0000	0.0000	0.0000	79.9419	142.7718	207.6262	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	203.8491	167.4508	147.5923	91.4102	47.4420	0.0000	0.0000	0.0000	0.0000	79.9419	142.7718	207.6262	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(219)
Water heating fuel used												1360.4750	(219)
Annual totals kWh/year													
Space heating fuel - main system												1088.0843	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												109.3871	(230a)
Total electricity for the above, kWh/year												109.3871	(231)
Electricity for lighting (calculated in Appendix L)												238.8813	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2796.8277	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1088.0843	13.1900	143.5183	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1360.4750	13.1900	179.4466	(247)
Mechanical ventilation fans	109.3871	13.1900	14.4282	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	238.8813	13.1900	31.5084	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			368.9016	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.6548	(257)
SAP value		76.9156	
SAP rating (Section 12)		77	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1088.0843	0.5190	564.7158	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1360.4750	0.5190	706.0865	(264)
Space and water heating			1270.8023	(265)
Pumps and fans	109.3871	0.5190	56.7719	(267)
Energy for lighting	238.8813	0.5190	123.9794	(268)
Energy saving/generation technologies				
PV Unit	-347.2100	0.5190	-180.2020	(269)
Total kg/year			1271.3516	(272)
CO2 emissions per m2			26.1400	(273)
EI value			81.8049	
EI rating			82	(274)
EI band			B	

Calculation of stars for heating and DHW

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	48.6300 (1b)	x	2.5000 (2b)	=	121.5750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	48.6300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.5750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		2.7600	
Infiltration rate		0.1380	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1070	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1176	0.1150	0.1150	0.1043	0.1070	0.0936	0.0882	0.0909	0.0909	0.1043	0.1043	0.1070	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2181	0.2155	0.2155	0.2048	0.2075	0.1941	0.1887	0.1914	0.1914	0.2048	0.2048	0.2075	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.3300	1.4151	10.3726			(27)
New External	44.1800	7.3300	36.8500	0.1600	5.8960			(29a)
External Roof 1	48.6300		48.6300	0.1500	7.2945			(30)
Total net area of external elements Aum(A, m2)			92.8100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.5631			(33)
Party Wall 1			17.8800	0.0000	0.0000			(32)
Corridor			28.1300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.8075	(36)
Total fabric heat loss (33) + (36) =	34.3706	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	8.7519	8.6447	8.6447	8.2156	8.3228	7.7865	7.5720	7.6792	7.6792	8.2156	8.2156	8.3228	(38)
Heat transfer coeff	43.1226	43.0153	43.0153	42.5862	42.6935	42.1571	41.9426	42.0499	42.0499	42.5862	42.5862	42.6935	(39)
Average = Sum(39)m / 12 =												42.5415	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8867	0.8845	0.8845	0.8757	0.8779	0.8669	0.8625	0.8647	0.8647	0.8757	0.8757	0.8779	(40)
HLP (average)												0.8748	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6498 (42)
Average daily hot water use (litres/day)	73.3839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	80.7223	77.7870	74.8516	71.9163	68.9809	66.0455	66.0455	68.9809	71.9163	74.8516	77.7870	80.7223	(44)
Energy conte	119.7089	104.6981	108.0391	94.1911	90.3786	77.9899	72.2691	82.9298	83.9203	97.8010	106.7574	115.9317	(45)
Energy content (annual)										Total = Sum(45)m =		1154.6150	(45)
Distribution loss (46)m = 0.15 x (45)m	17.9563	15.7047	16.2059	14.1287	13.5568	11.6985	10.8404	12.4395	12.5880	14.6701	16.0136	17.3897	(46)

Water storage loss:

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Total per year (kWh/year) = Sum(64)m =												1360.4750	(64)
Heat gains from water heating, kWh/month													
	53.7904	47.4457	49.9102	44.8545	44.0381	39.4676	38.0167	41.5614	41.4395	46.5060	49.0328	52.5345	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	98.9910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.8161	30.0352	24.4263	18.4922	13.8232	11.6701	12.6100	16.3909	21.9998	27.9338	32.6029	34.7560	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4424	216.6676	211.0601	199.1223	184.0530	169.8900	160.4282	158.2030	163.8105	175.7483	190.8176	204.9806	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	46.5489	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	-65.9940	(71)
Water heating gains (Table 5)													
	72.2989	70.6038	67.0836	62.2980	59.1910	54.8162	51.0977	55.8621	57.5548	62.5081	68.1012	70.6109	(72)
Total internal gains													
	400.1034	396.8525	382.1159	359.4585	336.6131	315.9222	303.6818	310.0019	322.9111	345.7362	371.0676	389.8934	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	1.3900	9.5471	0.3500	0.7000	0.7700	2.2531	(75)
Northwest	5.9400	9.5471	0.3500	0.7000	0.7700	9.6285	(81)

Solar gains	11.8816	25.4068	48.2783	81.7536	106.5771	115.7435	106.1791	83.4775	60.5672	33.3426	16.0621	10.3752	(83)
Total gains	411.9850	422.2593	430.3942	441.2121	443.1902	431.6657	409.8609	393.4794	383.4783	379.0787	387.1297	400.2686	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.3254	31.4036	31.4036	31.7200	31.6403	32.0428	32.2067	32.1246	32.1246	31.7200	31.7200	31.6403	
alpha	3.0884	3.0936	3.0936	3.1147	3.1094	3.1362	3.1471	3.1416	3.1416	3.1147	3.1147	3.1094	
util living area													
	0.9067	0.8930	0.8630	0.7888	0.6666	0.5062	0.3855	0.4191	0.6190	0.7956	0.8758	0.9128	(86)
MIT	19.7209	19.8455	20.0837	20.4592	20.7610	20.9285	20.9772	20.9694	20.8535	20.5128	20.0944	19.6939	(87)
Th 2	20.1788	20.1807	20.1807	20.1882	20.1863	20.1957	20.1995	20.1976	20.1976	20.1882	20.1882	20.1863	(88)
util rest of house													
	0.8956	0.8802	0.8460	0.7616	0.6227	0.4442	0.3113	0.3437	0.5624	0.7648	0.8590	0.9023	(89)
MIT 2	18.4878	18.6665	19.0040	19.5304	19.9270	20.1336	20.1851	20.1771	20.0548	19.6107	19.0287	18.4548	(90)
Living area fraction									fLA = Living area / (4) =			0.4987	(91)
MIT	19.1027	19.2544	19.5424	19.9935	20.3429	20.5300	20.5801	20.5722	20.4531	20.0605	19.5601	19.0727	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1027	19.2544	19.5424	19.9935	20.3429	20.5300	20.5801	20.5722	20.4531	20.0605	19.5601	19.0727	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8784	0.8633	0.8309	0.7545	0.6316	0.4706	0.3471	0.3795	0.5812	0.7595	0.8442	0.8854	(94)
Useful gains	361.8693	364.5519	357.6340	332.8987	279.8994	203.1620	142.2663	149.3441	222.8733	287.8972	326.8113	354.3830	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	608.1456	587.3488	535.2123	438.3632	326.3012	216.2650	145.9642	154.4161	250.3258	381.5954	500.8182	605.0829	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	183.2295	149.7195	132.1182	75.9345	34.5230	0.0000	0.0000	0.0000	0.0000	69.7115	125.2849	186.5207	(98)
Space heating												957.0418	(98)
Space heating per m2											(98) / (4) =	19.6801	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	957.0418	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	183.2295	149.7195	132.1182	75.9345	34.5230	0.0000	0.0000	0.0000	0.0000	69.7115	125.2849	186.5207	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	183.2295	149.7195	132.1182	75.9345	34.5230	0.0000	0.0000	0.0000	0.0000	69.7115	125.2849	186.5207	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	137.1929	120.4901	125.5231	111.1111	107.8626	94.9099	89.7531	100.4138	100.8403	115.2850	123.6774	133.4157	(219)
Water heating fuel used												1360.4750	(219)
Annual totals kWh/year													
Space heating fuel - main system												957.0418	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												109.3871	(230a)
Total electricity for the above, kWh/year												109.3871	(231)
Electricity for lighting (calculated in Appendix L)												238.8813	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2665.7852	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	957.0418	31.0800	297.4486	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1360.4750	31.0800	422.8356	(247)
Mechanical ventilation fans	109.3871	31.0800	33.9975	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	238.8813	31.0800	74.2443	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			828.5260	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	957.0418	0.5190	496.7047	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1360.4750	0.5190	706.0865	(264)
Space and water heating			1202.7912	(265)
Pumps and fans	109.3871	0.5190	56.7719	(267)
Energy for lighting	238.8813	0.5190	123.9794	(268)
Energy saving/generation technologies				
PV Unit	-347.2100	0.5190	-180.2020	(269)
Total kg/year			1203.3405	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	957.0418	3.0700	2938.1183	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1360.4750	3.0700	4176.6581	(264)
Space and water heating			7114.7764	(265)
Pumps and fans	109.3871	3.0700	335.8184	(267)
Energy for lighting	238.8813	3.0700	733.3657	(268)
Energy saving/generation technologies				
PV Unit	-347.2100	3.0700	-1065.9347	(269)
Primary energy kWh/year			7118.0259	(272)
Primary energy kWh/m2/year			146.3711	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 77
Current environmental impact rating: B 82

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 77
Potential environmental impact rating: B 82

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£829	£829	£0
Space heating	£331	£331	£0
Water heating	£423	£423	£0
Lighting	£74	£74	£0
Total cost of fuels	£829	£829	£0
Total cost of uses	£828	£828	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	25 kg/m²	25 kg/m²	0 kg/m²
Primary energy	146 kWh/m²	146 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-32	**Issued on Date**	11/01/2024
Assessment Reference	7765-32	**Prop Type Ref**	
Property	Flat 32, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	83 B	**DER**	18.02	**TER**	20.89
Environmental	88 B	**% DER<TER**	13.73		
CO_2 Emissions (t/year)	0.99	**DFEE**	27.32	**TFEE**	28.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	3.18		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Mid-floor flat, total floor area 68 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 20.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.02 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)28.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.97 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing North East: 3.02 m², No overhang
Windows facing South East: 4.81 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 481.95 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9700	
Infiltration rate		0.1985	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1538	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1961	0.1923	0.1885	0.1692	0.1654	0.1461	0.1461	0.1423	0.1538	0.1654	0.1731	0.1808	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2966	0.2928	0.2890	0.2697	0.2659	0.2466	0.2466	0.2428	0.2543	0.2659	0.2736	0.2813	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.8300	1.4151	11.0802			(27)
New External	41.4000	7.8300	33.5700	0.1600	5.3712			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4514			(33)
Party Wall 1			35.4000	0.0000	0.0000			(32)
Corridor			6.2800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0118	(36)
Total fabric heat loss (33) + (36) =	21.4632	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5193	16.3051	16.0910	15.0201	14.8059	13.7351	13.7351	13.5209	14.1634	14.8059	15.2343	15.6626	(38)
Heat transfer coeff	37.9825	37.7683	37.5541	36.4833	36.2691	35.1983	35.1983	34.9841	35.6266	36.2691	36.6975	37.1258	(39)
Average = Sum(39)m / 12 =												36.4297	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5627	0.5595	0.5564	0.5405	0.5373	0.5215	0.5215	0.5183	0.5278	0.5373	0.5437	0.5500	(40)
HLP (average)												0.5397	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
157.8847 138.5874 144.1978 127.3922 123.4847 108.3905 102.2449 114.7484 115.3460 132.1900 142.1306 153.4546 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
157.8847 138.5874 144.1978 127.3922 123.4847 108.3905 102.2449 114.7484 115.3460 132.1900 142.1306 153.4546 (64)
Total per year (kWh/year) = Sum(64)m = 1560.0516 (64)
Heat gains from water heating, kWh/month
60.6704 53.4631 56.1195 50.2680 49.2324 43.9499 42.1702 46.3276 46.2626 52.1269 55.1685 59.1974 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
19.0815 16.9480 13.7831 10.4347 7.8000 6.5851 7.1155 9.2489 12.4139 15.7623 18.3969 19.6118 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
191.3933 193.3794 188.3746 177.7199 164.2703 151.6296 143.1848 141.1987 146.2036 156.8582 170.3078 182.9485 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 33.9197 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 (71)
Water heating gains (Table 5)
81.5463 79.5581 75.4295 69.8167 66.1726 61.0416 56.6804 62.2683 64.2537 70.0631 76.6229 79.5664 (72)
Total internal gains
347.7801 345.6445 333.3461 313.7302 294.0020 275.0153 262.7396 268.4750 278.6301 298.4426 321.0867 337.8858 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	11.2829	0.3500	0.7000	0.7700	5.7853	(75)
Southeast	4.8100	36.7938	0.3500	0.7000	0.7700	30.0483	(77)

Solar gains	35.8336	62.9595	91.2482	121.6165	144.0297	146.4231	139.7380	122.4916	101.6823	70.9599	43.2703	30.4397	(83)
Total gains	383.6137	408.6041	424.5944	435.3468	438.0317	421.4384	402.4777	390.9666	380.3124	369.4026	364.3571	368.3255	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.3649	49.6448	49.9279	51.3934	51.6969	53.2697	53.2697	53.5958	52.6292	51.6969	51.0935	50.5040	
alpha	4.2910	4.3097	4.3285	4.4262	4.4465	4.5513	4.5513	4.5731	4.5086	4.4465	4.4062	4.3669	
util living area	0.9509	0.9327	0.8978	0.8213	0.6970	0.5197	0.3817	0.4074	0.6112	0.8248	0.9226	0.9564	(86)
MIT	20.1044	20.2448	20.4558	20.7186	20.8926	20.9788	20.9958	20.9944	20.9549	20.7564	20.4171	20.0929	(87)
Th 2	20.4637	20.4666	20.4694	20.4839	20.4867	20.5012	20.5012	20.5041	20.4954	20.4867	20.4810	20.4752	(88)
util rest of house	0.9456	0.9257	0.8871	0.8034	0.6690	0.4827	0.3395	0.3648	0.5738	0.8041	0.9135	0.9517	(89)
MIT 2	19.2412	19.4446	19.7474	20.1258	20.3605	20.4799	20.4978	20.4995	20.4478	20.1838	19.7045	19.2335	(90)
Living area fraction									fLA = Living area / (4) =			0.3950	(91)
MIT	19.5821	19.7606	20.0272	20.3599	20.5707	20.6770	20.6945	20.6950	20.6481	20.4099	19.9860	19.5730	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5821	19.7606	20.0272	20.3599	20.5707	20.6770	20.6945	20.6950	20.6481	20.4099	19.9860	19.5730	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9354	0.9150	0.8773	0.7988	0.6737	0.4959	0.3559	0.3813	0.5853	0.8008	0.9037	0.9421	(94)
Useful gains	358.8464	373.8706	372.4786	347.7761	295.1120	208.9756	143.2535	149.0828	222.6039	295.8008	329.2787	346.9982	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	580.4517	561.2603	508.0018	418.0953	321.7316	213.8992	144.1199	150.2551	233.2855	355.7973	472.8827	570.7338	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	164.8743	125.9259	100.8293	50.6298	19.8050	0.0000	0.0000	0.0000	0.0000	44.6374	103.3949	166.4593	(98)
Space heating												776.5559	(98)
Space heating per m2											(98) / (4) =	11.5045	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												776.5559	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	164.8743	125.9259	100.8293	50.6298	19.8050	0.0000	0.0000	0.0000	0.0000	44.6374	103.3949	166.4593	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	164.8743	125.9259	100.8293	50.6298	19.8050	0.0000	0.0000	0.0000	0.0000	44.6374	103.3949	166.4593	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(219)
Water heating fuel used												1560.0516	(219)
Annual totals kWh/year													
Space heating fuel - main system												776.5559	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												151.8328	(230a)
Total electricity for the above, kWh/year												151.8328	(231)
Electricity for lighting (calculated in Appendix L)												336.9855	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2825.4259	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	776.5559	0.5190	403.0325	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	0.5190	809.6668	(264)
Space and water heating			1212.6993	(265)
Pumps and fans	151.8328	0.5190	78.8012	(267)
Energy for lighting	336.9855	0.5190	174.8955	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	0.5190	-250.1321	(269)
Total CO2, kg/year			1216.2640	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0200	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.0200	ZC1
Total Floor Area	TFA	67.5000	
Assumed number of occupants	N	2.1839	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.8023	ZC2
CO2 emissions from cooking, equation (L16)		2.5395	ZC3
Total CO2 emissions		37.3618	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.3618	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1185	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3685	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2856	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3641	0.3570	0.3499	0.3142	0.3070	0.2713	0.2713	0.2642	0.2856	0.3070	0.3213	0.3356	(22b)
Effective ac	0.5663	0.5637	0.5612	0.5493	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			7.8300	1.3258	10.3807			(27)
New External	41.4000	7.8300	33.5700	0.1800	6.0426			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.4233			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.0134	(36)
Total fabric heat loss					(33) + (36) =		20.4367	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5358	31.3925	31.2519	30.5919	30.4684	29.8935	29.8935	29.7870	30.1149	30.4684	30.7182	30.9794	(38)
Heat transfer coeff	51.9725	51.8291	51.6886	51.0285	50.9051	50.3302	50.3302	50.2237	50.5516	50.9051	51.1549	51.4161	(39)
Average = Sum(39)m / 12 =												51.0280	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7700	0.7678	0.7658	0.7560	0.7541	0.7456	0.7456	0.7441	0.7489	0.7541	0.7579	0.7617	(40)
HLP (average)												0.7560	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839	(42)
Average daily hot water use (litres/day)	86.0684	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	186.5378	164.4675	172.8509	155.1209	152.1377	136.1193	130.8980	143.4014	143.0748	160.8431	169.8594	182.1077	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	186.5378	164.4675	172.8509	155.1209	152.1377	136.1193	130.8980	143.4014	143.0748	160.8431	169.8594	182.1077	(64)
								Total per year (kWh/year) = Sum(64)m =				1897.4185	(64)
Heat gains from water heating, kWh/month													
	83.5929	74.1672	79.0420	72.4510	72.1549	66.1330	65.0927	69.2501	68.4457	75.0494	77.3515	82.1199	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0815	16.9480	13.7831	10.4347	7.8000	6.5851	7.1155	9.2489	12.4139	15.7623	18.3969	19.6118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	112.3560	110.3679	106.2392	100.6264	96.9824	91.8514	87.4901	93.0780	95.0634	100.8729	107.4327	110.3762	(72)
Total internal gains													
	381.5899	379.4543	367.1559	347.5400	327.8117	308.8251	296.5494	302.2847	312.4399	332.2524	354.8965	371.6956	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	11.2829	0.6300	0.7000	0.7700	10.4136	(75)
Southeast	4.8100	36.7938	0.6300	0.7000	0.7700	54.0869	(77)

Solar gains	64.5005	113.3272	164.2468	218.9097	259.2535	263.5616	251.5285	220.4850	183.0281	127.7279	77.8866	54.7914	(83)
Total gains	446.0904	492.7815	531.4027	566.4497	587.0652	572.3867	548.0779	522.7697	495.4680	459.9803	432.7831	426.4870	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	90.1919	90.4414	90.6873	91.8603	92.0832	93.1350	93.1350	93.3324	92.7270	92.0832	91.6335	91.1680	
alpha	7.0128	7.0294	7.0458	7.1240	7.1389	7.2090	7.2090	7.2222	7.1818	7.1389	7.1089	7.0779	
util living area													
	0.9954	0.9898	0.9725	0.9112	0.7658	0.5588	0.4037	0.4413	0.6862	0.9295	0.9883	0.9966	(86)
MIT	20.3664	20.4815	20.6518	20.8482	20.9642	20.9966	20.9997	20.9995	20.9868	20.8472	20.5755	20.3431	(87)
Th 2	20.2794	20.2813	20.2831	20.2916	20.2932	20.3007	20.3007	20.3021	20.2978	20.2932	20.2900	20.2866	(88)
util rest of house													
	0.9940	0.9867	0.9644	0.8880	0.7195	0.4995	0.3397	0.3747	0.6235	0.9056	0.9843	0.9955	(89)
MIT 2	19.4320	19.6002	19.8450	20.1197	20.2603	20.2985	20.3006	20.3019	20.2882	20.1244	19.7441	19.4039	(90)
Living area fraction									fLA = Living area / (4) =			0.3950	(91)
MIT	19.8010	19.9483	20.1637	20.4074	20.5383	20.5742	20.5767	20.5774	20.5641	20.4099	20.0725	19.7748	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8010	19.9483	20.1637	20.4074	20.5383	20.5742	20.5767	20.5774	20.5641	20.4099	20.0725	19.7748	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9929	0.9850	0.9629	0.8921	0.7361	0.5229	0.3650	0.4010	0.6478	0.9100	0.9828	0.9946	(94)
Useful gains	442.9092	485.4021	511.6724	505.3285	432.1476	299.3004	200.0595	209.6317	320.9803	418.5947	425.3405	424.1659	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	805.6280	779.9400	706.2572	587.2077	449.9138	300.6847	200.1487	209.8038	326.7709	499.3747	663.6057	800.7968	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	269.8628	197.9294	144.7712	58.9530	13.2181	0.0000	0.0000	0.0000	0.0000	60.1003	171.5510	280.2134	(98)
Space heating												1196.5992	(98)
Space heating per m2											(98) / (4) =	17.7274	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1279.7852	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	269.8628	197.9294	144.7712	58.9530	13.2181	0.0000	0.0000	0.0000	0.0000	60.1003	171.5510	280.2134	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	288.6233	211.6892	154.8355	63.0514	14.1370	0.0000	0.0000	0.0000	0.0000	64.2784	183.4770	299.6934	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	186.5378	164.4675	172.8509	155.1209	152.1377	136.1193	130.8980	143.4014	143.0748	160.8431	169.8594	182.1077	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7980	85.3088	84.3454	82.4857	80.5614	79.8000	79.8000	79.8000	79.8000	82.4517	84.8403	85.9599	(217)
Fuel for water heating, kWh/month													
	217.4150	192.7909	204.9323	188.0580	188.8470	170.5756	164.0325	179.7010	179.2917	195.0754	200.2108	211.8518	(219)
Water heating fuel used												2292.7820	(219)
Annual totals kWh/year													
Space heating fuel - main system												1279.7852	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												336.9855	(232)
Total delivered energy for all uses												3984.5527	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1279.7852	0.2160	276.4336	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2292.7820	0.2160	495.2409	(264)
Space and water heating			771.6745	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	336.9855	0.5190	174.8955	(268)
Total CO2, kg/m2/year			985.4950	(272)
Emissions per m2 for space and water heating			11.4322	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.5910	(272b)
Emissions per m2 for pumps and fans			0.5767	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.4322 * 1.55) + 2.5910 + 0.5767, rounded to 2 d.p.			20.8900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1185	(8)
Pressure test		Yes	
Measured/design AP50		3.9700	
Infiltration rate		0.3170	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2457	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3133	0.3071	0.3010	0.2703	0.2641	0.2334	0.2334	0.2273	0.2457	0.2641	0.2764	0.2887	(22b)
Effective ac	0.5491	0.5472	0.5453	0.5365	0.5349	0.5272	0.5272	0.5258	0.5302	0.5349	0.5382	0.5417	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.8300	1.4151	11.0802			(27)
New External	41.4000	7.8300	33.5700	0.1600	5.3712			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.4514			(33)
Party Wall 1			35.4000	0.0000	0.0000			(32)
Corridor			6.2800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0118	(36)
Total fabric heat loss					(33) + (36) =		21.4632	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.5760	30.4699	30.3659	29.8774	29.7861	29.3606	29.3606	29.2818	29.5245	29.7861	29.9709	30.1642	(38)
Heat transfer coeff	52.0392	51.9331	51.8291	51.3406	51.2492	50.8238	50.8238	50.7450	50.9877	51.2492	51.4341	51.6274	(39)
Average = Sum(39)m / 12 =												51.3402	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7710	0.7694	0.7678	0.7606	0.7592	0.7529	0.7529	0.7518	0.7554	0.7592	0.7620	0.7649	(40)
HLP (average)												0.7606	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839	(42)
Average daily hot water use (litres/day)	86.0684	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

29.8351	26.0940	26.9267	23.4753	22.5251	19.4375	18.0117	20.6687	20.9155	24.3750	26.6072	28.8937 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0815	16.9480	13.7831	10.4347	7.8000	6.5851	7.1155	9.2489	12.4139	15.7623	18.3969	19.6118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	40.1010	38.8304	36.1918	32.6046	30.2757	26.9965	24.2093	27.7805	29.0493	32.7621	36.9545	38.8357	(72)
Total internal gains													
	306.3349	304.9168	294.1084	276.5182	258.1051	240.9702	230.2685	233.9872	243.4258	261.1417	281.4183	297.1551	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	11.2829	0.3500	0.7000	0.7700	5.7853	(75)
Southeast	4.8100	36.7938	0.3500	0.7000	0.7700	30.0483	(77)

Solar gains	35.8336	62.9595	91.2482	121.6165	144.0297	146.4231	139.7380	122.4916	101.6823	70.9599	43.2703	30.4397	(83)
Total gains	342.1685	367.8763	385.3567	398.1347	402.1348	387.3933	370.0066	356.4788	345.1081	332.1016	324.6886	327.5947	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.0305	36.1041	36.1766	36.5208	36.5859	36.8922	36.8922	36.9494	36.7736	36.5859	36.4544	36.3179	
alpha	3.4020	3.4069	3.4118	3.4347	3.4391	3.4595	3.4595	3.4633	3.4516	3.4391	3.4303	3.4212	
util living area													
	0.9741	0.9649	0.9473	0.9095	0.8355	0.7038	0.5575	0.5934	0.7828	0.9156	0.9625	0.9774	(86)
MIT	19.3676	19.5330	19.8210	20.2072	20.5695	20.8385	20.9468	20.9327	20.7496	20.2992	19.7694	19.3288	(87)
Th 2	20.2786	20.2799	20.2813	20.2876	20.2888	20.2943	20.2943	20.2953	20.2922	20.2888	20.2864	20.2839	(88)
util rest of house													
	0.9707	0.9603	0.9400	0.8958	0.8084	0.6524	0.4823	0.5200	0.7397	0.9002	0.9567	0.9745	(89)
MIT 2	18.7570	18.9218	19.2073	19.5900	19.9365	20.1817	20.2658	20.2575	20.1068	19.6840	19.1623	18.7227	(90)
Living area fraction										fLA = Living area / (4) =		0.3950	(91)
MIT	18.9982	19.1632	19.4497	19.8338	20.1865	20.4411	20.5347	20.5242	20.3607	19.9270	19.4021	18.9621	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9982	19.1632	19.4497	19.8338	20.1865	20.4411	20.5347	20.5242	20.3607	19.9270	19.4021	18.9621	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9631	0.9514	0.9298	0.8858	0.8041	0.6637	0.5089	0.5448	0.7442	0.8911	0.9479	0.9675	(94)
Useful gains	329.5517	349.9970	358.3010	352.6522	323.3463	257.1095	188.2918	194.2225	256.8364	295.9505	307.7802	316.9453	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	764.8827	740.7314	671.1706	561.3476	434.9264	296.8669	199.9789	209.2832	319.2182	477.9996	632.7469	762.1282	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	323.8863	262.5735	232.7750	150.2607	83.0156	0.0000	0.0000	0.0000	0.0000	135.4446	233.9761	331.2161	(98)
Space heating												1753.1479	(98)
Space heating per m2											(98) / (4) =	25.9726	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	477.7438	376.0962	385.6622	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8174	0.8784	0.8637	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	390.5085	330.3442	333.0945	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	534.8823	513.0030	498.7855	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	103.9491	135.8981	123.2741	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												363.1213	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	25.9873	33.9745	30.8185	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	90.7803 (107)
Space cooling per m2	1.3449 (108)
Energy for space heating	25.9726 (99)
Energy for space cooling	1.3449 (108)
Total	27.3175 (109)
Dwelling Fabric Energy Efficiency (DFEE)	27.3 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1185	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3685	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2856	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3641	0.3570	0.3499	0.3142	0.3070	0.2713	0.2713	0.2642	0.2856	0.3070	0.3213	0.3356	(22b)
Effective ac	0.5663	0.5637	0.5612	0.5493	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			7.8300	1.3258	10.3807			(27)
New External	41.4000	7.8300	33.5700	0.1800	6.0426			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4233			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.0134	(36)
Total fabric heat loss					(33) + (36) =		20.4367	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5358	31.3925	31.2519	30.5919	30.4684	29.8935	29.8935	29.7870	30.1149	30.4684	30.7182	30.9794	(38)
Heat transfer coeff	51.9725	51.8291	51.6886	51.0285	50.9051	50.3302	50.3302	50.2237	50.5516	50.9051	51.1549	51.4161	(39)
Average = Sum(39)m / 12 =												51.0280	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7700	0.7678	0.7658	0.7560	0.7541	0.7456	0.7456	0.7441	0.7489	0.7541	0.7579	0.7617	(40)
HLP (average)												0.7560	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839	(42)
Average daily hot water use (litres/day)	86.0684	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	29.8351	26.0940	26.9267	23.4753	22.5251	19.4375	18.0117	20.6687	20.9155	24.3750	26.6072	28.8937	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.0815	16.9480	13.7831	10.4347	7.8000	6.5851	7.1155	9.2489	12.4139	15.7623	18.3969	19.6118	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	40.1010	38.8304	36.1918	32.6046	30.2757	26.9965	24.2093	27.7805	29.0493	32.7621	36.9545	38.8357	(72)
Total internal gains													
	306.3349	304.9168	294.1084	276.5182	258.1051	240.9702	230.2685	233.9872	243.4258	261.1417	281.4183	297.1551	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	11.2829	0.6300	0.7000	0.7700	10.4136	(75)
Southeast	4.8100	36.7938	0.6300	0.7000	0.7700	54.0869	(77)

Solar gains	64.5005	113.3272	164.2468	218.9097	259.2535	263.5616	251.5285	220.4850	183.0281	127.7279	77.8866	54.7914	(83)
Total gains	370.8353	418.2440	458.3553	495.4279	517.3586	504.5318	481.7970	454.4721	426.4539	388.8696	359.3049	351.9465	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	90.1919	90.4414	90.6873	91.8603	92.0832	93.1350	93.1350	93.3324	92.7270	92.0832	91.6335	91.1680	
alpha	7.0128	7.0294	7.0458	7.1240	7.1389	7.2090	7.2090	7.2222	7.1818	7.1389	7.1089	7.0779	
util living area													
	0.9985	0.9961	0.9876	0.9506	0.8349	0.6291	0.4587	0.5065	0.7743	0.9681	0.9961	0.9990	(86)
MIT	20.2561	20.3752	20.5560	20.7804	20.9378	20.9929	20.9993	20.9987	20.9721	20.7706	20.4709	20.2331	(87)
Th 2	20.2794	20.2813	20.2831	20.2916	20.2932	20.3007	20.3007	20.3021	20.2978	20.2932	20.2900	20.2866	(88)
util rest of house													
	0.9981	0.9949	0.9836	0.9349	0.7926	0.5644	0.3863	0.4307	0.7115	0.9548	0.9947	0.9986	(89)
MIT 2	19.5913	19.7114	19.8917	20.1146	20.2522	20.2975	20.3005	20.3017	20.2830	20.1101	19.8145	19.5745	(90)
Living area fraction										fLA = Living area / (4) =		0.3950	(91)
MIT	19.8538	19.9735	20.1541	20.3776	20.5230	20.5722	20.5765	20.5770	20.5552	20.3710	20.0737	19.8346	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8538	19.9735	20.1541	20.3776	20.5230	20.5722	20.5765	20.5770	20.5552	20.3710	20.0737	19.8346	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9942	0.9827	0.9371	0.8071	0.5899	0.4150	0.4607	0.7356	0.9565	0.9941	0.9984	(94)
Useful gains	369.9840	415.8233	450.4327	464.2485	417.5666	297.6335	199.9312	209.3583	313.6958	371.9478	357.1891	351.3737	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	808.3724	781.2487	705.7605	585.6839	449.1342	300.5801	200.1391	209.7838	326.3195	497.3923	663.6704	803.8704	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	326.1609	245.5659	189.9639	87.4335	23.4863	0.0000	0.0000	0.0000	0.0000	93.3307	220.6665	336.6576	(98)
Space heating												1523.2655	(98)
Space heating per m2											(98) / (4) =	22.5669	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	473.1035	372.4432	381.7001	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9750	0.9917	0.9875	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	461.2668	369.3689	376.9119	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	671.7974	643.6671	613.3231	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	151.5820	204.0779	175.8899	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												531.5498	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	37.8955	51.0195	43.9725	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	132.8875 (107)
Space cooling per m2	1.9687 (108)
Energy for space heating	22.5669 (99)
Energy for space cooling	1.9687 (108)
Total	24.5356 (109)
Target Fabric Energy Efficiency (TFEE)	28.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9700	
Infiltration rate		0.1985	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1538	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1692	0.1654	0.1654	0.1500	0.1538	0.1346	0.1269	0.1308	0.1308	0.1500	0.1500	0.1538	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2697	0.2659	0.2659	0.2505	0.2543	0.2351	0.2274	0.2313	0.2313	0.2505	0.2505	0.2543	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.8300	1.4151	11.0802			(27)
New External	41.4000	7.8300	33.5700	0.1600	5.3712			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4514			(33)
Party Wall 1			35.4000	0.0000	0.0000			(32)
Corridor			6.2800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0118	(36)
Total fabric heat loss (33) + (36) =	21.4632	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.0201	14.8059	14.8059	13.9492	14.1634	13.0926	12.6642	12.8784	12.8784	13.9492	13.9492	14.1634	(38)
Heat transfer coeff	36.4833	36.2691	36.2691	35.4124	35.6266	34.5558	34.1274	34.3416	34.3416	35.4124	35.4124	35.6266	(39)
Average = Sum(39)m / 12 =												35.3232	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5405	0.5373	0.5373	0.5246	0.5278	0.5119	0.5056	0.5088	0.5088	0.5246	0.5246	0.5278	(40)
HLP (average)												0.5233	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
157.8847 138.5874 144.1978 127.3922 123.4847 108.3905 102.2449 114.7484 115.3460 132.1900 142.1306 153.4546 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
157.8847 138.5874 144.1978 127.3922 123.4847 108.3905 102.2449 114.7484 115.3460 132.1900 142.1306 153.4546 (64)
Total per year (kWh/year) = Sum(64)m = 1560.0516 (64)
RHI water heating demand 1560 (64)
Heat gains from water heating, kWh/month
60.6704 53.4631 56.1195 50.2680 49.2324 43.9499 42.1702 46.3276 46.2626 52.1269 55.1685 59.1974 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
47.7038 42.3701 34.4577 26.0867 19.5001 16.4628 17.7886 23.1223 31.0348 39.4058 45.9923 49.0296 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
285.6617 288.6260 281.1561 265.2536 245.1796 226.3128 213.7087 210.7444 218.2143 234.1167 254.1908 273.0575 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 50.2875 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 -87.3574 (71)
Water heating gains (Table 5)
81.5463 79.5581 75.4295 69.8167 66.1726 61.0416 56.6804 62.2683 64.2537 70.0631 76.6229 79.5664 (72)
Total internal gains
508.8780 504.5204 485.0095 455.1231 424.8185 397.7834 382.1439 390.1012 407.4689 437.5518 470.7723 495.6198 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	9.5471	0.3500	0.7000	0.7700	4.8953	(75)
Southeast	4.8100	31.1332	0.3500	0.7000	0.7700	25.4255	(77)

Solar gains	30.3207	55.9640	85.5452	117.5626	135.0279	139.8341	130.8658	113.1292	98.1455	67.7345	39.3367	27.5406	(83)
Total gains	539.1987	560.4844	570.5547	572.6858	559.8464	537.6175	513.0097	503.2305	505.6144	505.2863	510.1089	523.1604	(84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3934	51.6969	51.6969	52.9475	52.6292	54.2601	54.9412	54.5985	54.5985	52.9475	52.9475	52.6292	
alpha	4.4262	4.4465	4.4465	4.5298	4.5086	4.6173	4.6627	4.6399	4.6399	4.5298	4.5298	4.5086	
util living area	0.8465	0.8150	0.7626	0.6506	0.5137	0.3579	0.2591	0.2792	0.4359	0.6471	0.7817	0.8540	(86)
MIT	20.5729	20.6581	20.7681	20.9069	20.9727	20.9962	20.9994	20.9991	20.9904	20.9202	20.7678	20.5721	(87)
Th 2	20.4839	20.4867	20.4867	20.4983	20.4954	20.5099	20.5157	20.5128	20.5128	20.4983	20.4983	20.4954	(88)
util rest of house	0.8342	0.8008	0.7452	0.6278	0.4852	0.3271	0.2271	0.2463	0.4046	0.6210	0.7640	0.8422	(89)
MIT 2	19.9181	20.0385	20.1896	20.3853	20.4655	20.5064	20.5153	20.5121	20.5032	20.4041	20.2017	19.9270	(90)
Living area fraction									fLA = Living area / (4) =			0.3950	(91)
MIT	20.1768	20.2832	20.4181	20.5913	20.6658	20.6999	20.7065	20.7044	20.6956	20.6079	20.4253	20.1818	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1768	20.2832	20.4181	20.5913	20.6658	20.6999	20.7065	20.7044	20.6956	20.6079	20.4253	20.1818	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8264	0.7949	0.7427	0.6321	0.4949	0.3391	0.2397	0.2593	0.4164	0.6268	0.7614	0.8344	(94)
Useful gains	445.5753	445.5468	423.7695	362.0150	277.0956	182.3033	122.9591	130.4648	210.5291	316.7202	388.3815	436.5208	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	553.6981	532.5471	483.0349	385.6870	283.7946	183.1417	123.0795	130.6503	212.7669	336.6996	447.0924	544.4394	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	80.4433	58.4642	44.0934	17.0438	4.9840	0.0000	0.0000	0.0000	0.0000	14.8647	42.2719	80.2914	(98)
Space heating												342.4568	(98)
RHI space heating demand												342	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9700	
Infiltration rate		0.1985	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1538	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1961	0.1923	0.1885	0.1692	0.1654	0.1461	0.1461	0.1423	0.1538	0.1654	0.1731	0.1808	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2966	0.2928	0.2890	0.2697	0.2659	0.2466	0.2466	0.2428	0.2543	0.2659	0.2736	0.2813	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.8300	1.4151	11.0802			(27)
New External	41.4000	7.8300	33.5700	0.1600	5.3712			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.4514			(33)
Party Wall 1			35.4000	0.0000	0.0000			(32)
Corridor			6.2800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0118	(36)
Total fabric heat loss (33) + (36) =	21.4632	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.5193	16.3051	16.0910	15.0201	14.8059	13.7351	13.7351	13.5209	14.1634	14.8059	15.2343	15.6626	(38)
Heat transfer coeff	37.9825	37.7683	37.5541	36.4833	36.2691	35.1983	35.1983	34.9841	35.6266	36.2691	36.6975	37.1258	(39)
Average = Sum(39)m / 12 =												36.4297	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5627	0.5595	0.5564	0.5405	0.5373	0.5215	0.5215	0.5183	0.5278	0.5373	0.5437	0.5500	(40)
HLP (average)												0.5397	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
157.8847 138.5874 144.1978 127.3922 123.4847 108.3905 102.2449 114.7484 115.3460 132.1900 142.1306 153.4546 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
157.8847 138.5874 144.1978 127.3922 123.4847 108.3905 102.2449 114.7484 115.3460 132.1900 142.1306 153.4546 (64)
Total per year (kWh/year) = Sum(64)m = 1560.0516 (64)
Heat gains from water heating, kWh/month
60.6704 53.4631 56.1195 50.2680 49.2324 43.9499 42.1702 46.3276 46.2626 52.1269 55.1685 59.1974 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.7038	42.3701	34.4577	26.0867	19.5001	16.4628	17.7886	23.1223	31.0348	39.4058	45.9923	49.0296	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.6617	288.6260	281.1561	265.2536	245.1796	226.3128	213.7087	210.7444	218.2143	234.1167	254.1908	273.0575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	81.5463	79.5581	75.4295	69.8167	66.1726	61.0416	56.6804	62.2683	64.2537	70.0631	76.6229	79.5664	(72)
Total internal gains													
	508.8780	504.5204	485.0095	455.1231	424.8185	397.7834	382.1439	390.1012	407.4689	437.5518	470.7723	495.6198	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	11.2829	0.3500	0.7000	0.7700	5.7853	(75)
Southeast	4.8100	36.7938	0.3500	0.7000	0.7700	30.0483	(77)

Solar gains	35.8336	62.9595	91.2482	121.6165	144.0297	146.4231	139.7380	122.4916	101.6823	70.9599	43.2703	30.4397	(83)
Total gains	544.7116	567.4799	576.2577	576.7397	568.8482	544.2066	521.8819	512.5929	509.1512	508.5118	514.0426	526.0594	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.3649	49.6448	49.9279	51.3934	51.6969	53.2697	53.2697	53.5958	52.6292	51.6969	51.0935	50.5040	
alpha	4.2910	4.3097	4.3285	4.4262	4.4465	4.5513	4.5513	4.5731	4.5086	4.4465	4.4062	4.3669	
util living area													
	0.8672	0.8386	0.7886	0.6936	0.5679	0.4095	0.2959	0.3129	0.4733	0.6786	0.8119	0.8757	(86)
MIT	20.4618	20.5601	20.6999	20.8610	20.9521	20.9919	20.9985	20.9981	20.9836	20.8921	20.6892	20.4553	(87)
Th 2	20.4637	20.4666	20.4694	20.4839	20.4867	20.5012	20.5012	20.5041	20.4954	20.4867	20.4810	20.4752	(88)
util rest of house													
	0.8561	0.8257	0.7723	0.6721	0.5407	0.3787	0.2627	0.2795	0.4408	0.6535	0.7959	0.8653	(89)
MIT 2	19.7453	19.8850	20.0812	20.3119	20.4319	20.4932	20.5001	20.5026	20.4786	20.3574	20.0790	19.7459	(90)
Living area fraction									fLA = Living area / (4) =			0.3950	(91)
MIT	20.0283	20.1516	20.3256	20.5288	20.6374	20.6902	20.6969	20.6983	20.6781	20.5686	20.3200	20.0261	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0283	20.1516	20.3256	20.5288	20.6374	20.6902	20.6969	20.6983	20.6781	20.5686	20.3200	20.0261	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8464	0.8177	0.7677	0.6740	0.5487	0.3904	0.2757	0.2926	0.4527	0.6576	0.7907	0.8557	(94)
Useful gains	461.0662	464.0176	442.4054	388.7257	312.1522	212.4814	143.9054	149.9820	230.4746	334.3813	406.4543	450.1423	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	597.4003	576.0286	519.2070	424.2551	324.1506	214.3635	144.2050	150.3722	234.3548	361.5508	485.1395	587.5560	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	101.4326	75.2713	57.1404	25.5812	8.9268	0.0000	0.0000	0.0000	0.0000	20.2141	56.6534	102.2358	(98)
Space heating												447.4556	(98)
Space heating per m2											(98) / (4) =	6.6290	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	447.4556 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	101.4326	75.2713	57.1404	25.5812	8.9268	0.0000	0.0000	0.0000	0.0000	20.2141	56.6534	102.2358	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	101.4326	75.2713	57.1404	25.5812	8.9268	0.0000	0.0000	0.0000	0.0000	20.2141	56.6534	102.2358	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(219)
Water heating fuel used												1560.0516	(219)
Annual totals kWh/year													
Space heating fuel - main system												447.4556	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)	
mechanical ventilation fans (SFP = 0.7375)	151.8328 (230a)
Total electricity for the above, kWh/year	151.8328 (231)
Electricity for lighting (calculated in Appendix L)	336.9855 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
Total delivered energy for all uses	2496.3256 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	447.4556	13.1900	59.0194	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1560.0516	13.1900	205.7708	(247)
Mechanical ventilation fans	151.8328	13.1900	20.0267	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	336.9855	13.1900	44.4484	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			329.2653	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2293 (257)
SAP value		82.8519
SAP rating (Section 12)		83 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	447.4556	0.5190	232.2295	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	0.5190	809.6668	(264)
Space and water heating			1041.8963	(265)
Pumps and fans	151.8328	0.5190	78.8012	(267)
Energy for lighting	336.9855	0.5190	174.8955	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	0.5190	-250.1321	(269)
Total kg/year			1045.4609	(272)
CO2 emissions per m2			15.4900	(273)
EI value			87.5474	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9700	
Infiltration rate		0.1985	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1538	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1692	0.1654	0.1654	0.1500	0.1538	0.1346	0.1269	0.1308	0.1308	0.1500	0.1500	0.1538	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2697	0.2659	0.2659	0.2505	0.2543	0.2351	0.2274	0.2313	0.2313	0.2505	0.2505	0.2543	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.8300	1.4151	11.0802			(27)
New External	41.4000	7.8300	33.5700	0.1600	5.3712			(29a)
Total net area of external elements Aum(A, m2)			41.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.4514			(33)
Party Wall 1			35.4000	0.0000	0.0000			(32)
Corridor			6.2800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.0118	(36)
Total fabric heat loss (33) + (36) =	21.4632	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.0201	14.8059	14.8059	13.9492	14.1634	13.0926	12.6642	12.8784	12.8784	13.9492	13.9492	14.1634	(38)
Heat transfer coeff	36.4833	36.2691	36.2691	35.4124	35.6266	34.5558	34.1274	34.3416	34.3416	35.4124	35.4124	35.6266	(39)
Average = Sum(39)m / 12 =												35.3232	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5405	0.5373	0.5373	0.5246	0.5278	0.5119	0.5056	0.5088	0.5088	0.5246	0.5246	0.5278	(40)
HLP (average)												0.5233	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
								Total per year (kWh/year) = Sum(64)m =				1560.0516	(64)
Heat gains from water heating, kWh/month													
	60.6704	53.4631	56.1195	50.2680	49.2324	43.9499	42.1702	46.3276	46.2626	52.1269	55.1685	59.1974	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	47.7038	42.3701	34.4577	26.0867	19.5001	16.4628	17.7886	23.1223	31.0348	39.4058	45.9923	49.0296	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.6617	288.6260	281.1561	265.2536	245.1796	226.3128	213.7087	210.7444	218.2143	234.1167	254.1908	273.0575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	81.5463	79.5581	75.4295	69.8167	66.1726	61.0416	56.6804	62.2683	64.2537	70.0631	76.6229	79.5664	(72)
Total internal gains													
	508.8780	504.5204	485.0095	455.1231	424.8185	397.7834	382.1439	390.1012	407.4689	437.5518	470.7723	495.6198	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0200	9.5471	0.3500	0.7000	0.7700	4.8953	(75)
Southeast	4.8100	31.1332	0.3500	0.7000	0.7700	25.4255	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	30.3207	55.9640	85.5452	117.5626	135.0279	139.8341	130.8658	113.1292	98.1455	67.7345	39.3367	27.5406	(83)
Total gains	539.1987	560.4844	570.5547	572.6858	559.8464	537.6175	513.0097	503.2305	505.6144	505.2863	510.1089	523.1604	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.3934	51.6969	51.6969	52.9475	52.6292	54.2601	54.9412	54.5985	54.5985	52.9475	52.9475	52.6292	
alpha	4.4262	4.4465	4.4465	4.5298	4.5086	4.6173	4.6627	4.6399	4.6399	4.5298	4.5298	4.5086	
util living area													
	0.8465	0.8150	0.7626	0.6506	0.5137	0.3579	0.2591	0.2792	0.4359	0.6471	0.7817	0.8540	(86)
MIT	20.5729	20.6581	20.7681	20.9069	20.9727	20.9962	20.9994	20.9991	20.9904	20.9202	20.7678	20.5721	(87)
Th 2	20.4839	20.4867	20.4867	20.4983	20.4954	20.5099	20.5157	20.5128	20.5128	20.4983	20.4983	20.4954	(88)
util rest of house													
	0.8342	0.8008	0.7452	0.6278	0.4852	0.3271	0.2271	0.2463	0.4046	0.6210	0.7640	0.8422	(89)
MIT 2	19.9181	20.0385	20.1896	20.3853	20.4655	20.5064	20.5153	20.5121	20.5032	20.4041	20.2017	19.9270	(90)
Living area fraction									fLA = Living area / (4) =			0.3950	(91)
MIT	20.1768	20.2832	20.4181	20.5913	20.6658	20.6999	20.7065	20.7044	20.6956	20.6079	20.4253	20.1818	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1768	20.2832	20.4181	20.5913	20.6658	20.6999	20.7065	20.7044	20.6956	20.6079	20.4253	20.1818	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8264	0.7949	0.7427	0.6321	0.4949	0.3391	0.2397	0.2593	0.4164	0.6268	0.7614	0.8344	(94)
Useful gains	445.5753	445.5468	423.7695	362.0150	277.0956	182.3033	122.9591	130.4648	210.5291	316.7202	388.3815	436.5208	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	553.6981	532.5471	483.0349	385.6870	283.7946	183.1417	123.0795	130.6503	212.7669	336.6996	447.0924	544.4394	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	80.4433	58.4642	44.0934	17.0438	4.9840	0.0000	0.0000	0.0000	0.0000	14.8647	42.2719	80.2914	(98)
Space heating												342.4568	(98)
Space heating per m2											(98) / (4) =	5.0734	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	342.4568	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	80.4433	58.4642	44.0934	17.0438	4.9840	0.0000	0.0000	0.0000	0.0000	14.8647	42.2719	80.2914	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	80.4433	58.4642	44.0934	17.0438	4.9840	0.0000	0.0000	0.0000	0.0000	14.8647	42.2719	80.2914	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(219)
Water heating fuel used												1560.0516	(219)
Annual totals kWh/year													
Space heating fuel - main system												342.4568	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)		
mechanical ventilation fans (SFP = 0.7375)	151.8328	(230a)
Total electricity for the above, kWh/year	151.8328	(231)
Electricity for lighting (calculated in Appendix L)	336.9855	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2391.3268	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	342.4568	31.0800	106.4356	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1560.0516	31.0800	484.8640	(247)
Mechanical ventilation fans	151.8328	31.0800	47.1896	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	336.9855	31.0800	104.7351	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			743.2244	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	342.4568	0.5190	177.7351	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	0.5190	809.6668	(264)
Space and water heating			987.4019	(265)
Pumps and fans	151.8328	0.5190	78.8012	(267)
Energy for lighting	336.9855	0.5190	174.8955	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	0.5190	-250.1321	(269)
Total kg/year			990.9665	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	342.4568	3.0700	1051.3424	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	3.0700	4789.3585	(264)
Space and water heating			5840.7009	(265)
Pumps and fans	151.8328	3.0700	466.1267	(267)
Energy for lighting	336.9855	3.0700	1034.5455	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	3.0700	-1479.5865	(269)
Primary energy kWh/year			5861.7866	(272)
Primary energy kWh/m2/year			86.8413	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£743	£743	£0
Space heating	£154	£154	£0
Water heating	£485	£485	£0
Lighting	£105	£105	£0
Total cost of fuels	£743	£743	£0
Total cost of uses	£744	£744	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	87 kWh/m²	87 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-33	**Issued on Date**	11/01/2024
Assessment Reference	7765-33	**Prop Type Ref**	
Property	Flat 33, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	85 B	**DER**	18.47	**TER**	22.79
Environmental	89 B	**% DER<TER**	18.95		
CO_2 Emissions (t/year)	0.74	**DFEE**	22.75	**TFEE**	21.30
General Requirements Compliance	Fail	**% DFEE<TFEE**	-6.80		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Mid-floor flat, total floor area 45 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.47 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)21.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)22.7 kWh/m²/yrFail
Excess energy =1.4 kWh/m²/yr (6.6%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.53 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85: OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South East: 4.70 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.5 m³/m²h
Photovoltaic array 323.22 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5300	
Infiltration rate		0.1765	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1368	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1744	0.1710	0.1676	0.1505	0.1470	0.1299	0.1299	0.1265	0.1368	0.1470	0.1539	0.1607	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2749	0.2715	0.2681	0.2510	0.2475	0.2304	0.2304	0.2270	0.2373	0.2475	0.2544	0.2612	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.2670	10.1393	10.0116	9.3730	9.2453	8.6067	8.6067	8.4790	8.8622	9.2453	9.5007	9.7562	(38)
Heat transfer coeff	21.8238	21.6961	21.5684	20.9298	20.8021	20.1635	20.1635	20.0357	20.4189	20.8021	21.0575	21.3129	(39)
Average = Sum(39)m / 12 =												20.8978	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4821	0.4793	0.4764	0.4623	0.4595	0.4454	0.4454	0.4426	0.4510	0.4595	0.4652	0.4708	(40)
HLP (average)												0.4616	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
								Total per year (kWh/year) = Sum(64)m =				1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	265.6589	263.8765	254.6514	240.0837	225.6862	211.6571	202.4835	207.2382	214.6937	229.4237	246.2288	258.4516	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.3500	0.7000	0.7700	29.3611	(77)

Solar gains	29.3611	50.0128	68.4297	84.7877	94.9693	94.2825	90.8984	83.3025	74.0949	55.2748	35.1678	25.1270	(83)
Total gains	295.0199	313.8893	323.0811	324.8714	320.6555	305.9396	293.3819	290.5407	288.7886	284.6985	281.3966	283.5786	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6206	57.9598	58.3030	60.0819	60.4508	62.3653	62.3653	62.7628	61.5851	60.4508	59.7175	59.0018	
alpha	4.8414	4.8640	4.8869	5.0055	5.0301	5.1577	5.1577	5.1842	5.1057	5.0301	4.9812	4.9335	
util living area													
	0.9034	0.8706	0.8164	0.7159	0.5835	0.4189	0.3020	0.3167	0.4814	0.7032	0.8488	0.9122	(86)
MIT	20.4972	20.6090	20.7478	20.8928	20.9671	20.9954	20.9993	20.9991	20.9903	20.9163	20.7213	20.4870	(87)
Th 2	20.5373	20.5399	20.5425	20.5555	20.5581	20.5711	20.5711	20.5737	20.5659	20.5581	20.5529	20.5477	(88)
util rest of house													
	0.8951	0.8601	0.8022	0.6966	0.5590	0.3916	0.2727	0.2875	0.4526	0.6807	0.8356	0.9045	(89)
MIT 2	19.8582	20.0176	20.2131	20.4216	20.5200	20.5666	20.5706	20.5730	20.5558	20.4566	20.1879	19.8528	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	20.1852	20.3203	20.4868	20.6628	20.7488	20.7861	20.7900	20.7911	20.7781	20.6919	20.4609	20.1774	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1852	20.3203	20.4868	20.6628	20.7488	20.7861	20.7900	20.7911	20.7781	20.6919	20.4609	20.1774	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8882	0.8548	0.8005	0.7013	0.5697	0.4053	0.2876	0.3024	0.4667	0.6876	0.8327	0.8976	(94)
Useful gains	262.0418	268.3101	258.6157	227.8431	182.6778	124.0072	84.3873	87.8540	134.7837	195.7657	234.3291	254.5518	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	346.6761	334.5607	301.6717	246.1924	188.2346	124.7326	84.4853	87.9794	136.3604	209.9315	281.3476	340.5249	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	62.9680	44.5204	32.0337	13.2115	4.1342	0.0000	0.0000	0.0000	0.0000	10.5393	33.8534	63.9640	(98)
Space heating												265.2244	(98)
Space heating per m2											(98) / (4) =	5.8587	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												265.2244	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	62.9680	44.5204	32.0337	13.2115	4.1342	0.0000	0.0000	0.0000	0.0000	10.5393	33.8534	63.9640	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	62.9680	44.5204	32.0337	13.2115	4.1342	0.0000	0.0000	0.0000	0.0000	10.5393	33.8534	63.9640	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												265.2244	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												1934.5527	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	265.2244	0.5190	137.6515	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			824.8329	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total CO2, kg/year			836.2817	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.4700	ZC1
Total Floor Area	TFA	45.2700	
Assumed number of occupants	N	1.5524	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.6683	ZC2
CO2 emissions from cooking, equation (L16)		3.4517	ZC3
Total CO2 emissions		39.5900	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		39.5900	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.7000	1.3258	6.2311			(27)
New External	19.1300	4.7000	14.4300	0.1800	2.5974			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8285			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.9970	(36)
Total fabric heat loss					(33) + (36) =		10.8255	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	32.8193	32.6904	32.5641	31.9705	31.8595	31.3425	31.3425	31.2468	31.5416	31.8595	32.0841	32.3190	(39)
Average = Sum(39)m / 12 =												31.9700	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7250	0.7221	0.7193	0.7062	0.7038	0.6923	0.6923	0.6902	0.6967	0.7038	0.7087	0.7139	(40)
HLP (average)												0.7062	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
								Total per year (kWh/year) = Sum(64)m =				1661.4159	(64)
Heat gains from water heating, kWh/month													
	75.4571	67.0516	71.6994	66.0495	66.0125	60.8326	60.1810	63.6139	62.7422	68.4026	70.0960	74.2408	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	101.4209	99.7792	96.3701	91.7355	88.7265	84.4897	80.8885	85.5026	87.1420	91.9390	97.3556	99.7861	(72)
Total internal gains													
	299.4686	297.6863	288.4611	273.8934	259.4960	245.4668	236.2933	241.0480	248.5034	263.2334	280.0385	292.2614	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.6300	0.7000	0.7700	52.8500	(77)

Solar gains	52.8500	90.0230	123.1735	152.6179	170.9447	169.7086	163.6172	149.9445	133.3708	99.4946	63.3021	45.2286	(83)
Total gains	352.3186	387.7093	411.6346	426.5113	430.4407	415.1754	399.9104	390.9925	381.8742	362.7281	343.3406	337.4899	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.7895	96.1673	96.5405	98.3328	98.6755	100.3031	100.3031	100.6104	99.6699	98.6755	97.9846	97.2726	
alpha	7.3860	7.4112	7.4360	7.5555	7.5784	7.6869	7.6869	7.7074	7.6447	7.5784	7.5323	7.4848	
util living area													
	0.9860	0.9704	0.9326	0.8357	0.6752	0.4822	0.3448	0.3675	0.5666	0.8397	0.9640	0.9890	(86)
MIT	20.5487	20.6623	20.8013	20.9314	20.9872	20.9991	20.9999	20.9999	20.9971	20.9396	20.7406	20.5286	(87)
Th 2	20.3188	20.3213	20.3238	20.3353	20.3375	20.3476	20.3476	20.3495	20.3437	20.3375	20.3331	20.3286	(88)
util rest of house													
	0.9822	0.9629	0.9170	0.8050	0.6314	0.4335	0.2937	0.3156	0.5141	0.8040	0.9538	0.9860	(89)
MIT 2	19.7271	19.8903	20.0841	20.2618	20.3262	20.3470	20.3476	20.3494	20.3417	20.2760	20.0123	19.7064	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.1476	20.2855	20.4511	20.6045	20.6645	20.6808	20.6815	20.6824	20.6771	20.6157	20.3851	20.1272	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1476	20.2855	20.4511	20.6045	20.6645	20.6808	20.6815	20.6824	20.6771	20.6157	20.3851	20.1272	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9625	0.9201	0.8179	0.6532	0.4584	0.3198	0.3422	0.5409	0.8196	0.9547	0.9850	(94)
Useful gains	345.6643	373.1693	378.7625	348.8457	281.1812	190.3275	127.9099	133.7872	206.5565	297.3046	327.7885	332.4167	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	520.1078	502.9571	454.3055	374.1993	285.6042	190.5873	127.9235	133.8098	207.4540	319.0933	426.2403	514.7523	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	129.7860	87.2174	56.2040	18.2546	3.2907	0.0000	0.0000	0.0000	0.0000	16.2108	70.8853	135.6577	(98)
Space heating												517.5065	(98)
Space heating per m2											(98) / (4) =	11.4316	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												553.4829	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	129.7860	87.2174	56.2040	18.2546	3.2907	0.0000	0.0000	0.0000	0.0000	16.2108	70.8853	135.6577	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	138.8086	93.2806	60.1112	19.5236	3.5195	0.0000	0.0000	0.0000	0.0000	17.3378	75.8132	145.0884	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.2285	83.5409	82.4471	80.9334	80.0273	79.8000	79.8000	79.8000	79.8000	80.7858	82.9765	84.4035	(217)
Fuel for water heating, kWh/month													
	192.4163	171.2543	182.8661	167.8768	167.0234	150.5993	145.5216	158.4594	157.7964	174.3531	178.4097	187.6833	(219)
Water heating fuel used												2034.2597	(219)
Annual totals kWh/year													
Space heating fuel - main system												553.4829	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Total delivered energy for all uses												2906.1927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	553.4829	0.2160	119.5523	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2034.2597	0.2160	439.4001	(264)
Space and water heating			558.9524	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Total CO2, kg/m2/year			724.2280	(272)
Emissions per m2 for space and water heating			12.3471	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.7910	(272b)
Emissions per m2 for pumps and fans			0.8598	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3471 * 1.55) + 2.7910 + 0.8598, rounded to 2 d.p.			22.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		3.5300	
Infiltration rate		0.3532	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2737	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3490	0.3422	0.3353	0.3011	0.2943	0.2601	0.2601	0.2532	0.2737	0.2943	0.3080	0.3216	(22b)
Effective ac	0.5609	0.5585	0.5562	0.5453	0.5433	0.5338	0.5338	0.5321	0.5375	0.5433	0.5474	0.5517	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.5970	(36)
Total fabric heat loss					(33) + (36) =		11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.9487	20.8603	20.7738	20.3671	20.2910	19.9368	19.9368	19.8712	20.0732	20.2910	20.4449	20.6058	(38)
Heat transfer coeff	32.5054	32.4171	32.3305	31.9238	31.8477	31.4935	31.4935	31.4279	31.6300	31.8477	32.0017	32.1626	(39)
Average = Sum(39)m / 12 =												31.9235	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7180	0.7161	0.7142	0.7052	0.7035	0.6957	0.6957	0.6942	0.6987	0.7035	0.7069	0.7105	(40)
HLP (average)												0.7052	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5524 (42)
Average daily hot water use (litres/day)		71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

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

	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)

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

	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)

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

	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)

Water heating gains (Table 5)

	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)

Total internal gains

	228.1601	226.9702	218.9754	206.0804	192.7689	180.2688	172.3949	175.4844	182.3482	195.3470	210.1972	221.5429	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.3500	0.7000	0.7700	29.3611	(77)

Solar gains	29.3611	50.0128	68.4297	84.7877	94.9693	94.2825	90.8984	83.3025	74.0949	55.2748	35.1678	25.1270	(83)
Total gains	257.5212	276.9830	287.4051	290.8681	287.7382	274.5514	263.2933	258.7869	256.4431	250.6218	245.3650	246.6699	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.6859	38.7913	38.8952	39.3907	39.4848	39.9288	39.9288	40.0122	39.7566	39.4848	39.2948	39.0982	
alpha	3.5791	3.5861	3.5930	3.6260	3.6323	3.6619	3.6619	3.6675	3.6504	3.6323	3.6197	3.6065	
util living area	0.9623	0.9488	0.9254	0.8792	0.7953	0.6517	0.5013	0.5274	0.7177	0.8781	0.9444	0.9670	(86)
MIT	19.6308	19.7965	20.0572	20.3909	20.6856	20.8940	20.9691	20.9622	20.8400	20.4811	20.0065	19.5949	(87)
Th 2	20.3249	20.3266	20.3283	20.3363	20.3377	20.3446	20.3446	20.3459	20.3420	20.3377	20.3347	20.3316	(88)
util rest of house	0.9577	0.9426	0.9159	0.8629	0.7662	0.6020	0.4345	0.4618	0.6730	0.8589	0.9366	0.9629	(89)
MIT 2	19.0520	19.2165	19.4738	19.8040	20.0827	20.2714	20.3282	20.3249	20.2257	19.8948	19.4315	19.0219	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.3482	19.5133	19.7724	20.1044	20.3913	20.5901	20.6562	20.6510	20.5401	20.1949	19.7258	19.3152	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3482	19.5133	19.7724	20.1044	20.3913	20.5901	20.6562	20.6510	20.5401	20.1949	19.7258	19.3152	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9497	0.9337	0.9070	0.8567	0.7687	0.6213	0.4669	0.4931	0.6871	0.8543	0.9283	0.9554	(94)
Useful gains	244.5619	258.6283	260.6807	249.1807	221.1771	170.5676	122.9257	127.6079	176.1977	214.1125	227.7654	235.6684	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	489.1488	473.7215	429.1029	357.6860	276.7967	188.6478	127.7448	133.6014	203.7012	305.5760	404.0460	486.1438	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	181.9726	144.5426	125.3061	78.1239	41.3810	0.0000	0.0000	0.0000	0.0000	68.0488	126.9221	186.3537	(98)
Space heating												952.6508	(98)
Space heating per m2											(98) / (4) =	21.0438	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	296.0391	233.0520	238.8522	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8719	0.9212	0.9139	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	258.1248	214.6816	218.2815	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	380.9028	366.7148	362.5480	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	88.4001	113.1127	107.3343	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												308.8470	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

Space cooling kWh

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	22.1000	28.2782	26.8336	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												77.2118 (107)
Space cooling per m2												1.7056 (108)
Energy for space heating												21.0438 (99)
Energy for space cooling												1.7056 (108)
Total												22.7493 (109)
Dwelling Fabric Energy Efficiency (DFEE)												22.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.7000	1.3258	6.2311			(27)
New External	19.1300	4.7000	14.4300	0.1800	2.5974			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8285			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.9970	(36)
Total fabric heat loss					(33) + (36) =		10.8255	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	32.8193	32.6904	32.5641	31.9705	31.8595	31.3425	31.3425	31.2468	31.5416	31.8595	32.0841	32.3190	(39)
Average = Sum(39)m / 12 =												31.9700	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7250	0.7221	0.7193	0.7062	0.7038	0.6923	0.6923	0.6902	0.6967	0.7038	0.7087	0.7139	(40)
HLP (average)												0.7062	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)
Total internal gains													
	228.1601	226.9702	218.9754	206.0804	192.7689	180.2688	172.3949	175.4844	182.3482	195.3470	210.1972	221.5429	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.6300	0.7000	0.7700	52.8500	(77)

Solar gains	52.8500	90.0230	123.1735	152.6179	170.9447	169.7086	163.6172	149.9445	133.3708	99.4946	63.3021	45.2286	(83)
Total gains	281.0101	316.9933	342.1489	358.6983	363.7137	349.9774	336.0121	325.4289	315.7190	294.8416	273.4993	266.7714	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.7895	96.1673	96.5405	98.3328	98.6755	100.3031	100.3031	100.6104	99.6699	98.6755	97.9846	97.2726	
alpha	7.3860	7.4112	7.4360	7.5555	7.5784	7.6869	7.6869	7.7074	7.6447	7.5784	7.5323	7.4848	
util living area	0.9965	0.9906	0.9731	0.9136	0.7761	0.5697	0.4102	0.4412	0.6764	0.9281	0.9901	0.9975	(86)
MIT	20.3972	20.5223	20.6866	20.8665	20.9683	20.9973	20.9998	20.9997	20.9907	20.8697	20.6048	20.3761	(87)
Th 2	20.3188	20.3213	20.3238	20.3353	20.3375	20.3476	20.3476	20.3495	20.3437	20.3375	20.3331	20.3286	(88)
util rest of house	0.9954	0.9878	0.9654	0.8913	0.7321	0.5132	0.3495	0.3791	0.6173	0.9046	0.9867	0.9967	(89)
MIT 2	19.7656	19.8916	20.0540	20.2318	20.3174	20.3464	20.3475	20.3494	20.3391	20.2393	19.9841	19.7531	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	20.0889	20.2144	20.3778	20.5567	20.6506	20.6795	20.6814	20.6822	20.6726	20.5619	20.3018	20.0720	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0889	20.2144	20.3778	20.5567	20.6506	20.6795	20.6814	20.6822	20.6726	20.5619	20.3018	20.0720	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9873	0.9661	0.8993	0.7534	0.5421	0.3806	0.4109	0.6473	0.9133	0.9865	0.9964	(94)
Useful gains	279.6008	312.9754	330.5427	322.5670	274.0376	189.7329	127.8735	133.7215	204.3769	269.2645	269.8184	265.8082	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	518.1813	500.6350	451.9160	372.6702	285.1598	190.5479	127.9208	133.8051	207.3109	317.3818	423.5687	512.9654	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	177.5039	126.1073	90.3018	36.0743	8.2749	0.0000	0.0000	0.0000	0.0000	35.7992	110.7002	183.8849	(98)
Space heating												768.6465	(98)
Space heating per m2											(98) / (4) =	16.9792	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	294.6196	231.9346	237.4755	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9894	0.9971	0.9960	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	291.4943	231.2608	236.5347	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	469.0630	451.7107	440.4412	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.8495	164.0147	151.7065	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.5707	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.9624	0.0000	37.9266	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												69.8890	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling per m2	1.5438 (108)
Energy for space heating	16.9792 (99)
Energy for space cooling	1.5438 (108)
Total	18.5230 (109)
Target Fabric Energy Efficiency (TFEE)	21.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5300	
Infiltration rate		0.1765	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1368	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1505	0.1470	0.1470	0.1334	0.1368	0.1197	0.1128	0.1163	0.1163	0.1334	0.1334	0.1368	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2510	0.2475	0.2475	0.2339	0.2373	0.2202	0.2133	0.2168	0.2168	0.2339	0.2339	0.2373	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.3730	9.2453	9.2453	8.7344	8.8622	8.2236	7.9681	8.0958	8.0958	8.7344	8.7344	8.8622	(38)
Heat transfer coeff	20.9298	20.8021	20.8021	20.2912	20.4189	19.7803	19.5249	19.6526	19.6526	20.2912	20.2912	20.4189	(39)
Average = Sum(39)m / 12 =												20.2380	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4623	0.4595	0.4595	0.4482	0.4510	0.4369	0.4313	0.4341	0.4341	0.4482	0.4482	0.4510	(40)
HLP (average)												0.4471	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (64)
Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
RHI water heating demand 1324 (64)
Heat gains from water heating, kWh/month
52.5347 46.3475 48.7769 43.8665 43.0900 38.6495 37.2586 40.6915 40.5592 45.4801 47.9130 51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
34.4629 30.6096 24.8934 18.8459 14.0875 11.8933 12.8511 16.7044 22.4206 28.4681 33.2265 35.4207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
201.4582 203.5487 198.2807 187.0658 172.9089 159.6034 150.7145 148.6240 153.8920 165.1070 179.2639 192.5693 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 (71)
Water heating gains (Table 5)
70.6111 68.9695 65.5603 60.9257 57.9167 53.6799 50.0787 54.6928 56.3322 61.1292 66.5458 68.9763 (72)
Total internal gains
383.4462 380.0418 365.6485 343.7514 321.8271 302.0906 290.5584 296.9352 309.5588 331.6183 355.9502 373.8804 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	31.1332	0.3500	0.7000	0.7700	24.8440	(77)

Solar gains	24.8440	44.4558	64.1528	81.9615	89.0337	90.0398	85.1271	76.9354	71.5177	52.7623	31.9707	22.7339	(83)
Total gains	408.2902	424.4976	429.8013	425.7128	410.8609	392.1304	375.6855	373.8707	381.0765	384.3806	387.9209	396.6143	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0819	60.4508	60.4508	61.9727	61.5851	63.5733	64.4050	63.9865	63.9865	61.9727	61.9727	61.5851	
alpha	5.0055	5.0301	5.0301	5.1315	5.1057	5.2382	5.2937	5.2658	5.2658	5.1315	5.1315	5.1057	
util living area	0.7416	0.6996	0.6397	0.5280	0.4098	0.2822	0.2027	0.2155	0.3345	0.5135	0.6548	0.7491	(86)
MIT	20.8338	20.8789	20.9264	20.9764	20.9943	20.9994	20.9999	20.9999	20.9986	20.9818	20.9279	20.8353	(87)
Th 2	20.5555	20.5581	20.5581	20.5685	20.5659	20.5790	20.5842	20.5816	20.5816	20.5685	20.5685	20.5659	(88)
util rest of house	0.7274	0.6845	0.6229	0.5093	0.3889	0.2611	0.1811	0.1935	0.3132	0.4926	0.6374	0.7353	(89)
MIT 2	20.3386	20.4017	20.4652	20.5402	20.5597	20.5785	20.5842	20.5815	20.5802	20.5473	20.4781	20.3505	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.5921	20.6459	20.7013	20.7635	20.7822	20.7939	20.7970	20.7956	20.7943	20.7697	20.7083	20.5986	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5921	20.6459	20.7013	20.7635	20.7822	20.7939	20.7970	20.7956	20.7943	20.7697	20.7083	20.5986	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7286	0.6876	0.6284	0.5178	0.3994	0.2719	0.1921	0.2047	0.3240	0.5024	0.6431	0.7364	(94)
Useful gains	297.4825	291.8734	270.1006	220.4334	164.0878	106.6086	72.1732	76.5452	123.4764	193.1117	249.4664	292.0549	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	326.3383	312.9862	282.9345	224.4912	165.0289	106.6935	72.1826	76.5596	123.6999	196.2090	261.9253	320.5479	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	21.4687	14.1878	9.5484	2.9216	0.7002	0.0000	0.0000	0.0000	0.0000	2.3044	8.9704	21.1988	(98)
Space heating												81.3003	(98)
RHI space heating demand												81	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5300	
Infiltration rate		0.1765	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1368	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1744	0.1710	0.1676	0.1505	0.1470	0.1299	0.1299	0.1265	0.1368	0.1470	0.1539	0.1607	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2749	0.2715	0.2681	0.2510	0.2475	0.2304	0.2304	0.2270	0.2373	0.2475	0.2544	0.2612	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.2670	10.1393	10.0116	9.3730	9.2453	8.6067	8.6067	8.4790	8.8622	9.2453	9.5007	9.7562	(38)
Heat transfer coeff	21.8238	21.6961	21.5684	20.9298	20.8021	20.1635	20.1635	20.0357	20.4189	20.8021	21.0575	21.3129	(39)
Average = Sum(39)m / 12 =												20.8978	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4821	0.4793	0.4764	0.4623	0.4595	0.4454	0.4454	0.4426	0.4510	0.4595	0.4652	0.4708	(40)
HLP (average)												0.4616	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (64)
Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
Heat gains from water heating, kWh/month
52.5347 46.3475 48.7769 43.8665 43.0900 38.6495 37.2586 40.6915 40.5592 45.4801 47.9130 51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.4629	30.6096	24.8934	18.8459	14.0875	11.8933	12.8511	16.7044	22.4206	28.4681	33.2265	35.4207	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	383.4462	380.0418	365.6485	343.7514	321.8271	302.0906	290.5584	296.9352	309.5588	331.6183	355.9502	373.8804	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.3500	0.7000	0.7700	29.3611	(77)

Solar gains	29.3611	50.0128	68.4297	84.7877	94.9693	94.2825	90.8984	83.3025	74.0949	55.2748	35.1678	25.1270	(83)
Total gains	412.8073	430.0546	434.0782	428.5391	416.7965	396.3732	381.4568	380.2377	383.6537	386.8931	391.1180	399.0074	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6206	57.9598	58.3030	60.0819	60.4508	62.3653	62.3653	62.7628	61.5851	60.4508	59.7175	59.0018	
alpha	4.8414	4.8640	4.8869	5.0055	5.0301	5.1577	5.1577	5.1842	5.1057	5.0301	4.9812	4.9335	
util living area													
	0.7734	0.7335	0.6730	0.5728	0.4589	0.3249	0.2325	0.2423	0.3658	0.5455	0.6944	0.7835	(86)
MIT	20.7680	20.8260	20.8939	20.9597	20.9886	20.9986	20.9998	20.9998	20.9972	20.9726	20.8908	20.7655	(87)
Th 2	20.5373	20.5399	20.5425	20.5555	20.5581	20.5711	20.5711	20.5737	20.5659	20.5581	20.5529	20.5477	(88)
util rest of house													
	0.7601	0.7190	0.6565	0.5541	0.4380	0.3033	0.2099	0.2199	0.3432	0.5244	0.6774	0.7706	(89)
MIT 2	20.2319	20.3131	20.4073	20.5063	20.5451	20.5698	20.5710	20.5735	20.5631	20.5258	20.4140	20.2381	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.5063	20.5756	20.6564	20.7384	20.7721	20.7892	20.7905	20.7917	20.7853	20.7545	20.6580	20.5081	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5063	20.5756	20.6564	20.7384	20.7721	20.7892	20.7905	20.7917	20.7853	20.7545	20.6580	20.5081	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7591	0.7202	0.6606	0.5619	0.4481	0.3143	0.2214	0.2313	0.3546	0.5338	0.6815	0.7694	(94)
Useful gains	313.3773	309.7041	286.7630	240.7807	186.7826	124.5760	84.4665	87.9565	136.0553	206.5428	266.5400	307.0055	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	353.6832	340.0990	305.3302	247.7742	188.7179	124.7967	84.4942	87.9908	136.5056	211.2336	285.4977	347.5723	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	29.9876	20.4254	13.8139	5.0353	1.4399	0.0000	0.0000	0.0000	0.0000	3.4900	13.6495	30.1817	(98)
Space heating												118.0233	(98)
Space heating per m2											(98) / (4) =	2.6071	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	118.0233	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	29.9876	20.4254	13.8139	5.0353	1.4399	0.0000	0.0000	0.0000	0.0000	3.4900	13.6495	30.1817	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	29.9876	20.4254	13.8139	5.0353	1.4399	0.0000	0.0000	0.0000	0.0000	3.4900	13.6495	30.1817	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												118.0233	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												1787.3516	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	118.0233	13.1900	15.5673	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	13.1900	174.6421	(247)
Mechanical ventilation fans	101.8292	13.1900	13.4313	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	243.4500	13.1900	32.1111	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			235.7517	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0969	(257)
SAP value		84.6985	
SAP rating (Section 12)		85	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	118.0233	0.5190	61.2541	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			748.4355	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			759.8843	(272)
CO2 emissions per m2			16.7900	(273)
EI value			88.7200	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.5300	
Infiltration rate		0.1765	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1368	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1505	0.1470	0.1470	0.1334	0.1368	0.1197	0.1128	0.1163	0.1163	0.1334	0.1334	0.1368	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2510	0.2475	0.2475	0.2339	0.2373	0.2202	0.2133	0.2168	0.2168	0.2339	0.2339	0.2373	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.3730	9.2453	9.2453	8.7344	8.8622	8.2236	7.9681	8.0958	8.0958	8.7344	8.7344	8.8622	(38)
Heat transfer coeff	20.9298	20.8021	20.8021	20.2912	20.4189	19.7803	19.5249	19.6526	19.6526	20.2912	20.2912	20.4189	(39)
Average = Sum(39)m / 12 =												20.2380	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4623	0.4595	0.4595	0.4482	0.4510	0.4369	0.4313	0.4341	0.4341	0.4482	0.4482	0.4510	(40)
HLP (average)												0.4471	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (56)

If cylinder contains dedicated solar storage

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582 (64)

Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
Heat gains from water heating, kWh/month

	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)

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

	34.4629	30.6096	24.8934	18.8459	14.0875	11.8933	12.8511	16.7044	22.4206	28.4681	33.2265	35.4207 (67)

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

	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693 (68)

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

	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948 (71)

Water heating gains (Table 5)

	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763 (72)

Total internal gains

	383.4462	380.0418	365.6485	343.7514	321.8271	302.0906	290.5584	296.9352	309.5588	331.6183	355.9502	373.8804 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	31.1332	0.3500	0.7000	0.7700	24.8440	(77)

Solar gains	24.8440	44.4558	64.1528	81.9615	89.0337	90.0398	85.1271	76.9354	71.5177	52.7623	31.9707	22.7339 (83)
Total gains	408.2902	424.4976	429.8013	425.7128	410.8609	392.1304	375.6855	373.8707	381.0765	384.3806	387.9209	396.6143 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0819	60.4508	60.4508	61.9727	61.5851	63.5733	64.4050	63.9865	63.9865	61.9727	61.9727	61.5851	
alpha	5.0055	5.0301	5.0301	5.1315	5.1057	5.2382	5.2937	5.2658	5.2658	5.1315	5.1315	5.1057	
util living area	0.7416	0.6996	0.6397	0.5280	0.4098	0.2822	0.2027	0.2155	0.3345	0.5135	0.6548	0.7491	(86)
MIT	20.8338	20.8789	20.9264	20.9764	20.9943	20.9994	20.9999	20.9999	20.9986	20.9818	20.9279	20.8353	(87)
Th 2	20.5555	20.5581	20.5581	20.5685	20.5659	20.5790	20.5842	20.5842	20.5816	20.5685	20.5685	20.5659	(88)
util rest of house	0.7274	0.6845	0.6229	0.5093	0.3889	0.2611	0.1811	0.1935	0.3132	0.4926	0.6374	0.7353	(89)
MIT 2	20.3386	20.4017	20.4652	20.5402	20.5597	20.5785	20.5842	20.5815	20.5802	20.5473	20.4781	20.3505	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.5921	20.6459	20.7013	20.7635	20.7822	20.7939	20.7970	20.7956	20.7943	20.7697	20.7083	20.5986	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5921	20.6459	20.7013	20.7635	20.7822	20.7939	20.7970	20.7956	20.7943	20.7697	20.7083	20.5986	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7286	0.6876	0.6284	0.5178	0.3994	0.2719	0.1921	0.2047	0.3240	0.5024	0.6431	0.7364	(94)
Useful gains	297.4825	291.8734	270.1006	220.4334	164.0878	106.6086	72.1732	76.5452	123.4764	193.1117	249.4664	292.0549	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	326.3383	312.9862	282.9345	224.4912	165.0289	106.6935	72.1826	76.5596	123.6999	196.2090	261.9253	320.5479	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	21.4687	14.1878	9.5484	2.9216	0.7002	0.0000	0.0000	0.0000	0.0000	2.3044	8.9704	21.1988	(98)
Space heating												81.3003	(98)
Space heating per m2										(98) / (4) =		1.7959	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												81.3003	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	21.4687	14.1878	9.5484	2.9216	0.7002	0.0000	0.0000	0.0000	0.0000	2.3044	8.9704	21.1988	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	21.4687	14.1878	9.5484	2.9216	0.7002	0.0000	0.0000	0.0000	0.0000	2.3044	8.9704	21.1988	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												81.3003	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												1750.6286	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	81.3003	31.0800	25.2681	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	31.0800	411.5144	(247)
Mechanical ventilation fans	101.8292	31.0800	31.6485	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	243.4500	31.0800	75.6643	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			544.0954	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	81.3003	0.5190	42.1949	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			729.3763	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			740.8250	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	81.3003	3.0700	249.5919	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	3.0700	4064.8305	(264)
Space and water heating			4314.4224	(265)
Pumps and fans	101.8292	3.0700	312.6157	(267)
Energy for lighting	243.4500	3.0700	747.3916	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	3.0700	-992.2854	(269)
Primary energy kWh/year			4382.1443	(272)
Primary energy kWh/m2/year			96.8002	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£544	£544	£0
Space heating	£57	£57	£0
Water heating	£412	£412	£0
Lighting	£76	£76	£0
Total cost of fuels	£544	£544	£0
Total cost of uses	£545	£545	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	97 kWh/m²	97 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-34	**Issued on Date**	11/01/2024
Assessment Reference	7765-34	**Prop Type Ref**	
Property	Flat 34, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	85 B	**DER**	18.56	**TER**	22.79
Environmental	89 B	**% DER<TER**	18.56		
CO_2 Emissions (t/year)	0.74	**DFEE**	22.82	**TFEE**	21.30
General Requirements Compliance	Fail	**% DFEE<TFEE**	-7.12		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Mid-floor flat, total floor area 45 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.79 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.56 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)21.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)22.8 kWh/m²/yrFail
Excess energy =1.5 kWh/m²/yr (7.0%)
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.63 (measured in this dwelling)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework
---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK
---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South East: 4.70 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None
---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.6 m³/m²h
Photovoltaic array 323.22 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.6300	
Infiltration rate		0.1815	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1407	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1793	0.1758	0.1723	0.1547	0.1512	0.1336	0.1336	0.1301	0.1407	0.1512	0.1582	0.1653	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2798	0.2763	0.2728	0.2552	0.2517	0.2341	0.2341	0.2306	0.2412	0.2517	0.2587	0.2658	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4516	10.3202	10.1889	9.5322	9.4009	8.7442	8.7442	8.6129	9.0069	9.4009	9.6636	9.9262	(38)
Heat transfer coeff	22.0083	21.8770	21.7456	21.0890	20.9576	20.3009	20.3009	20.1696	20.5636	20.9576	21.2203	21.4830	(39)
Average = Sum(39)m / 12 =												21.0561	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4862	0.4833	0.4804	0.4658	0.4629	0.4484	0.4484	0.4455	0.4542	0.4629	0.4687	0.4746	(40)
HLP (average)												0.4651	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (64)
Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
Heat gains from water heating, kWh/month
52.5347 46.3475 48.7769 43.8665 43.0900 38.6495 37.2586 40.6915 40.5592 45.4801 47.9130 51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
13.7851 12.2438 9.9574 7.5384 5.6350 4.7573 5.1405 6.6818 8.9682 11.3872 13.2906 14.1683 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
134.9770 136.3776 132.8481 125.3341 115.8489 106.9343 100.9787 99.5781 103.1077 110.6217 120.1068 129.0215 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 30.7619 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 (71)
Water heating gains (Table 5)
70.6111 68.9695 65.5603 60.9257 57.9167 53.6799 50.0787 54.6928 56.3322 61.1292 66.5458 68.9763 (72)
Total internal gains
265.6589 263.8765 254.6514 240.0837 225.6862 211.6571 202.4835 207.2382 214.6937 229.4237 246.2288 258.4516 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.3500	0.7000	0.7700	29.3611	(77)

Solar gains	29.3611	50.0128	68.4297	84.7877	94.9693	94.2825	90.8984	83.3025	74.0949	55.2748	35.1678	25.1270	(83)
Total gains	295.0199	313.8893	323.0811	324.8714	320.6555	305.9396	293.3819	290.5407	288.7886	284.6985	281.3966	283.5786	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1375	57.4805	57.8277	59.6283	60.0020	61.9429	61.9429	62.3463	61.1517	60.0020	59.2593	58.5347	
alpha	4.8092	4.8320	4.8552	4.9752	5.0001	5.1295	5.1295	5.1564	5.0768	5.0001	4.9506	4.9023	
util living area	0.9049	0.8725	0.8190	0.7191	0.5870	0.4216	0.3040	0.3187	0.4845	0.7065	0.8509	0.9135	(86)
MIT	20.4845	20.5980	20.7394	20.8885	20.9654	20.9952	20.9993	20.9991	20.9897	20.9129	20.7132	20.4751	(87)
Th 2	20.5335	20.5362	20.5389	20.5522	20.5549	20.5683	20.5683	20.5710	20.5630	20.5549	20.5496	20.5442	(88)
util rest of house	0.8966	0.8621	0.8049	0.6998	0.5623	0.3940	0.2743	0.2892	0.4553	0.6839	0.8378	0.9058	(89)
MIT 2	19.8373	19.9990	20.1984	20.4129	20.5149	20.5635	20.5677	20.5702	20.5522	20.4492	20.1739	19.8330	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.1685	20.3056	20.4753	20.6563	20.7455	20.7844	20.7886	20.7897	20.7761	20.6865	20.4499	20.1616	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1685	20.3056	20.4753	20.6563	20.7455	20.7844	20.7886	20.7897	20.7761	20.6865	20.4499	20.1616	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8896	0.8566	0.8029	0.7044	0.5730	0.4079	0.2895	0.3043	0.4696	0.6907	0.8347	0.8989	(94)
Useful gains	262.4500	268.8789	259.3955	228.8267	183.7256	124.7785	84.9273	88.4047	135.6156	196.6329	234.8890	254.8989	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	349.2398	337.0270	303.9012	247.9283	189.5718	125.5495	85.0326	88.5391	137.2854	211.3890	283.2889	342.9029	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	64.5716	45.7955	33.1123	13.7531	4.3496	0.0000	0.0000	0.0000	0.0000	10.9786	34.8479	65.4750	(98)

Space heating 272.8836 (98)
Space heating per m2 (98) / (4) = 6.0279 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	272.8836	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	64.5716	45.7955	33.1123	13.7531	4.3496	0.0000	0.0000	0.0000	0.0000	10.9786	34.8479	65.4750	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	64.5716	45.7955	33.1123	13.7531	4.3496	0.0000	0.0000	0.0000	0.0000	10.9786	34.8479	65.4750	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												272.8836	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)		
mechanical ventilation fans (SFP = 0.7375)	101.8292	(230a)
Total electricity for the above, kWh/year	101.8292	(231)
Electricity for lighting (calculated in Appendix L)	243.4500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	1942.2119	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	272.8836	0.5190	141.6266	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			828.8080	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total CO2, kg/year			840.2568	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.5600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.5600	ZC1
Total Floor Area	TFA	45.2700	
Assumed number of occupants	N	1.5524	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.6683	ZC2
CO2 emissions from cooking, equation (L16)		3.4517	ZC3
Total CO2 emissions		39.6800	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		39.6800	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.7000	1.3258	6.2311			(27)
New External	19.1300	4.7000	14.4300	0.1800	2.5974			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8285			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.9970	(36)
Total fabric heat loss					(33) + (36) =		10.8255	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	32.8193	32.6904	32.5641	31.9705	31.8595	31.3425	31.3425	31.2468	31.5416	31.8595	32.0841	32.3190	(39)
Average = Sum(39)m / 12 =												31.9700	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7250	0.7221	0.7193	0.7062	0.7038	0.6923	0.6923	0.6902	0.6967	0.7038	0.7087	0.7139	(40)
HLP (average)												0.7062	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
								Total per year (kWh/year) = Sum(64)m =				1661.4159	(64)
Heat gains from water heating, kWh/month													
	75.4571	67.0516	71.6994	66.0495	66.0125	60.8326	60.1810	63.6139	62.7422	68.4026	70.0960	74.2408	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	101.4209	99.7792	96.3701	91.7355	88.7265	84.4897	80.8885	85.5026	87.1420	91.9390	97.3556	99.7861	(72)
Total internal gains													
	299.4686	297.6863	288.4611	273.8934	259.4960	245.4668	236.2933	241.0480	248.5034	263.2334	280.0385	292.2614	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.6300	0.7000	0.7700	52.8500	(77)

Solar gains	52.8500	90.0230	123.1735	152.6179	170.9447	169.7086	163.6172	149.9445	133.3708	99.4946	63.3021	45.2286	(83)
Total gains	352.3186	387.7093	411.6346	426.5113	430.4407	415.1754	399.9104	390.9925	381.8742	362.7281	343.3406	337.4899	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.7895	96.1673	96.5405	98.3328	98.6755	100.3031	100.3031	100.6104	99.6699	98.6755	97.9846	97.2726	
alpha	7.3860	7.4112	7.4360	7.5555	7.5784	7.6869	7.6869	7.7074	7.6447	7.5784	7.5323	7.4848	
util living area													
	0.9860	0.9704	0.9326	0.8357	0.6752	0.4822	0.3448	0.3675	0.5666	0.8397	0.9640	0.9890	(86)
MIT	20.5487	20.6623	20.8013	20.9314	20.9872	20.9991	20.9999	20.9999	20.9971	20.9396	20.7406	20.5286	(87)
Th 2	20.3188	20.3213	20.3238	20.3353	20.3375	20.3476	20.3476	20.3495	20.3437	20.3375	20.3331	20.3286	(88)
util rest of house													
	0.9822	0.9629	0.9170	0.8050	0.6314	0.4335	0.2937	0.3156	0.5141	0.8040	0.9538	0.9860	(89)
MIT 2	19.7271	19.8903	20.0841	20.2618	20.3262	20.3470	20.3476	20.3494	20.3417	20.2760	20.0123	19.7064	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.1476	20.2855	20.4511	20.6045	20.6645	20.6808	20.6815	20.6824	20.6771	20.6157	20.3851	20.1272	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1476	20.2855	20.4511	20.6045	20.6645	20.6808	20.6815	20.6824	20.6771	20.6157	20.3851	20.1272	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9811	0.9625	0.9201	0.8179	0.6532	0.4584	0.3198	0.3422	0.5409	0.8196	0.9547	0.9850	(94)
Useful gains	345.6643	373.1693	378.7625	348.8457	281.1812	190.3275	127.9099	133.7872	206.5565	297.3046	327.7885	332.4167	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	520.1078	502.9571	454.3055	374.1993	285.6042	190.5873	127.9235	133.8098	207.4540	319.0933	426.2403	514.7523	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	129.7860	87.2174	56.2040	18.2546	3.2907	0.0000	0.0000	0.0000	0.0000	16.2108	70.8853	135.6577	(98)
Space heating												517.5065	(98)
Space heating per m2											(98) / (4) =	11.4316	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												553.4829	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	129.7860	87.2174	56.2040	18.2546	3.2907	0.0000	0.0000	0.0000	0.0000	16.2108	70.8853	135.6577	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	138.8086	93.2806	60.1112	19.5236	3.5195	0.0000	0.0000	0.0000	0.0000	17.3378	75.8132	145.0884	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.2285	83.5409	82.4471	80.9334	80.0273	79.8000	79.8000	79.8000	79.8000	80.7858	82.9765	84.4035	(217)
Fuel for water heating, kWh/month													
	192.4163	171.2543	182.8661	167.8768	167.0234	150.5993	145.5216	158.4594	157.7964	174.3531	178.4097	187.6833	(219)
Water heating fuel used												2034.2597	(219)
Annual totals kWh/year													
Space heating fuel - main system												553.4829	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Total delivered energy for all uses												2906.1927	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	553.4829	0.2160	119.5523	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2034.2597	0.2160	439.4001	(264)
Space and water heating			558.9524	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Total CO2, kg/m2/year			724.2280	(272)
Emissions per m2 for space and water heating			12.3471	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.7910	(272b)
Emissions per m2 for pumps and fans			0.8598	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3471 * 1.55) + 2.7910 + 0.8598, rounded to 2 d.p.			22.7900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		3.6300	
Infiltration rate		0.3582	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2776	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3540	0.3470	0.3401	0.3054	0.2984	0.2637	0.2637	0.2568	0.2776	0.2984	0.3123	0.3262	(22b)
Effective ac	0.5626	0.5602	0.5578	0.5466	0.5445	0.5348	0.5348	0.5330	0.5385	0.5445	0.5488	0.5532	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							2.5970	(36)
Total fabric heat loss					(33) + (36) =		11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.0135	20.9227	20.8336	20.4153	20.3371	19.9728	19.9728	19.9053	20.1131	20.3371	20.4954	20.6609	(38)
Heat transfer coeff	32.5703	32.4794	32.3904	31.9721	31.8938	31.5295	31.5295	31.4621	31.6699	31.8938	32.0521	32.2177	(39)
Average = Sum(39)m / 12 =												31.9717	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7195	0.7175	0.7155	0.7063	0.7045	0.6965	0.6965	0.6950	0.6996	0.7045	0.7080	0.7117	(40)
HLP (average)												0.7062	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5524 (42)
Average daily hot water use (litres/day)		71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

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

	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)

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

	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)

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

	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)

Water heating gains (Table 5)

	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)

Total internal gains

	228.1601	226.9702	218.9754	206.0804	192.7689	180.2688	172.3949	175.4844	182.3482	195.3470	210.1972	221.5429	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.3500	0.7000	0.7700	29.3611	(77)

Solar gains	29.3611	50.0128	68.4297	84.7877	94.9693	94.2825	90.8984	83.3025	74.0949	55.2748	35.1678	25.1270	(83)
Total gains	257.5212	276.9830	287.4051	290.8681	287.7382	274.5514	263.2933	258.7869	256.4431	250.6218	245.3650	246.6699	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.6088	38.7168	38.8233	39.3312	39.4277	39.8832	39.8832	39.9688	39.7065	39.4277	39.2329	39.0314	
alpha	3.5739	3.5811	3.5882	3.6221	3.6285	3.6589	3.6589	3.6646	3.6471	3.6285	3.6155	3.6021	
util living area	0.9624	0.9489	0.9256	0.8794	0.7957	0.6521	0.5017	0.5279	0.7181	0.8784	0.9445	0.9670	(86)
MIT	19.6266	19.7926	20.0539	20.3888	20.6842	20.8935	20.9690	20.9619	20.8393	20.4794	20.0037	19.5914	(87)
Th 2	20.3237	20.3254	20.3272	20.3353	20.3368	20.3439	20.3439	20.3453	20.3412	20.3368	20.3338	20.3305	(88)
util rest of house	0.9578	0.9427	0.9161	0.8632	0.7665	0.6024	0.4349	0.4622	0.6734	0.8591	0.9367	0.9629	(89)
MIT 2	19.0469	19.2117	19.4697	19.8011	20.0806	20.2704	20.3274	20.3241	20.2244	19.8924	19.4281	19.0176	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.3436	19.5090	19.7687	20.1019	20.3896	20.5893	20.6557	20.6506	20.5391	20.1928	19.7227	19.3113	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3436	19.5090	19.7687	20.1019	20.3896	20.5893	20.6557	20.6506	20.5391	20.1928	19.7227	19.3113	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9497	0.9338	0.9072	0.8569	0.7690	0.6216	0.4673	0.4935	0.6875	0.8545	0.9284	0.9554	(94)
Useful gains	244.5763	258.6526	260.7215	249.2411	221.2729	170.6707	123.0261	127.7032	176.2926	214.1631	227.7858	235.6780	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	489.9750	474.4932	429.7769	358.1478	277.1437	188.8393	127.8755	133.7312	203.9260	305.9522	404.5854	486.8494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	182.5766	145.0449	125.7772	78.4128	41.5679	0.0000	0.0000	0.0000	0.0000	68.2911	127.2957	186.8715	(98)
Space heating												955.8377	(98)
Space heating per m2											(98) / (4) =	21.1142	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	296.3776	233.3185	239.1117	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8715	0.9208	0.9135	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	258.2799	214.8443	218.4333	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	380.9028	366.7148	362.5480	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	88.2885	112.9916	107.2213	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												308.5014	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

Space cooling kWh

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	22.0721	28.2479	26.8053	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												77.1254 (107)
Space cooling per m2												1.7037 (108)
Energy for space heating												21.1142 (99)
Energy for space cooling												1.7037 (108)
Total												22.8178 (109)
Dwelling Fabric Energy Efficiency (DFEE)												22.8 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.7000	1.3258	6.2311			(27)
New External	19.1300	4.7000	14.4300	0.1800	2.5974			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	8.8285			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.9970	(36)
Total fabric heat loss					(33) + (36) =		10.8255	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	32.8193	32.6904	32.5641	31.9705	31.8595	31.3425	31.3425	31.2468	31.5416	31.8595	32.0841	32.3190	(39)
Average = Sum(39)m / 12 =												31.9700	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7250	0.7221	0.7193	0.7062	0.7038	0.6923	0.6923	0.6902	0.6967	0.7038	0.7087	0.7139	(40)
HLP (average)												0.7062	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.7851	12.2438	9.9574	7.5384	5.6350	4.7573	5.1405	6.6818	8.9682	11.3872	13.2906	14.1683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)
Total internal gains													
	228.1601	226.9702	218.9754	206.0804	192.7689	180.2688	172.3949	175.4844	182.3482	195.3470	210.1972	221.5429	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.6300	0.7000	0.7700	52.8500	(77)

Solar gains	52.8500	90.0230	123.1735	152.6179	170.9447	169.7086	163.6172	149.9445	133.3708	99.4946	63.3021	45.2286	(83)
Total gains	281.0101	316.9933	342.1489	358.6983	363.7137	349.9774	336.0121	325.4289	315.7190	294.8416	273.4993	266.7714	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.7895	96.1673	96.5405	98.3328	98.6755	100.3031	100.3031	100.6104	99.6699	98.6755	97.9846	97.2726	
alpha	7.3860	7.4112	7.4360	7.5555	7.5784	7.6869	7.6869	7.7074	7.6447	7.5784	7.5323	7.4848	
util living area	0.9965	0.9906	0.9731	0.9136	0.7761	0.5697	0.4102	0.4412	0.6764	0.9281	0.9901	0.9975	(86)
MIT	20.3972	20.5223	20.6866	20.8665	20.9683	20.9973	20.9998	20.9997	20.9907	20.8697	20.6048	20.3761	(87)
Th 2	20.3188	20.3213	20.3238	20.3353	20.3375	20.3476	20.3476	20.3495	20.3437	20.3375	20.3331	20.3286	(88)
util rest of house	0.9954	0.9878	0.9654	0.8913	0.7321	0.5132	0.3495	0.3791	0.6173	0.9046	0.9867	0.9967	(89)
MIT 2	19.7656	19.8916	20.0540	20.2318	20.3174	20.3464	20.3475	20.3494	20.3391	20.2393	19.9841	19.7531	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	20.0889	20.2144	20.3778	20.5567	20.6506	20.6795	20.6814	20.6822	20.6726	20.5619	20.3018	20.0720	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0889	20.2144	20.3778	20.5567	20.6506	20.6795	20.6814	20.6822	20.6726	20.5619	20.3018	20.0720	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9873	0.9661	0.8993	0.7534	0.5421	0.3806	0.4109	0.6473	0.9133	0.9865	0.9964	(94)
Useful gains	279.6008	312.9754	330.5427	322.5670	274.0376	189.7329	127.8735	133.7215	204.3769	269.2645	269.8184	265.8082	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	518.1813	500.6350	451.9160	372.6702	285.1598	190.5479	127.9208	133.8051	207.3109	317.3818	423.5687	512.9654	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	177.5039	126.1073	90.3018	36.0743	8.2749	0.0000	0.0000	0.0000	0.0000	35.7992	110.7002	183.8849	(98)
Space heating												768.6465	(98)
Space heating per m2											(98) / (4) =	16.9792	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	294.6196	231.9346	237.4755	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9894	0.9971	0.9960	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	291.4943	231.2608	236.5347	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	469.0630	451.7107	440.4412	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	127.8495	164.0147	151.7065	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												443.5707	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.9624	0.0000	37.9266	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												69.8890	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling per m2	1.5438 (108)
Energy for space heating	16.9792 (99)
Energy for space cooling	1.5438 (108)
Total	18.5230 (109)
Target Fabric Energy Efficiency (TFEE)	21.3 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.6300	
Infiltration rate		0.1815	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1407	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1547	0.1512	0.1512	0.1371	0.1407	0.1231	0.1160	0.1196	0.1196	0.1371	0.1371	0.1407	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2552	0.2517	0.2517	0.2376	0.2412	0.2236	0.2165	0.2201	0.2201	0.2376	0.2376	0.2412	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5322	9.4009	9.4009	8.8755	9.0069	8.3502	8.0875	8.2189	8.2189	8.8755	8.8755	9.0069	(38)
Heat transfer coeff	21.0890	20.9576	20.9576	20.4323	20.5636	19.9069	19.6443	19.7756	19.7756	20.4323	20.4323	20.5636	(39)
Average = Sum(39)m / 12 =												20.3776	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4658	0.4629	0.4629	0.4513	0.4542	0.4397	0.4339	0.4368	0.4368	0.4513	0.4513	0.4542	(40)
HLP (average)												0.4501	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (64)
Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
RHI water heating demand 1324 (64)
Heat gains from water heating, kWh/month
52.5347 46.3475 48.7769 43.8665 43.0900 38.6495 37.2586 40.6915 40.5592 45.4801 47.9130 51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
34.4629 30.6096 24.8934 18.8459 14.0875 11.8933 12.8511 16.7044 22.4206 28.4681 33.2265 35.4207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
201.4582 203.5487 198.2807 187.0658 172.9089 159.6034 150.7145 148.6240 153.8920 165.1070 179.2639 192.5693 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 (71)
Water heating gains (Table 5)
70.6111 68.9695 65.5603 60.9257 57.9167 53.6799 50.0787 54.6928 56.3322 61.1292 66.5458 68.9763 (72)
Total internal gains
383.4462 380.0418 365.6485 343.7514 321.8271 302.0906 290.5584 296.9352 309.5588 331.6183 355.9502 373.8804 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	31.1332	0.3500	0.7000	0.7700	24.8440	(77)

Solar gains 24.8440 44.4558 64.1528 81.9615 89.0337 90.0398 85.1271 76.9354 71.5177 52.7623 31.9707 22.7339 (83)
Total gains 408.2902 424.4976 429.8013 425.7128 410.8609 392.1304 375.6855 373.8707 381.0765 384.3806 387.9209 396.6143 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6283	60.0020	60.0020	61.5448	61.1517	63.1689	64.0136	63.5884	63.5884	61.5448	61.5448	61.1517	
alpha	4.9752	5.0001	5.0001	5.1030	5.0768	5.2113	5.2676	5.2392	5.2392	5.1030	5.1030	5.0768	
util living area	0.7447	0.7029	0.6432	0.5311	0.4126	0.2840	0.2039	0.2168	0.3366	0.5166	0.6581	0.7520	(86)
MIT	20.8274	20.8738	20.9230	20.9752	20.9940	20.9994	20.9999	20.9999	20.9985	20.9808	20.9249	20.8293	(87)
Th 2	20.5522	20.5549	20.5549	20.5656	20.5630	20.5764	20.5818	20.5791	20.5791	20.5656	20.5656	20.5630	(88)
util rest of house	0.7305	0.6877	0.6263	0.5123	0.3914	0.2626	0.1820	0.1946	0.3150	0.4955	0.6405	0.7382	(89)
MIT 2	20.3270	20.3920	20.4577	20.5358	20.5564	20.5758	20.5817	20.5790	20.5776	20.5433	20.4713	20.3397	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.5831	20.6386	20.6959	20.7607	20.7803	20.7926	20.7958	20.7944	20.7930	20.7672	20.7034	20.5903	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5831	20.6386	20.6959	20.7607	20.7803	20.7926	20.7958	20.7944	20.7930	20.7672	20.7034	20.5903	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7315	0.6906	0.6317	0.5208	0.4020	0.2735	0.1932	0.2060	0.3259	0.5054	0.6461	0.7391	(94)
Useful gains	298.6604	293.1767	271.4986	221.7178	165.1582	107.2594	72.5903	76.9988	124.2096	194.2539	250.6450	293.1244	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	328.6320	315.1739	284.9371	225.9954	166.1610	107.3506	72.6004	77.0143	124.4480	197.5228	263.6466	322.6494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	22.2988	14.7821	9.9983	3.0798	0.7461	0.0000	0.0000	0.0000	0.0000	2.4321	9.3611	21.9667	(98)
Space heating												84.6649	(98)
RHI space heating demand												85	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.6300	
Infiltration rate		0.1815	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1407	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1793	0.1758	0.1723	0.1547	0.1512	0.1336	0.1336	0.1301	0.1407	0.1512	0.1582	0.1653	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2798	0.2763	0.2728	0.2552	0.2517	0.2341	0.2341	0.2306	0.2412	0.2517	0.2587	0.2658	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.4516	10.3202	10.1889	9.5322	9.4009	8.7442	8.7442	8.6129	9.0069	9.4009	9.6636	9.9262	(38)
Heat transfer coeff	22.0083	21.8770	21.7456	21.0890	20.9576	20.3009	20.3009	20.1696	20.5636	20.9576	21.2203	21.4830	(39)
Average = Sum(39)m / 12 =												21.0561	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4862	0.4833	0.4804	0.4658	0.4629	0.4484	0.4484	0.4455	0.4542	0.4629	0.4687	0.4746	(40)
HLP (average)												0.4651	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (64)
Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
Heat gains from water heating, kWh/month
52.5347 46.3475 48.7769 43.8665 43.0900 38.6495 37.2586 40.6915 40.5592 45.4801 47.9130 51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.4629	30.6096	24.8934	18.8459	14.0875	11.8933	12.8511	16.7044	22.4206	28.4681	33.2265	35.4207	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	383.4462	380.0418	365.6485	343.7514	321.8271	302.0906	290.5584	296.9352	309.5588	331.6183	355.9502	373.8804	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	36.7938	0.3500	0.7000	0.7700	29.3611	(77)

Solar gains	29.3611	50.0128	68.4297	84.7877	94.9693	94.2825	90.8984	83.3025	74.0949	55.2748	35.1678	25.1270	(83)
Total gains	412.8073	430.0546	434.0782	428.5391	416.7965	396.3732	381.4568	380.2377	383.6537	386.8931	391.1180	399.0074	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.1375	57.4805	57.8277	59.6283	60.0020	61.9429	61.9429	62.3463	61.1517	60.0020	59.2593	58.5347	
alpha	4.8092	4.8320	4.8552	4.9752	5.0001	5.1295	5.1295	5.1564	5.0768	5.0001	4.9506	4.9023	
util living area													
	0.7765	0.7369	0.6766	0.5763	0.4620	0.3271	0.2341	0.2439	0.3683	0.5489	0.6978	0.7864	(86)
MIT	20.7592	20.8188	20.8890	20.9576	20.9879	20.9985	20.9998	20.9997	20.9970	20.9711	20.8861	20.7571	(87)
Th 2	20.5335	20.5362	20.5389	20.5522	20.5549	20.5683	20.5683	20.5710	20.5630	20.5549	20.5496	20.5442	(88)
util rest of house													
	0.7632	0.7223	0.6600	0.5575	0.4409	0.3052	0.2111	0.2212	0.3454	0.5276	0.6808	0.7735	(89)
MIT 2	20.2165	20.3000	20.3974	20.5005	20.5411	20.5668	20.5682	20.5708	20.5599	20.5208	20.4047	20.2235	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	20.4942	20.5655	20.6490	20.7344	20.7698	20.7878	20.7891	20.7903	20.7836	20.7513	20.6511	20.4966	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4942	20.5655	20.6490	20.7344	20.7698	20.7878	20.7891	20.7903	20.7836	20.7513	20.6511	20.4966	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7620	0.7233	0.6640	0.5652	0.4511	0.3163	0.2229	0.2328	0.3570	0.5371	0.6847	0.7721	(94)
Useful gains	314.5564	311.0491	288.2393	242.2073	188.0230	125.3812	85.0122	88.5144	136.9576	207.7960	267.7790	308.0702	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	356.4080	342.7138	307.6797	249.5758	190.0810	125.6178	85.0421	88.5514	137.4395	212.7469	287.5579	350.0996	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	31.1376	21.2787	14.4637	5.3053	1.5312	0.0000	0.0000	0.0000	0.0000	3.6835	14.2408	31.2698	(98)
Space heating												122.9105	(98)
Space heating per m2											(98) / (4) =	2.7151	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												122.9105	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	31.1376	21.2787	14.4637	5.3053	1.5312	0.0000	0.0000	0.0000	0.0000	3.6835	14.2408	31.2698	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	31.1376	21.2787	14.4637	5.3053	1.5312	0.0000	0.0000	0.0000	0.0000	3.6835	14.2408	31.2698	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												122.9105	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												1792.2388	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	122.9105	13.1900	16.2119	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	13.1900	174.6421	(247)
Mechanical ventilation fans	101.8292	13.1900	13.4313	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	243.4500	13.1900	32.1111	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			236.3963	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0999	(257)
SAP value		84.6566	
SAP rating (Section 12)		85	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	122.9105	0.5190	63.7905	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			750.9720	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			762.4207	(272)
CO2 emissions per m2			16.8400	(273)
EI value			88.6824	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.6300	
Infiltration rate		0.1815	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1407	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1547	0.1512	0.1512	0.1371	0.1407	0.1231	0.1160	0.1196	0.1196	0.1371	0.1371	0.1407	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2552	0.2517	0.2517	0.2376	0.2412	0.2236	0.2165	0.2201	0.2201	0.2376	0.2376	0.2412	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.7000	1.4151	6.6509			(27)
New External	19.1300	4.7000	14.4300	0.1600	2.3088			(29a)
Total net area of external elements Aum(A, m2)			19.1300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		8.9597			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	2.5970	(36)
Total fabric heat loss (33) + (36) =	11.5567	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.5322	9.4009	9.4009	8.8755	9.0069	8.3502	8.0875	8.2189	8.2189	8.8755	8.8755	9.0069	(38)
Heat transfer coeff	21.0890	20.9576	20.9576	20.4323	20.5636	19.9069	19.6443	19.7756	19.7756	20.4323	20.4323	20.5636	(39)
Average = Sum(39)m / 12 =												20.3776	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4658	0.4629	0.4629	0.4513	0.4542	0.4397	0.4339	0.4368	0.4368	0.4513	0.4513	0.4542	(40)
HLP (average)												0.4501	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
133.4163 117.1871 122.1147 108.1396 105.0113 92.4494 87.4731 97.7975 98.1927 112.1995 120.3094 129.7582 (64)
Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
Heat gains from water heating, kWh/month
52.5347 46.3475 48.7769 43.8665 43.0900 38.6495 37.2586 40.6915 40.5592 45.4801 47.9130 51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
34.4629 30.6096 24.8934 18.8459 14.0875 11.8933 12.8511 16.7044 22.4206 28.4681 33.2265 35.4207 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
201.4582 203.5487 198.2807 187.0658 172.9089 159.6034 150.7145 148.6240 153.8920 165.1070 179.2639 192.5693 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 45.8666 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 -62.0948 (71)
Water heating gains (Table 5)
70.6111 68.9695 65.5603 60.9257 57.9167 53.6799 50.0787 54.6928 56.3322 61.1292 66.5458 68.9763 (72)
Total internal gains
383.4462 380.0418 365.6485 343.7514 321.8271 302.0906 290.5584 296.9352 309.5588 331.6183 355.9502 373.8804 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.7000	31.1332	0.3500	0.7000	0.7700	24.8440	(77)

Solar gains	24.8440	44.4558	64.1528	81.9615	89.0337	90.0398	85.1271	76.9354	71.5177	52.7623	31.9707	22.7339	(83)
Total gains	408.2902	424.4976	429.8013	425.7128	410.8609	392.1304	375.6855	373.8707	381.0765	384.3806	387.9209	396.6143	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.6283	60.0020	60.0020	61.5448	61.1517	63.1689	64.0136	63.5884	63.5884	61.5448	61.5448	61.1517	
alpha	4.9752	5.0001	5.0001	5.1030	5.0768	5.2113	5.2676	5.2392	5.2392	5.1030	5.1030	5.0768	
util living area	0.7447	0.7029	0.6432	0.5311	0.4126	0.2840	0.2039	0.2168	0.3366	0.5166	0.6581	0.7520	(86)
MIT	20.8274	20.8738	20.9230	20.9752	20.9940	20.9994	20.9999	20.9999	20.9985	20.9808	20.9249	20.8293	(87)
Th 2	20.5522	20.5549	20.5549	20.5656	20.5630	20.5764	20.5818	20.5791	20.5791	20.5656	20.5656	20.5630	(88)
util rest of house	0.7305	0.6877	0.6263	0.5123	0.3914	0.2626	0.1820	0.1946	0.3150	0.4955	0.6405	0.7382	(89)
MIT 2	20.3270	20.3920	20.4577	20.5358	20.5564	20.5758	20.5817	20.5790	20.5776	20.5433	20.4713	20.3397	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	20.5831	20.6386	20.6959	20.7607	20.7803	20.7926	20.7958	20.7944	20.7930	20.7672	20.7034	20.5903	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5831	20.6386	20.6959	20.7607	20.7803	20.7926	20.7958	20.7944	20.7930	20.7672	20.7034	20.5903	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7315	0.6906	0.6317	0.5208	0.4020	0.2735	0.1932	0.2060	0.3259	0.5054	0.6461	0.7391	(94)
Useful gains	298.6604	293.1767	271.4986	221.7178	165.1582	107.2594	72.5903	76.9988	124.2096	194.2539	250.6450	293.1244	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	328.6320	315.1739	284.9371	225.9954	166.1610	107.3506	72.6004	77.0143	124.4480	197.5228	263.6466	322.6494	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	22.2988	14.7821	9.9983	3.0798	0.7461	0.0000	0.0000	0.0000	0.0000	2.4321	9.3611	21.9667	(98)
Space heating												84.6649	(98)
Space heating per m2											(98) / (4) =	1.8702	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												84.6649	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	22.2988	14.7821	9.9983	3.0798	0.7461	0.0000	0.0000	0.0000	0.0000	2.4321	9.3611	21.9667	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	22.2988	14.7821	9.9983	3.0798	0.7461	0.0000	0.0000	0.0000	0.0000	2.4321	9.3611	21.9667	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												84.6649	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												243.4500	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												1753.9932	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	84.6649	31.0800	26.3139	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	31.0800	411.5144	(247)
Mechanical ventilation fans	101.8292	31.0800	31.6485	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	243.4500	31.0800	75.6643	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			545.1411	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	84.6649	0.5190	43.9411	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			731.1225	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	243.4500	0.5190	126.3506	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			742.5713	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	84.6649	3.0700	259.9214	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	3.0700	4064.8305	(264)
Space and water heating			4324.7519	(265)
Pumps and fans	101.8292	3.0700	312.6157	(267)
Energy for lighting	243.4500	3.0700	747.3916	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	3.0700	-992.2854	(269)
Primary energy kWh/year			4392.4738	(272)
Primary energy kWh/m2/year			97.0284	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 89

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£545	£545	£0
Space heating	£58	£58	£0
Water heating	£412	£412	£0
Lighting	£76	£76	£0
Total cost of fuels	£545	£545	£0
Total cost of uses	£546	£546	£0
Delivered energy	39 kWh/m²	39 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	97 kWh/m²	97 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-35	**Issued on Date**	11/01/2024
Assessment Reference	7765-35	**Prop Type Ref**	
Property	Flat 35, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	83 B	**DER**	17.39	**TER**	20.31
Environmental	88 B	**% DER<TER**	14.36		
CO_2 Emissions (t/year)	0.97	**DFEE**	25.86	**TFEE**	26.00
General Requirements Compliance	Pass	**% DFEE<TFEE**	0.54		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Mid-floor flat, total floor area 68 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 20.31 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.39 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)26.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)25.9 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.00 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South East: 7.19 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Photovoltaic array 484.16 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2981	0.2943	0.2904	0.2710	0.2671	0.2478	0.2478	0.2439	0.2555	0.2671	0.2749	0.2826	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.1900	1.4151	10.1745			(27)
New External	41.4300	7.1900	34.2400	0.1600	5.4784			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6529			(33)
Party Wall 1			28.1500	0.0000	0.0000			(32)
Corridor			14.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6208	(36)
Total fabric heat loss (33) + (36) =	20.2737	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.6781	16.4613	16.2445	15.1606	14.9438	13.8599	13.8599	13.6432	14.2935	14.9438	15.3774	15.8110	(38)
Heat transfer coeff	36.9518	36.7350	36.5182	35.4343	35.2176	34.1337	34.1337	33.9169	34.5672	35.2176	35.6511	36.0847	(39)
Average = Sum(39)m / 12 =												35.3802	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5449	0.5417	0.5385	0.5226	0.5194	0.5034	0.5034	0.5002	0.5098	0.5194	0.5258	0.5321	(40)
HLP (average)												0.5218	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1918 (42)
Average daily hot water use (litres/day)	86.2554 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	21.1058	18.4593	19.0484	16.6068	15.9346	13.7504	12.7417	14.6213	14.7960	17.2433	18.8224	20.4399	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (64)
Total per year (kWh/year) = Sum(64)m = 1562.9927 (64)
Heat gains from water heating, kWh/month
60.7718 53.5517 56.2110 50.3478 49.3090 44.0160 42.2314 46.3978 46.3337 52.2098 55.2589 59.2956 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
19.5341 17.3500 14.1100 10.6821 7.9850 6.7413 7.2842 9.4683 12.7083 16.1361 18.8332 20.0770 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
192.1327 194.1265 189.1023 178.4065 164.9049 152.2154 143.7380 141.7442 146.7684 157.4642 170.9658 183.6553 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 33.9590 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 (71)
Water heating gains (Table 5)
81.6826 79.6901 75.5525 69.9275 66.2755 61.1333 56.7626 62.3627 64.3524 70.1744 76.7485 79.6984 (72)
Total internal gains
349.2264 347.0436 334.6418 314.8932 295.0425 275.9671 263.6619 269.4523 279.7062 299.6518 322.4246 339.3078 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	36.7938	0.3500	0.7000	0.7700	44.9162	(77)

Solar gains	44.9162	76.5089	104.6829	129.7072	145.2828	144.2322	139.0553	127.4351	113.3494	84.5587	53.7993	38.4389	(83)
Total gains	394.1426	423.5525	439.3247	444.6003	440.3253	420.1993	402.7171	396.8874	393.0556	384.2105	376.2239	377.7467	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.9748	51.2756	51.5800	53.1578	53.4850	55.1834	55.1834	55.5361	54.4912	53.4850	52.8345	52.1997	
alpha	4.3983	4.4184	4.4387	4.5439	4.5657	4.6789	4.6789	4.7024	4.6327	4.5657	4.5223	4.4800	
util living area	0.9448	0.9224	0.8834	0.8044	0.6827	0.5079	0.3706	0.3901	0.5817	0.8002	0.9114	0.9511	(86)
MIT	20.1842	20.3298	20.5273	20.7606	20.9093	20.9829	20.9968	20.9960	20.9666	20.8017	20.4867	20.1721	(87)
Th 2	20.4798	20.4827	20.4856	20.5002	20.5031	20.5177	20.5177	20.5207	20.5119	20.5031	20.4973	20.4915	(88)
util rest of house	0.9391	0.9146	0.8719	0.7861	0.6552	0.4725	0.3308	0.3505	0.5459	0.7785	0.9015	0.9459	(89)
MIT 2	19.3678	19.5779	19.8604	20.1966	20.3967	20.5005	20.5152	20.5173	20.4768	20.2579	19.8155	19.3595	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	19.7225	19.9046	20.1501	20.4417	20.6194	20.7101	20.7244	20.7253	20.6896	20.4941	20.1071	19.7125	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7225	19.9046	20.1501	20.4417	20.6194	20.7101	20.7244	20.7253	20.6896	20.4941	20.1071	19.7125	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9294	0.9049	0.8637	0.7838	0.6618	0.4867	0.3479	0.3675	0.5591	0.7781	0.8930	0.9368	(94)
Useful gains	366.3317	383.2515	379.4394	348.4768	291.3879	204.5222	140.1103	145.8393	219.7630	298.9494	335.9592	353.8908	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	569.8899	551.1927	498.4782	408.9711	314.1202	208.5600	140.7819	146.7002	227.7835	348.4479	463.7175	559.7639	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	151.4472	112.8564	88.5649	43.5559	16.9129	0.0000	0.0000	0.0000	0.0000	36.8269	91.9860	153.1696	(98)
Space heating												695.3199	(98)
Space heating per m2											(98) / (4) =	10.2539	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	695.3199	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	151.4472	112.8564	88.5649	43.5559	16.9129	0.0000	0.0000	0.0000	0.0000	36.8269	91.9860	153.1696	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	151.4472	112.8564	88.5649	43.5559	16.9129	0.0000	0.0000	0.0000	0.0000	36.8269	91.9860	153.1696	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	158.1896	138.8540	144.4730	127.6321	123.7149	108.5892	102.4290	114.9596	115.5598	132.4391	142.4025	153.7499	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	158.1896	138.8540	144.4730	127.6321	123.7149	108.5892	102.4290	114.9596	115.5598	132.4391	142.4025	153.7499	(219)
Water heating fuel used												1562.9927	(219)
Annual totals kWh/year													
Space heating fuel - main system												695.3199	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)		
mechanical ventilation fans (SFP = 0.7375)	152.5301	(230a)
Total electricity for the above, kWh/year	152.5301	(231)
Electricity for lighting (calculated in Appendix L)	344.9777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2755.8204	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	695.3199	0.5190	360.8710	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1562.9927	0.5190	811.1932	(264)
Space and water heating			1172.0642	(265)
Pumps and fans	152.5301	0.5190	79.1631	(267)
Energy for lighting	344.9777	0.5190	179.0434	(268)
Energy saving/generation technologies				
PV Unit	-484.1600	0.5190	-251.2790	(269)
Total CO2, kg/year			1178.9917	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.3900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.3900	ZC1
Total Floor Area	TFA	67.8100	
Assumed number of occupants	N	2.1918	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.7901	ZC2
CO2 emissions from cooking, equation (L16)		2.5306	ZC3
Total CO2 emissions		36.7108	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.7108	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1180	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3680	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2852	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3636	0.3565	0.3493	0.3137	0.3066	0.2709	0.2709	0.2638	0.2852	0.3066	0.3208	0.3351	(22b)
Effective ac	0.5661	0.5635	0.5610	0.5492	0.5470	0.5367	0.5367	0.5348	0.5407	0.5470	0.5515	0.5561	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			7.1900	1.3258	9.5322			(27)
New External	41.4300	7.1900	34.2400	0.1800	6.1632			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6954			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8288	(36)
Total fabric heat loss					(33) + (36) =		19.5242	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.6698	31.5262	31.3854	30.7243	30.6006	30.0247	30.0247	29.9181	30.2465	30.6006	30.8508	31.1124	(38)
Heat transfer coeff	51.1940	51.0503	50.9096	50.2484	50.1247	49.5489	49.5489	49.4423	49.7707	50.1247	50.3750	50.6366	(39)
Average = Sum(39)m / 12 =												50.2479	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7550	0.7528	0.7508	0.7410	0.7392	0.7307	0.7307	0.7291	0.7340	0.7392	0.7429	0.7467	(40)
HLP (average)												0.7410	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1918	(42)
Average daily hot water use (litres/day)	86.2554	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	21.1058	18.4593	19.0484	16.6068	15.9346	13.7504	12.7417	14.6213	14.7960	17.2433	18.8224	20.4399	(46)

Water storage loss:		
Store volume	145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3665	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7379	(55)

Total storage loss													
	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

If cylinder contains dedicated solar storage

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	186.8427	164.7342	173.1261	155.3609	152.3680	136.3180	131.0820	143.6127	143.2885	161.0922	170.1313	182.4030	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	186.8427	164.7342	173.1261	155.3609	152.3680	136.3180	131.0820	143.6127	143.2885	161.0922	170.1313	182.4030	(64)
								Total per year (kWh/year) = Sum(64)m =				1900.3595	(64)
Heat gains from water heating, kWh/month													
	83.6943	74.2559	79.1335	72.5308	72.2314	66.1990	65.1539	69.3203	68.5167	75.1322	77.4420	82.2181	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.5341	17.3500	14.1100	10.6821	7.9850	6.7413	7.2842	9.4683	12.7083	16.1361	18.8332	20.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	192.1327	194.1265	189.1023	178.4065	164.9049	152.2154	143.7380	141.7442	146.7684	157.4642	170.9658	183.6553	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	(71)
Water heating gains (Table 5)													
	112.4923	110.4998	106.3622	100.7372	97.0853	91.9431	87.5724	93.1724	95.1621	100.9842	107.5583	110.5082	(72)
Total internal gains													
	383.0362	380.8533	368.4516	348.7029	328.8523	309.7768	297.4716	303.2620	313.5159	333.4616	356.2344	373.1175	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	36.7938	0.6300	0.7000	0.7700	80.8492	(77)

Solar gains	80.8492	137.7161	188.4292	233.4729	261.5091	259.6180	250.2995	229.3832	204.0290	152.2056	96.8387	69.1901	(83)
Total gains	463.8854	518.5694	556.8807	582.1758	590.3614	569.3948	547.7711	532.6452	517.5449	485.6672	453.0731	442.3076	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.9841	92.2428	92.4979	93.7149	93.9462	95.0380	95.0380	95.2429	94.6144	93.9462	93.4795	92.9965	
alpha	7.1323	7.1495	7.1665	7.2477	7.2631	7.3359	7.3359	7.3495	7.3076	7.2631	7.2320	7.1998	
util living area													
	0.9941	0.9860	0.9638	0.8969	0.7548	0.5535	0.3977	0.4265	0.6520	0.9077	0.9844	0.9957	(86)
MIT	20.4123	20.5362	20.6991	20.8716	20.9692	20.9971	20.9998	20.9996	20.9911	20.8796	20.6197	20.3867	(87)
Th 2	20.2925	20.2944	20.2962	20.3047	20.3063	20.3138	20.3138	20.3152	20.3109	20.3063	20.3031	20.2997	(88)
util rest of house													
	0.9924	0.9820	0.9538	0.8717	0.7089	0.4957	0.3359	0.3633	0.5916	0.8798	0.9793	0.9944	(89)
MIT 2	19.5092	19.6894	19.9217	20.1610	20.2781	20.3119	20.3137	20.3150	20.3045	20.1764	19.8180	19.4778	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	19.9016	20.0573	20.2594	20.4697	20.5784	20.6096	20.6118	20.6124	20.6028	20.4819	20.1663	19.8727	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9016	20.0573	20.2594	20.4697	20.5784	20.6096	20.6118	20.6124	20.6028	20.4819	20.1663	19.8727	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9804	0.9532	0.8781	0.7274	0.5208	0.3627	0.3908	0.6176	0.8875	0.9781	0.9934	(94)
Useful gains	459.8017	508.3981	530.8259	511.2297	429.4512	296.5415	198.7039	208.1450	319.6418	431.0082	443.1331	439.3732	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	798.7064	773.7863	700.4865	581.3598	445.0266	297.7692	198.7786	208.2727	323.6480	495.3276	658.2145	793.6105	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	252.1451	178.3409	126.2275	50.4937	11.5881	0.0000	0.0000	0.0000	0.0000	47.8536	154.8586	263.5525	(98)
Space heating												1085.0600	(98)
Space heating per m2											(98) / (4) =	16.0015	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	93.5000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	1160.4920 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	252.1451	178.3409	126.2275	50.4937	11.5881	0.0000	0.0000	0.0000	0.0000	47.8536	154.8586	263.5525	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	269.6739	190.7389	135.0027	54.0039	12.3937	0.0000	0.0000	0.0000	0.0000	51.1803	165.6242	281.8743	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	186.8427	164.7342	173.1261	155.3609	152.3680	136.3180	131.0820	143.6127	143.2885	161.0922	170.1313	182.4030	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6140	85.0257	83.9871	82.1834	80.4725	79.8000	79.8000	79.8000	79.8000	82.0210	84.5642	85.7948	(217)
Fuel for water heating, kWh/month													
	218.2384	193.7463	206.1340	189.0417	189.3417	170.8245	164.2632	179.9657	179.5596	196.4037	201.1860	212.6039	(219)
Water heating fuel used												2301.3088	(219)
Annual totals kWh/year													
Space heating fuel - main system												1160.4920	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												344.9777	(232)
Total delivered energy for all uses												3881.7784	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1160.4920	0.2160	250.6663	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2301.3088	0.2160	497.0827	(264)
Space and water heating			747.7490	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	344.9777	0.5190	179.0434	(268)
Total CO2, kg/m2/year			965.7174	(272)
Emissions per m2 for space and water heating			11.0271	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.6404	(272b)
Emissions per m2 for pumps and fans			0.5740	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.0271 * 1.55) + 2.6404 + 0.5740, rounded to 2 d.p.			20.3100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1180	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.3180	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2464	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3142	0.3080	0.3019	0.2711	0.2649	0.2341	0.2341	0.2279	0.2464	0.2649	0.2772	0.2896	(22b)
Effective ac	0.5494	0.5474	0.5456	0.5367	0.5351	0.5274	0.5274	0.5260	0.5304	0.5351	0.5384	0.5419	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.1900	1.4151	10.1745			(27)
New External	41.4300	7.1900	34.2400	0.1600	5.4784			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6529			(33)
Party Wall 1			28.1500	0.0000	0.0000			(32)
Corridor			14.3300	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6208	(36)
Total fabric heat loss					(33) + (36) =		20.2737	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7330	30.6258	30.5207	30.0270	29.9347	29.5047	29.5047	29.4251	29.6703	29.9347	30.1215	30.3169	(38)
Heat transfer coeff	51.0068	50.8995	50.7944	50.3008	50.2084	49.7784	49.7784	49.6988	49.9440	50.2084	50.3952	50.5906	(39)
Average = Sum(39)m / 12 =												50.3003	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7522	0.7506	0.7491	0.7418	0.7404	0.7341	0.7341	0.7329	0.7365	0.7404	0.7432	0.7461	(40)
HLP (average)												0.7418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1918 (42)
Average daily hot water use (litres/day)		86.2554 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month

29.8999	26.1507	26.9852	23.5263	22.5741	19.4797	18.0508	20.7136	20.9609	24.4280	26.6650	28.9565 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	(66)

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

	19.5341	17.3500	14.1100	10.6821	7.9850	6.7413	7.2842	9.4683	12.7083	16.1361	18.8332	20.0770	(67)

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

	192.1327	194.1265	189.1023	178.4065	164.9049	152.2154	143.7380	141.7442	146.7684	157.4642	170.9658	183.6553	(68)

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

	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	(71)

Water heating gains (Table 5)

	40.1881	38.9147	36.2704	32.6754	30.3415	27.0551	24.2618	27.8408	29.1124	32.8333	37.0348	38.9200	(72)

Total internal gains

	307.7320	306.2682	295.3597	277.6411	259.1085	241.8889	231.1611	234.9304	244.4662	262.3107	282.7108	298.5294	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	36.7938	0.3500	0.7000	0.7700	44.9162	(77)

Solar gains	44.9162	76.5089	104.6829	129.7072	145.2828	144.2322	139.0553	127.4351	113.3494	84.5587	53.7993	38.4389	(83)
Total gains	352.6482	382.7772	400.0426	407.3483	404.3913	386.1211	370.2163	362.3655	357.8156	346.8694	336.5101	336.9683	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.9286	37.0064	37.0830	37.4470	37.5159	37.8399	37.8399	37.9005	37.7144	37.5159	37.3768	37.2324	
alpha	3.4619	3.4671	3.4722	3.4965	3.5011	3.5227	3.5227	3.5267	3.5143	3.5011	3.4918	3.4822	
util living area	0.9718	0.9606	0.9413	0.9028	0.8301	0.6989	0.5497	0.5785	0.7636	0.9047	0.9583	0.9755	(86)
MIT	19.4442	19.6186	19.8986	20.2608	20.5970	20.8500	20.9522	20.9415	20.7805	20.3603	19.8406	19.4033	(87)
Th 2	20.2949	20.2963	20.2977	20.3041	20.3053	20.3108	20.3108	20.3119	20.3087	20.3053	20.3028	20.3003	(88)
util rest of house	0.9681	0.9555	0.9333	0.8885	0.8028	0.6481	0.4764	0.5071	0.7198	0.8881	0.9520	0.9723	(89)
MIT 2	18.8451	19.0184	19.2957	19.6544	19.9755	20.2061	20.2851	20.2790	20.1471	19.7550	19.2448	18.8088	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	19.1054	19.2792	19.5576	19.9178	20.2455	20.4858	20.5749	20.5668	20.4223	20.0179	19.5036	19.0671	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1054	19.2792	19.5576	19.9178	20.2455	20.4858	20.5749	20.5668	20.4223	20.0179	19.5036	19.0671	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9605	0.9466	0.9234	0.8795	0.8003	0.6617	0.5054	0.5345	0.7275	0.8803	0.9434	0.9653	(94)
Useful gains	338.7169	362.3518	369.4136	358.2664	323.6203	255.5033	187.0964	193.6874	260.3125	305.3375	317.4553	325.2920	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	755.1748	731.8925	663.2551	554.2059	429.0564	292.9881	197.8657	207.0872	315.7604	472.8595	625.0837	752.1359	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	309.8447	248.3314	218.6181	141.0764	78.4445	0.0000	0.0000	0.0000	0.0000	124.6364	221.4924	317.5719	(98)
Space heating												1660.0158	(98)
Space heating per m2										(98) / (4) =		24.4804	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	467.9171	368.3603	377.7108	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8272	0.8873	0.8769	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	387.0396	326.8411	331.2207	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	533.8573	513.7175	506.1989	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	105.7088	139.0360	130.1838	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												374.9286	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

Space cooling kWh

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	26.4272	34.7590	32.5459	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.7321 (107)
Space cooling per m2												1.3823 (108)
Energy for space heating												24.4804 (99)
Energy for space cooling												1.3823 (108)
Total												25.8627 (109)
Dwelling Fabric Energy Efficiency (DFEE)												25.9 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1180	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3680	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2852	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3636	0.3565	0.3493	0.3137	0.3066	0.2709	0.2709	0.2638	0.2852	0.3066	0.3208	0.3351	(22b)
Effective ac	0.5661	0.5635	0.5610	0.5492	0.5470	0.5367	0.5367	0.5348	0.5407	0.5470	0.5515	0.5561	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			7.1900	1.3258	9.5322			(27)
New External	41.4300	7.1900	34.2400	0.1800	6.1632			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6954			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.8288	(36)
Total fabric heat loss					(33) + (36) =		19.5242	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.6698	31.5262	31.3854	30.7243	30.6006	30.0247	30.0247	29.9181	30.2465	30.6006	30.8508	31.1124	(38)
Heat transfer coeff	51.1940	51.0503	50.9096	50.2484	50.1247	49.5489	49.5489	49.4423	49.7707	50.1247	50.3750	50.6366	(39)
Average = Sum(39)m / 12 =												50.2479	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7550	0.7528	0.7508	0.7410	0.7392	0.7307	0.7307	0.7291	0.7340	0.7392	0.7429	0.7467	(40)
HLP (average)												0.7410	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1918	(42)
Average daily hot water use (litres/day)	86.2554	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	29.8999	26.1507	26.9852	23.5263	22.5741	19.4797	18.0508	20.7136	20.9609	24.4280	26.6650	28.9565	(65)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	109.5902	(66)

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

	19.5341	17.3500	14.1100	10.6821	7.9850	6.7413	7.2842	9.4683	12.7083	16.1361	18.8332	20.0770	(67)

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

	192.1327	194.1265	189.1023	178.4065	164.9049	152.2154	143.7380	141.7442	146.7684	157.4642	170.9658	183.6553	(68)

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

	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	33.9590	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	(71)

Water heating gains (Table 5)

	40.1881	38.9147	36.2704	32.6754	30.3415	27.0551	24.2618	27.8408	29.1124	32.8333	37.0348	38.9200	(72)

Total internal gains

	307.7320	306.2682	295.3597	277.6411	259.1085	241.8889	231.1611	234.9304	244.4662	262.3107	282.7108	298.5294	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	36.7938	0.6300	0.7000	0.7700	80.8492	(77)

Solar gains	80.8492	137.7161	188.4292	233.4729	261.5091	259.6180	250.2995	229.3832	204.0290	152.2056	96.8387	69.1901	(83)
Total gains	388.5812	443.9843	483.7889	511.1140	520.6176	501.5069	481.4605	464.3136	448.4951	414.5163	379.5496	367.7195	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	91.9841	92.2428	92.4979	93.7149	93.9462	95.0380	95.0380	95.2429	94.6144	93.9462	93.4795	92.9965	
alpha	7.1323	7.1495	7.1665	7.2477	7.2631	7.3359	7.3359	7.3495	7.3076	7.2631	7.2320	7.1998	
util living area	0.9980	0.9943	0.9828	0.9405	0.8253	0.6241	0.4521	0.4885	0.7371	0.9544	0.9945	0.9986	(86)
MIT	20.3029	20.4320	20.6076	20.8095	20.9453	20.9938	20.9995	20.9991	20.9808	20.8118	20.5172	20.2773	(87)
Th 2	20.2925	20.2944	20.2962	20.3047	20.3063	20.3138	20.3138	20.3152	20.3109	20.3063	20.3031	20.2997	(88)
util rest of house	0.9974	0.9926	0.9774	0.9228	0.7826	0.5608	0.3820	0.4165	0.6745	0.9370	0.9925	0.9982	(89)
MIT 2	19.6491	19.7790	19.9534	20.1529	20.2705	20.3110	20.3136	20.3149	20.3010	20.1594	19.8717	19.6298	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	19.9331	20.0627	20.2376	20.4382	20.5637	20.6076	20.6116	20.6121	20.5963	20.4429	20.1521	19.9111	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9331	20.0627	20.2376	20.4382	20.5637	20.6076	20.6116	20.6121	20.5963	20.4429	20.1521	19.9111	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9919	0.9769	0.9265	0.7992	0.5882	0.4125	0.4478	0.7012	0.9409	0.9920	0.9979	(94)
Useful gains	387.4222	440.3871	472.6077	473.5551	416.0858	295.0016	198.5930	207.9406	314.4856	390.0008	376.4993	366.9541	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	800.3221	774.0615	699.3767	579.7758	444.2904	297.6717	198.7703	208.2579	323.3262	493.3714	657.5005	795.5576	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	307.1976	224.2292	168.7161	76.4789	20.9842	0.0000	0.0000	0.0000	0.0000	76.9077	202.3208	318.8810	(98)
Space heating												1395.7156	(98)
Space heating per m2											(98) / (4) =	20.5827	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	465.7598	366.6620	375.7613	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9775	0.9930	0.9904	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	455.2929	364.0979	372.1605	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	668.7238	643.7432	625.3590	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	153.6703	208.0561	188.3797	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												550.1060	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.4176	52.0140	47.0949	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.5265	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling per m2	2.0281 (108)
Energy for space heating	20.5827 (99)
Energy for space cooling	2.0281 (108)
Total	22.6109 (109)
Target Fabric Energy Efficiency (TFEE)	26.0 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1705	0.1666	0.1666	0.1511	0.1550	0.1356	0.1279	0.1318	0.1318	0.1511	0.1511	0.1550	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2710	0.2671	0.2671	0.2516	0.2555	0.2361	0.2284	0.2323	0.2323	0.2516	0.2516	0.2555	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.1900	1.4151	10.1745			(27)
New External	41.4300	7.1900	34.2400	0.1600	5.4784			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6529			(33)
Party Wall 1			28.1500	0.0000	0.0000			(32)
Corridor			14.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6208	(36)
Total fabric heat loss (33) + (36) =	20.2737	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.1606	14.9438	14.9438	14.0767	14.2935	13.2096	12.7760	12.9928	12.9928	14.0767	14.0767	14.2935	(38)
Heat transfer coeff	35.4343	35.2176	35.2176	34.3504	34.5672	33.4833	33.0498	33.2665	33.2665	34.3504	34.3504	34.5672	(39)
Average = Sum(39)m / 12 =												34.2601	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5226	0.5194	0.5194	0.5066	0.5098	0.4938	0.4874	0.4906	0.4906	0.5066	0.5066	0.5098	(40)
HLP (average)												0.5052	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1918 (42)
Average daily hot water use (litres/day)	86.2554 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	21.1058	18.4593	19.0484	16.6068	15.9346	13.7504	12.7417	14.6213	14.7960	17.2433	18.8224	20.4399	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF HEAT DEMAND 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (64)
Total per year (kWh/year) = Sum(64)m = 1562.9927 (64)
RHI water heating demand 1563 (64)
Heat gains from water heating, kWh/month
60.7718 53.5517 56.2110 50.3478 49.3090 44.0160 42.2314 46.3978 46.3337 52.2098 55.2589 59.2956 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
48.8352 43.3750 35.2749 26.7054 19.9626 16.8532 18.2105 23.6707 31.7708 40.3403 47.0831 50.1924 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
286.7653 289.7410 282.2422 266.2783 246.1268 227.1871 214.5343 211.5585 219.0573 235.0212 255.1728 274.1124 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 50.3426 (69)
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 -87.6722 (71)
Water heating gains (Table 5)
81.6826 79.6901 75.5525 69.9275 66.2755 61.1333 56.7626 62.3627 64.3524 70.1744 76.7485 79.6984 (72)
Total internal gains
511.4617 506.9847 487.2483 457.0899 426.5435 399.3524 383.6862 391.7707 409.3592 439.7147 473.1831 498.1820 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	31.1332	0.3500	0.7000	0.7700	38.0060	(77)

Solar gains 38.0060 68.0080 98.1402 125.3836 136.2027 137.7418 130.2263 117.6948 109.4068 80.7151 48.9084 34.7781 (83)
Total gains 549.4677 574.9927 585.3885 582.4735 562.7462 537.0942 513.9125 509.4655 518.7660 520.4298 522.0916 532.9600 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1578	53.4850	53.4850	54.8351	54.4912	56.2552	56.9932	56.6218	56.6218	54.8351	54.8351	54.4912	
alpha	4.5439	4.5657	4.5657	4.6557	4.6327	4.7503	4.7995	4.7748	4.7748	4.6557	4.6557	4.6327	
util living area	0.8322	0.7956	0.7402	0.6290	0.4986	0.3476	0.2506	0.2674	0.4131	0.6191	0.7607	0.8398	(86)
MIT	20.6308	20.7137	20.8105	20.9262	20.9785	20.9972	20.9996	20.9994	20.9934	20.9394	20.8092	20.6311	(87)
Th 2	20.5002	20.5031	20.5031	20.5148	20.5119	20.5265	20.5324	20.5295	20.5295	20.5148	20.5148	20.5119	(88)
util rest of house	0.8194	0.7810	0.7226	0.6069	0.4714	0.3186	0.2206	0.2368	0.3841	0.5939	0.7428	0.8276	(89)
MIT 2	20.0122	20.1289	20.2612	20.4255	20.4883	20.5239	20.5321	20.5290	20.5229	20.4436	20.2718	20.0229	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	20.2809	20.3830	20.4998	20.6430	20.7013	20.7295	20.7352	20.7333	20.7273	20.6590	20.5053	20.2871	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2809	20.3830	20.4998	20.6430	20.7013	20.7295	20.7352	20.7333	20.7273	20.6590	20.5053	20.2871	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8136	0.7773	0.7225	0.6128	0.4820	0.3311	0.2336	0.2501	0.3963	0.6015	0.7425	0.8216	(94)
Useful gains	447.0244	446.9694	422.9521	356.9551	271.2486	177.8146	120.0561	127.3939	205.5981	313.0249	387.6333	437.9014	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	541.4692	520.6213	471.9093	375.8975	276.5819	178.4509	120.1421	127.5223	207.1597	328.3566	436.4313	531.8911	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	70.2669	49.4941	36.4242	13.6385	3.9680	0.0000	0.0000	0.0000	0.0000	11.4068	35.1345	69.9283	(98)
Space heating												290.2613	(98)
RHI space heating demand												290	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1976	0.1938	0.1899	0.1705	0.1666	0.1473	0.1473	0.1434	0.1550	0.1666	0.1744	0.1821	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2981	0.2943	0.2904	0.2710	0.2671	0.2478	0.2478	0.2439	0.2555	0.2671	0.2749	0.2826	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.1900	1.4151	10.1745			(27)
New External	41.4300	7.1900	34.2400	0.1600	5.4784			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6529			(33)
Party Wall 1			28.1500	0.0000	0.0000			(32)
Corridor			14.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6208	(36)
Total fabric heat loss (33) + (36) =	20.2737	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.6781	16.4613	16.2445	15.1606	14.9438	13.8599	13.8599	13.6432	14.2935	14.9438	15.3774	15.8110	(38)
Heat transfer coeff	36.9518	36.7350	36.5182	35.4343	35.2176	34.1337	34.1337	33.9169	34.5672	35.2176	35.6511	36.0847	(39)
Average = Sum(39)m / 12 =												35.3802	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5449	0.5417	0.5385	0.5226	0.5194	0.5034	0.5034	0.5002	0.5098	0.5194	0.5258	0.5321	(40)
HLP (average)												0.5218	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1918 (42)
Average daily hot water use (litres/day)	86.2554 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	21.1058	18.4593	19.0484	16.6068	15.9346	13.7504	12.7417	14.6213	14.7960	17.2433	18.8224	20.4399	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (64)
Total per year (kWh/year) = Sum(64)m = 1562.9927 (64)
Heat gains from water heating, kWh/month
60.7718 53.5517 56.2110 50.3478 49.3090 44.0160 42.2314 46.3978 46.3337 52.2098 55.2589 59.2956 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.8352	43.3750	35.2749	26.7054	19.9626	16.8532	18.2105	23.6707	31.7708	40.3403	47.0831	50.1924	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	286.7653	289.7410	282.2422	266.2783	246.1268	227.1871	214.5343	211.5585	219.0573	235.0212	255.1728	274.1124	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	(71)
Water heating gains (Table 5)													
	81.6826	79.6901	75.5525	69.9275	66.2755	61.1333	56.7626	62.3627	64.3524	70.1744	76.7485	79.6984	(72)
Total internal gains													
	511.4617	506.9847	487.2483	457.0899	426.5435	399.3524	383.6862	391.7707	409.3592	439.7147	473.1831	498.1820	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	36.7938	0.3500	0.7000	0.7700	44.9162	(77)

Solar gains	44.9162	76.5089	104.6829	129.7072	145.2828	144.2322	139.0553	127.4351	113.3494	84.5587	53.7993	38.4389	(83)
Total gains	556.3779	583.4937	591.9312	586.7970	571.8264	543.5846	522.7414	519.2058	522.7086	524.2734	526.9824	536.6209	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.9748	51.2756	51.5800	53.1578	53.4850	55.1834	55.1834	55.5361	54.4912	53.4850	52.8345	52.1997	
alpha	4.3983	4.4184	4.4387	4.5439	4.5657	4.6789	4.6789	4.7024	4.6327	4.5657	4.5223	4.4800	
util living area													
	0.8543	0.8209	0.7680	0.6733	0.5526	0.3985	0.2867	0.2998	0.4497	0.6512	0.7929	0.8636	(86)
MIT	20.5274	20.6247	20.7496	20.8867	20.9612	20.9937	20.9989	20.9987	20.9883	20.9163	20.7387	20.5213	(87)
Th 2	20.4798	20.4827	20.4856	20.5002	20.5031	20.5177	20.5177	20.5207	20.5119	20.5031	20.4973	20.4915	(88)
util rest of house													
	0.8428	0.8076	0.7514	0.6521	0.5265	0.3693	0.2555	0.2688	0.4194	0.6266	0.7765	0.8527	(89)
MIT 2	19.8502	19.9878	20.1627	20.3603	20.4588	20.5116	20.5169	20.5196	20.4999	20.4031	20.1603	19.8518	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	20.1444	20.2645	20.4176	20.5890	20.6771	20.7210	20.7263	20.7277	20.7121	20.6261	20.4116	20.1427	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1444	20.2645	20.4176	20.5890	20.6771	20.7210	20.7263	20.7277	20.7121	20.6261	20.4116	20.1427	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8349	0.8016	0.7491	0.6560	0.5357	0.3817	0.2690	0.2822	0.4319	0.6328	0.7736	0.8448	(94)
Useful gains	464.5249	467.7502	443.4250	384.9259	306.3425	207.4605	140.6238	146.5067	225.7486	331.7624	407.6657	453.3170	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	585.4804	564.4144	508.2480	414.1921	316.1511	208.9338	140.8465	146.7838	228.5611	353.0932	474.5738	575.2857	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	89.9909	64.9583	48.2283	21.0717	7.2976	0.0000	0.0000	0.0000	0.0000	15.8701	48.1738	90.7447	(98)
Space heating												386.3353	(98)
Space heating per m2										(98) / (4) =		5.6973	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												386.3353	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	89.9909	64.9583	48.2283	21.0717	7.2976	0.0000	0.0000	0.0000	0.0000	15.8701	48.1738	90.7447	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	89.9909	64.9583	48.2283	21.0717	7.2976	0.0000	0.0000	0.0000	0.0000	15.8701	48.1738	90.7447	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	158.1896	138.8540	144.4730	127.6321	123.7149	108.5892	102.4290	114.9596	115.5598	132.4391	142.4025	153.7499	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	158.1896	138.8540	144.4730	127.6321	123.7149	108.5892	102.4290	114.9596	115.5598	132.4391	142.4025	153.7499	(219)
Water heating fuel used												1562.9927	(219)
Annual totals kWh/year													
Space heating fuel - main system												386.3353	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												152.5301	(230a)
Total electricity for the above, kWh/year												152.5301	(231)
Electricity for lighting (calculated in Appendix L)												344.9777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2446.8358	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	386.3353	13.1900	50.9576	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1562.9927	13.1900	206.1587	(247)
Mechanical ventilation fans	152.5301	13.1900	20.1187	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	344.9777	13.1900	45.5026	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			322.7376	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2016	(257)
SAP value		83.2380	
SAP rating (Section 12)		83	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	386.3353	0.5190	200.5080	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1562.9927	0.5190	811.1932	(264)
Space and water heating			1011.7012	(265)
Pumps and fans	152.5301	0.5190	79.1631	(267)
Energy for lighting	344.9777	0.5190	179.0434	(268)
Energy saving/generation technologies				
PV Unit	-484.1600	0.5190	-251.2790	(269)
Total kg/year			1018.6288	(272)
CO2 emissions per m2			15.0200	(273)
EI value			87.9003	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.8100 (1b)	x	2.5000 (2b)	=	169.5250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.8100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.5250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1550	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1705	0.1666	0.1666	0.1511	0.1550	0.1356	0.1279	0.1318	0.1318	0.1511	0.1511	0.1550	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2710	0.2671	0.2671	0.2516	0.2555	0.2361	0.2284	0.2323	0.2323	0.2516	0.2516	0.2555	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			7.1900	1.4151	10.1745			(27)
New External	41.4300	7.1900	34.2400	0.1600	5.4784			(29a)
Total net area of external elements Aum(A, m2)			41.4300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.6529			(33)
Party Wall 1			28.1500	0.0000	0.0000			(32)
Corridor			14.3300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.6208	(36)
Total fabric heat loss (33) + (36) =	20.2737	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	15.1606	14.9438	14.9438	14.0767	14.2935	13.2096	12.7760	12.9928	12.9928	14.0767	14.0767	14.2935	(38)
Heat transfer coeff	35.4343	35.2176	35.2176	34.3504	34.5672	33.4833	33.0498	33.2665	33.2665	34.3504	34.3504	34.5672	(39)
Average = Sum(39)m / 12 =												34.2601	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5226	0.5194	0.5194	0.5066	0.5098	0.4938	0.4874	0.4906	0.4906	0.5066	0.5066	0.5098	(40)
HLP (average)												0.5052	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1918 (42)
Average daily hot water use (litres/day)	86.2554 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.8809	91.4307	87.9805	84.5303	81.0800	77.6298	77.6298	81.0800	84.5303	87.9805	91.4307	94.8809	(44)
Energy conte	140.7056	123.0620	126.9890	110.7121	106.2309	91.6692	84.9450	97.4756	98.6398	114.9551	125.4825	136.2659	(45)
Energy content (annual)										Total = Sum(45)m =		1357.1327	(45)
Distribution loss (46)m = 0.15 x (45)m	21.1058	18.4593	19.0484	16.6068	15.9346	13.7504	12.7417	14.6213	14.7960	17.2433	18.8224	20.4399	(46)

Water storage loss:	
Store volume	145.0000 (47)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (56)
If cylinder contains dedicated solar storage
17.4840 15.7920 17.4840 16.9200 17.4840 16.9200 17.4840 17.4840 16.9200 17.4840 16.9200 17.4840 (57)
Primary loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (59)
Total heat required for water heating calculated for each month
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
158.1896 138.8540 144.4730 127.6321 123.7149 108.5892 102.4290 114.9596 115.5598 132.4391 142.4025 153.7499 (64)
Total per year (kWh/year) = Sum(64)m = 1562.9927 (64)
Heat gains from water heating, kWh/month
60.7718 53.5517 56.2110 50.3478 49.3090 44.0160 42.2314 46.3978 46.3337 52.2098 55.2589 59.2956 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	131.5083	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.8352	43.3750	35.2749	26.7054	19.9626	16.8532	18.2105	23.6707	31.7708	40.3403	47.0831	50.1924	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	286.7653	289.7410	282.2422	266.2783	246.1268	227.1871	214.5343	211.5585	219.0573	235.0212	255.1728	274.1124	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	50.3426	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	-87.6722	(71)
Water heating gains (Table 5)													
	81.6826	79.6901	75.5525	69.9275	66.2755	61.1333	56.7626	62.3627	64.3524	70.1744	76.7485	79.6984	(72)
Total internal gains													
	511.4617	506.9847	487.2483	457.0899	426.5435	399.3524	383.6862	391.7707	409.3592	439.7147	473.1831	498.1820	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	7.1900	31.1332	0.3500	0.7000	0.7700	38.0060	(77)

Solar gains	38.0060	68.0080	98.1402	125.3836	136.2027	137.7418	130.2263	117.6948	109.4068	80.7151	48.9084	34.7781	(83)
Total gains	549.4677	574.9927	585.3885	582.4735	562.7462	537.0942	513.9125	509.4655	518.7660	520.4298	522.0916	532.9600	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.1578	53.4850	53.4850	54.8351	54.4912	56.2552	56.9932	56.6218	56.6218	54.8351	54.8351	54.4912	
alpha	4.5439	4.5657	4.5657	4.6557	4.6327	4.7503	4.7995	4.7748	4.7748	4.6557	4.6557	4.6327	
util living area													
	0.8322	0.7956	0.7402	0.6290	0.4986	0.3476	0.2506	0.2674	0.4131	0.6191	0.7607	0.8398	(86)
MIT	20.6308	20.7137	20.8105	20.9262	20.9785	20.9972	20.9996	20.9994	20.9934	20.9394	20.8092	20.6311	(87)
Th 2	20.5002	20.5031	20.5031	20.5148	20.5119	20.5265	20.5324	20.5295	20.5295	20.5148	20.5148	20.5119	(88)
util rest of house													
	0.8194	0.7810	0.7226	0.6069	0.4714	0.3186	0.2206	0.2368	0.3841	0.5939	0.7428	0.8276	(89)
MIT 2	20.0122	20.1289	20.2612	20.4255	20.4883	20.5239	20.5321	20.5290	20.5229	20.4436	20.2718	20.0229	(90)
Living area fraction									fLA = Living area / (4) =			0.4344	(91)
MIT	20.2809	20.3830	20.4998	20.6430	20.7013	20.7295	20.7352	20.7333	20.7273	20.6590	20.5053	20.2871	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2809	20.3830	20.4998	20.6430	20.7013	20.7295	20.7352	20.7333	20.7273	20.6590	20.5053	20.2871	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8136	0.7773	0.7225	0.6128	0.4820	0.3311	0.2336	0.2501	0.3963	0.6015	0.7425	0.8216	(94)
Useful gains	447.0244	446.9694	422.9521	356.9551	271.2486	177.8146	120.0561	127.3939	205.5981	313.0249	387.6333	437.9014	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	541.4692	520.6213	471.9093	375.8975	276.5819	178.4509	120.1421	127.5223	207.1597	328.3566	436.4313	531.8911	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	70.2669	49.4941	36.4242	13.6385	3.9680	0.0000	0.0000	0.0000	0.0000	11.4068	35.1345	69.9283	(98)
Space heating												290.2613	(98)
Space heating per m2											(98) / (4) =	4.2805	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												290.2613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	70.2669	49.4941	36.4242	13.6385	3.9680	0.0000	0.0000	0.0000	0.0000	11.4068	35.1345	69.9283	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	70.2669	49.4941	36.4242	13.6385	3.9680	0.0000	0.0000	0.0000	0.0000	11.4068	35.1345	69.9283	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	158.1896	138.8540	144.4730	127.6321	123.7149	108.5892	102.4290	114.9596	115.5598	132.4391	142.4025	153.7499	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	158.1896	138.8540	144.4730	127.6321	123.7149	108.5892	102.4290	114.9596	115.5598	132.4391	142.4025	153.7499	(219)
Water heating fuel used												1562.9927	(219)
Annual totals kWh/year													
Space heating fuel - main system												290.2613	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												152.5301	(230a)
Total electricity for the above, kWh/year												152.5301	(231)
Electricity for lighting (calculated in Appendix L)												344.9777	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2350.7618	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	290.2613	31.0800	90.2132	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1562.9927	31.0800	485.7781	(247)
Mechanical ventilation fans	152.5301	31.0800	47.4064	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	344.9777	31.0800	107.2191	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			730.6168	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	290.2613	0.5190	150.6456	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1562.9927	0.5190	811.1932	(264)
Space and water heating			961.8388	(265)
Pumps and fans	152.5301	0.5190	79.1631	(267)
Energy for lighting	344.9777	0.5190	179.0434	(268)
Energy saving/generation technologies				
PV Unit	-484.1600	0.5190	-251.2790	(269)
Total kg/year			968.7663	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	290.2613	3.0700	891.1022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1562.9927	3.0700	4798.3875	(264)
Space and water heating			5689.4897	(265)
Pumps and fans	152.5301	3.0700	468.2675	(267)
Energy for lighting	344.9777	3.0700	1059.0815	(268)
Energy saving/generation technologies				
PV Unit	-484.1600	3.0700	-1486.3712	(269)
Primary energy kWh/year			5730.4675	(272)
Primary energy kWh/m2/year			84.5077	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 88

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£731	£731	£0
Space heating	£138	£138	£0
Water heating	£486	£486	£0
Lighting	£107	£107	£0
Total cost of fuels	£731	£731	£0
Total cost of uses	£731	£731	£0
Delivered energy	35 kWh/m²	35 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	85 kWh/m²	85 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-36	**Issued on Date**	11/01/2024
Assessment Reference	7765-36	**Prop Type Ref**	
Property	Flat 36, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	76 C	**DER**	26.65	**TER**	29.22
Environmental	81 B	**% DER<TER**	8.78		
CO_2 Emissions (t/year)	1.47	**DFEE**	44.56	**TFEE**	56.39
General Requirements Compliance	Pass	**% DFEE<TFEE**	20.98		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Top-floor flat, total floor area 68 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 29.22 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 26.65 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)56.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.82 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing North East: 3.01 m², No overhang
Windows facing South East: 3.12 m², No overhang
Windows facing North West: 2.31 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 481.95 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.1910	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1480	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1887	0.1850	0.1813	0.1628	0.1591	0.1406	0.1406	0.1369	0.1480	0.1591	0.1665	0.1739	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2892	0.2855	0.2818	0.2633	0.2596	0.2411	0.2411	0.2374	0.2485	0.2596	0.2670	0.2744	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Existing Windows (Uw = 1.50)			2.3100	1.4151	3.2689			(27)
New Windows (Uw = 1.50)			6.1300	1.4151	8.6745			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1600	8.1344			(29a)
External Roof 1	67.5000		67.5000	0.1500	10.1250			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.2028			(33)
Party Wall 1			17.3800	0.0000	0.0000			(32)
Corridor			6.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7501	(36)
Total fabric heat loss (33) + (36) =	42.9529	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1066	15.9005	15.6944	14.6641	14.4580	13.4276	13.4276	13.2215	13.8397	14.4580	14.8701	15.2823	(38)
Heat transfer coeff	59.0595	58.8534	58.6473	57.6169	57.4109	56.3805	56.3805	56.1744	56.7926	57.4109	57.8230	58.2352	(39)
Average = Sum(39)m / 12 =												57.5654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8750	0.8719	0.8688	0.8536	0.8505	0.8353	0.8353	0.8322	0.8414	0.8505	0.8566	0.8627	(40)
HLP (average)												0.8528	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:
Store volume 145.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (56)

If cylinder contains dedicated solar storage

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546 (64)

Total per year (kWh/year) = Sum(64)m = 1560.0516 (64)

Heat gains from water heating, kWh/month

	60.6704	53.4631	56.1195	50.2680	49.2324	43.9499	42.1702	46.3276	46.2626	52.1269	55.1685	59.1974 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)

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

	18.7673	16.6689	13.5561	10.2628	7.6716	6.4767	6.9983	9.0966	12.2095	15.5027	18.0940	19.2889 (67)

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

	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485 (68)

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

	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574 (71)

Water heating gains (Table 5)

	81.5463	79.5581	75.4295	69.8167	66.1726	61.0416	56.6804	62.2683	64.2537	70.0631	76.6229	79.5664 (72)

Total internal gains

	347.4659	345.3655	333.1192	313.5584	293.8735	274.9069	262.6225	268.3227	278.4257	298.1831	320.7837	337.5629 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northwest	2.3100	11.2829	0.4000	0.7000	0.7700	5.0574	(81)
Northeast	3.0100	11.2829	0.3500	0.7000	0.7700	5.7662	(75)
Southeast	3.1200	36.7938	0.3500	0.7000	0.7700	19.4908	(77)

Solar gains	30.3143	55.2317	85.1197	121.4737	150.6703	156.0071	147.7331	124.9686	97.5542	63.6175	36.9643	25.5191 (83)
Total gains	377.7802	400.5971	418.2389	435.0321	444.5438	430.9139	410.3556	393.2913	375.9799	361.8006	357.7480	363.0820 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.7476	31.8588	31.9708	32.5425	32.6593	33.2562	33.2562	33.3782	33.0148	32.6593	32.4265	32.1970	
alpha	3.1165	3.1239	3.1314	3.1695	3.1773	3.2171	3.2171	3.2252	3.2010	3.1773	3.1618	3.1465	
util living area	0.9684	0.9596	0.9418	0.9019	0.8251	0.6914	0.5507	0.5870	0.7775	0.9085	0.9555	0.9717	(86)
MIT	19.1848	19.3506	19.6614	20.1009	20.5064	20.8131	20.9344	20.9181	20.7050	20.2074	19.6391	19.1614	(87)
Th 2	20.1888	20.1914	20.1941	20.2071	20.2098	20.2229	20.2229	20.2255	20.2176	20.2098	20.2045	20.1993	(88)
util rest of house	0.9641	0.9541	0.9334	0.8866	0.7952	0.6359	0.4698	0.5081	0.7311	0.8913	0.9485	0.9679	(89)
MIT 2	17.7285	17.9703	18.4213	19.0588	19.6256	20.0358	20.1729	20.1599	19.9026	19.2182	18.3990	17.7011	(90)
Living area fraction									fLA = Living area / (4) =			0.4034	(91)
MIT	18.3160	18.5272	18.9216	19.4792	19.9809	20.3494	20.4801	20.4658	20.2263	19.6172	18.8993	18.2902	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3160	18.5272	18.9216	19.4792	19.9809	20.3494	20.4801	20.4658	20.2263	19.6172	18.8993	18.2902	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9509	0.9393	0.9167	0.8698	0.7855	0.6455	0.4977	0.5338	0.7316	0.8757	0.9337	0.9556	(94)
Useful gains	359.2294	376.2811	383.3817	378.3898	349.1862	278.1743	204.2397	209.9434	275.0776	316.8326	334.0343	346.9705	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	827.7786	802.0054	728.4928	609.5411	475.4161	324.1512	218.7629	228.3934	347.9276	517.6874	682.2701	820.5429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	348.6006	286.0868	256.7626	166.4290	93.9150	0.0000	0.0000	0.0000	0.0000	149.4359	250.7298	352.3379	(98)
Space heating												1904.2976	(98)
Space heating per m2											(98) / (4) =	28.2118	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1904.2976	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	348.6006	286.0868	256.7626	166.4290	93.9150	0.0000	0.0000	0.0000	0.0000	149.4359	250.7298	352.3379	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	348.6006	286.0868	256.7626	166.4290	93.9150	0.0000	0.0000	0.0000	0.0000	149.4359	250.7298	352.3379	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(219)
Water heating fuel used												1560.0516	(219)
Annual totals kWh/year													
Space heating fuel - main system												1904.2976	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												151.8328	(230a)
Total electricity for the above, kWh/year												151.8328	(231)
Electricity for lighting (calculated in Appendix L)												331.4361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3947.6182	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1904.2976	0.5190	988.3305	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	0.5190	809.6668	(264)
Space and water heating			1797.9973	(265)
Pumps and fans	151.8328	0.5190	78.8012	(267)
Energy for lighting	331.4361	0.5190	172.0153	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	0.5190	-250.1321	(269)
Total CO2, kg/year			1798.6818	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			26.6500	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		26.6500	ZC1
Total Floor Area	TFA	67.5000	
Assumed number of occupants	N	2.1839	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.8023	ZC2
CO2 emissions from cooking, equation (L16)		2.5395	ZC3
Total CO2 emissions		45.9918	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		45.9918	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1185	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3685	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2856	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3641	0.3570	0.3499	0.3142	0.3070	0.2713	0.2713	0.2642	0.2856	0.3070	0.3213	0.3356	(22b)
Effective ac	0.5663	0.5637	0.5612	0.5493	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			8.4400	1.3258	11.1894			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1800	9.1512			(29a)
External Roof 1	67.5000		67.5000	0.1300	8.7750			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.1156			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2009	(36)
Total fabric heat loss						(33) + (36) =	47.3165	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5358	31.3925	31.2519	30.5919	30.4684	29.8935	29.8935	29.7870	30.1149	30.4684	30.7182	30.9794	(38)
Heat transfer coeff	78.8523	78.7089	78.5684	77.9084	77.7849	77.2100	77.2100	77.1035	77.4314	77.7849	78.0347	78.2959	(39)
Average = Sum(39)m / 12 =												77.9078	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1682	1.1661	1.1640	1.1542	1.1524	1.1439	1.1439	1.1423	1.1471	1.1524	1.1561	1.1599	(40)
HLP (average)												1.1542	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839	(42)
Average daily hot water use (litres/day)	86.0684	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	186.5378	164.4675	172.8509	155.1209	152.1377	136.1193	130.8980	143.4014	143.0748	160.8431	169.8594	182.1077	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	186.5378	164.4675	172.8509	155.1209	152.1377	136.1193	130.8980	143.4014	143.0748	160.8431	169.8594	182.1077	(64)
								Total per year (kWh/year) = Sum(64)m =				1897.4185	(64)
Heat gains from water heating, kWh/month													
	83.5929	74.1672	79.0420	72.4510	72.1549	66.1330	65.0927	69.2501	68.4457	75.0494	77.3515	82.1199	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7673	16.6689	13.5561	10.2628	7.6716	6.4767	6.9983	9.0966	12.2095	15.5027	18.0940	19.2889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	112.3560	110.3679	106.2392	100.6264	96.9824	91.8514	87.4901	93.0780	95.0634	100.8729	107.4327	110.3762	(72)
Total internal gains													
	381.2757	379.1752	366.9289	347.3682	327.6833	308.7166	296.4322	302.1324	312.2355	331.9928	354.5935	371.3726	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0100	11.2829	0.6300	0.7000	0.7700	10.3791	(75)
Southeast	3.1200	36.7938	0.6300	0.7000	0.7700	35.0834	(77)
Northwest	2.3100	11.2829	0.6300	0.7000	0.7700	7.9654	(81)

Solar gains	53.4279	97.1007	149.0424	211.7991	261.9941	270.9913	256.7319	217.6189	170.5126	111.6809	65.1039	45.0051	(83)
Total gains	434.7035	476.2759	515.9713	559.1672	589.6774	579.7079	553.1641	519.7514	482.7480	443.6737	419.6974	416.3777	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4466	59.5549	59.6614	60.1668	60.2624	60.7111	60.7111	60.7949	60.5374	60.2624	60.0694	59.8691	
alpha	4.9631	4.9703	4.9774	5.0111	5.0175	5.0474	5.0474	5.0530	5.0358	5.0175	5.0046	4.9913	
util living area													
	0.9973	0.9952	0.9893	0.9690	0.9063	0.7617	0.5928	0.6475	0.8736	0.9772	0.9947	0.9978	(86)
MIT	19.7750	19.8995	20.1273	20.4427	20.7372	20.9267	20.9835	20.9747	20.8433	20.4779	20.0727	19.7502	(87)
Th 2	19.9455	19.9472	19.9489	19.9568	19.9583	19.9652	19.9652	19.9665	19.9625	19.9583	19.9553	19.9522	(88)
util rest of house													
	0.9963	0.9935	0.9854	0.9565	0.8674	0.6715	0.4642	0.5189	0.8076	0.9657	0.9925	0.9971	(89)
MIT 2	18.3195	18.5022	18.8345	19.2918	19.6916	19.9143	19.9589	19.9556	19.8319	19.3483	18.7612	18.2879	(90)
Living area fraction									fLA = Living area / (4) =			0.4034	(91)
MIT	18.9067	19.0659	19.3561	19.7561	20.1134	20.3227	20.3723	20.3668	20.2399	19.8040	19.2903	18.8778	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9067	19.0659	19.3561	19.7561	20.1134	20.3227	20.3723	20.3668	20.2399	19.8040	19.2903	18.8778	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9916	0.9824	0.9535	0.8741	0.7051	0.5165	0.5711	0.8279	0.9635	0.9906	0.9960	(94)
Useful gains	432.5486	472.2717	506.8945	533.1842	515.4141	408.7632	285.7285	296.8516	399.6572	427.4702	415.7626	414.7013	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1151.7697	1114.9847	1010.0808	845.7801	654.4375	441.8505	291.2562	305.8505	475.4232	715.9299	951.2658	1149.2102	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	535.1005	431.9031	374.3706	225.0690	103.4334	0.0000	0.0000	0.0000	0.0000	214.6141	385.5623	546.4746	(98)
Space heating												2816.5276	(98)
Space heating per m2											(98) / (4) =	41.7263	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3012.3289	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	535.1005	431.9031	374.3706	225.0690	103.4334	0.0000	0.0000	0.0000	0.0000	214.6141	385.5623	546.4746	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000		(210)
Space heating fuel (main heating system)													
	572.3000	461.9285	400.3963	240.7155	110.6239	0.0000	0.0000	0.0000	0.0000	229.5337	412.3660	584.4648	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	186.5378	164.4675	172.8509	155.1209	152.1377	136.1193	130.8980	143.4014	143.0748	160.8431	169.8594	182.1077	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.4684	87.2728	86.8228	85.8057	83.8103	79.8000	79.8000	79.8000	79.8000	85.5840	86.9351	87.5653	(217)
Fuel for water heating, kWh/month													
	213.2632	188.4522	199.0848	180.7815	181.5262	170.5756	164.0325	179.7010	179.2917	187.9360	195.3863	207.9678	(219)
Water heating fuel used												2247.9989	(219)
Annual totals kWh/year													
Space heating fuel - main system												3012.3289	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												331.4361	(232)
Total delivered energy for all uses												5666.7639	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3012.3289	0.2160	650.6630	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2247.9989	0.2160	485.5678	(264)
Space and water heating			1136.2308	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	331.4361	0.5190	172.0153	(268)
Total CO2, kg/m2/year			1347.1711	(272)
Emissions per m2 for space and water heating			16.8330	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.5484	(272b)
Emissions per m2 for pumps and fans			0.5767	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8330 * 1.55) + 2.5484 + 0.5767, rounded to 2 d.p.			29.2200	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1185	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.3095	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2399	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3058	0.2998	0.2938	0.2639	0.2579	0.2279	0.2279	0.2219	0.2399	0.2579	0.2699	0.2819	(22b)
Effective ac	0.5468	0.5450	0.5432	0.5348	0.5332	0.5260	0.5260	0.5246	0.5288	0.5332	0.5364	0.5397	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Existing Windows (Uw = 1.50)			2.3100	1.4151	3.2689			(27)
New Windows (Uw = 1.50)			6.1300	1.4151	8.6745			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1600	8.1344			(29a)
External Roof 1	67.5000		67.5000	0.1500	10.1250			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.2028			(33)
Party Wall 1			17.3800	0.0000	0.0000			(32)
Corridor			6.4500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.7501	(36)
Total fabric heat loss					(33) + (36) =		42.9529	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.4483	30.3471	30.2480	29.7824	29.6952	29.2897	29.2897	29.2146	29.4459	29.6952	29.8715	30.0557	(38)
Heat transfer coeff	73.4011	73.3000	73.2009	72.7353	72.6481	72.2426	72.2426	72.1675	72.3988	72.6481	72.8244	73.0086	(39)
Average = Sum(39)m / 12 =												72.7348	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0874	1.0859	1.0845	1.0776	1.0763	1.0703	1.0703	1.0691	1.0726	1.0763	1.0789	1.0816	(40)
HLP (average)												1.0776	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1839	(42)
Average daily hot water use (litres/day)												86.0684	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	29.8351	26.0940	26.9267	23.4753	22.5251	19.4375	18.0117	20.6687	20.9155	24.3750	26.6072	28.8937	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.7673	16.6689	13.5561	10.2628	7.6716	6.4767	6.9983	9.0966	12.2095	15.5027	18.0940	19.2889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	40.1010	38.8304	36.1918	32.6046	30.2757	26.9965	24.2093	27.7805	29.0493	32.7621	36.9545	38.8357	(72)
Total internal gains													
	306.0206	304.6377	293.8815	276.3464	257.9766	240.8618	230.1514	233.8349	243.2214	260.8821	281.1153	296.8321	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northwest	2.3100	11.2829	0.4000	0.7000	0.7700	5.0574	(81)
Northeast	3.0100	11.2829	0.3500	0.7000	0.7700	5.7662	(75)
Southeast	3.1200	36.7938	0.3500	0.7000	0.7700	19.4908	(77)

Solar gains	30.3143	55.2317	85.1197	121.4737	150.6703	156.0071	147.7331	124.9686	97.5542	63.6175	36.9643	25.5191	(83)
Total gains	336.3350	359.8694	379.0012	397.8200	408.6470	396.8689	377.8845	358.8035	340.7756	324.4996	318.0796	322.3512	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.5446	25.5798	25.6144	25.7784	25.8093	25.9542	25.9542	25.9812	25.8982	25.8093	25.7469	25.6819	
alpha	2.7030	2.7053	2.7076	2.7186	2.7206	2.7303	2.7303	2.7321	2.7265	2.7206	2.7165	2.7121	
util living area													
	0.9778	0.9717	0.9596	0.9332	0.8811	0.7851	0.6659	0.7030	0.8525	0.9402	0.9701	0.9802	(86)
MIT	18.5734	18.7521	19.1103	19.6185	20.1428	20.5896	20.8197	20.7829	20.4315	19.7765	19.0904	18.5314	(87)
Th 2	20.0111	20.0123	20.0135	20.0192	20.0203	20.0252	20.0252	20.0261	20.0233	20.0203	20.0181	20.0159	(88)
util rest of house													
	0.9744	0.9673	0.9527	0.9205	0.8544	0.7273	0.5652	0.6089	0.8093	0.9264	0.9646	0.9772	(89)
MIT 2	17.7778	17.9561	18.3124	18.8176	19.3268	19.7441	19.9330	19.9085	19.6070	18.9779	18.2978	17.7394	(90)
Living area fraction									fLA = Living area / (4) =			0.4034	(91)
MIT	18.0988	18.2772	18.6343	19.1407	19.6560	20.0852	20.2907	20.2612	19.9396	19.3001	18.6176	18.0589	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0988	18.2772	18.6343	19.1407	19.6560	20.0852	20.2907	20.2612	19.9396	19.3001	18.6176	18.0589	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9655	0.9569	0.9403	0.9062	0.8426	0.7314	0.5954	0.6342	0.8049	0.9134	0.9542	0.9689	(94)
Useful gains	324.7261	344.3608	356.3873	360.5093	344.3221	290.2554	224.9982	227.5680	274.2923	296.4045	303.5064	312.3353	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1012.8449	980.5477	888.2416	744.8626	577.9884	396.2621	266.6281	278.6536	422.7818	632.0435	838.7586	1011.8202	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	511.9604	427.5176	395.6996	276.7343	173.8477	0.0000	0.0000	0.0000	0.0000	249.7154	385.3815	520.4168	(98)
Space heating												2941.2734	(98)
Space heating per m2											(98) / (4) =	43.5744	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	679.0804	534.5952	548.4729	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6479	0.7232	0.6983	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	439.9625	386.6078	383.0224	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	545.8132	522.0549	501.2999	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	76.2125	100.7727	87.9984	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												264.9836	(104)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Cooled fraction                                                                  fC = cooled area / (4) =      1.0000 (105)
Intermittency factor (Table 10b)
                0.0000    0.0000    0.0000    0.0000    0.0000    0.2500    0.2500    0.2500    0.0000    0.0000    0.0000    0.0000 (106)
Space cooling kWh
                0.0000    0.0000    0.0000    0.0000    0.0000   19.0531   25.1932   21.9996    0.0000    0.0000    0.0000    0.0000 (107)
Space cooling                                                                                                          66.2459 (107)
Space cooling per m2                                                                                                    0.9814 (108)
Energy for space heating                                                                                               43.5744 (99)
Energy for space cooling                                                                                                0.9814 (108)
Total                                                                                                                  44.5558 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                  44.6 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1185	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3685	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2856	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3641	0.3570	0.3499	0.3142	0.3070	0.2713	0.2713	0.2642	0.2856	0.3070	0.3213	0.3356	(22b)
Effective ac	0.5663	0.5637	0.5612	0.5493	0.5471	0.5368	0.5368	0.5349	0.5408	0.5471	0.5516	0.5563	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			8.4400	1.3258	11.1894			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1800	9.1512			(29a)
External Roof 1	67.5000		67.5000	0.1300	8.7750			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.1156			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.2009	(36)
Total fabric heat loss					(33) + (36) =		47.3165	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	31.5358	31.3925	31.2519	30.5919	30.4684	29.8935	29.8935	29.7870	30.1149	30.4684	30.7182	30.9794	(38)
Heat transfer coeff	78.8523	78.7089	78.5684	77.9084	77.7849	77.2100	77.2100	77.1035	77.4314	77.7849	78.0347	78.2959	(39)
Average = Sum(39)m / 12 =												77.9078	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1682	1.1661	1.1640	1.1542	1.1524	1.1439	1.1439	1.1423	1.1471	1.1524	1.1561	1.1599	(40)
HLP (average)												1.1542	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839	(42)
Average daily hot water use (litres/day)	86.0684	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	29.8351	26.0940	26.9267	23.4753	22.5251	19.4375	18.0117	20.6687	20.9155	24.3750	26.6072	28.8937 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	109.1967	(66)

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

	18.7673	16.6689	13.5561	10.2628	7.6716	6.4767	6.9983	9.0966	12.2095	15.5027	18.0940	19.2889	(67)

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

	191.3933	193.3794	188.3746	177.7199	164.2703	151.6296	143.1848	141.1987	146.2036	156.8582	170.3078	182.9485	(68)

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

	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	33.9197	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)

Water heating gains (Table 5)

	40.1010	38.8304	36.1918	32.6046	30.2757	26.9965	24.2093	27.7805	29.0493	32.7621	36.9545	38.8357	(72)

Total internal gains

	306.0206	304.6377	293.8815	276.3464	257.9766	240.8618	230.1514	233.8349	243.2214	260.8821	281.1153	296.8321	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.0100	11.2829	0.6300	0.7000	0.7700	10.3791	(75)
Southeast	3.1200	36.7938	0.6300	0.7000	0.7700	35.0834	(77)
Northwest	2.3100	11.2829	0.6300	0.7000	0.7700	7.9654	(81)

Solar gains	53.4279	97.1007	149.0424	211.7991	261.9941	270.9913	256.7319	217.6189	170.5126	111.6809	65.1039	45.0051	(83)
Total gains	359.4485	401.7384	442.9238	488.1455	519.9708	511.8531	486.8832	451.4538	413.7339	372.5630	346.2192	341.8372	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.4466	59.5549	59.6614	60.1668	60.2624	60.7111	60.7111	60.7949	60.5374	60.2624	60.0694	59.8691	
alpha	4.9631	4.9703	4.9774	5.0111	5.0175	5.0474	5.0474	5.0530	5.0358	5.0175	5.0046	4.9913	
util living area	0.9988	0.9977	0.9944	0.9818	0.9378	0.8196	0.6591	0.7208	0.9208	0.9889	0.9978	0.9991	(86)
MIT	19.6718	19.7981	20.0302	20.3557	20.6721	20.8961	20.9738	20.9592	20.7866	20.3873	19.9726	19.6475	(87)
Th 2	19.9455	19.9472	19.9489	19.9568	19.9583	19.9652	19.9652	19.9665	19.9625	19.9583	19.9553	19.9522	(88)
util rest of house	0.9984	0.9969	0.9923	0.9740	0.9083	0.7358	0.5230	0.5886	0.8705	0.9827	0.9968	0.9988	(89)
MIT 2	18.7324	18.8598	19.0924	19.4202	19.7218	19.9128	19.9579	19.9536	19.8320	19.4551	19.0407	18.7135	(90)
Living area fraction										fLA = Living area / (4) =		0.4034	(91)
MIT	19.1114	19.2383	19.4707	19.7976	20.1052	20.3094	20.3677	20.3593	20.2171	19.8312	19.4167	19.0903	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1114	19.2383	19.4707	19.7976	20.1052	20.3094	20.3677	20.3593	20.2171	19.8312	19.4167	19.0903	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9962	0.9910	0.9725	0.9133	0.7667	0.5788	0.6427	0.8853	0.9818	0.9961	0.9985	(94)
Useful gains	358.7302	400.2103	438.9390	474.7066	474.8738	392.4422	281.8008	290.1716	366.2637	365.7680	344.8792	341.3076	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1167.9093	1128.5541	1019.0908	849.0140	653.7941	440.8259	290.9061	305.2738	473.6530	718.0457	961.1267	1165.8468	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	602.0292	489.4471	431.6329	269.5013	133.1167	0.0000	0.0000	0.0000	0.0000	262.0946	443.6982	613.4571	(98)
Space heating												3244.9772	(98)
Space heating per m2											(98) / (4) =	48.0737	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	725.7738	571.3538	585.9867	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8065	0.8832	0.8508	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	585.3009	504.6128	498.5733	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	680.2103	649.4560	609.5925	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.3348	107.7633	82.5983	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												258.6964	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    17.0837    26.9408    20.6496     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                          64.6741 (107)
Space cooling per m2                                                                                                                    0.9581 (108)
Energy for space heating                                                                                                               48.0737 (99)
Energy for space cooling                                                                                                                0.9581 (108)
Total                                                                                                                                  49.0319 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                                    56.4 (109)


-------------------------------------------------------------------------------------------------------
```

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.1910	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1480	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1628	0.1591	0.1591	0.1443	0.1480	0.1295	0.1221	0.1258	0.1258	0.1443	0.1443	0.1480	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2633	0.2596	0.2596	0.2448	0.2485	0.2300	0.2226	0.2263	0.2263	0.2448	0.2448	0.2485	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Existing Windows (Uw = 1.50)			2.3100	1.4151	3.2689			(27)
New Windows (Uw = 1.50)			6.1300	1.4151	8.6745			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1600	8.1344			(29a)
External Roof 1	67.5000		67.5000	0.1500	10.1250			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.2028			(33)
Party Wall 1			17.3800	0.0000	0.0000			(32)
Corridor			6.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7501	(36)
Total fabric heat loss (33) + (36) =	42.9529	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.6641	14.4580	14.4580	13.6337	13.8397	12.8093	12.3972	12.6033	12.6033	13.6337	13.6337	13.8397	(38)
Heat transfer coeff	57.6169	57.4109	57.4109	56.5866	56.7926	55.7622	55.3501	55.5562	55.5562	56.5866	56.5866	56.7926	(39)
Average = Sum(39)m / 12 =												56.5007	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8536	0.8505	0.8505	0.8383	0.8414	0.8261	0.8200	0.8231	0.8231	0.8383	0.8383	0.8414	(40)
HLP (average)												0.8370	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839	(42)
Average daily hot water use (litres/day)	86.0684	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:
Store volume 145.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (56)

If cylinder contains dedicated solar storage

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546 (64)

Total per year (kWh/year) = Sum(64)m = 1560.0516 (64)
RHI water heating demand 1560 (64)
Heat gains from water heating, kWh/month

	60.6704	53.4631	56.1195	50.2680	49.2324	43.9499	42.1702	46.3276	46.2626	52.1269	55.1685	59.1974 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	(66)

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

	46.9182	41.6723	33.8902	25.6571	19.1790	16.1917	17.4957	22.7416	30.5237	38.7568	45.2349	48.2222	(67)

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

	285.6617	288.6260	281.1561	265.2536	245.1796	226.3128	213.7087	210.7444	218.2143	234.1167	254.1908	273.0575	(68)

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

	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)

Water heating gains (Table 5)

	81.5463	79.5581	75.4295	69.8167	66.1726	61.0416	56.6804	62.2683	64.2537	70.0631	76.6229	79.5664	(72)

Total internal gains

	508.0924	503.8226	484.4420	454.6936	424.4974	397.5123	381.8509	389.7205	406.9578	436.9029	470.0149	494.8124	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northwest	2.3100	9.5471	0.4000	0.7000	0.7700	4.2793	(81)
Northeast	3.0100	9.5471	0.3500	0.7000	0.7700	4.8791	(75)
Southeast	3.1200	31.1332	0.3500	0.7000	0.7700	16.4922	(77)

Solar gains	25.6506	49.0948	79.7997	117.4245	141.2534	148.9868	138.3532	115.4169	94.1610	60.7258	33.6039	23.0887	(83)
Total gains	533.7430	552.9174	564.2418	572.1181	565.7508	546.4991	520.2042	505.1373	501.1189	497.6287	503.6188	517.9011	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.5425	32.6593	32.6593	33.1351	33.0148	33.6249	33.8753	33.7496	33.7496	33.1351	33.1351	33.0148	
alpha	3.1695	3.1773	3.1773	3.2090	3.2010	3.2417	3.2584	3.2500	3.2500	3.2090	3.2090	3.2010	
util living area	0.9170	0.9019	0.8727	0.8029	0.6885	0.5274	0.4008	0.4317	0.6283	0.8054	0.8864	0.9226	(86)
MIT	19.7245	19.8616	20.0975	20.4658	20.7573	20.9283	20.9780	20.9710	20.8618	20.5270	20.1083	19.7062	(87)
Th 2	20.2071	20.2098	20.2098	20.2202	20.2176	20.2308	20.2360	20.2334	20.2334	20.2202	20.2202	20.2176	(88)
util rest of house	0.9070	0.8900	0.8568	0.7773	0.6462	0.4664	0.3274	0.3576	0.5735	0.7761	0.8710	0.9132	(89)
MIT 2	18.5132	18.7104	19.0454	19.5658	19.9513	20.1674	20.2217	20.2135	20.0972	19.6558	19.0722	18.4945	(90)
Living area fraction									fLA = Living area / (4) =			0.4034	(91)
MIT	19.0018	19.1748	19.4698	19.9289	20.2765	20.4744	20.5268	20.5190	20.4057	20.0073	19.4902	18.9833	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0018	19.1748	19.4698	19.9289	20.2765	20.4744	20.5268	20.5190	20.4057	20.0073	19.4902	18.9833	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8888	0.8718	0.8398	0.7668	0.6496	0.4863	0.3558	0.3858	0.5864	0.7673	0.8543	0.8955	(94)
Useful gains	474.3674	482.0421	473.8234	438.7187	367.5036	265.7481	185.1109	194.8744	293.8324	381.8133	430.2252	463.7655	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	806.7434	779.3424	710.1615	578.8168	430.2883	282.9574	189.6745	201.0600	328.0958	504.0326	661.5072	799.8296	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	247.2877	199.7858	175.8355	100.8706	46.7118	0.0000	0.0000	0.0000	0.0000	90.9312	166.5231	250.0317	(98)

Space heating 1277.9774 (98)
RHI space heating demand 1278 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.1910	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1480	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1887	0.1850	0.1813	0.1628	0.1591	0.1406	0.1406	0.1369	0.1480	0.1591	0.1665	0.1739	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2892	0.2855	0.2818	0.2633	0.2596	0.2411	0.2411	0.2374	0.2485	0.2596	0.2670	0.2744	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Existing Windows (Uw = 1.50)			2.3100	1.4151	3.2689			(27)
New Windows (Uw = 1.50)			6.1300	1.4151	8.6745			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1600	8.1344			(29a)
External Roof 1	67.5000		67.5000	0.1500	10.1250			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.2028			(33)
Party Wall 1			17.3800	0.0000	0.0000			(32)
Corridor			6.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7501	(36)
Total fabric heat loss (33) + (36) =	42.9529	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.1066	15.9005	15.6944	14.6641	14.4580	13.4276	13.4276	13.2215	13.8397	14.4580	14.8701	15.2823	(38)
Heat transfer coeff	59.0595	58.8534	58.6473	57.6169	57.4109	56.3805	56.3805	56.1744	56.7926	57.4109	57.8230	58.2352	(39)
Average = Sum(39)m / 12 =												57.5654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8750	0.8719	0.8688	0.8536	0.8505	0.8353	0.8353	0.8322	0.8414	0.8505	0.8566	0.8627	(40)
HLP (average)												0.8528	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

```
Water storage loss:
Store volume                                                                                                    145.0000 (47)
a) If  manufacturer declared loss factor is known  (kWh/day):                                                     0.9400 (48)
  Temperature factor from Table 2b                                                                                0.6000 (49)
Enter (49) or (54) in (55)                                                                                        0.5640 (55)
Total storage loss
              17.4840    15.7920    17.4840    16.9200    17.4840    16.9200    17.4840    17.4840    16.9200    17.4840    16.9200    17.4840 (56)
If cylinder contains dedicated solar storage
              17.4840    15.7920    17.4840    16.9200    17.4840    16.9200    17.4840    17.4840    16.9200    17.4840    16.9200    17.4840 (57)
Primary loss      0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (59)
Total heat required for water heating calculated for each month
             157.8847   138.5874   144.1978   127.3922   123.4847   108.3905   102.2449   114.7484   115.3460   132.1900   142.1306   153.4546 (62)
Solar input       0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                  Solar input (sum of months) = Sum(63)m =       0.0000 (63)
Output from w/h
             157.8847   138.5874   144.1978   127.3922   123.4847   108.3905   102.2449   114.7484   115.3460   132.1900   142.1306   153.4546 (64)
                                                                                    Total per year (kWh/year) = Sum(64)m =   1560.0516 (64)
Heat gains from water heating, kWh/month
              60.6704    53.4631    56.1195    50.2680    49.2324    43.9499    42.1702    46.3276    46.2626    52.1269    55.1685    59.1974 (65)
```

---

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

```
Metabolic gains (Table 5), Watts
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m       131.0360   131.0360   131.0360   131.0360   131.0360   131.0360   131.0360   131.0360   131.0360   131.0360   131.0360   131.0360 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              46.9182    41.6723    33.8902    25.6571    19.1790    16.1917    17.4957    22.7416    30.5237    38.7568    45.2349    48.2222 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             285.6617   288.6260   281.1561   265.2536   245.1796   226.3128   213.7087   210.7444   218.2143   234.1167   254.1908   273.0575 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              50.2875    50.2875    50.2875    50.2875    50.2875    50.2875    50.2875    50.2875    50.2875    50.2875    50.2875    50.2875 (69)
Pumps, fans       0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
             -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574   -87.3574 (71)
Water heating gains (Table 5)
              81.5463    79.5581    75.4295    69.8167    66.1726    61.0416    56.6804    62.2683    64.2537    70.0631    76.6229    79.5664 (72)
Total internal gains
             508.0924   503.8226   484.4420   454.6936   424.4974   397.5123   381.8509   389.7205   406.9578   436.9029   470.0149   494.8124 (73)
```

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northwest	2.3100	11.2829	0.4000	0.7000	0.7700	5.0574	(81)
Northeast	3.0100	11.2829	0.3500	0.7000	0.7700	5.7662	(75)
Southeast	3.1200	36.7938	0.3500	0.7000	0.7700	19.4908	(77)

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Solar gains    30.3143    55.2317    85.1197   121.4737   150.6703   156.0071   147.7331   124.9686    97.5542    63.6175    36.9643    25.5191 (83)
Total gains   538.4067   559.0543   569.5617   576.1672   575.1677   553.5194   529.5841   514.6891   504.5121   500.5204   506.9792   520.3315 (84)
```

---

7. Mean internal temperature (heating season)

```
Temperature during heating periods in the living area from Table 9, Th1 (C)                                     21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau          31.7476    31.8588    31.9708    32.5425    32.6593    33.2562    33.2562    33.3782    33.0148    32.6593    32.4265    32.1970
alpha         3.1165     3.1239     3.1314     3.1695     3.1773     3.2171     3.2171     3.2252     3.2010     3.1773     3.1618     3.1465
util living area
              0.9249     0.9110     0.8837     0.8270     0.7316     0.5833     0.4458     0.4734     0.6586     0.8229     0.8992     0.9307 (86)

MIT          19.5715    19.7164    19.9822    20.3491    20.6659    20.8872    20.9644    20.9561    20.8234    20.4531    19.9751    19.5478 (87)
Th 2         20.1888    20.1914    20.1941    20.2071    20.2098    20.2229    20.2229    20.2255    20.2176    20.2098    20.2045    20.1993 (88)
util rest of house
              0.9160     0.9004     0.8692     0.8046     0.6953     0.5277     0.3744     0.4026     0.6066     0.7962     0.8856     0.9225 (89)
MIT 2        18.2812    18.4902    18.8710    19.3954    19.8265    20.1144    20.1969    20.1921    20.0378    19.5472    18.8722    18.2545 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.4034 (91)
MIT          18.8017    18.9849    19.3193    19.7801    20.1651    20.4262    20.5065    20.5003    20.3547    19.9127    19.3171    18.7762 (92)
Temperature adjustment                                                                                                          0.0000
adjusted MIT 18.8017    18.9849    19.3193    19.7801    20.1651    20.4262    20.5065    20.5003    20.3547    19.9127    19.3171    18.7762 (93)
```

---

8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation       0.8974     0.8815     0.8511     0.7912     0.6931     0.5428     0.4011     0.4284     0.6162     0.7851     0.8679     0.9045 (94)
Useful gains    483.1786   492.8324   484.7392   455.8579   398.6750   300.4576   212.4082   220.4864   310.8741   392.9423   439.9962   470.6248 (95)
Ext temp.         4.3000     4.9000     6.5000     8.9000    11.7000    14.6000    16.6000    16.4000    14.1000    10.6000     7.1000     4.2000 (96)
Heat loss rate W
             856.4618   828.9417   751.8170   626.8793   485.9881   328.4830   220.2521   230.3319   355.2231   534.6484   706.4317   848.8502 (97)
Month fracti      1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             277.7227   225.8655   198.7059   123.1353    64.9609     0.0000     0.0000     0.0000     0.0000   105.4294   191.8335   281.3997 (98)
Space heating                                                                                                   1469.0529 (98)
Space heating per m2                                                                                (98) / (4) =     21.7637 (99)
```

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1469.0529	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	277.7227	225.8655	198.7059	123.1353	64.9609	0.0000	0.0000	0.0000	0.0000	105.4294	191.8335	281.3997	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	277.7227	225.8655	198.7059	123.1353	64.9609	0.0000	0.0000	0.0000	0.0000	105.4294	191.8335	281.3997	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(219)
Water heating fuel used												1560.0516	(219)
Annual totals kWh/year													
Space heating fuel - main system												1469.0529	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)
mechanical ventilation fans (SFP = 0.7375) 151.8328 (230a)

Total electricity for the above, kWh/year	151.8328	(231)
Electricity for lighting (calculated in Appendix L)	331.4361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	3512.3734	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1469.0529	13.1900	193.7681	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1560.0516	13.1900	205.7708	(247)
Mechanical ventilation fans	151.8328	13.1900	20.0267	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	331.4361	13.1900	43.7164	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			463.2821	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.7296	(257)
SAP value	75.8723	
SAP rating (Section 12)	76	(258)
SAP band	C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1469.0529	0.5190	762.4385	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	0.5190	809.6668	(264)
Space and water heating			1572.1053	(265)
Pumps and fans	151.8328	0.5190	78.8012	(267)
Energy for lighting	331.4361	0.5190	172.0153	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	0.5190	-250.1321	(269)
Total kg/year			1572.7898	(272)
CO2 emissions per m2			23.3000	(273)
EI value			81.2663	
EI rating			81	(274)
EI band			B	

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	67.5000 (1b)	x	2.5000 (2b)	=	168.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.8200	
Infiltration rate		0.1910	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1480	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1628	0.1591	0.1591	0.1443	0.1480	0.1295	0.1221	0.1258	0.1258	0.1443	0.1443	0.1480	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2633	0.2596	0.2596	0.2448	0.2485	0.2300	0.2226	0.2263	0.2263	0.2448	0.2448	0.2485	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Existing Windows (Uw = 1.50)			2.3100	1.4151	3.2689			(27)
New Windows (Uw = 1.50)			6.1300	1.4151	8.6745			(27)
NewWall 1	59.2800	8.4400	50.8400	0.1600	8.1344			(29a)
External Roof 1	67.5000		67.5000	0.1500	10.1250			(30)
Total net area of external elements Aum(A, m2)			126.7800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.2028			(33)
Party Wall 1			17.3800	0.0000	0.0000			(32)
Corridor			6.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.7501	(36)
Total fabric heat loss (33) + (36) =	42.9529	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.6641	14.4580	14.4580	13.6337	13.8397	12.8093	12.3972	12.6033	12.6033	13.6337	13.6337	13.8397	(38)
Heat transfer coeff	57.6169	57.4109	57.4109	56.5866	56.7926	55.7622	55.3501	55.5562	55.5562	56.5866	56.5866	56.7926	(39)
Average = Sum(39)m / 12 =												56.5007	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8536	0.8505	0.8505	0.8383	0.8414	0.8261	0.8200	0.8231	0.8231	0.8383	0.8383	0.8414	(40)
HLP (average)												0.8370	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.1839 (42)
Average daily hot water use (litres/day)	86.0684 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	94.6753	91.2325	87.7898	84.3471	80.9043	77.4616	77.4616	80.9043	84.3471	87.7898	91.2325	94.6753	(44)
Energy conte	140.4007	122.7954	126.7138	110.4722	106.0007	91.4705	84.7609	97.2644	98.4260	114.7060	125.2106	135.9706	(45)
Energy content (annual)										Total = Sum(45)m =		1354.1916	(45)
Distribution loss (46)m = 0.15 x (45)m	21.0601	18.4193	19.0071	16.5708	15.9001	13.7206	12.7141	14.5897	14.7639	17.2059	18.7816	20.3956	(46)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
								Total per year (kWh/year) = Sum(64)m =				1560.0516	(64)
Heat gains from water heating, kWh/month													
	60.6704	53.4631	56.1195	50.2680	49.2324	43.9499	42.1702	46.3276	46.2626	52.1269	55.1685	59.1974	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	131.0360	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.9182	41.6723	33.8902	25.6571	19.1790	16.1917	17.4957	22.7416	30.5237	38.7568	45.2349	48.2222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	285.6617	288.6260	281.1561	265.2536	245.1796	226.3128	213.7087	210.7444	218.2143	234.1167	254.1908	273.0575	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	50.2875	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	-87.3574	(71)
Water heating gains (Table 5)													
	81.5463	79.5581	75.4295	69.8167	66.1726	61.0416	56.6804	62.2683	64.2537	70.0631	76.6229	79.5664	(72)
Total internal gains													
	508.0924	503.8226	484.4420	454.6936	424.4974	397.5123	381.8509	389.7205	406.9578	436.9029	470.0149	494.8124	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northwest	2.3100	9.5471	0.4000	0.7000	0.7700	4.2793	(81)
Northeast	3.0100	9.5471	0.3500	0.7000	0.7700	4.8791	(75)
Southeast	3.1200	31.1332	0.3500	0.7000	0.7700	16.4922	(77)

Solar gains	25.6506	49.0948	79.7997	117.4245	141.2534	148.9868	138.3532	115.4169	94.1610	60.7258	33.6039	23.0887	(83)
Total gains	533.7430	552.9174	564.2418	572.1181	565.7508	546.4991	520.2042	505.1373	501.1189	497.6287	503.6188	517.9011	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.5425	32.6593	32.6593	33.1351	33.0148	33.6249	33.8753	33.7496	33.7496	33.1351	33.1351	33.0148	
alpha	3.1695	3.1773	3.1773	3.2090	3.2010	3.2417	3.2584	3.2500	3.2500	3.2090	3.2090	3.2010	
util living area													
	0.9170	0.9019	0.8727	0.8029	0.6885	0.5274	0.4008	0.4317	0.6283	0.8054	0.8864	0.9226	(86)
MIT	19.7245	19.8616	20.0975	20.4658	20.7573	20.9283	20.9780	20.9710	20.8618	20.5270	20.1083	19.7062	(87)
Th 2	20.2071	20.2098	20.2098	20.2202	20.2176	20.2308	20.2360	20.2334	20.2334	20.2202	20.2202	20.2176	(88)
util rest of house													
	0.9070	0.8900	0.8568	0.7773	0.6462	0.4664	0.3274	0.3576	0.5735	0.7761	0.8710	0.9132	(89)
MIT 2	18.5132	18.7104	19.0454	19.5658	19.9513	20.1674	20.2217	20.2135	20.0972	19.6558	19.0722	18.4945	(90)
Living area fraction									fLA = Living area / (4) =			0.4034	(91)
MIT	19.0018	19.1748	19.4698	19.9289	20.2765	20.4744	20.5268	20.5190	20.4057	20.0073	19.4902	18.9833	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0018	19.1748	19.4698	19.9289	20.2765	20.4744	20.5268	20.5190	20.4057	20.0073	19.4902	18.9833	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8888	0.8718	0.8398	0.7668	0.6496	0.4863	0.3558	0.3858	0.5864	0.7673	0.8543	0.8955	(94)
Useful gains	474.3674	482.0421	473.8234	438.7187	367.5036	265.7481	185.1109	194.8744	293.8324	381.8133	430.2252	463.7655	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	806.7434	779.3424	710.1615	578.8168	430.2883	282.9574	189.6745	201.0600	328.0958	504.0326	661.5072	799.8296	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	247.2877	199.7858	175.8355	100.8706	46.7118	0.0000	0.0000	0.0000	0.0000	90.9312	166.5231	250.0317	(98)
Space heating												1277.9774	(98)
Space heating per m2											(98) / (4) =	18.9330	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1277.9774	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	247.2877	199.7858	175.8355	100.8706	46.7118	0.0000	0.0000	0.0000	0.0000	90.9312	166.5231	250.0317	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	247.2877	199.7858	175.8355	100.8706	46.7118	0.0000	0.0000	0.0000	0.0000	90.9312	166.5231	250.0317	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	157.8847	138.5874	144.1978	127.3922	123.4847	108.3905	102.2449	114.7484	115.3460	132.1900	142.1306	153.4546	(219)
Water heating fuel used												1560.0516	(219)
Annual totals kWh/year													
Space heating fuel - main system												1277.9774	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												151.8328	(230a)
Total electricity for the above, kWh/year												151.8328	(231)
Electricity for lighting (calculated in Appendix L)												331.4361	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3321.2979	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1277.9774	31.0800	397.1954	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1560.0516	31.0800	484.8640	(247)
Mechanical ventilation fans	151.8328	31.0800	47.1896	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	331.4361	31.0800	103.0103	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			1032.2594	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1277.9774	0.5190	663.2703	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	0.5190	809.6668	(264)
Space and water heating			1472.9370	(265)
Pumps and fans	151.8328	0.5190	78.8012	(267)
Energy for lighting	331.4361	0.5190	172.0153	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	0.5190	-250.1321	(269)
Total kg/year			1473.6216	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1277.9774	3.0700	3923.3905	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1560.0516	3.0700	4789.3585	(264)
Space and water heating			8712.7490	(265)
Pumps and fans	151.8328	3.0700	466.1267	(267)
Energy for lighting	331.4361	3.0700	1017.5088	(268)
Energy saving/generation technologies				
PV Unit	-481.9500	3.0700	-1479.5865	(269)
Primary energy kWh/year			8716.7980	(272)
Primary energy kWh/m2/year			129.1377	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 76
Current environmental impact rating: B 81

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 76
Potential environmental impact rating: B 81

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£1032	£1032	£0
Space heating	£444	£444	£0
Water heating	£485	£485	£0
Lighting	£103	£103	£0
Total cost of fuels	£1032	£1032	£0
Total cost of uses	£1032	£1032	£0
Delivered energy	49 kWh/m²	49 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.5 tonnes	0.0 tonnes
CO2 emissions per m²	22 kg/m²	22 kg/m²	0 kg/m²
Primary energy	129 kWh/m²	129 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-37	**Issued on Date**	11/01/2024
Assessment Reference	7765-37	**Prop Type Ref**	
Property	Flat 37, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	81 B	**DER**	24.83	**TER**	27.93
Environmental	85 B	**% DER<TER**	11.11		
CO_2 Emissions (t/year)	0.94	**DFEE**	35.54	**TFEE**	40.20
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.58		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Top-floor flat, total floor area 45 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.93 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 24.83 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)40.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.5 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.76 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South East: 4.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 323.22 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7600	
Infiltration rate		0.1880	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1457	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1858	0.1821	0.1785	0.1603	0.1566	0.1384	0.1384	0.1348	0.1457	0.1566	0.1639	0.1712	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2863	0.2826	0.2790	0.2608	0.2571	0.2389	0.2389	0.2353	0.2462	0.2571	0.2644	0.2717	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5359	(36)
Total fabric heat loss					(33) + (36) =		21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6914	10.5554	10.4194	9.7392	9.6031	8.9229	8.9229	8.7869	9.1950	9.6031	9.8752	10.1473	(38)
Heat transfer coeff	32.5383	32.4023	32.2662	31.5860	31.4500	30.7698	30.7698	30.6338	31.0419	31.4500	31.7221	31.9942	(39)
Average = Sum(39)m / 12 =												31.5520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7188	0.7158	0.7128	0.6977	0.6947	0.6797	0.6797	0.6767	0.6857	0.6947	0.7007	0.7067	(40)
HLP (average)												0.6970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Total per year (kWh/year) = Sum(64)m =												1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	265.8848	264.0772	254.8146	240.2073	225.7786	211.7351	202.5678	207.3478	214.8407	229.6104	246.4466	258.6839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.3500	0.7000	0.7700	27.1746	(77)

Solar gains	27.1746	46.2884	63.3339	78.4737	87.8971	87.2615	84.1294	77.0991	68.5772	51.1586	32.5489	23.2558	(83)
Total gains	293.0595	310.3657	318.1485	318.6810	313.6757	298.9966	286.6972	284.4469	283.4179	280.7690	278.9956	281.9397	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.6468	38.8090	38.9726	39.8119	39.9841	40.8680	40.8680	41.0495	40.5098	39.9841	39.6412	39.3041	
alpha	3.5765	3.5873	3.5982	3.6541	3.6656	3.7245	3.7245	3.7366	3.7007	3.6656	3.6427	3.6203	
util living area													
	0.9462	0.9307	0.9038	0.8501	0.7574	0.6035	0.4565	0.4766	0.6663	0.8412	0.9213	0.9516	(86)
MIT	19.7654	19.9185	20.1613	20.4793	20.7427	20.9223	20.9788	20.9748	20.8807	20.5741	20.1404	19.7447	(87)
Th 2	20.3243	20.3269	20.3296	20.3428	20.3455	20.3588	20.3588	20.3615	20.3535	20.3455	20.3402	20.3349	(88)
util rest of house													
	0.9399	0.9227	0.8923	0.8316	0.7263	0.5551	0.3951	0.4163	0.6209	0.8187	0.9110	0.9459	(89)
MIT 2	18.6529	18.8744	19.2237	19.6819	20.0431	20.2812	20.3424	20.3412	20.2285	19.8196	19.2049	18.6308	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.2223	19.4088	19.7035	20.0900	20.4012	20.6093	20.6681	20.6655	20.5624	20.2058	19.6837	19.2009	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2223	19.4088	19.7035	20.0900	20.4012	20.6093	20.6681	20.6655	20.5624	20.2058	19.6837	19.2009	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9277	0.9100	0.8801	0.8238	0.7291	0.5745	0.4251	0.4454	0.6361	0.8135	0.8993	0.9342	(94)
Useful gains	271.8626	282.4269	280.0153	262.5305	228.7089	171.7689	121.8893	126.7065	180.2856	228.3921	250.8870	263.3997	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	485.5455	470.1176	426.0286	353.4488	273.6514	184.9060	125.1747	130.6669	200.6036	302.1009	399.1816	479.9416	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	158.9801	126.1282	108.6339	65.4612	33.4372	0.0000	0.0000	0.0000	0.0000	54.8393	106.7721	161.1072	(98)
Space heating												815.3592	(98)
Space heating per m2											(98) / (4) =	18.0110	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	815.3592	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	158.9801	126.1282	108.6339	65.4612	33.4372	0.0000	0.0000	0.0000	0.0000	54.8393	106.7721	161.1072	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	158.9801	126.1282	108.6339	65.4612	33.4372	0.0000	0.0000	0.0000	0.0000	54.8393	106.7721	161.1072	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)

Annual totals kWh/year		
Space heating fuel - main system	815.3592	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)		
mechanical ventilation fans (SFP = 0.7375)	101.8292	(230a)
Total electricity for the above, kWh/year	101.8292	(231)
Electricity for lighting (calculated in Appendix L)	247.4412	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2488.6786	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	815.3592	0.5190	423.1714	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			1110.3529	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total CO2, kg/year			1123.8730	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			24.8300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		24.8300	ZC1
Total Floor Area	TFA	45.2700	
Assumed number of occupants	N	1.5524	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.6683	ZC2
CO2 emissions from cooking, equation (L16)		3.4517	ZC3
Total CO2 emissions		45.9500	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		45.9500	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.3500	1.3258	5.7670			(27)
New External	19.1300	4.3500	14.7800	0.1800	2.6604			(29a)
External Roof 1	45.2700		45.2700	0.1300	5.8851			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3125			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0779	(36)
Total fabric heat loss					(33) + (36) =		22.3904	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	44.3843	44.2554	44.1290	43.5355	43.4244	42.9075	42.9075	42.8118	43.1066	43.4244	43.6491	43.8840	(39)
Average = Sum(39)m / 12 =												43.5350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9804	0.9776	0.9748	0.9617	0.9592	0.9478	0.9478	0.9457	0.9522	0.9592	0.9642	0.9694	(40)
HLP (average)												0.9617	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Total heat required for water heating calculated for each month

	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
								Total per year (kWh/year) = Sum(64)m =				1661.4159	(64)

Heat gains from water heating, kWh/month

	75.4571	67.0516	71.6994	66.0495	66.0125	60.8326	60.1810	63.6139	62.7422	68.4026	70.0960	74.2408	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

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

	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)

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

	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)

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

	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)

Water heating gains (Table 5)

	101.4209	99.7792	96.3701	91.7355	88.7265	84.4897	80.8885	85.5026	87.1420	91.9390	97.3556	99.7861	(72)

Total internal gains

	299.6946	297.8870	288.6244	274.0170	259.5884	245.5448	236.3775	241.1575	248.6504	263.4201	280.2564	292.4937	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.6300	0.7000	0.7700	48.9143	(77)

Solar gains	48.9143	83.3192	114.0010	141.2527	158.2148	157.0707	151.4329	138.7784	123.4389	92.0855	58.5881	41.8605	(83)
Total gains	348.6089	381.2062	402.6253	415.2697	417.8032	402.6155	387.8104	379.9360	372.0894	355.5056	338.8445	334.3541	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8302	71.0365	71.2399	72.2112	72.3959	73.2681	73.2681	73.4319	72.9296	72.3959	72.0232	71.6378	
alpha	5.7220	5.7358	5.7493	5.8141	5.8264	5.8845	5.8845	5.8955	5.8620	5.8264	5.8015	5.7759	
util living area	0.9929	0.9869	0.9730	0.9338	0.8386	0.6575	0.4832	0.5131	0.7444	0.9344	0.9847	0.9943	(86)
MIT	20.1542	20.2797	20.4683	20.7014	20.8851	20.9787	20.9970	20.9957	20.9560	20.7433	20.4136	20.1316	(87)
Th 2	20.0997	20.1021	20.1044	20.1154	20.1174	20.1270	20.1270	20.1288	20.1233	20.1174	20.1133	20.1089	(88)
util rest of house	0.9907	0.9830	0.9645	0.9127	0.7909	0.5780	0.3893	0.4187	0.6699	0.9095	0.9792	0.9925	(89)
MIT 2	18.9838	19.1670	19.4389	19.7717	20.0070	20.1130	20.1259	20.1271	20.0906	19.8343	19.3704	18.9581	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.5829	19.7365	19.9658	20.2475	20.4564	20.5561	20.5717	20.5717	20.5335	20.2995	19.9044	19.5587	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5829	19.7365	19.9658	20.2475	20.4564	20.5561	20.5717	20.5717	20.5335	20.2995	19.9044	19.5587	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9891	0.9810	0.9629	0.9163	0.8105	0.6180	0.4375	0.4671	0.7062	0.9153	0.9777	0.9911	(94)
Useful gains	344.8088	373.9507	387.6978	380.5010	338.6146	248.8321	169.6578	177.4848	262.7826	325.3982	331.2759	331.3902	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	678.3195	656.5967	594.2309	494.0204	380.2436	255.5608	170.4168	178.5958	277.3262	421.1968	558.8987	674.0021	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	248.1320	189.9381	153.6606	81.7340	30.9720	0.0000	0.0000	0.0000	0.0000	71.2742	163.8885	254.9032	(98)
Space heating												1194.5026	(98)
Space heating per m2											(98) / (4) =	26.3862	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1277.5429	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	248.1320	189.9381	153.6606	81.7340	30.9720	0.0000	0.0000	0.0000	0.0000	71.2742	163.8885	254.9032	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	265.3818	203.1424	164.3429	87.4160	33.1251	0.0000	0.0000	0.0000	0.0000	76.2290	175.2818	272.6238	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9468	85.5706	84.8645	83.5086	81.6153	79.8000	79.8000	79.8000	79.8000	83.1013	85.0855	86.0765	(217)
Fuel for water heating, kWh/month													
	188.5693	167.1921	177.6570	162.6999	163.7737	150.5993	145.5216	158.4594	157.7964	169.4952	173.9876	184.0356	(219)
Water heating fuel used												1999.7871	(219)
Annual totals kWh/year													
Space heating fuel - main system												1277.5429	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												247.4412	(232)
Total delivered energy for all uses												3599.7711	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1277.5429	0.2160	275.9493	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.7871	0.2160	431.9540	(264)
Space and water heating			707.9033	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Total CO2, kg/m2/year			875.2502	(272)
Emissions per m2 for space and water heating			15.6374	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.8368	(272b)
Emissions per m2 for pumps and fans			0.8598	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6374 * 1.55) + 2.8368 + 0.8598, rounded to 2 d.p.			27.9300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1767	(8)
Pressure test			Yes	
Measured/design AP50			3.7600	
Infiltration rate			0.3647	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2827	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3604	0.3533	0.3463	0.3109	0.3039	0.2685	0.2685	0.2615	0.2827	0.3039	0.3180	0.3321	(22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5462	0.5361	0.5361	0.5342	0.5399	0.5462	0.5506	0.5552	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5359	(36)
Total fabric heat loss					(33) + (36) =		21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.0992	21.0050	20.9127	20.4791	20.3980	20.0203	20.0203	19.9504	20.1658	20.3980	20.5621	20.7337	(38)
Heat transfer coeff	42.9461	42.8519	42.7596	42.3260	42.2449	41.8672	41.8672	41.7973	42.0127	42.2449	42.4090	42.5805	(39)
Average = Sum(39)m / 12 =												42.3256	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9487	0.9466	0.9445	0.9350	0.9332	0.9248	0.9248	0.9233	0.9280	0.9332	0.9368	0.9406	(40)
HLP (average)												0.9350	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.5524 (42)
Average daily hot water use (litres/day)		71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)
Total internal gains													
	228.3861	227.1710	219.1387	206.2040	192.8613	180.3468	172.4792	175.5940	182.4952	195.5337	210.4151	221.7752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.3500	0.7000	0.7700	27.1746	(77)

Solar gains	27.1746	46.2884	63.3339	78.4737	87.8971	87.2615	84.1294	77.0991	68.5772	51.1586	32.5489	23.2558	(83)
Total gains	255.5607	273.4594	282.4725	284.6777	280.7584	267.6083	256.6086	252.6931	251.0724	246.6923	242.9640	245.0310	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.2809	29.3453	29.4086	29.7099	29.7669	30.0354	30.0354	30.0857	29.9314	29.7669	29.6517	29.5323	
alpha	2.9521	2.9564	2.9606	2.9807	2.9845	3.0024	3.0024	3.0057	2.9954	2.9845	2.9768	2.9688	
util living area													
	0.9689	0.9598	0.9444	0.9146	0.8581	0.7506	0.6160	0.6406	0.8008	0.9129	0.9567	0.9723	(86)
MIT	19.0078	19.1852	19.4991	19.9264	20.3516	20.7129	20.8881	20.8698	20.6202	20.0863	19.4786	18.9698	(87)
Th 2	20.1263	20.1281	20.1298	20.1379	20.1394	20.1464	20.1464	20.1477	20.1437	20.1394	20.1363	20.1331	(88)
util rest of house													
	0.9645	0.9541	0.9360	0.9001	0.8303	0.6947	0.5255	0.5543	0.7539	0.8956	0.9496	0.9684	(89)
MIT 2	18.2885	18.4653	18.7769	19.2023	19.6129	19.9482	20.0881	20.0767	19.8674	19.3625	18.7636	18.2559	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	18.6567	18.8338	19.1465	19.5729	19.9910	20.3396	20.4975	20.4826	20.2527	19.7330	19.1295	18.6213	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6567	18.8338	19.1465	19.5729	19.9910	20.3396	20.4975	20.4826	20.2527	19.7330	19.1295	18.6213	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9551	0.9436	0.9244	0.8889	0.8249	0.7085	0.5648	0.5903	0.7605	0.8859	0.9393	0.9597	(94)
Useful gains	244.0925	258.0245	261.1117	253.0633	231.6038	189.5873	144.9379	149.1609	190.9464	218.5376	228.2070	235.1451	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	616.5621	597.0878	540.7602	451.7402	350.2504	240.3009	163.1787	170.6435	258.4920	385.8209	510.1601	614.0656	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	277.1174	227.8505	208.0584	143.0474	88.2730	0.0000	0.0000	0.0000	0.0000	124.4587	203.0062	281.9169	(98)
Space heating												1553.7285	(98)
Space heating per m2											(98) / (4) =	34.3214	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	393.5518	309.8174	317.6593	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7296	0.8024	0.7909	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	287.1246	248.6075	251.2483	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	372.8913	359.0136	355.5712	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	61.7520	82.1421	77.6162	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												221.5103	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	15.4380	20.5355	19.4040	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	55.3776 (107)
Space cooling per m2	1.2233 (108)
Energy for space heating	34.3214 (99)
Energy for space cooling	1.2233 (108)
Total	35.5446 (109)
Dwelling Fabric Energy Efficiency (DFEE)	35.5 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.3500	1.3258	5.7670			(27)
New External	19.1300	4.3500	14.7800	0.1800	2.6604			(29a)
External Roof 1	45.2700		45.2700	0.1300	5.8851			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3125			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0779	(36)
Total fabric heat loss					(33) + (36) =		22.3904	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	44.3843	44.2554	44.1290	43.5355	43.4244	42.9075	42.9075	42.8118	43.1066	43.4244	43.6491	43.8840	(39)
Average = Sum(39)m / 12 =												43.5350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9804	0.9776	0.9748	0.9617	0.9592	0.9478	0.9478	0.9457	0.9522	0.9592	0.9642	0.9694	(40)
HLP (average)												0.9617	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

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

	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)

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

	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)

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

	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)

Water heating gains (Table 5)

	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)
Total internal gains													
	228.3861	227.1710	219.1387	206.2040	192.8613	180.3468	172.4792	175.5940	182.4952	195.5337	210.4151	221.7752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.6300	0.7000	0.7700	48.9143	(77)

Solar gains	48.9143	83.3192	114.0010	141.2527	158.2148	157.0707	151.4329	138.7784	123.4389	92.0855	58.5881	41.8605	(83)
Total gains	277.3004	310.4902	333.1396	347.4567	351.0761	337.4175	323.9121	314.3724	305.9342	287.6191	269.0032	263.6356	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8302	71.0365	71.2399	72.2112	72.3959	73.2681	73.2681	73.4319	72.9296	72.3959	72.0232	71.6378	
alpha	5.7220	5.7358	5.7493	5.8141	5.8264	5.8845	5.8845	5.8955	5.8620	5.8264	5.8015	5.7759	
util living area													
	0.9977	0.9952	0.9886	0.9678	0.9061	0.7544	0.5725	0.6110	0.8420	0.9725	0.9950	0.9983	(86)
MIT	20.0056	20.1357	20.3346	20.5908	20.8157	20.9568	20.9927	20.9895	20.9142	20.6306	20.2720	19.9831	(87)
Th 2	20.0997	20.1021	20.1044	20.1154	20.1174	20.1270	20.1270	20.1288	20.1233	20.1174	20.1133	20.1089	(88)
util rest of house													
	0.9970	0.9936	0.9846	0.9558	0.8701	0.6741	0.4644	0.5032	0.7760	0.9598	0.9931	0.9978	(89)
MIT 2	19.1903	19.3218	19.5208	19.7799	19.9884	20.1061	20.1251	20.1257	20.0755	19.8225	19.4672	19.1756	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	19.6076	19.7384	19.9373	20.1949	20.4119	20.5415	20.5692	20.5678	20.5048	20.2361	19.8791	19.5889	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6076	19.7384	19.9373	20.1949	20.4119	20.5415	20.5692	20.5678	20.5048	20.2361	19.8791	19.5889	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9837	0.9570	0.8834	0.7140	0.5200	0.5587	0.8070	0.9619	0.9924	0.9973	(94)
Useful gains	276.3248	308.2466	327.7252	332.5208	310.1406	240.9273	168.4468	175.6383	246.9018	276.6493	266.9639	262.9320	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	679.4165	656.6793	592.9753	491.7286	378.3075	254.9352	170.3067	178.4314	276.0887	418.4416	557.7960	675.3242	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	299.9002	234.1468	197.3461	114.6296	50.7162	0.0000	0.0000	0.0000	0.0000	105.4935	209.3991	306.8198	(98)
Space heating												1518.4513	(98)
Space heating per m2											(98) / (4) =	33.5421	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	403.3304	317.5154	325.3694	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9005	0.9534	0.9437	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	363.2164	302.7036	307.0591	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	454.4865	437.6800	427.6638	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	65.7145	100.4225	89.7299	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												255.8669	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	16.4286	25.1056	22.4325	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	63.9667 (107)
Space cooling per m2	1.4130 (108)
Energy for space heating	33.5421 (99)
Energy for space cooling	1.4130 (108)
Total	34.9551 (109)
Target Fabric Energy Efficiency (TFEE)	40.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7600	
Infiltration rate		0.1880	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1457	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1603	0.1566	0.1566	0.1421	0.1457	0.1275	0.1202	0.1238	0.1238	0.1421	0.1421	0.1457	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2608	0.2571	0.2571	0.2426	0.2462	0.2280	0.2207	0.2243	0.2243	0.2426	0.2426	0.2462	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5359	(36)
Total fabric heat loss (33) + (36) =	21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.7392	9.6031	9.6031	9.0590	9.1950	8.5148	8.2427	8.3788	8.3788	9.0590	9.0590	9.1950	(38)
Heat transfer coeff	31.5860	31.4500	31.4500	30.9058	31.0419	30.3617	30.0896	30.2256	30.2256	30.9058	30.9058	31.0419	(39)
Average = Sum(39)m / 12 =												30.8492	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6977	0.6947	0.6947	0.6827	0.6857	0.6707	0.6647	0.6677	0.6677	0.6827	0.6827	0.6857	(40)
HLP (average)												0.6814	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume 145.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (56)

If cylinder contains dedicated solar storage

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582 (64)

Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
RHI water heating demand 1324 (64)
Heat gains from water heating, kWh/month

	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)

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

	35.0279	31.1114	25.3015	19.1549	14.3185	12.0883	13.0618	16.9782	22.7882	28.9348	33.7712	36.0014 (67)

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

	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693 (68)

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

	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948 (71)

Water heating gains (Table 5)

	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763 (72)
Total internal gains												
	384.0112	380.5436	366.0566	344.0603	322.0581	302.2856	290.7691	297.2091	309.9264	332.0850	356.4949	374.4611 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	31.1332	0.3500	0.7000	0.7700	22.9939	(77)

Solar gains	22.9939	41.1453	59.3755	75.8579	82.4036	83.3347	78.7878	71.2062	66.1919	48.8332	29.5899	21.0410 (83)
Total gains	407.0051	421.6889	425.4321	419.9183	404.4617	385.6203	369.5569	368.4153	376.1183	380.9182	386.0848	395.5020 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.8119	39.9841	39.9841	40.6881	40.5098	41.4173	41.7918	41.6037	41.6037	40.6881	40.6881	40.5098	
alpha	3.6541	3.6656	3.6656	3.7125	3.7007	3.7612	3.7861	3.7736	3.7736	3.7125	3.7125	3.7007	
util living area													
	0.8610	0.8364	0.7962	0.7100	0.5875	0.4294	0.3147	0.3327	0.4998	0.6944	0.8089	0.8684	(86)
MIT	20.2749	20.3833	20.5388	20.7594	20.9058	20.9789	20.9950	20.9936	20.9598	20.8048	20.5497	20.2649	(87)
Th 2	20.3428	20.3455	20.3455	20.3561	20.3535	20.3668	20.3721	20.3695	20.3695	20.3561	20.3561	20.3535	(88)
util rest of house													
	0.8478	0.8213	0.7773	0.6836	0.5505	0.3840	0.2651	0.2829	0.4566	0.6638	0.7898	0.8559	(89)
MIT 2	19.3863	19.5398	19.7562	20.0646	20.2508	20.3480	20.3688	20.3649	20.3302	20.1270	19.7828	19.3809	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.8411	19.9715	20.1568	20.4202	20.5860	20.6709	20.6893	20.6867	20.6525	20.4739	20.1753	19.8334	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8411	19.9715	20.1568	20.4202	20.5860	20.6709	20.6893	20.6867	20.6525	20.4739	20.1753	19.8334	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8368	0.8120	0.7715	0.6863	0.5641	0.4060	0.2903	0.3081	0.4763	0.6696	0.7841	0.8449	(94)
Useful gains	340.5979	342.4295	328.2403	288.2032	228.1559	156.5541	107.2737	113.4936	179.1360	255.0588	302.7207	334.1512	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	468.7714	451.9850	410.6347	331.3170	244.7974	160.0330	108.0010	114.4548	185.9624	289.7092	382.4691	463.5593	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	95.3611	73.6213	61.3015	31.0419	12.3813	0.0000	0.0000	0.0000	0.0000	25.7799	57.4188	96.2797	(98)
Space heating												453.1854	(98)
RHI space heating demand												453	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7600	
Infiltration rate		0.1880	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1457	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1858	0.1821	0.1785	0.1603	0.1566	0.1384	0.1384	0.1348	0.1457	0.1566	0.1639	0.1712	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2863	0.2826	0.2790	0.2608	0.2571	0.2389	0.2389	0.2353	0.2462	0.2571	0.2644	0.2717	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5359	(36)
Total fabric heat loss (33) + (36) =	21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.6914	10.5554	10.4194	9.7392	9.6031	8.9229	8.9229	8.7869	9.1950	9.6031	9.8752	10.1473	(38)
Heat transfer coeff	32.5383	32.4023	32.2662	31.5860	31.4500	30.7698	30.7698	30.6338	31.0419	31.4500	31.7221	31.9942	(39)
Average = Sum(39)m / 12 =												31.5520	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7188	0.7158	0.7128	0.6977	0.6947	0.6797	0.6797	0.6767	0.6857	0.6947	0.7007	0.7067	(40)
HLP (average)												0.6970	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Total per year (kWh/year) = Sum(64)m =												1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0279	31.1114	25.3015	19.1549	14.3185	12.0883	13.0618	16.9782	22.7882	28.9348	33.7712	36.0014	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	384.0112	380.5436	366.0566	344.0603	322.0581	302.2856	290.7691	297.2091	309.9264	332.0850	356.4949	374.4611	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.3500	0.7000	0.7700	27.1746	(77)

Solar gains	27.1746	46.2884	63.3339	78.4737	87.8971	87.2615	84.1294	77.0991	68.5772	51.1586	32.5489	23.2558	(83)
Total gains	411.1858	426.8321	429.3905	422.5341	409.9552	389.5471	374.8985	374.3082	378.5036	383.2436	389.0438	397.7169	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.6468	38.8090	38.9726	39.8119	39.9841	40.8680	40.8680	41.0495	40.5098	39.9841	39.6412	39.3041	
alpha	3.5765	3.5873	3.5982	3.6541	3.6656	3.7245	3.7245	3.7366	3.7007	3.6656	3.6427	3.6203	
util living area													
	0.8755	0.8529	0.8148	0.7441	0.6387	0.4850	0.3559	0.3703	0.5338	0.7196	0.8308	0.8837	(86)
MIT	20.1490	20.2677	20.4512	20.6828	20.8564	20.9623	20.9907	20.9891	20.9429	20.7596	20.4498	20.1325	(87)
Th 2	20.3243	20.3269	20.3296	20.3428	20.3455	20.3588	20.3588	20.3615	20.3535	20.3455	20.3402	20.3349	(88)
util rest of house													
	0.8636	0.8392	0.7973	0.7201	0.6051	0.4414	0.3058	0.3209	0.4908	0.6907	0.8136	0.8725	(89)
MIT 2	19.1941	19.3629	19.6220	19.9510	20.1819	20.3224	20.3519	20.3530	20.2959	20.0587	19.6317	19.1793	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	19.6828	19.8260	20.0464	20.3256	20.5271	20.6499	20.6789	20.6786	20.6271	20.4174	20.0504	19.6672	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6828	19.8260	20.0464	20.3256	20.5271	20.6499	20.6789	20.6786	20.6271	20.4174	20.0504	19.6672	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8511	0.8280	0.7894	0.7194	0.6147	0.4614	0.3310	0.3456	0.5093	0.6940	0.8054	0.8600	(94)
Useful gains	349.9576	353.4261	338.9704	303.9836	251.9855	179.7475	124.0798	129.3689	192.7697	265.9731	313.3517	342.0390	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	500.5315	483.6362	437.0905	360.8878	277.6127	186.1555	125.5054	131.0689	202.6124	308.7580	410.8147	494.8584	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	112.0269	87.5012	73.0013	40.9710	19.0666	0.0000	0.0000	0.0000	0.0000	31.8319	70.1734	113.6977	(98)
Space heating												548.2701	(98)
Space heating per m2											(98) / (4) =	12.1111	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	100.0000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	548.2701 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	112.0269	87.5012	73.0013	40.9710	19.0666	0.0000	0.0000	0.0000	0.0000	31.8319	70.1734	113.6977	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	112.0269	87.5012	73.0013	40.9710	19.0666	0.0000	0.0000	0.0000	0.0000	31.8319	70.1734	113.6977	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												548.2701	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)	
mechanical ventilation fans (SFP = 0.7375)	101.8292 (230a)
Total electricity for the above, kWh/year	101.8292 (231)
Electricity for lighting (calculated in Appendix L)	247.4412 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
Total delivered energy for all uses	2221.5895 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	548.2701	13.1900	72.3168	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	13.1900	174.6421	(247)
Mechanical ventilation fans	101.8292	13.1900	13.4313	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.4412	13.1900	32.6375	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			293.0277	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.3634 (257)
SAP value		80.9810
SAP rating (Section 12)		81 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	548.2701	0.5190	284.5522	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			971.7336	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			985.2538	(272)
CO2 emissions per m2			21.7600	(273)
EI value			85.3745	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.7600	
Infiltration rate		0.1880	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1457	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1603	0.1566	0.1566	0.1421	0.1457	0.1275	0.1202	0.1238	0.1238	0.1421	0.1421	0.1457	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2608	0.2571	0.2571	0.2426	0.2462	0.2280	0.2207	0.2243	0.2243	0.2426	0.2426	0.2462	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5359	(36)
Total fabric heat loss					(33) + (36) =		21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	9.7392	9.6031	9.6031	9.0590	9.1950	8.5148	8.2427	8.3788	8.3788	9.0590	9.0590	9.1950	(38)
Heat transfer coeff	31.5860	31.4500	31.4500	30.9058	31.0419	30.3617	30.0896	30.2256	30.2256	30.9058	30.9058	31.0419	(39)
Average = Sum(39)m / 12 =												30.8492	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6977	0.6947	0.6947	0.6827	0.6857	0.6707	0.6647	0.6677	0.6677	0.6827	0.6827	0.6857	(40)
HLP (average)												0.6814	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
								Total per year (kWh/year) = Sum(64)m =				1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0279	31.1114	25.3015	19.1549	14.3185	12.0883	13.0618	16.9782	22.7882	28.9348	33.7712	36.0014	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	384.0112	380.5436	366.0566	344.0603	322.0581	302.2856	290.7691	297.2091	309.9264	332.0850	356.4949	374.4611	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	31.1332	0.3500	0.7000	0.7700	22.9939	(77)

Solar gains	22.9939	41.1453	59.3755	75.8579	82.4036	83.3347	78.7878	71.2062	66.1919	48.8332	29.5899	21.0410	(83)
Total gains	407.0051	421.6889	425.4321	419.9183	404.4617	385.6203	369.5569	368.4153	376.1183	380.9182	386.0848	395.5020	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.8119	39.9841	39.9841	40.6881	40.5098	41.4173	41.7918	41.6037	41.6037	40.6881	40.6881	40.5098	
alpha	3.6541	3.6656	3.6656	3.7125	3.7007	3.7612	3.7861	3.7736	3.7736	3.7125	3.7125	3.7007	
util living area													
	0.8610	0.8364	0.7962	0.7100	0.5875	0.4294	0.3147	0.3327	0.4998	0.6944	0.8089	0.8684	(86)
MIT	20.2749	20.3833	20.5388	20.7594	20.9058	20.9789	20.9950	20.9936	20.9598	20.8048	20.5497	20.2649	(87)
Th 2	20.3428	20.3455	20.3455	20.3561	20.3535	20.3668	20.3721	20.3695	20.3695	20.3561	20.3561	20.3535	(88)
util rest of house													
	0.8478	0.8213	0.7773	0.6836	0.5505	0.3840	0.2651	0.2829	0.4566	0.6638	0.7898	0.8559	(89)
MIT 2	19.3863	19.5398	19.7562	20.0646	20.2508	20.3480	20.3688	20.3649	20.3302	20.1270	19.7828	19.3809	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	19.8411	19.9715	20.1568	20.4202	20.5860	20.6709	20.6893	20.6867	20.6525	20.4739	20.1753	19.8334	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8411	19.9715	20.1568	20.4202	20.5860	20.6709	20.6893	20.6867	20.6525	20.4739	20.1753	19.8334	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8368	0.8120	0.7715	0.6863	0.5641	0.4060	0.2903	0.3081	0.4763	0.6696	0.7841	0.8449	(94)
Useful gains	340.5979	342.4295	328.2403	288.2032	228.1559	156.5541	107.2737	113.4936	179.1360	255.0588	302.7207	334.1512	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	468.7714	451.9850	410.6347	331.3170	244.7974	160.0330	108.0010	114.4548	185.9624	289.7092	382.4691	463.5593	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	95.3611	73.6213	61.3015	31.0419	12.3813	0.0000	0.0000	0.0000	0.0000	25.7799	57.4188	96.2797	(98)
Space heating												453.1854	(98)
Space heating per m2											(98) / (4) =	10.0107	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	453.1854	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	95.3611	73.6213	61.3015	31.0419	12.3813	0.0000	0.0000	0.0000	0.0000	25.7799	57.4188	96.2797	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	95.3611	73.6213	61.3015	31.0419	12.3813	0.0000	0.0000	0.0000	0.0000	25.7799	57.4188	96.2797	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)

Annual totals kWh/year		
Space heating fuel - main system	453.1854	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)		
mechanical ventilation fans (SFP = 0.7375)	101.8292	(230a)
Total electricity for the above, kWh/year	101.8292	(231)
Electricity for lighting (calculated in Appendix L)	247.4412	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2126.5049	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	453.1854	31.0800	140.8500	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	31.0800	411.5144	(247)
Mechanical ventilation fans	101.8292	31.0800	31.6485	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.4412	31.0800	76.9047	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			660.9177	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	453.1854	0.5190	235.2032	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			922.3847	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			935.9048	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	453.1854	3.0700	1391.2793	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	3.0700	4064.8305	(264)
Space and water heating			5456.1098	(265)
Pumps and fans	101.8292	3.0700	312.6157	(267)
Energy for lighting	247.4412	3.0700	759.6444	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	3.0700	-992.2854	(269)
Primary energy kWh/year			5536.0845	(272)
Primary energy kWh/m2/year			122.2904	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 81
Current environmental impact rating: B 85

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 81
Potential environmental impact rating: B 85

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£661	£661	£0
Space heating	£172	£172	£0
Water heating	£412	£412	£0
Lighting	£77	£77	£0
Total cost of fuels	£661	£661	£0
Total cost of uses	£661	£661	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	21 kg/m²	21 kg/m²	0 kg/m²
Primary energy	122 kWh/m²	122 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-38	**Issued on Date**	11/01/2024
Assessment Reference	7765-38	**Prop Type Ref**	
Property	Flat 38, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	81 B	**DER**	25.03	**TER**	27.93
Environmental	85 B	**% DER<TER**	10.40		
CO_2 Emissions (t/year)	0.94	**DFEE**	35.68	**TFEE**	40.20
General Requirements Compliance	Pass	**% DFEE<TFEE**	11.23		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Top-floor flat, total floor area 45 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.93 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 25.03 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)40.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)35.7 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.96 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South East: 4.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 323.22 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9600	
Infiltration rate		0.1980	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1535	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1956	0.1918	0.1880	0.1688	0.1650	0.1458	0.1458	0.1419	0.1535	0.1650	0.1726	0.1803	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2961	0.2923	0.2885	0.2693	0.2655	0.2463	0.2463	0.2424	0.2540	0.2655	0.2731	0.2808	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5359	(36)
Total fabric heat loss					(33) + (36) =		21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.0605	10.9172	10.7739	10.0576	9.9143	9.1979	9.1979	9.0546	9.4845	9.9143	10.2008	10.4874	(38)
Heat transfer coeff	32.9073	32.7641	32.6208	31.9044	31.7611	31.0448	31.0448	30.9015	31.3313	31.7611	32.0477	32.3342	(39)
Average = Sum(39)m / 12 =												31.8686	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7269	0.7237	0.7206	0.7048	0.7016	0.6858	0.6858	0.6826	0.6921	0.7016	0.7079	0.7143	(40)
HLP (average)												0.7040	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Total per year (kWh/year) = Sum(64)m =												1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	265.8848	264.0772	254.8146	240.2073	225.7786	211.7351	202.5678	207.3478	214.8407	229.6104	246.4466	258.6839	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.3500	0.7000	0.7700	27.1746	(77)

Solar gains	27.1746	46.2884	63.3339	78.4737	87.8971	87.2615	84.1294	77.0991	68.5772	51.1586	32.5489	23.2558	(83)
Total gains	293.0595	310.3657	318.1485	318.6810	313.6757	298.9966	286.6972	284.4469	283.4179	280.7690	278.9956	281.9397	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.2133	38.3805	38.5490	39.4146	39.5924	40.5060	40.5060	40.6938	40.1356	39.5924	39.2384	38.8907	
alpha	3.5476	3.5587	3.5699	3.6276	3.6395	3.7004	3.7004	3.7129	3.6757	3.6395	3.6159	3.5927	
util living area													
	0.9468	0.9316	0.9050	0.8521	0.7603	0.6069	0.4599	0.4800	0.6696	0.8432	0.9222	0.9521	(86)
MIT	19.7418	19.8962	20.1420	20.4657	20.7342	20.9191	20.9777	20.9735	20.8762	20.5628	20.1231	19.7227	(87)
Th 2	20.3171	20.3199	20.3227	20.3366	20.3394	20.3534	20.3534	20.3562	20.3478	20.3394	20.3338	20.3283	(88)
util rest of house													
	0.9405	0.9236	0.8936	0.8336	0.7292	0.5582	0.3977	0.4189	0.6241	0.8207	0.9120	0.9464	(89)
MIT 2	18.6140	18.8376	19.1913	19.6584	20.0269	20.2726	20.3361	20.3349	20.2181	19.7995	19.1757	18.5945	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	19.1912	19.3795	19.6779	20.0716	20.3889	20.6035	20.6645	20.6618	20.5549	20.1902	19.6606	19.1719	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1912	19.3795	19.6779	20.0716	20.3889	20.6035	20.6645	20.6618	20.5549	20.1902	19.6606	19.1719	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9282	0.9107	0.8812	0.8255	0.7317	0.5775	0.4280	0.4483	0.6391	0.8152	0.9001	0.9347	(94)
Useful gains	272.0135	282.6528	280.3621	263.0634	229.5070	172.6811	122.7184	127.5307	181.1267	228.8834	251.1153	263.5200	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	490.0309	474.4058	429.8730	356.4221	275.9697	186.3769	126.1812	131.6947	202.2409	304.5949	402.5381	484.1053	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	162.2049	128.8581	111.2361	67.2183	34.5683	0.0000	0.0000	0.0000	0.0000	56.3294	109.0244	164.1155	(98)
Space heating												833.5549	(98)
Space heating per m2											(98) / (4) =	18.4130	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												833.5549	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	162.2049	128.8581	111.2361	67.2183	34.5683	0.0000	0.0000	0.0000	0.0000	56.3294	109.0244	164.1155	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	162.2049	128.8581	111.2361	67.2183	34.5683	0.0000	0.0000	0.0000	0.0000	56.3294	109.0244	164.1155	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												833.5549	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												247.4412	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2506.8744	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	833.5549	0.5190	432.6150	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			1119.7965	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total CO2, kg/year			1133.3166	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			25.0300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		25.0300	ZC1
Total Floor Area	TFA	45.2700	
Assumed number of occupants	N	1.5524	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.6683	ZC2
CO2 emissions from cooking, equation (L16)		3.4517	ZC3
Total CO2 emissions		46.1500	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		46.1500	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.3500	1.3258	5.7670			(27)
New External	19.1300	4.3500	14.7800	0.1800	2.6604			(29a)
External Roof 1	45.2700		45.2700	0.1300	5.8851			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3125			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0779	(36)
Total fabric heat loss					(33) + (36) =		22.3904	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	44.3843	44.2554	44.1290	43.5355	43.4244	42.9075	42.9075	42.8118	43.1066	43.4244	43.6491	43.8840	(39)
Average = Sum(39)m / 12 =												43.5350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9804	0.9776	0.9748	0.9617	0.9592	0.9478	0.9478	0.9457	0.9522	0.9592	0.9642	0.9694	(40)
HLP (average)												0.9617	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Total heat required for water heating calculated for each month

	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
								Total per year (kWh/year) = Sum(64)m =				1661.4159	(64)

Heat gains from water heating, kWh/month

	75.4571	67.0516	71.6994	66.0495	66.0125	60.8326	60.1810	63.6139	62.7422	68.4026	70.0960	74.2408	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

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

	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)

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

	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)

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

	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)

Water heating gains (Table 5)

	101.4209	99.7792	96.3701	91.7355	88.7265	84.4897	80.8885	85.5026	87.1420	91.9390	97.3556	99.7861	(72)

Total internal gains

	299.6946	297.8870	288.6244	274.0170	259.5884	245.5448	236.3775	241.1575	248.6504	263.4201	280.2564	292.4937	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.6300	0.7000	0.7700	48.9143	(77)

Solar gains	48.9143	83.3192	114.0010	141.2527	158.2148	157.0707	151.4329	138.7784	123.4389	92.0855	58.5881	41.8605	(83)
Total gains	348.6089	381.2062	402.6253	415.2697	417.8032	402.6155	387.8104	379.9360	372.0894	355.5056	338.8445	334.3541	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8302	71.0365	71.2399	72.2112	72.3959	73.2681	73.2681	73.4319	72.9296	72.3959	72.0232	71.6378	
alpha	5.7220	5.7358	5.7493	5.8141	5.8264	5.8845	5.8845	5.8955	5.8620	5.8264	5.8015	5.7759	
util living area	0.9929	0.9869	0.9730	0.9338	0.8386	0.6575	0.4832	0.5131	0.7444	0.9344	0.9847	0.9943	(86)
MIT	20.1542	20.2797	20.4683	20.7014	20.8851	20.9787	20.9970	20.9957	20.9560	20.7433	20.4136	20.1316	(87)
Th 2	20.0997	20.1021	20.1044	20.1154	20.1174	20.1270	20.1270	20.1288	20.1233	20.1174	20.1133	20.1089	(88)
util rest of house	0.9907	0.9830	0.9645	0.9127	0.7909	0.5780	0.3893	0.4187	0.6699	0.9095	0.9792	0.9925	(89)
MIT 2	18.9838	19.1670	19.4389	19.7717	20.0070	20.1130	20.1259	20.1271	20.0906	19.8343	19.3704	18.9581	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.5829	19.7365	19.9658	20.2475	20.4564	20.5561	20.5717	20.5717	20.5335	20.2995	19.9044	19.5587	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5829	19.7365	19.9658	20.2475	20.4564	20.5561	20.5717	20.5717	20.5335	20.2995	19.9044	19.5587	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9891	0.9810	0.9629	0.9163	0.8105	0.6180	0.4375	0.4671	0.7062	0.9153	0.9777	0.9911	(94)
Useful gains	344.8088	373.9507	387.6978	380.5010	338.6146	248.8321	169.6578	177.4848	262.7826	325.3982	331.2759	331.3902	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	678.3195	656.5967	594.2309	494.0204	380.2436	255.5608	170.4168	178.5958	277.3262	421.1968	558.8987	674.0021	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	248.1320	189.9381	153.6606	81.7340	30.9720	0.0000	0.0000	0.0000	0.0000	71.2742	163.8885	254.9032	(98)
Space heating												1194.5026	(98)
Space heating per m2											(98) / (4) =	26.3862	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1277.5429	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	248.1320	189.9381	153.6606	81.7340	30.9720	0.0000	0.0000	0.0000	0.0000	71.2742	163.8885	254.9032	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	265.3818	203.1424	164.3429	87.4160	33.1251	0.0000	0.0000	0.0000	0.0000	76.2290	175.2818	272.6238	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	162.0694	143.0673	150.7678	135.8683	133.6644	120.1782	116.1262	126.4506	125.9215	140.8526	148.0382	158.4113	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.9468	85.5706	84.8645	83.5086	81.6153	79.8000	79.8000	79.8000	79.8000	83.1013	85.0855	86.0765	(217)
Fuel for water heating, kWh/month													
	188.5693	167.1921	177.6570	162.6999	163.7737	150.5993	145.5216	158.4594	157.7964	169.4952	173.9876	184.0356	(219)
Water heating fuel used												1999.7871	(219)
Annual totals kWh/year													
Space heating fuel - main system												1277.5429	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												247.4412	(232)
Total delivered energy for all uses												3599.7711	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1277.5429	0.2160	275.9493	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1999.7871	0.2160	431.9540	(264)
Space and water heating			707.9033	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Total CO2, kg/m2/year			875.2502	(272)
Emissions per m2 for space and water heating			15.6374	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.8368	(272b)
Emissions per m2 for pumps and fans			0.8598	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6374 * 1.55) + 2.8368 + 0.8598, rounded to 2 d.p.			27.9300	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000	/ (5) =	0.1767	(8)
Pressure test			Yes	
Measured/design AP50			3.9600	
Infiltration rate			0.3747	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2904	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3703	0.3630	0.3557	0.3194	0.3122	0.2759	0.2759	0.2686	0.2904	0.3122	0.3267	0.3412	(22b)
Effective ac	0.5685	0.5659	0.5633	0.5510	0.5487	0.5381	0.5381	0.5361	0.5422	0.5487	0.5534	0.5582	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5359	(36)
Total fabric heat loss					(33) + (36) =		21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.2340	21.1346	21.0372	20.5795	20.4938	20.0952	20.0952	20.0214	20.2487	20.4938	20.6671	20.8482	(38)
Heat transfer coeff	43.0809	42.9815	42.8840	42.4263	42.3407	41.9421	41.9421	41.8682	42.0956	42.3407	42.5139	42.6950	(39)
Average = Sum(39)m / 12 =												42.4259	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9516	0.9494	0.9473	0.9372	0.9353	0.9265	0.9265	0.9249	0.9299	0.9353	0.9391	0.9431	(40)
HLP (average)												0.9372	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)
Total internal gains													
	228.3861	227.1710	219.1387	206.2040	192.8613	180.3468	172.4792	175.5940	182.4952	195.5337	210.4151	221.7752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.3500	0.7000	0.7700	27.1746	(77)

Solar gains	27.1746	46.2884	63.3339	78.4737	87.8971	87.2615	84.1294	77.0991	68.5772	51.1586	32.5489	23.2558	(83)
Total gains	255.5607	273.4594	282.4725	284.6777	280.7584	267.6083	256.6086	252.6931	251.0724	246.6923	242.9640	245.0310	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.1893	29.2568	29.3233	29.6396	29.6996	29.9818	29.9818	30.0347	29.8725	29.6996	29.5785	29.4531	
alpha	2.9460	2.9505	2.9549	2.9760	2.9800	2.9988	2.9988	3.0023	2.9915	2.9800	2.9719	2.9635	
util living area													
	0.9689	0.9599	0.9445	0.9148	0.8584	0.7511	0.6166	0.6412	0.8012	0.9131	0.9568	0.9723	(86)
MIT	19.0005	19.1784	19.4931	19.9223	20.3487	20.7115	20.8874	20.8691	20.6184	20.0829	19.4737	18.9635	(87)
Th 2	20.1238	20.1257	20.1275	20.1360	20.1376	20.1450	20.1450	20.1464	20.1422	20.1376	20.1344	20.1310	(88)
util rest of house													
	0.9645	0.9542	0.9361	0.9003	0.8307	0.6951	0.5260	0.5547	0.7543	0.8958	0.9497	0.9684	(89)
MIT 2	18.2795	18.4568	18.7693	19.1969	19.6088	19.9459	20.0864	20.0750	19.8646	19.3580	18.7574	18.2482	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	18.6485	18.8261	19.1398	19.5682	19.9875	20.3378	20.4963	20.4814	20.2504	19.7290	19.1240	18.6143	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6485	18.8261	19.1398	19.5682	19.9875	20.3378	20.4963	20.4814	20.2504	19.7290	19.1240	18.6143	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9551	0.9436	0.9245	0.8891	0.8252	0.7088	0.5653	0.5907	0.7609	0.8860	0.9393	0.9597	(94)
Useful gains	244.0985	258.0376	261.1372	253.1056	231.6800	189.6879	145.0616	149.2740	191.0314	218.5737	228.2185	235.1483	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	618.1475	598.5648	542.0442	452.6122	350.8971	240.6538	163.4198	170.8825	258.9068	386.5295	511.1896	615.4201	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	278.2924	228.8343	208.9948	143.6448	88.6975	0.0000	0.0000	0.0000	0.0000	124.9591	203.7392	282.9223	(98)
Space heating												1560.0843	(98)
Space heating per m2											(98) / (4) =	34.4618	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	394.2554	310.3712	318.1986	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7287	0.8016	0.7901	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	287.2795	248.7948	251.4191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	372.8913	359.0136	355.5712	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	61.6405	82.0028	77.4892	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												221.1324	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	15.4101	20.5007	19.3723	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling	55.2831 (107)
Space cooling per m2	1.2212 (108)
Energy for space heating	34.4618 (99)
Energy for space cooling	1.2212 (108)
Total	35.6830 (109)
Dwelling Fabric Energy Efficiency (DFEE)	35.7 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1767	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4267	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3307	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4217	0.4134	0.4051	0.3638	0.3555	0.3142	0.3142	0.3059	0.3307	0.3555	0.3720	0.3886	(22b)
Effective ac	0.5889	0.5854	0.5821	0.5662	0.5632	0.5494	0.5494	0.5468	0.5547	0.5632	0.5692	0.5755	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			4.3500	1.3258	5.7670			(27)
New External	19.1300	4.3500	14.7800	0.1800	2.6604			(29a)
External Roof 1	45.2700		45.2700	0.1300	5.8851			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.3125			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0779	(36)
Total fabric heat loss					(33) + (36) =		22.3904	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.9939	21.8650	21.7386	21.1451	21.0340	20.5170	20.5170	20.4213	20.7162	21.0340	21.2587	21.4935	(38)
Heat transfer coeff	44.3843	44.2554	44.1290	43.5355	43.4244	42.9075	42.9075	42.8118	43.1066	43.4244	43.6491	43.8840	(39)
Average = Sum(39)m / 12 =												43.5350	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9804	0.9776	0.9748	0.9617	0.9592	0.9478	0.9478	0.9457	0.9522	0.9592	0.9642	0.9694	(40)
HLP (average)												0.9617	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	24.6356	21.5465	22.2340	19.3842	18.5996	16.0500	14.8727	17.0666	17.2705	20.1271	21.9703	23.8583	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	77.6185	(66)

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

	14.0111	12.4446	10.1206	7.6620	5.7274	4.8353	5.2247	6.7913	9.1153	11.5739	13.5085	14.4006	(67)

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

	134.9770	136.3776	132.8481	125.3341	115.8489	106.9343	100.9787	99.5781	103.1077	110.6217	120.1068	129.0215	(68)

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

	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	30.7619	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)

Water heating gains (Table 5)

	33.1124	32.0632	29.8844	26.9224	24.9994	22.2917	19.9902	22.9390	23.9867	27.0525	30.5142	32.0676	(72)
Total internal gains													
	228.3861	227.1710	219.1387	206.2040	192.8613	180.3468	172.4792	175.5940	182.4952	195.5337	210.4151	221.7752	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.6300	0.7000	0.7700	48.9143	(77)

Solar gains	48.9143	83.3192	114.0010	141.2527	158.2148	157.0707	151.4329	138.7784	123.4389	92.0855	58.5881	41.8605	(83)
Total gains	277.3004	310.4902	333.1396	347.4567	351.0761	337.4175	323.9121	314.3724	305.9342	287.6191	269.0032	263.6356	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.8302	71.0365	71.2399	72.2112	72.3959	73.2681	73.2681	73.4319	72.9296	72.3959	72.0232	71.6378	
alpha	5.7220	5.7358	5.7493	5.8141	5.8264	5.8845	5.8845	5.8955	5.8620	5.8264	5.8015	5.7759	
util living area													
	0.9977	0.9952	0.9886	0.9678	0.9061	0.7544	0.5725	0.6110	0.8420	0.9725	0.9950	0.9983	(86)
MIT	20.0056	20.1357	20.3346	20.5908	20.8157	20.9568	20.9927	20.9895	20.9142	20.6306	20.2720	19.9831	(87)
Th 2	20.0997	20.1021	20.1044	20.1154	20.1174	20.1270	20.1270	20.1288	20.1233	20.1174	20.1133	20.1089	(88)
util rest of house													
	0.9970	0.9936	0.9846	0.9558	0.8701	0.6741	0.4644	0.5032	0.7760	0.9598	0.9931	0.9978	(89)
MIT 2	19.1903	19.3218	19.5208	19.7799	19.9884	20.1061	20.1251	20.1257	20.0755	19.8225	19.4672	19.1756	(90)
Living area fraction										fLA = Living area / (4) =		0.5118	(91)
MIT	19.6076	19.7384	19.9373	20.1949	20.4119	20.5415	20.5692	20.5678	20.5048	20.2361	19.8791	19.5889	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6076	19.7384	19.9373	20.1949	20.4119	20.5415	20.5692	20.5678	20.5048	20.2361	19.8791	19.5889	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9928	0.9837	0.9570	0.8834	0.7140	0.5200	0.5587	0.8070	0.9619	0.9924	0.9973	(94)
Useful gains	276.3248	308.2466	327.7252	332.5208	310.1406	240.9273	168.4468	175.6383	246.9018	276.6493	266.9639	262.9320	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	679.4165	656.6793	592.9753	491.7286	378.3075	254.9352	170.3067	178.4314	276.0887	418.4416	557.7960	675.3242	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	299.9002	234.1468	197.3461	114.6296	50.7162	0.0000	0.0000	0.0000	0.0000	105.4935	209.3991	306.8198	(98)
Space heating												1518.4513	(98)
Space heating per m2											(98) / (4) =	33.5421	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	403.3304	317.5154	325.3694	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9005	0.9534	0.9437	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	363.2164	302.7036	307.0591	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	454.4865	437.6800	427.6638	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	65.7145	100.4225	89.7299	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												255.8669	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	16.4286	25.1056	22.4325	0.0000	0.0000	0.0000	0.0000	(107)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	63.9667 (107)
Space cooling per m2	1.4130 (108)
Energy for space heating	33.5421 (99)
Energy for space cooling	1.4130 (108)
Total	34.9551 (109)
Target Fabric Energy Efficiency (TFEE)	40.2 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9600	
Infiltration rate		0.1980	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1535	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1688	0.1650	0.1650	0.1496	0.1535	0.1343	0.1266	0.1304	0.1304	0.1496	0.1496	0.1535	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2693	0.2655	0.2655	0.2501	0.2540	0.2348	0.2271	0.2309	0.2309	0.2501	0.2501	0.2540	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5359	(36)
Total fabric heat loss (33) + (36) =	21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.0576	9.9143	9.9143	9.3412	9.4845	8.7681	8.4815	8.6248	8.6248	9.3412	9.3412	9.4845	(38)
Heat transfer coeff	31.9044	31.7611	31.7611	31.1880	31.3313	30.6149	30.3284	30.4717	30.4717	31.1880	31.1880	31.3313	(39)
Average = Sum(39)m / 12 =												31.1283	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7048	0.7016	0.7016	0.6889	0.6921	0.6763	0.6699	0.6731	0.6731	0.6889	0.6889	0.6921	(40)
HLP (average)												0.6876	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume 145.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 0.9400 (48)
Temperature factor from Table 2b 0.6000 (49)
Enter (49) or (54) in (55) 0.5640 (55)
Total storage loss

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (56)

If cylinder contains dedicated solar storage

	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

Total heat required for water heating calculated for each month

	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h

	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582 (64)

Total per year (kWh/year) = Sum(64)m = 1324.0490 (64)
RHI water heating demand 1324 (64)
Heat gains from water heating, kWh/month

	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)

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

	35.0279	31.1114	25.3015	19.1549	14.3185	12.0883	13.0618	16.9782	22.7882	28.9348	33.7712	36.0014 (67)

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

	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693 (68)

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

	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948 (71)

Water heating gains (Table 5)

	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763 (72)

Total internal gains

	384.0112	380.5436	366.0566	344.0603	322.0581	302.2856	290.7691	297.2091	309.9264	332.0850	356.4949	374.4611 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	31.1332	0.3500	0.7000	0.7700	22.9939	(77)

Solar gains	22.9939	41.1453	59.3755	75.8579	82.4036	83.3347	78.7878	71.2062	66.1919	48.8332	29.5899	21.0410 (83)
Total gains	407.0051	421.6889	425.4321	419.9183	404.4617	385.6203	369.5569	368.4153	376.1183	380.9182	386.0848	395.5020 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.4146	39.5924	39.5924	40.3199	40.1356	41.0747	41.4628	41.2678	41.2678	40.3199	40.3199	40.1356	
alpha	3.6276	3.6395	3.6395	3.6880	3.6757	3.7383	3.7642	3.7512	3.7512	3.6880	3.6880	3.6757	
util living area	0.8628	0.8385	0.7987	0.7131	0.5911	0.4324	0.3171	0.3352	0.5030	0.6976	0.8112	0.8700	(86)
MIT	20.2566	20.3667	20.5250	20.7511	20.9016	20.9778	20.9948	20.9932	20.9580	20.7979	20.5374	20.2479	(87)
Th 2	20.3366	20.3394	20.3394	20.3506	20.3478	20.3618	20.3675	20.3646	20.3646	20.3506	20.3506	20.3478	(88)
util rest of house	0.8496	0.8234	0.7799	0.6866	0.5538	0.3865	0.2668	0.2847	0.4594	0.6668	0.7921	0.8575	(89)
MIT 2	19.3559	19.5120	19.7323	20.0489	20.2406	20.3420	20.3639	20.3598	20.3236	20.1133	19.7616	19.3527	(90)

Living area fraction fLA = Living area / (4) = 0.5118 (91)

MIT	19.8169	19.9495	20.1380	20.4083	20.5789	20.6674	20.6868	20.6840	20.6483	20.4637	20.1587	19.8109	(92)

Temperature adjustment 0.0000
adjusted MIT 19.8169 19.9495 20.1380 20.4083 20.5789 20.6674 20.6868 20.6840 20.6483 20.4637 20.1587 19.8109 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8384	0.8138	0.7737	0.6890	0.5673	0.4087	0.2923	0.3102	0.4791	0.6724	0.7860	0.8463	(94)
Useful gains	341.2264	343.1863	329.1771	289.3429	229.4626	157.5985	108.0102	114.2860	180.2043	256.1254	303.4756	334.6961	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	472.7238	455.7558	414.1011	333.9720	246.8574	161.2622	108.7814	115.3049	187.3495	292.0348	385.4422	467.1777	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	97.8341	75.6467	63.1835	32.1329	12.9417	0.0000	0.0000	0.0000	0.0000	26.7166	59.0159	98.5663	(98)

Space heating 466.0378 (98)
RHI space heating demand 466 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9600	
Infiltration rate		0.1980	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1535	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1956	0.1918	0.1880	0.1688	0.1650	0.1458	0.1458	0.1419	0.1535	0.1650	0.1726	0.1803	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2961	0.2923	0.2885	0.2693	0.2655	0.2463	0.2463	0.2424	0.2540	0.2655	0.2731	0.2808	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.5359	(36)
Total fabric heat loss (33) + (36) =	21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.0605	10.9172	10.7739	10.0576	9.9143	9.1979	9.1979	9.0546	9.4845	9.9143	10.2008	10.4874	(38)
Heat transfer coeff	32.9073	32.7641	32.6208	31.9044	31.7611	31.0448	31.0448	30.9015	31.3313	31.7611	32.0477	32.3342	(39)
Average = Sum(39)m / 12 =												31.8686	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7269	0.7237	0.7206	0.7048	0.7016	0.6858	0.6858	0.6826	0.6921	0.7016	0.7079	0.7143	(40)
HLP (average)												0.7040	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524 (42)
Average daily hot water use (litres/day)	71.0688 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Total per year (kWh/year) = Sum(64)m =												1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0279	31.1114	25.3015	19.1549	14.3185	12.0883	13.0618	16.9782	22.7882	28.9348	33.7712	36.0014	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	384.0112	380.5436	366.0566	344.0603	322.0581	302.2856	290.7691	297.2091	309.9264	332.0850	356.4949	374.4611	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	36.7938	0.3500	0.7000	0.7700	27.1746	(77)

Solar gains	27.1746	46.2884	63.3339	78.4737	87.8971	87.2615	84.1294	77.0991	68.5772	51.1586	32.5489	23.2558	(83)
Total gains	411.1858	426.8321	429.3905	422.5341	409.9552	389.5471	374.8985	374.3082	378.5036	383.2436	389.0438	397.7169	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.2133	38.3805	38.5490	39.4146	39.5924	40.5060	40.5060	40.6938	40.1356	39.5924	39.2384	38.8907	
alpha	3.5476	3.5587	3.5699	3.6276	3.6395	3.7004	3.7004	3.7129	3.6757	3.6395	3.6159	3.5927	
util living area													
	0.8772	0.8549	0.8173	0.7472	0.6424	0.4884	0.3588	0.3732	0.5374	0.7228	0.8330	0.8852	(86)
MIT	20.1266	20.2471	20.4341	20.6718	20.8503	20.9604	20.9902	20.9885	20.9401	20.7509	20.4343	20.1114	(87)
Th 2	20.3171	20.3199	20.3227	20.3366	20.3394	20.3534	20.3534	20.3562	20.3478	20.3394	20.3338	20.3283	(88)
util rest of house													
	0.8653	0.8412	0.7999	0.7231	0.6086	0.4443	0.3080	0.3231	0.4940	0.6938	0.8158	0.8740	(89)
MIT 2	19.1571	19.3287	19.5930	19.9311	20.1689	20.3152	20.3461	20.3473	20.2875	20.0423	19.6054	19.1445	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.6533	19.7988	20.0235	20.3102	20.5177	20.6455	20.6757	20.6755	20.6215	20.4049	20.0296	19.6394	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6533	19.7988	20.0235	20.3102	20.5177	20.6455	20.6757	20.6755	20.6215	20.4049	20.0296	19.6394	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8526	0.8298	0.7916	0.7221	0.6179	0.4645	0.3335	0.3481	0.5125	0.6968	0.8073	0.8613	(94)
Useful gains	350.5699	354.1768	339.9075	305.1208	253.3221	180.9403	125.0150	130.3154	193.9979	267.0575	314.0935	342.5652	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	505.2373	488.1450	441.1471	364.0365	280.0587	187.6799	126.5302	132.1178	204.3286	311.4165	414.3649	499.2216	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	115.0726	90.0266	75.3223	42.4193	19.8920	0.0000	0.0000	0.0000	0.0000	33.0030	72.1954	116.5524	(98)
Space heating												564.4836	(98)
Space heating per m2											(98) / (4) =	12.4693	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	564.4836	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	115.0726	90.0266	75.3223	42.4193	19.8920	0.0000	0.0000	0.0000	0.0000	33.0030	72.1954	116.5524	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	115.0726	90.0266	75.3223	42.4193	19.8920	0.0000	0.0000	0.0000	0.0000	33.0030	72.1954	116.5524	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)

Annual totals kWh/year		
Space heating fuel - main system	564.4836	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)		
mechanical ventilation fans (SFP = 0.7375)	101.8292	(230a)
Total electricity for the above, kWh/year	101.8292	(231)
Electricity for lighting (calculated in Appendix L)	247.4412	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
Total delivered energy for all uses	2237.8031	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	564.4836	13.1900	74.4554	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	13.1900	174.6421	(247)
Mechanical ventilation fans	101.8292	13.1900	13.4313	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.4412	13.1900	32.6375	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			295.1662	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.3733	(257)
SAP value	80.8422	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	564.4836	0.5190	292.9670	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			980.1485	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			993.6686	(272)
CO2 emissions per m2			21.9500	(273)
EI value			85.2496	
EI rating			85	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency 13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.2700 (1b)	x	2.5000 (2b)	=	113.1750	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.2700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	113.1750	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.9600	
Infiltration rate		0.1980	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1535	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1688	0.1650	0.1650	0.1496	0.1535	0.1343	0.1266	0.1304	0.1304	0.1496	0.1496	0.1535	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2693	0.2655	0.2655	0.2501	0.2540	0.2348	0.2271	0.2309	0.2309	0.2501	0.2501	0.2540	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			4.3500	1.4151	6.1557			(27)
New External	19.1300	4.3500	14.7800	0.1600	2.3648			(29a)
External Roof 1	45.2700		45.2700	0.1500	6.7905			(30)
Total net area of external elements Aum(A, m2)			64.4000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	15.3110			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			31.8000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5359	(36)
Total fabric heat loss					(33) + (36) =		21.8469	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	10.0576	9.9143	9.9143	9.3412	9.4845	8.7681	8.4815	8.6248	8.6248	9.3412	9.3412	9.4845	(38)
Heat transfer coeff	31.9044	31.7611	31.7611	31.1880	31.3313	30.6149	30.3284	30.4717	30.4717	31.1880	31.1880	31.3313	(39)
Average = Sum(39)m / 12 =												31.1283	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7048	0.7016	0.7016	0.6889	0.6921	0.6763	0.6699	0.6731	0.6731	0.6889	0.6889	0.6921	(40)
HLP (average)												0.6876	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.5524	(42)
Average daily hot water use (litres/day)	71.0688	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.1757	75.3329	72.4902	69.6474	66.8047	63.9619	63.9619	66.8047	69.6474	72.4902	75.3329	78.1757	(44)
Energy conte	115.9323	101.3951	104.6307	91.2196	87.5273	75.5294	69.9891	80.3135	81.2727	94.7155	103.3894	112.2742	(45)
Energy content (annual)										Total = Sum(45)m =		1118.1890	(45)
Distribution loss (46)m = 0.15 x (45)m	17.3898	15.2093	15.6946	13.6829	13.1291	11.3294	10.4984	12.0470	12.1909	14.2073	15.5084	16.8411	(46)

Water storage loss:

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
								Total per year (kWh/year) = Sum(64)m =				1324.0490	(64)
Heat gains from water heating, kWh/month													
	52.5347	46.3475	48.7769	43.8665	43.0900	38.6495	37.2586	40.6915	40.5592	45.4801	47.9130	51.3184	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	93.1422	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.0279	31.1114	25.3015	19.1549	14.3185	12.0883	13.0618	16.9782	22.7882	28.9348	33.7712	36.0014	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.4582	203.5487	198.2807	187.0658	172.9089	159.6034	150.7145	148.6240	153.8920	165.1070	179.2639	192.5693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	45.8666	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	-62.0948	(71)
Water heating gains (Table 5)													
	70.6111	68.9695	65.5603	60.9257	57.9167	53.6799	50.0787	54.6928	56.3322	61.1292	66.5458	68.9763	(72)
Total internal gains													
	384.0112	380.5436	366.0566	344.0603	322.0581	302.2856	290.7691	297.2091	309.9264	332.0850	356.4949	374.4611	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3500	31.1332	0.3500	0.7000	0.7700	22.9939	(77)

Solar gains	22.9939	41.1453	59.3755	75.8579	82.4036	83.3347	78.7878	71.2062	66.1919	48.8332	29.5899	21.0410	(83)
Total gains	407.0051	421.6889	425.4321	419.9183	404.4617	385.6203	369.5569	368.4153	376.1183	380.9182	386.0848	395.5020	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.4146	39.5924	39.5924	40.3199	40.1356	41.0747	41.4628	41.2678	41.2678	40.3199	40.3199	40.1356	
alpha	3.6276	3.6395	3.6395	3.6880	3.6757	3.7383	3.7642	3.7512	3.7512	3.6880	3.6880	3.6757	
util living area													
	0.8628	0.8385	0.7987	0.7131	0.5911	0.4324	0.3171	0.3352	0.5030	0.6976	0.8112	0.8700	(86)
MIT	20.2566	20.3667	20.5250	20.7511	20.9016	20.9778	20.9948	20.9932	20.9580	20.7979	20.5374	20.2479	(87)
Th 2	20.3366	20.3394	20.3394	20.3506	20.3478	20.3618	20.3675	20.3646	20.3646	20.3506	20.3506	20.3478	(88)
util rest of house													
	0.8496	0.8234	0.7799	0.6866	0.5538	0.3865	0.2668	0.2847	0.4594	0.6668	0.7921	0.8575	(89)
MIT 2	19.3559	19.5120	19.7323	20.0489	20.2406	20.3420	20.3639	20.3598	20.3236	20.1133	19.7616	19.3527	(90)
Living area fraction									fLA = Living area / (4) =			0.5118	(91)
MIT	19.8169	19.9495	20.1380	20.4083	20.5789	20.6674	20.6868	20.6840	20.6483	20.4637	20.1587	19.8109	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8169	19.9495	20.1380	20.4083	20.5789	20.6674	20.6868	20.6840	20.6483	20.4637	20.1587	19.8109	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8384	0.8138	0.7737	0.6890	0.5673	0.4087	0.2923	0.3102	0.4791	0.6724	0.7860	0.8463	(94)
Useful gains	341.2264	343.1863	329.1771	289.3429	229.4626	157.5985	108.0102	114.2860	180.2043	256.1254	303.4756	334.6961	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	472.7238	455.7558	414.1011	333.9720	246.8574	161.2622	108.7814	115.3049	187.3495	292.0348	385.4422	467.1777	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	97.8341	75.6467	63.1835	32.1329	12.9417	0.0000	0.0000	0.0000	0.0000	26.7166	59.0159	98.5663	(98)
Space heating												466.0378	(98)
Space heating per m2											(98) / (4) =	10.2946	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												466.0378	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	97.8341	75.6467	63.1835	32.1329	12.9417	0.0000	0.0000	0.0000	0.0000	26.7166	59.0159	98.5663	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	97.8341	75.6467	63.1835	32.1329	12.9417	0.0000	0.0000	0.0000	0.0000	26.7166	59.0159	98.5663	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	133.4163	117.1871	122.1147	108.1396	105.0113	92.4494	87.4731	97.7975	98.1927	112.1995	120.3094	129.7582	(219)
Water heating fuel used												1324.0490	(219)
Annual totals kWh/year													
Space heating fuel - main system												466.0378	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												101.8292	(230a)
Total electricity for the above, kWh/year												101.8292	(231)
Electricity for lighting (calculated in Appendix L)												247.4412	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2139.3573	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	466.0378	31.0800	144.8446	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1324.0490	31.0800	411.5144	(247)
Mechanical ventilation fans	101.8292	31.0800	31.6485	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	247.4412	31.0800	76.9047	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			664.9122	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	466.0378	0.5190	241.8736	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	0.5190	687.1814	(264)
Space and water heating			929.0551	(265)
Pumps and fans	101.8292	0.5190	52.8494	(267)
Energy for lighting	247.4412	0.5190	128.4220	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	0.5190	-167.7512	(269)
Total kg/year			942.5752	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	466.0378	3.0700	1430.7361	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1324.0490	3.0700	4064.8305	(264)
Space and water heating			5495.5666	(265)
Pumps and fans	101.8292	3.0700	312.6157	(267)
Energy for lighting	247.4412	3.0700	759.6444	(268)
Energy saving/generation technologies				
PV Unit	-323.2200	3.0700	-992.2854	(269)
Primary energy kWh/year			5575.5414	(272)
Primary energy kWh/m2/year			123.1619	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 81
Current environmental impact rating: B 85

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 81
Potential environmental impact rating: B 85

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£665	£665	£0
Space heating	£176	£176	£0
Water heating	£412	£412	£0
Lighting	£77	£77	£0
Total cost of fuels	£665	£665	£0
Total cost of uses	£665	£665	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	21 kg/m²	21 kg/m²	0 kg/m²
Primary energy	123 kWh/m²	123 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Built)

Design SAP
elmhurst energy

Property Reference	7765-39	**Issued on Date**	11/01/2024
Assessment Reference	7765-39	**Prop Type Ref**	
Property	Flat 39, Dispensary Mansions, 80 Old Mill Street, MANCHESTER, M4 6ND		

SAP Rating	76 C	**DER**	26.26	**TER**	29.11
Environmental	81 B	**% DER<TER**	9.78		
CO_2 Emissions (t/year)	1.49	**DFEE**	43.43	**TFEE**	55.72
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.05		

Assessor Details	Mr. Adam Lindley, Complete Sustainability Solutions, Tel: 01617060298, adam@completesustainability.co.uk	**Assessor ID**	m004-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

---
REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
---

DWELLING AS BUILT

Top-floor flat, total floor area 70 m²

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

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 29.11 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 26.26 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 4.51 (measured in this dwelling)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 0.94 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

---
6 Controls
Space heating controls: Programmer and appliance thermostats OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.59
Maximum 1.5 OK
MVHR efficiency: 94%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (West Pennines (England)):Not significant OK
Based on:
Overshading: Average
Windows facing South East: 4.39 m², No overhang
Windows facing South West: 1.37 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Photovoltaic array 500.15 kWh/Year

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5100	
Infiltration rate		0.2255	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1748	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2228	0.2185	0.2141	0.1922	0.1879	0.1660	0.1660	0.1617	0.1748	0.1879	0.1966	0.2053	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3233	0.3190	0.3146	0.2927	0.2884	0.2665	0.2665	0.2622	0.2753	0.2884	0.2971	0.3058	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			5.7600	1.4151	8.1509			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1600	9.5312			(29a)
External Roof 1	70.0500		70.0500	0.1500	10.5075			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.1896			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			7.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.9011	(36)
Total fabric heat loss (33) + (36) =	41.0907	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.6852	18.4327	18.1802	16.9177	16.6652	15.4028	15.4028	15.1503	15.9078	16.6652	17.1702	17.6752	(38)
Heat transfer coeff	59.7759	59.5234	59.2709	58.0085	57.7560	56.4935	56.4935	56.2410	56.9985	57.7560	58.2610	58.7660	(39)
Average = Sum(39)m / 12 =												57.9454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8533	0.8497	0.8461	0.8281	0.8245	0.8065	0.8065	0.8029	0.8137	0.8245	0.8317	0.8389	(40)
HLP (average)												0.8272	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2473 (42)
Average daily hot water use (litres/day)	87.5743 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4286	18.7416	19.3396	16.8607	16.1783	13.9606	12.9366	14.8449	15.0222	17.5069	19.1102	20.7524	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
								Total per year (kWh/year) = Sum(64)m =				1583.7444	(64)
Heat gains from water heating, kWh/month													
	61.4872	54.1774	56.8567	50.9107	49.8491	44.4821	42.6633	46.8934	46.8352	52.7942	55.8969	59.9884	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1351	18.7720	15.2664	11.5577	8.6395	7.2938	7.8812	10.2443	13.7499	17.4587	20.3769	21.7225	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.4137	199.4623	194.3000	183.3102	169.4375	156.3992	147.6888	145.6402	150.8025	161.7923	175.6650	188.7033	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)
Water heating gains (Table 5)													
	82.6441	80.6211	76.4203	70.7092	67.0014	61.7806	57.3431	63.0288	65.0489	70.9600	77.6346	80.6296	(72)
Total internal gains													
	357.9030	355.5655	342.6968	322.2872	301.7886	282.1838	269.6232	275.6235	286.3114	306.9211	330.3865	347.7655	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	36.7938	0.3500	0.7000	0.7700	27.4245	(77)
Southwest	1.3700	36.7938	0.3500	0.7000	0.7700	8.5584	(79)

Solar gains	35.9830	61.2923	83.8628	103.9100	116.3879	115.5463	111.3989	102.0899	90.8057	67.7410	43.0993	30.7939	(83)
Total gains	393.8860	416.8578	426.5596	426.1973	418.1765	397.7300	381.0221	377.7133	377.1171	374.6621	373.4858	378.5594	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.5521	32.6902	32.8295	33.5439	33.6906	34.4435	34.4435	34.5981	34.1383	33.6906	33.3986	33.1116	
alpha	3.1701	3.1793	3.1886	3.2363	3.2460	3.2962	3.2962	3.3065	3.2759	3.2460	3.2266	3.2074	
util living area													
	0.9676	0.9587	0.9430	0.9111	0.8499	0.7294	0.5864	0.6081	0.7820	0.9060	0.9539	0.9710	(86)
MIT	19.2457	19.4096	19.6968	20.0998	20.4776	20.7932	20.9272	20.9159	20.7159	20.2491	19.6998	19.2286	(87)
Th 2	20.2073	20.2104	20.2135	20.2290	20.2322	20.2477	20.2477	20.2508	20.2415	20.2322	20.2259	20.2197	(88)
util rest of house													
	0.9632	0.9531	0.9348	0.8970	0.8230	0.6768	0.5056	0.5306	0.7368	0.8887	0.9468	0.9671	(89)
MIT 2	17.8281	18.0673	18.4848	19.0733	19.6064	20.0363	20.1908	20.1822	19.9363	19.2918	18.4998	17.8111	(90)
Living area fraction									fLA = Living area / (4) =			0.4547	(91)
MIT	18.4726	18.6776	19.0359	19.5400	20.0025	20.3804	20.5256	20.5158	20.2908	19.7271	19.0454	18.4556	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4726	18.6776	19.0359	19.5400	20.0025	20.3804	20.5256	20.5158	20.2908	19.7271	19.0454	18.4556	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9508	0.9392	0.9196	0.8821	0.8139	0.6868	0.5368	0.5593	0.7401	0.8752	0.9330	0.9555	(94)
Useful gains	374.4969	391.5169	392.2439	375.9378	340.3481	273.1568	204.5139	211.2725	279.0887	327.9214	348.4543	361.7267	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	847.1817	820.0922	743.0120	617.2131	479.5182	326.5562	221.7703	231.4775	352.8653	527.1440	695.9526	837.7429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	351.6775	288.0026	260.9714	173.7182	103.5426	0.0000	0.0000	0.0000	0.0000	148.2216	250.1988	354.1560	(98)
Space heating												1930.4888	(98)
Space heating per m2											(98) / (4) =	27.5587	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1930.4888	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	351.6775	288.0026	260.9714	173.7182	103.5426	0.0000	0.0000	0.0000	0.0000	148.2216	250.1988	354.1560	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	351.6775	288.0026	260.9714	173.7182	103.5426	0.0000	0.0000	0.0000	0.0000	148.2216	250.1988	354.1560	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(219)
Water heating fuel used												1583.7444	(219)
Annual totals kWh/year													
Space heating fuel - main system												1930.4888	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												157.5687	(230a)
Total electricity for the above, kWh/year												157.5687	(231)
Electricity for lighting (calculated in Appendix L)												373.2531	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4045.0551	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1930.4888	0.5190	1001.9237	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1583.7444	0.5190	821.9634	(264)
Space and water heating			1823.8871	(265)
Pumps and fans	157.5687	0.5190	81.7782	(267)
Energy for lighting	373.2531	0.5190	193.7184	(268)
Energy saving/generation technologies				
PV Unit	-500.1500	0.5190	-259.5779	(269)
Total CO2, kg/year			1839.8057	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			26.2600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		26.2600	ZC1
Total Floor Area	TFA	70.0500	
Assumed number of occupants	N	2.2473	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.7000	ZC2
CO2 emissions from cooking, equation (L16)		2.4688	ZC3
Total CO2 emissions		45.4287	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		45.4287	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1713	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4213	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3265	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4163	0.4081	0.4000	0.3592	0.3510	0.3102	0.3102	0.3020	0.3265	0.3510	0.3673	0.3837	(22b)
Effective ac	0.5867	0.5833	0.5800	0.5645	0.5616	0.5481	0.5481	0.5456	0.5533	0.5616	0.5675	0.5736	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			5.7600	1.3258	7.6364			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1800	10.7226			(29a)
External Roof 1	70.0500		70.0500	0.1300	9.1065			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.4655			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.4495	(36)
Total fabric heat loss					(33) + (36) =		46.9150	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.9035	33.7090	33.5184	32.6231	32.4556	31.6758	31.6758	31.5314	31.9762	32.4556	32.7945	33.1487	(38)
Heat transfer coeff	80.8184	80.6240	80.4334	79.5381	79.3706	78.5908	78.5908	78.4464	78.8912	79.3706	79.7094	80.0637	(39)
Average = Sum(39)m / 12 =												79.5373	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1537	1.1509	1.1482	1.1354	1.1331	1.1219	1.1219	1.1199	1.1262	1.1331	1.1379	1.1430	(40)
HLP (average)												1.1354	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2473	(42)
Average daily hot water use (litres/day)												87.5743	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4286	18.7416	19.3396	16.8607	16.1783	13.9606	12.9366	14.8449	15.0222	17.5069	19.1102	20.7524	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	188.9942	166.6160	175.0679	157.0538	153.9923	137.7197	132.3809	145.1032	144.7968	162.8500	172.0500	184.4866 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	188.9942	166.6160	175.0679	157.0538	153.9923	137.7197	132.3809	145.1032	144.7968	162.8500	172.0500	184.4866 (64)
								Total per year (kWh/year) = Sum(64)m =				1921.1113 (64)
Heat gains from water heating, kWh/month												
	84.4097	74.8816	79.7791	73.0937	72.7715	66.6651	65.5857	69.8159	69.0183	75.7167	78.0799	82.9109 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1351	18.7720	15.2664	11.5577	8.6395	7.2938	7.8812	10.2443	13.7499	17.4587	20.3769	21.7225	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.4137	199.4623	194.3000	183.3102	169.4375	156.3992	147.6888	145.6402	150.8025	161.7923	175.6650	188.7033	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)
Water heating gains (Table 5)													
	113.4538	111.4309	107.2300	101.5190	97.8112	92.5904	88.1529	93.8386	95.8587	101.7698	108.4444	111.4393	(72)
Total internal gains													
	391.7128	389.3753	376.5066	356.0970	335.5983	315.9935	303.4330	309.4332	320.1212	340.7308	364.1963	381.5753	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	36.7938	0.6300	0.7000	0.7700	49.3641	(77)
Southwest	1.3700	36.7938	0.6300	0.7000	0.7700	15.4052	(79)

Solar gains	64.7693	110.3261	150.9530	187.0381	209.4982	207.9833	200.5181	183.7618	163.4502	121.9339	77.5787	55.4290 (83)
Total gains	456.4821	499.7014	527.4596	543.1351	545.0966	523.9768	503.9510	493.1950	483.5714	462.6647	441.7750	437.0043 (84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1915	60.3367	60.4797	61.1604	61.2895	61.8976	61.8976	62.0116	61.6620	61.2895	61.0290	60.7589	
alpha	5.0128	5.0224	5.0320	5.0774	5.0860	5.1265	5.1265	5.1341	5.1108	5.0860	5.0686	5.0506	
util living area	0.9971	0.9949	0.9898	0.9754	0.9335	0.8192	0.6515	0.6854	0.8816	0.9762	0.9943	0.9977	(86)
MIT	19.8015	19.9264	20.1360	20.4184	20.6917	20.9006	20.9764	20.9692	20.8411	20.4973	20.1015	19.7796	(87)
Th 2	19.9572	19.9594	19.9616	19.9720	19.9739	19.9830	19.9830	19.9846	19.9795	19.9739	19.9700	19.9659	(88)
util rest of house	0.9961	0.9932	0.9861	0.9652	0.9028	0.7363	0.5180	0.5560	0.8185	0.9643	0.9920	0.9969	(89)
MIT 2	18.3664	18.5500	18.8564	19.2703	19.6497	19.9094	19.9734	19.9709	19.8453	19.3872	18.8136	18.3406	(90)
Living area fraction										fLA = Living area / (4) =		0.4547	(91)
MIT	19.0189	19.1758	19.4382	19.7923	20.1235	20.3601	20.4295	20.4248	20.2980	19.8919	19.3992	18.9949	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0189	19.1758	19.4382	19.7923	20.1235	20.3601	20.4295	20.4248	20.2980	19.8919	19.3992	18.9949	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9914	0.9836	0.9630	0.9081	0.7701	0.5793	0.6152	0.8410	0.9630	0.9903	0.9959	(94)
Useful gains	454.1624	495.3925	518.8022	523.0306	495.0010	403.5152	291.9512	303.4271	406.6651	445.5689	437.4711	435.2080	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1189.5608	1150.9756	1040.6661	866.3528	668.5764	452.6914	300.9618	315.7308	488.9695	737.5041	980.3584	1184.5351	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	547.1364	440.5518	388.2668	247.1920	129.1401	0.0000	0.0000	0.0000	0.0000	217.1998	390.8788	557.4994	(98)
Space heating												2917.8651	(98)
Space heating per m2											(98) / (4) =	41.6540	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3120.7113	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	547.1364	440.5518	388.2668	247.1920	129.1401	0.0000	0.0000	0.0000	0.0000	217.1998	390.8788	557.4994	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	585.1726	471.1784	415.2586	264.3765	138.1177	0.0000	0.0000	0.0000	0.0000	232.2993	418.0522	596.2560	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	188.9942	166.6160	175.0679	157.0538	153.9923	137.7197	132.3809	145.1032	144.7968	162.8500	172.0500	184.4866	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.4882	87.2882	86.8797	86.0190	84.3487	79.8000	79.8000	79.8000	79.8000	85.5828	86.9372	87.5802	(217)
Fuel for water heating, kWh/month													
	216.0225	190.8802	201.5060	182.5804	182.5664	172.5810	165.8909	181.8335	181.4497	190.2835	197.9015	210.6488	(219)
Water heating fuel used												2274.1442	(219)
Annual totals kWh/year													
Space heating fuel - main system												3120.7113	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												373.2531	(232)
Total delivered energy for all uses												5843.1086	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3120.7113	0.2160	674.0736	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2274.1442	0.2160	491.2152	(264)
Space and water heating			1165.2888	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	373.2531	0.5190	193.7184	(268)
Total CO2, kg/m2/year			1397.9322	(272)
Emissions per m2 for space and water heating			16.6351	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.7654	(272b)
Emissions per m2 for pumps and fans			0.5557	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.6351 * 1.55) + 2.7654 + 0.5557, rounded to 2 d.p.			29.1100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1713	(8)
Pressure test			Yes	
Measured/design AP50			4.5100	
Infiltration rate			0.3968	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3075	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3921	0.3844	0.3767	0.3383	0.3306	0.2921	0.2921	0.2845	0.3075	0.3306	0.3460	0.3613	(22b)
Effective ac	0.5769	0.5739	0.5710	0.5572	0.5546	0.5427	0.5427	0.5405	0.5473	0.5546	0.5598	0.5653	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			5.7600	1.4151	8.1509			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1600	9.5312			(29a)
External Roof 1	70.0500		70.0500	0.1500	10.5075			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.1896			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			7.4500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.9011	(36)
Total fabric heat loss					(33) + (36) =		41.0907	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.3380	33.1655	32.9964	32.2022	32.0536	31.3619	31.3619	31.2338	31.6283	32.0536	32.3542	32.6685	(38)
Heat transfer coeff	74.4287	74.2562	74.0871	73.2929	73.1443	72.4526	72.4526	72.3245	72.7191	73.1443	73.4449	73.7592	(39)
Average = Sum(39)m / 12 =												73.2922	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0625	1.0600	1.0576	1.0463	1.0442	1.0343	1.0343	1.0325	1.0381	1.0442	1.0485	1.0530	(40)
HLP (average)												1.0463	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2473	(42)
Average daily hot water use (litres/day)	87.5743	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.3571	26.5506	27.3978	23.8861	22.9192	19.7776	18.3268	21.0303	21.2815	24.8015	27.0728	29.3993	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	21.1351	18.7720	15.2664	11.5577	8.6395	7.2938	7.8812	10.2443	13.7499	17.4587	20.3769	21.7225	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.4137	199.4623	194.3000	183.3102	169.4375	156.3992	147.6888	145.6402	150.8025	161.7923	175.6650	188.7033	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)
Water heating gains (Table 5)													
	40.8026	39.5097	36.8250	33.1751	30.8054	27.4688	24.6328	28.2665	29.5576	33.3353	37.6011	39.5152	(72)
Total internal gains													
	316.0616	314.4541	303.1015	284.7530	265.5926	247.8719	236.9129	240.8612	250.8201	269.2964	290.3530	306.6511	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	36.7938	0.3500	0.7000	0.7700	27.4245	(77)
Southwest	1.3700	36.7938	0.3500	0.7000	0.7700	8.5584	(79)

Solar gains	35.9830	61.2923	83.8628	103.9100	116.3879	115.5463	111.3989	102.0899	90.8057	67.7410	43.0993	30.7939	(83)
Total gains	352.0445	375.7464	386.9643	388.6631	381.9805	363.4182	348.3118	342.9511	341.6257	337.0374	333.4523	337.4450	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.1436	26.2043	26.2641	26.5487	26.6026	26.8566	26.8566	26.9042	26.7582	26.6026	26.4938	26.3809	
alpha	2.7429	2.7470	2.7509	2.7699	2.7735	2.7904	2.7904	2.7936	2.7839	2.7735	2.7663	2.7587	
util living area													
	0.9773	0.9711	0.9606	0.9402	0.9002	0.8183	0.7028	0.7251	0.8572	0.9389	0.9691	0.9797	(86)
MIT	18.6357	18.8134	19.1490	19.6205	20.1094	20.5581	20.8034	20.7766	20.4457	19.8238	19.1556	18.6022	(87)
Th 2	20.0316	20.0336	20.0356	20.0449	20.0467	20.0548	20.0548	20.0564	20.0517	20.0467	20.0431	20.0394	(88)
util rest of house													
	0.9738	0.9666	0.9540	0.9287	0.8771	0.7662	0.6060	0.6349	0.8156	0.9251	0.9635	0.9767	(89)
MIT 2	17.8537	18.0314	18.3661	18.8388	19.3174	19.7446	19.9506	19.9322	19.6427	19.0428	18.3796	17.8259	(90)
Living area fraction									fLA = Living area / (4) =			0.4547	(91)
MIT	18.2092	18.3870	18.7220	19.1943	19.6775	20.1145	20.3384	20.3161	20.0078	19.3979	18.7324	18.1788	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2092	18.3870	18.7220	19.1943	19.6775	20.1145	20.3384	20.3161	20.0078	19.3979	18.7324	18.1788	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9651	0.9566	0.9424	0.9159	0.8663	0.7700	0.6381	0.6626	0.8134	0.9132	0.9535	0.9687	(94)
Useful gains	339.7721	359.4424	364.6722	355.9742	330.9230	279.8331	222.2733	227.2309	277.8709	307.7910	317.9424	326.8672	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1035.2467	1001.4904	905.4942	754.4969	583.5088	399.5400	270.8535	283.2330	429.6082	643.5176	854.3400	1031.0683	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	517.4331	431.4563	402.3716	286.9364	187.9238	0.0000	0.0000	0.0000	0.0000	249.7806	386.2063	523.9257	(98)
Space heating												2986.0338	(98)
Space heating per m2											(98) / (4) =	42.6272	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	681.0547	536.1495	549.6665	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6227	0.7027	0.6898	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	424.1053	376.7711	379.1480	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	509.8673	490.6516	486.2548	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	61.7486	84.7271	79.6875	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												226.1632	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	15.4372	21.1818	19.9219	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												56.5408 (107)
Space cooling per m2												0.8071 (108)
Energy for space heating												42.6272 (99)
Energy for space cooling												0.8071 (108)
Total												43.4343 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.4 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000	/ (5) =	0.1713	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.4213	(18)
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3265	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4163	0.4081	0.4000	0.3592	0.3510	0.3102	0.3102	0.3020	0.3265	0.3510	0.3673	0.3837	(22b)
Effective ac	0.5867	0.5833	0.5800	0.5645	0.5616	0.5481	0.5481	0.5456	0.5533	0.5616	0.5675	0.5736	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			5.7600	1.3258	7.6364			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1800	10.7226			(29a)
External Roof 1	70.0500		70.0500	0.1300	9.1065			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.4655			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.4495	(36)
Total fabric heat loss					(33) + (36) =		46.9150	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.9035	33.7090	33.5184	32.6231	32.4556	31.6758	31.6758	31.5314	31.9762	32.4556	32.7945	33.1487	(38)
Heat transfer coeff	80.8184	80.6240	80.4334	79.5381	79.3706	78.5908	78.5908	78.4464	78.8912	79.3706	79.7094	80.0637	(39)
Average = Sum(39)m / 12 =												79.5373	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1537	1.1509	1.1482	1.1354	1.1331	1.1219	1.1219	1.1199	1.1262	1.1331	1.1379	1.1430	(40)
HLP (average)												1.1354	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2473	(42)
Average daily hot water use (litres/day)												87.5743	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	30.3571	26.5506	27.3978	23.8861	22.9192	19.7776	18.3268	21.0303	21.2815	24.8015	27.0728	29.3993 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	112.3669	(66)

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

	21.1351	18.7720	15.2664	11.5577	8.6395	7.2938	7.8812	10.2443	13.7499	17.4587	20.3769	21.7225	(67)

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

	197.4137	199.4623	194.3000	183.3102	169.4375	156.3992	147.6888	145.6402	150.8025	161.7923	175.6650	188.7033	(68)

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

	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	34.2367	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

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

	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)

Water heating gains (Table 5)

	40.8026	39.5097	36.8250	33.1751	30.8054	27.4688	24.6328	28.2665	29.5576	33.3353	37.6011	39.5152	(72)

Total internal gains

	316.0616	314.4541	303.1015	284.7530	265.5926	247.8719	236.9129	240.8612	250.8201	269.2964	290.3530	306.6511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	36.7938	0.6300	0.7000	0.7700	49.3641	(77)
Southwest	1.3700	36.7938	0.6300	0.7000	0.7700	15.4052	(79)

Solar gains	64.7693	110.3261	150.9530	187.0381	209.4982	207.9833	200.5181	183.7618	163.4502	121.9339	77.5787	55.4290	(83)
Total gains	380.8309	424.7802	454.0545	471.7911	475.0908	455.8552	437.4310	424.6230	414.2703	391.2303	367.9317	362.0801	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1915	60.3367	60.4797	61.1604	61.2895	61.8976	61.8976	62.0116	61.6620	61.2895	61.0290	60.7589	
alpha	5.0128	5.0224	5.0320	5.0774	5.0860	5.1265	5.1265	5.1341	5.1108	5.0860	5.0686	5.0506	
util living area	0.9987	0.9975	0.9947	0.9862	0.9593	0.8750	0.7255	0.7622	0.9271	0.9881	0.9975	0.9990	(86)
MIT	19.7013	19.8280	20.0416	20.3317	20.6202	20.8597	20.9617	20.9498	20.7842	20.4098	20.0044	19.6799	(87)
Th 2	19.9572	19.9594	19.9616	19.9720	19.9739	19.9830	19.9830	19.9846	19.9795	19.9739	19.9700	19.9659	(88)
util rest of house	0.9983	0.9967	0.9926	0.9800	0.9381	0.8040	0.5883	0.6329	0.8797	0.9816	0.9964	0.9987	(89)
MIT 2	18.7712	18.8994	19.1140	19.4097	19.6901	19.9068	19.9715	19.9679	19.8457	19.4898	19.0842	18.7568	(90)
Living area fraction									fLA = Living area / (4) =			0.4547	(91)
MIT	19.1941	19.3216	19.5357	19.8289	20.1130	20.3400	20.4217	20.4143	20.2724	19.9081	19.5026	19.1765	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1941	19.3216	19.5357	19.8289	20.1130	20.3400	20.4217	20.4143	20.2724	19.9081	19.5026	19.1765	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9960	0.9915	0.9789	0.9416	0.8324	0.6518	0.6925	0.8959	0.9811	0.9958	0.9983	(94)
Useful gains	380.0169	423.0610	450.2129	461.8581	447.3231	379.4404	285.1323	294.0375	371.1416	383.8183	366.3866	361.4824	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1203.7183	1162.7288	1048.5075	869.2653	667.7459	451.1151	300.3499	314.9108	486.9454	738.7880	988.6047	1199.0778	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	612.8339	497.0568	445.1312	293.3332	163.9946	0.0000	0.0000	0.0000	0.0000	264.0974	447.9970	623.1710	(98)
Space heating												3347.6149	(98)
Space heating per m2											(98) / (4) =	47.7889	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	738.7536	581.5719	596.1927	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7541	0.8460	0.8265	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	557.0984	492.0381	492.7640	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	617.9105	594.8168	581.7155	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.7847	76.4674	66.1799	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												186.4320	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

Space cooling kWh

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	10.9462	19.1168	16.5450	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												46.6080 (107)
Space cooling per m2												0.6654 (108)
Energy for space heating												47.7889 (99)
Energy for space cooling												0.6654 (108)
Total												48.4543 (109)
Target Fabric Energy Efficiency (TFEE)												55.7 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5100	
Infiltration rate		0.2255	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1748	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1922	0.1879	0.1879	0.1704	0.1748	0.1529	0.1442	0.1485	0.1485	0.1704	0.1704	0.1748	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2927	0.2884	0.2884	0.2709	0.2753	0.2534	0.2447	0.2490	0.2490	0.2709	0.2709	0.2753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			5.7600	1.4151	8.1509			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1600	9.5312			(29a)
External Roof 1	70.0500		70.0500	0.1500	10.5075			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.1896			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			7.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.9011	(36)
Total fabric heat loss (33) + (36) =	41.0907	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.9177	16.6652	16.6652	15.6553	15.9078	14.6453	14.1403	14.3928	14.3928	15.6553	15.6553	15.9078	(38)
Heat transfer coeff	58.0085	57.7560	57.7560	56.7460	56.9985	55.7360	55.2311	55.4835	55.4835	56.7460	56.7460	56.9985	(39)
Average = Sum(39)m / 12 =												56.6408	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8281	0.8245	0.8245	0.8101	0.8137	0.7957	0.7885	0.7921	0.7921	0.8101	0.8101	0.8137	(40)
HLP (average)												0.8086	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2473 (42)
Average daily hot water use (litres/day)	87.5743 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4286	18.7416	19.3396	16.8607	16.1783	13.9606	12.9366	14.8449	15.0222	17.5069	19.1102	20.7524	(46)

Water storage loss:

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
								Total per year (kWh/year) = Sum(64)m =				1583.7444	(64)
RHI water heating demand												1584	(64)
Heat gains from water heating, kWh/month													
	61.4872	54.1774	56.8567	50.9107	49.8491	44.4821	42.6633	46.8934	46.8352	52.7942	55.8969	59.9884	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.8378	46.9301	38.1661	28.8942	21.5988	18.2346	19.7031	25.6109	34.3748	43.6467	50.9422	54.3064	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	294.6474	297.7049	290.0000	273.5973	252.8919	233.4316	220.4310	217.3735	225.0783	241.4811	262.1865	281.6467	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)
Water heating gains (Table 5)													
	82.6441	80.6211	76.4203	70.7092	67.0014	61.7806	57.3431	63.0288	65.0489	70.9600	77.6346	80.6296	(72)
Total internal gains													
	525.8074	520.9342	500.2646	468.8789	437.1702	409.1250	393.1554	401.6913	420.1802	451.7659	486.4414	512.2608	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	31.1332	0.3500	0.7000	0.7700	23.2054	(77)
Southwest	1.3700	31.1332	0.3500	0.7000	0.7700	7.2418	(79)

Solar gains	30.4471	54.4820	78.6214	100.4464	109.1137	110.3467	104.3260	94.2868	87.6472	64.6619	39.1812	27.8612	(83)
Total gains	556.2545	575.4163	578.8859	569.3253	546.2839	519.4717	497.4814	495.9781	507.8274	516.4278	525.6226	540.1220	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.5439	33.6906	33.6906	34.2902	34.1383	34.9116	35.2308	35.0705	35.0705	34.2902	34.2902	34.1383	
alpha	3.2363	3.2460	3.2460	3.2860	3.2759	3.3274	3.3487	3.3380	3.3380	3.2860	3.2860	3.2759	
util living area													
	0.9137	0.8981	0.8714	0.8100	0.7084	0.5514	0.4177	0.4396	0.6253	0.7979	0.8807	0.9191	(86)
MIT	19.7947	19.9287	20.1424	20.4795	20.7514	20.9253	20.9778	20.9725	20.8745	20.5671	20.1729	19.7840	(87)
Th 2	20.2290	20.2322	20.2322	20.2446	20.2415	20.2571	20.2634	20.2602	20.2602	20.2446	20.2446	20.2415	(88)
util rest of house													
	0.9035	0.8861	0.8557	0.7854	0.6676	0.4908	0.3443	0.3668	0.5719	0.7685	0.8650	0.9096	(89)
MIT 2	18.6279	18.8207	19.1243	19.6043	19.9660	20.1900	20.2486	20.2410	20.1359	19.7279	19.1797	18.6215	(90)
Living area fraction									fLA = Living area / (4) =			0.4547	(91)
MIT	19.1584	19.3245	19.5872	20.0022	20.3231	20.5243	20.5802	20.5736	20.4717	20.1095	19.6313	19.1500	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1584	19.3245	19.5872	20.0022	20.3231	20.5243	20.5802	20.5736	20.4717	20.1095	19.6313	19.1500	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8868	0.8696	0.8407	0.7767	0.6722	0.5132	0.3764	0.3982	0.5878	0.7628	0.8505	0.8933	(94)
Useful gains	493.3100	500.4094	486.6538	442.2145	367.2281	266.6125	187.2517	197.5217	298.4964	393.9343	447.0392	482.5101	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	821.3079	792.6718	721.2110	584.6099	434.5041	285.6078	192.2142	203.8241	331.3306	511.2510	671.3780	812.2307	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	244.0304	196.4003	174.5106	102.5247	50.0534	0.0000	0.0000	0.0000	0.0000	87.2836	161.5239	245.3121	(98)
Space heating												1261.6389	(98)
RHI space heating demand												1262	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5100	
Infiltration rate		0.2255	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1748	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2228	0.2185	0.2141	0.1922	0.1879	0.1660	0.1660	0.1617	0.1748	0.1879	0.1966	0.2053	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3233	0.3190	0.3146	0.2927	0.2884	0.2665	0.2665	0.2622	0.2753	0.2884	0.2971	0.3058	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			5.7600	1.4151	8.1509			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1600	9.5312			(29a)
External Roof 1	70.0500		70.0500	0.1500	10.5075			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.1896			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			7.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.9011	(36)
Total fabric heat loss (33) + (36) =	41.0907	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.6852	18.4327	18.1802	16.9177	16.6652	15.4028	15.4028	15.1503	15.9078	16.6652	17.1702	17.6752	(38)
Heat transfer coeff	59.7759	59.5234	59.2709	58.0085	57.7560	56.4935	56.4935	56.2410	56.9985	57.7560	58.2610	58.7660	(39)
Average = Sum(39)m / 12 =												57.9454	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8533	0.8497	0.8461	0.8281	0.8245	0.8065	0.8065	0.8029	0.8137	0.8245	0.8317	0.8389	(40)
HLP (average)												0.8272	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2473 (42)
Average daily hot water use (litres/day)	87.5743 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4286	18.7416	19.3396	16.8607	16.1783	13.9606	12.9366	14.8449	15.0222	17.5069	19.1102	20.7524	(46)

Water storage loss:

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
								Total per year (kWh/year) = Sum(64)m =				1583.7444	(64)
Heat gains from water heating, kWh/month													
	61.4872	54.1774	56.8567	50.9107	49.8491	44.4821	42.6633	46.8934	46.8352	52.7942	55.8969	59.9884	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.8378	46.9301	38.1661	28.8942	21.5988	18.2346	19.7031	25.6109	34.3748	43.6467	50.9422	54.3064	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	294.6474	297.7049	290.0000	273.5973	252.8919	233.4316	220.4310	217.3735	225.0783	241.4811	262.1865	281.6467	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)
Water heating gains (Table 5)													
	82.6441	80.6211	76.4203	70.7092	67.0014	61.7806	57.3431	63.0288	65.0489	70.9600	77.6346	80.6296	(72)
Total internal gains													
	525.8074	520.9342	500.2646	468.8789	437.1702	409.1250	393.1554	401.6913	420.1802	451.7659	486.4414	512.2608	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	36.7938	0.3500	0.7000	0.7700	27.4245	(77)
Southwest	1.3700	36.7938	0.3500	0.7000	0.7700	8.5584	(79)

Solar gains	35.9830	61.2923	83.8628	103.9100	116.3879	115.5463	111.3989	102.0899	90.8057	67.7410	43.0993	30.7939	(83)
Total gains	561.7904	582.2265	584.1273	572.7890	553.5581	524.6713	504.5543	503.7812	510.9859	519.5070	529.5407	543.0547	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.5521	32.6902	32.8295	33.5439	33.6906	34.4435	34.4435	34.5981	34.1383	33.6906	33.3986	33.1116	
alpha	3.1701	3.1793	3.1886	3.2363	3.2460	3.2962	3.2962	3.3065	3.2759	3.2460	3.2266	3.2074	
util living area													
	0.9223	0.9081	0.8833	0.8350	0.7528	0.6104	0.4672	0.4843	0.6580	0.8167	0.8946	0.9280	(86)
MIT	19.6351	19.7770	20.0210	20.3580	20.6539	20.8805	20.9628	20.9573	20.8353	20.4929	20.0366	19.6185	(87)
Th 2	20.2073	20.2104	20.2135	20.2290	20.2322	20.2477	20.2477	20.2508	20.2415	20.2322	20.2259	20.2197	(88)
util rest of house													
	0.9132	0.8973	0.8691	0.8135	0.7183	0.5557	0.3955	0.4145	0.6071	0.7900	0.8808	0.9196	(89)
MIT 2	18.3843	18.5891	18.9395	19.4251	19.8314	20.1311	20.2201	20.2178	20.0731	19.6177	18.9736	18.3691	(90)
Living area fraction									fLA = Living area / (4) =			0.4547	(91)
MIT	18.9530	19.1292	19.4312	19.8493	20.2054	20.4718	20.5578	20.5540	20.4196	20.0157	19.4569	18.9372	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9530	19.1292	19.4312	19.8493	20.2054	20.4718	20.5578	20.5540	20.4196	20.0157	19.4569	18.9372	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8959	0.8800	0.8528	0.8018	0.7170	0.5726	0.4257	0.4434	0.6196	0.7817	0.8650	0.9029	(94)
Useful gains	503.3285	512.3658	498.1263	459.2574	396.8895	300.4411	214.8109	223.3802	316.6293	406.0749	458.0338	490.3284	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	875.8987	846.9711	766.4448	635.1511	491.2375	331.7195	223.5908	233.6275	360.2095	543.8111	719.9241	866.0429	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	277.1923	224.8547	199.6290	126.6434	70.1949	0.0000	0.0000	0.0000	0.0000	102.4757	188.5610	279.5316	(98)
Space heating												1469.0827	(98)
Space heating per m2											(98) / (4) =	20.9719	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1469.0827	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	277.1923	224.8547	199.6290	126.6434	70.1949	0.0000	0.0000	0.0000	0.0000	102.4757	188.5610	279.5316	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	277.1923	224.8547	199.6290	126.6434	70.1949	0.0000	0.0000	0.0000	0.0000	102.4757	188.5610	279.5316	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(219)
Water heating fuel used												1583.7444	(219)
Annual totals kWh/year													
Space heating fuel - main system												1469.0827	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												157.5687	(230a)
Total electricity for the above, kWh/year												157.5687	(231)
Electricity for lighting (calculated in Appendix L)												373.2531	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3583.6490	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1469.0827	13.1900	193.7720	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1583.7444	13.1900	208.8959	(247)
Mechanical ventilation fans	157.5687	13.1900	20.7833	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	373.2531	13.1900	49.2321	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			472.6833	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.7256	(257)
SAP value		75.9283	
SAP rating (Section 12)		76	(258)
SAP band		C	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1469.0827	0.5190	762.4539	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1583.7444	0.5190	821.9634	(264)
Space and water heating			1584.4173	(265)
Pumps and fans	157.5687	0.5190	81.7782	(267)
Energy for lighting	373.2531	0.5190	193.7184	(268)
Energy saving/generation technologies				
PV Unit	-500.1500	0.5190	-259.5779	(269)
Total kg/year			1600.3360	(272)
CO2 emissions per m2			22.8500	(273)
EI value			81.3607	
EI rating			81	(274)
EI band			B	

Calculation of stars for heating and DHW

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	13.19 × (1 + 0.29 × 0.00) / 1.0000 = 13.190, stars = 1
Main heating environmental impact	0.519 × (1 + 0.29 × 0.00) / 1.0000 = 0.5190, stars = 2
Water heating energy efficiency	13.19 / 1.0000 = 13.190, stars = 1
Water heating environmental impact	0.519 / 1.0000 = 0.5190, stars = 2

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0500 (1b)	x	2.5000 (2b)	=	175.1250	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.1250	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		4.5100	
Infiltration rate		0.2255	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1748	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.3000	4.3000	3.9000	4.0000	3.5000	3.3000	3.4000	3.4000	3.9000	3.9000	4.0000	(22)
Wind factor	1.1000	1.0750	1.0750	0.9750	1.0000	0.8750	0.8250	0.8500	0.8500	0.9750	0.9750	1.0000	(22a)
Adj infilt rate	0.1922	0.1879	0.1879	0.1704	0.1748	0.1529	0.1442	0.1485	0.1485	0.1704	0.1704	0.1748	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	79.9000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2927	0.2884	0.2884	0.2709	0.2753	0.2534	0.2447	0.2490	0.2490	0.2709	0.2709	0.2753	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
New Windows (Uw = 1.50)			5.7600	1.4151	8.1509			(27)
NewWall 1	65.3300	5.7600	59.5700	0.1600	9.5312			(29a)
External Roof 1	70.0500		70.0500	0.1500	10.5075			(30)
Total net area of external elements Aum(A, m2)			135.3800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.1896			(33)
Party Wall 1			17.5000	0.0000	0.0000			(32)
Corridor			7.4500	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.9011	(36)
Total fabric heat loss					(33) + (36) =		41.0907	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.9177	16.6652	16.6652	15.6553	15.9078	14.6453	14.1403	14.3928	14.3928	15.6553	15.6553	15.9078	(38)
Heat transfer coeff	58.0085	57.7560	57.7560	56.7460	56.9985	55.7360	55.2311	55.4835	55.4835	56.7460	56.7460	56.9985	(39)
Average = Sum(39)m / 12 =												56.6408	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8281	0.8245	0.8245	0.8101	0.8137	0.7957	0.7885	0.7921	0.7921	0.8101	0.8101	0.8137	(40)
HLP (average)												0.8086	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2473	(42)
Average daily hot water use (litres/day)	87.5743	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.3317	92.8287	89.3258	85.8228	82.3198	78.8169	78.8169	82.3198	85.8228	89.3258	92.8287	96.3317	(44)
Energy conte	142.8571	124.9438	128.9308	112.4050	107.8553	93.0709	86.2439	98.9661	100.1481	116.7129	127.4013	138.3495	(45)
Energy content (annual)										Total = Sum(45)m =		1377.8844	(45)
Distribution loss (46)m = 0.15 x (45)m	21.4286	18.7416	19.3396	16.8607	16.1783	13.9606	12.9366	14.8449	15.0222	17.5069	19.1102	20.7524	(46)

Water storage loss:

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												0.9400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.5640	(55)
Total storage loss													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(56)
If cylinder contains dedicated solar storage													
	17.4840	15.7920	17.4840	16.9200	17.4840	16.9200	17.4840	17.4840	16.9200	17.4840	16.9200	17.4840	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
								Total per year (kWh/year) = Sum(64)m =				1583.7444	(64)
Heat gains from water heating, kWh/month													
	61.4872	54.1774	56.8567	50.9107	49.8491	44.4821	42.6633	46.8934	46.8352	52.7942	55.8969	59.9884	(65)

---

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	134.8403	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.8378	46.9301	38.1661	28.8942	21.5988	18.2346	19.7031	25.6109	34.3748	43.6467	50.9422	54.3064	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	294.6474	297.7049	290.0000	273.5973	252.8919	233.4316	220.4310	217.3735	225.0783	241.4811	262.1865	281.6467	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	50.7314	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	-89.8935	(71)
Water heating gains (Table 5)													
	82.6441	80.6211	76.4203	70.7092	67.0014	61.7806	57.3431	63.0288	65.0489	70.9600	77.6346	80.6296	(72)
Total internal gains													
	525.8074	520.9342	500.2646	468.8789	437.1702	409.1250	393.1554	401.6913	420.1802	451.7659	486.4414	512.2608	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.3900	31.1332	0.3500	0.7000	0.7700	23.2054	(77)
Southwest	1.3700	31.1332	0.3500	0.7000	0.7700	7.2418	(79)

Solar gains	30.4471	54.4820	78.6214	100.4464	109.1137	110.3467	104.3260	94.2868	87.6472	64.6619	39.1812	27.8612	(83)
Total gains	556.2545	575.4163	578.8859	569.3253	546.2839	519.4717	497.4814	495.9781	507.8274	516.4278	525.6226	540.1220	(84)

---

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.5439	33.6906	33.6906	34.2902	34.1383	34.9116	35.2308	35.0705	35.0705	34.2902	34.2902	34.1383	
alpha	3.2363	3.2460	3.2460	3.2860	3.2759	3.3274	3.3487	3.3380	3.3380	3.2860	3.2860	3.2759	
util living area													
	0.9137	0.8981	0.8714	0.8100	0.7084	0.5514	0.4177	0.4396	0.6253	0.7979	0.8807	0.9191	(86)
MIT	19.7947	19.9287	20.1424	20.4795	20.7514	20.9253	20.9778	20.9725	20.8745	20.5671	20.1729	19.7840	(87)
Th 2	20.2290	20.2322	20.2322	20.2446	20.2415	20.2571	20.2634	20.2602	20.2602	20.2446	20.2446	20.2415	(88)
util rest of house													
	0.9035	0.8861	0.8557	0.7854	0.6676	0.4908	0.3443	0.3668	0.5719	0.7685	0.8650	0.9096	(89)
MIT 2	18.6279	18.8207	19.1243	19.6043	19.9660	20.1900	20.2486	20.2410	20.1359	19.7279	19.1797	18.6215	(90)
Living area fraction									fLA = Living area / (4) =			0.4547	(91)
MIT	19.1584	19.3245	19.5872	20.0022	20.3231	20.5243	20.5802	20.5736	20.4717	20.1095	19.6313	19.1500	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1584	19.3245	19.5872	20.0022	20.3231	20.5243	20.5802	20.5736	20.4717	20.1095	19.6313	19.1500	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8868	0.8696	0.8407	0.7767	0.6722	0.5132	0.3764	0.3982	0.5878	0.7628	0.8505	0.8933	(94)
Useful gains	493.3100	500.4094	486.6538	442.2145	367.2281	266.6125	187.2517	197.5217	298.4964	393.9343	447.0392	482.5101	(95)
Ext temp.	5.0000	5.6000	7.1000	9.7000	12.7000	15.4000	17.1000	16.9000	14.5000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	821.3079	792.6718	721.2110	584.6099	434.5041	285.6078	192.2142	203.8241	331.3306	511.2510	671.3780	812.2307	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	244.0304	196.4003	174.5106	102.5247	50.0534	0.0000	0.0000	0.0000	0.0000	87.2836	161.5239	245.3121	(98)
Space heating												1261.6389	(98)
Space heating per m2											(98) / (4) =	18.0105	(99)

8c. Space cooling requirement

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	1261.6389	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	244.0304	196.4003	174.5106	102.5247	50.0534	0.0000	0.0000	0.0000	0.0000	87.2836	161.5239	245.3121	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	244.0304	196.4003	174.5106	102.5247	50.0534	0.0000	0.0000	0.0000	0.0000	87.2836	161.5239	245.3121	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	160.3411	140.7358	146.4148	129.3250	125.3393	109.9909	103.7279	116.4501	117.0681	134.1969	144.3213	155.8335	(219)
Water heating fuel used												1583.7444	(219)
Annual totals kWh/year													
Space heating fuel - main system												1261.6389	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7375)													
mechanical ventilation fans (SFP = 0.7375)												157.5687	(230a)
Total electricity for the above, kWh/year												157.5687	(231)
Electricity for lighting (calculated in Appendix L)												373.2531	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3376.2052	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1261.6389	31.0800	392.1174	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1583.7444	31.0800	492.2278	(247)
Mechanical ventilation fans	157.5687	31.0800	48.9724	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	373.2531	31.0800	116.0071	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			1049.3246	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1261.6389	0.5190	654.7906	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1583.7444	0.5190	821.9634	(264)
Space and water heating			1476.7540	(265)
Pumps and fans	157.5687	0.5190	81.7782	(267)
Energy for lighting	373.2531	0.5190	193.7184	(268)
Energy saving/generation technologies				
PV Unit	-500.1500	0.5190	-259.5779	(269)
Total kg/year			1492.6727	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1261.6389	3.0700	3873.2315	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1583.7444	3.0700	4862.0954	(264)
Space and water heating			8735.3270	(265)
Pumps and fans	157.5687	3.0700	483.7360	(267)
Energy for lighting	373.2531	3.0700	1145.8870	(268)
Energy saving/generation technologies				
PV Unit	-500.1500	3.0700	-1535.4605	(269)
Primary energy kWh/year			8829.4895	(272)
Primary energy kWh/m2/year			126.0455	(273)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 76
Current environmental impact rating: B 81

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: C 76
Potential environmental impact rating: B 81

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, West Pennines (England)):

	Current	Potential	Saving
Electricity	£1049	£1049	£0
Space heating	£441	£441	£0
Water heating	£492	£492	£0
Lighting	£116	£116	£0
Total cost of fuels	£1049	£1049	£0
Total cost of uses	£1049	£1049	£0
Delivered energy	48 kWh/m²	48 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.5 tonnes	0.0 tonnes
CO2 emissions per m²	21 kg/m²	21 kg/m²	0 kg/m²
Primary energy	126 kWh/m²	126 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

```
-------------------------------------------------------------------------------------------------
SAP 2012 WORKSHEET FOR New Build (As Built)    (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING      09 Jan 2014
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------

No improvements selected / applicable
```

6.7. Appendix G – Water Meter Product Literature

United Utilities Water
Meter Selection Catalogue

Do you really need to print me?
Really? Think of the trees!
unitedutilities.com

United Utilities
helping life flow smoothly

Table of Contents

Foreword. 3
Operating principles of different meter types 4
Available Meters 5
Flow Data 8

Foreword.

This document contains a catalogue of water meters which are approved for use by United Utilities Water (UUW) for fiscal use, and these meters may be selected by a new Water Supply Licensee (WSL).

Only water meters contained within this document are available for selection. UUW will not accept the installation of any alternative water meter as a fiscal meter.

All water meters will be provided by UUW. The WSL will have a role in selecting the preferred meter to be used.

This document should be read in conjunction with the following documentation:-

a) Operating Code OC1 – Pulsed Output
b) Operating Code OC2 – Meter Size Change
c) Operating Code OC3 – Meter Testing
d) Operating Code OC4 – Alterations to meter location or housing
e) Operating Code OC5 – Maintenance activity required
f) Operating Code OC6 – Failure of data logging equipment
g) Wholesale Supply Common Contract

This document facilitates Licensee requests to upsize, downsize or exchange existing water meters as described in Section 7 ; Section 12 of the Wholesale Supply Common Contract.

Operating principles of different meter types

.

Piston meter (Volumetric). Standard 15/20/25/40mm meters

Piston meters, also known as rotary piston or semi-positive displacement meters, the piston meter operates on the principle of a piston rotating within a chamber of known volume. For each rotation, an amount of water passes through the piston chamber. Through a gear mechanism and, sometimes, a magnetic drive, a needle dial and odometer type display is advanced.

- Accurate at low flow
- Low maintenance

Single jet meter 50mm – 100mm

A single jet meter consists of a simple impeller with radial vanes, impinged upon by a single jet. A magnetic coupling to the register drives directly off the rotor and a needle dial and odometer type display are advanced.

- Low to Medium range meter
- Low headloss across meter

Woltmann meter 50 – 150mm (can go to 250mm for bespoke)

The Woltmann meter comprises a rotor with helical blades inserted axially in the flow, much like a ducted fan; it can be considered a type of turbine flow meter. They are commonly referred to as helix meters, and are popular at larger sizes. A magnetic coupling to the register drives directly off the rotor and a needle dial and odometer type display are advanced.

- High flow range meter
- Horizontal or Vertical Installation

Combination Meters 50 – 150mm

Combination meters combined a volumetric meter and a Voltmann meter in one meter body. During periods of low flow the water is recorded through the volumetric meter. When the flow increases a changeover valve diverts the water through the Voltmann meter.

- Low to high flow range meter
- Suitable for low consumption customers with firefighting facilities
- Horizontal or Vertical Installation

Magnetic flow meters 50mm+ (bespoke sites or Raw Water supplies)

Magnetic flow meters, often called "mag meter's" or "electromag's", use a magnetic field applied to the metering tube, which results in a potential difference proportional to the flow velocity perpendicular to the flux lines. The potential difference is sensed by electrodes aligned perpendicular to the flow and the applied magnetic field. The physical principle at work is Faraday's law of electromagnetic induction.

- Battery or mains powered
- Bi directional
- Do not require strainers
- No mechanical measuring element
- Suitable for non-potable water

Available Meters

The following are standard meters and are available for selection and accepted by UUW.

Size 15mm / 20mm - Diehl Altair (Piston)







- Accurate at low flows
- Supplied with AMR unit attached & paired to meter
- Sizes available – 15mm & 20mm.
- Flow ranges from 5 litres/hr – 5 m^3/hr
- Composite meter body

Size 25mm / 40mm - Diehl Altair (piston

- Accurate at low flows
- Supplied with AMR unit attached & paired to meter
- Reliable, low maintenance
- Sizes available – 25mm & 40mm
- Flow range from 35 litres/hr – 20 m^3/hr



Size 50mm / 100mm Diehl Aquila (Single Jet)

- Low – Mid flow rate meter
- Supplied with AMR unit attached & paired to meter
- Low headloss across meter
- Sizes available – 50mm/80mm/100mm
- Flow range from – 90 litres/hr – 100 m^3/hr



Size 50mm – 150mm Honeywell (Elster)H4000 (Woltmann)

- High flow rate meter
- AMR Enabled retrospectively
- Sizes available – 50mm/80mm/100mm/150mm.
- Flow range from – 0.35 m^3/hr – 600 m^3/hr
- Inductive Pulse output (Primary & Secondary available)
- PR7 Pulse unit



Size 50mm – 150mm Honeywell (Elster)H5000 (Woltmann)



- Wide measuring range
- AMR Enabled retrospectively
- Retro-fit mechanism into the H4000 body
- Electronic register includes an integrated communications cable
- Electronic register pre-equipped for AMR
- AMR features such as flow rate display, leak detection, tamper alarms and tariffing
- Sizes available 50mm/80mm/100mm/150mm.
- Flow range from 50 litres/hr – 200 m^3/hr

Size 50mm – 150mm Honeywell (Elster)C4000 (Combination)

- Accurate for large variations in flow rate
- AMR Enabled retrospectively
- Sizes available – 50mm/80mm/100mm/150mm*
- Primary and Secondary pulsed outputs available on both dials
- Main meter – PR7 Pulse unit
- By-pass – PR6 Pulse unit



The following are Non-standard and may be subject to additional charges if requested

Size 50mm – 200mm Honeywell (Elster) Q4000 (Electromagnetic)



- Electromagnetic meter
- Visually Read
- Low headloss across meter
- Low – high flow range
- Bi-directional pulsed output (2 outputs if using the remote display)
- Suitable for non-potable water
- Sizes available 50 – 200 mm
- Flow range from 0.10 m^3/hr – 788 m^3/hr

Size 50mm – 300mm ABB AquaMaster (Electromagnetic)

- Electromagnetic meter
- Visually Read
- Low headloss across meter
- Low – high flow range
- User defined pulsed output
- Suitable for non-potable water
- Sizes available 50 – 300 mm
- Flow range from 0.10 m^3/hr – 788 m^3/hr



Size 50mm – 500mm ABB WaterMaster (Electromagnetic)



- Electromagnetic meter
- Visually Read
- Low headloss across meter
- Low – high flow range
- User defined pulsed output
- Suitable for non-potable water
- Sizes available 50 – 500 mm
- Flow range from 0.10 m^3/hr – 788 m^3/hr

Flow Data

Flow Data

Size	Operating Type	UU recommended Flow Range (overload flow)	Meters Available	Compliance Standards	Output Capability	Number of Outputs Available	Pulse Splitter Compatible
15mm	Piston (in-line)	5 l/hr – 3.125 m^3/hr	**Diehl Altair V4**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output. Requires pulse splitter installation.	1 (with AMR unit removed)	Yes with specific pulse unit
	Piston (Concentric)	5 l/hr – 3.125 m^3/hr	**Diehl Altair V4**	EN14154, OIML R49, ISO 4064, MID		1 (with AMR unit removed)	Yes with specific pulse unit
20mm	Piston (in-line)	25 l/hr – 5 m^3/hr	**Diehl Altair V4**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output Requires pulse splitter installation.	1 (with AMR unit removed)	Yes with specific pulse unit
	Piston (Concentric)	25 l/hr – 5 m^3/hr	**Diehl Altair V4**	EN14154, OIML R49, ISO 4064, MID		1 (with AMR unit removed)	Yes with specific pulse unit
25mm	Piston	35 l/hr – 3.5 m^3/hr (7 m^3/hr)	**Diehl Altair V4**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output Requires pulse splitter installation	1 (with AMR unit removed)	Yes with specific pulse unit
40mm	Piston	100 l/hr – 10 m^3/hr (20 m^3/hr)	**Diehl Altair V4**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output Requires pulse splitter installation	1 (with AMR unit removed)	Yes with specific pulse unit
50mm	Single Jet	80 l/hr – 25m^3/hr (31.25m^3/hr)	**Diehl Aquila V5**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output Requires pulse splitter installation	1 (with AMR unit removed)	Yes with specific pulse unit
	Woltmann	0.75 m^3/hr – 15 m^3/hr (30 m^3/hr)	**Elster H4000**	ISO4064/BS5728/EEC specification Class B	recommend using K 10:10	2	Yes
		0.05 m^3/hr – 63 m^3/hr (79 m^3/hr)	**Elster H5000**	(MID) Directive 2004/22/EC	Integrated communication cable.	2, or 4 with splitter	Yes
	Combination	15 l/hr – 25 m^3/hr (50 m^3/hr)	**Elster C4000**	(MID) Directive 2004/22/EC	Main meter - PR7, Low flow meter - PR6 unit	2 (on each)	Yes
	Electromagnetic	0.1 m^3/hr – 40 m^3/hr (50 m^3/hr)**	**Elster Q4000**	(MID) Directive 2004/22/EC	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
		0.25 m^3/hr – 40 m^3/hr (50 m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		0.2 m^3/hr – 63 m^3/hr (79 m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes

80mm	Single Jet	180 l/hr – 30 m^3/hr (60 m^3/hr)	**Diehl Aquila V5**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output Requires pulse splitter installation	1 (with AMR unit removed)	Yes with specific pulse unit
	Woltmann	1.2 m^3/hr – 40 m^3/hr (80 m^3/hr)	**Elster H4000**	ISO4064/BS5728/EEC specification Class B	recommend using K 10:10	2	Yes
		0.05 m3/hr – 63 m3/hr (79 m3/hr) or 0.13 m3/hr - 160 m3/hr (200 m3/hr)	**Elster H5000**	(MID) 2004/22/EC	Integrated communication cable.	2, or 4 with splitter	Yes
	Combination	15 l/hr – 40 m^3/hr (80 m^3/hr)	**Elster C4000**	(MID) Directive 2004/22/EC	Main meter - PR7, Low flow meter - PR6 unit	2 (on each)	Yes
	Electromagnetic	0.25 m^3/hr – 100m^3/hr (125m^3/hr)**	**Elster Q4000**	(MID) Directive 2004/22/EC	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
		0.63 m^3/hr – 100 m^3/hr (125 m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		0.51 m^3/hr – 160 m^3/hr (200 m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes
100mm	Single Jet	300 l/hr – 50 m^3/hr (100 m^3/hr)	**Diehl Aquila V5**	EN14154, OIML R49, ISO 4064, MID	AMR meter, no available free output Requires pulse splitter installation	1 (with AMR unit removed)	Yes with specific pulse unit
	Woltmann	1.8 m^3/hr – 60 m^3/hr (120 m^3/hr)	**Elster H4000**	ISO4064/BS5728/EEC specification Class B	recommend using K 10:10	2	Yes
		0.13 m^3/hr – 160 m^3/hr (200 m^3/hr)	**Elster H5000**	(MID) Directive 2004/22/EC	Integrated communication cable.	2, or 4 with splitter	Yes
	Combination	15 l/hr – 60 m^3/hr (120 m^3/hr)	**Elster C4000**	(MID) Directive 2004/22/EC	Main meter - PR7, Low flow meter - PR6 unit	2 (on each)	Yes
	Electromagnetic	0.4 m^3/hr – 160 m^3/hr (200 m^3/hr)**	**Elster Q4000**	(MID) Directive 2004/22/EC	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
		1.0 m^3/hr – 160 m^3/hr (200 m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		0.79 m^3/hr – 250 m^3/hr (313 m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes
150mm	Woltmann	4.5 m^3/hr – 150 m^3/hr (300 m^3/hr)	**Elster H4000**	ISO4064/BS5728/EEC specification Class B	PR7 unit 100 l/pulse, dual output recommend use K 10:10	2	Yes
		0.13 m^3/hr – 160 m^3/hr (200 m^3/hr)	**Elster H5000**	(MID) Directive 2004/22/EC	Integrated communication cable.	2, or 4 with splitter	Yes
	Combination	60 l/hr – 150 m^3/hr (300 m^3/hr)	**Elster C4200**	German National Approval	Main meter - PR7, Low flow meter - T-probe	2 (on each)	Yes
	Electromagnetic	1 m^3/hr – 400 m^3/hr (500 m^3/hr)**	**Elster Q4000**	CEN pr14154, ISO4064, OIML R49	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
		2.5 m^3/hr – 400 m^3/hr (500 m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		2.0 m^3/hr – 630 m^3/hr (788 m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes

200mm	Electromagnetic	1.6 m^3/hr – 630 m^3/hr (788 m^3/hr)**	**Elster Q4000**	(MID) Directive 2004/22/EC	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
		3.9 m^3/hr – 630 m^3/hr (788 m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		3.2 m^3/hr – 1000m^3/hr (1250m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes
250mm	Electromagnetic	6.8m^3/hr – 1000m^3/hr (1250 m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		5.1 m^3/hr – 1600m^3/hr (2000m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes
		2.5 m^3/hr – 1000m^3/hr (1250 m^3/hr)**	**Elster Q4000B Flanged**	JIS B8570 conforms to (MID) Directive 2004/22/EC	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
300mm	Electromagnetic	10 m^3/hr – 1600 m^3/hr (2000m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		7.9 m^3/hr – 2500m^3/hr (3125m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes
		2.5 m^3/hr – 1000m^3/hr (1250 m^3/hr)**	**Elster Q4000B Flanged**	JIS B8570 conforms to (MID) Directive 2004/22/EC	MX39 dual output Pulser or MX35 dual output remote display	2	Yes
350mm	Electromagnetic	25 m^3/hr – 1600 m^3/hr (2000m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		12.7m^3/hr – 4000m^3/hr (5000m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes
400mm	Electromagnetic	40 m^3/hr – 2500 m^3/hr (3125m^3/hr)	**ABB AquaMaster**	OIML R49	Variable output determined by user	1	Yes
		12.7m^3/hr – 4000m^3/hr (5000m^3/hr)	**ABB WaterMaster**	OIML R49, (MID) 2004/22/EC	Pulsed output & 4-20mA signal available	2	Yes

6.8. Appendix H – Waste Dashboard Final

Waste Management Dashboard

CN210005 - Ancoats Dispensary

Reporting Month
Dec-23

Headline Figures

Waste Removed		
Total Waste Removed (tonnes)	**Waste Recycled (tonnes)**	**Waste To Landfill (tonnes)**
399.23	398.10	1.13

Skip Capacity (m3)
The maximum skip filling capacity is 75% of the overall skip volume (m3)

Available Skip Space	Used Skip Space
1158.00	572.06

Skip Fill Performance
The skip fill target is 50% of the skip capacity

Target	Actual
55%	49%

Project Details

Start Date	31-Jan-22
End Date	01-Dec-23
Business Sector	Residential
Business Unit	EW Construction

Waste Management Company
Kenny Waste

Forecast Vs Actual

Containers	Forecast	Actual	Variance
FEL	0	0	0
3 Yard	0	0	0
4 Yard	0	0	0
6 Yard	0	0	0
8 Yard	35	7	28
10 Yard	0	0	0
12 Yard	0	0	0
14 Yard	4	42	-38
16 Yard	0	55	-55
18 Yard	0	0	0
20 Yard	0	1	-1
25 Yard	0	0	0
30 Yard	0	0	0
40 Yard	0	0	0
Wheelie Bin (240Ltrs)	0	0	0
Wheelie Bin (660Ltrs)	0	0	0
Wheelie Bin (1100Ltrs)	0	0	0
Drum	2	0	2
20 Tonne Wagon	0	0	0
Total	41	105	-64

Waste (tonnes)	Forecast	Actual	Variance
Mixed Construction	200.00	283.18	-83.18
Wood	12.00	0.00	12.00
Plastic	0.00	0.00	0.00
Steel	0.00	0.00	0.00
Mixed Metal	12.00	0.00	12.00
Hardcore	0.00	0.00	0.00
Plasterboard	53.00	68.79	-15.79
Inert	22.00	47.26	-25.26
Inert - Glass	0.00	0.00	0.00
Cardboard	0.00	0.00	0.00
Packaging	0.00	0.00	0.00
Hazardous	0.50	0.00	0.50
Other	0.50	0.00	0.50
Total	300.00	399.23	-99.23

Recycling and Carbon Footprint

Recycling Rate	
Recycled	**To Landfill**
99.72%	0.28%

Carbon Emissions
The tonnes of CO2 produced from waste removal
2.73

Waste Segregation

	Tonnes
Non Segregated Waste	283.18
Segregated Waste	116.05

	Percentage
Non Segregated Waste	70.93%
Segregated Waste	29.07%

Waste Costs

Total Cost	The total cost of waste removals	£39,961.06
Waste Removed	The cost of the waste removed	£19,741.10
Void Skip Space	The cost of void skip space	£20,219.96
Materials	The value of materials disposed of in skips	£149,711.25

6.9. Appendix I – Eric Wright ISO 14001 Certificate

Certificate of Registration

This certificate has been awarded to

Eric Wright Group Ltd

Sceptre House, Sceptre Way, Bamber Bridge, Preston, Lancashire, PR5 6AW, United Kingdom

in recognition of the organization's Environmental Management System which complies with

ISO 14001:2015

The scope of activities covered by this certificate is defined below

Please refer to the Appendix

Certificate Number **2127/B/0001/UK/En**

A certificate number of 0001, confirms the Client has a single site Certified & the site is their Head Office or Main site in relation to the Certified scope with URS. A certificate number of 0002, or greater (e.g.: xxxx/B/0002/UK/En) refers to a client that has more than one site certified with URS, as such, the following statement shall apply - 'The validity of this certificate depends on the validity of the main certificate'.

Date of Issue of Certification Cycle	Issue Number	Certificate Expiry Date	Certification Cycle
16 September 2023	**17**	**15 September 2026**	**7**
Revision Date	Revision Number	Original Certificate Issue Date	Scheme Number
05 September 2023	**2**	**16 September 2003**	**n/a**

For detailed explanation for the data fields above, refer to http://www.urs-holdings.com/logos-and-regulations

Issued by Mukesh Singhal - On behalf of the Schemes Manager

If there is any doubt as to the authenticity of this certificate, please do not hesitate to contact the Head Office of the Group on info@urs-certification.com.
URS is a member of United Registrar of Systems (Holdings) Ltd, United House, 28 Poole Hill, Bournemouth BH2 5PS, UK. Company Registration no. 5298466

Appendix to Certificate

The Provision of Civil, Mechanical and Electrical Engineering Contracting for Projects within the Infrastructure, Rail, Water and Wastewater Industries, Project Management for Design and Build Contracts Including All Aspects of Property and Facilities Management and Including the Provision of Consultancy Services across Health, Local Authorities, Education and the Wider Public Sector. Partnering on Services such as Building Consultancy, Strategic Estates Advice, and Healthcare Development and SPV Management.

Certificate Number **2127/B/0001/UK/En**

A certificate number of 0001, confirms the Client has a single site Certified & the site is their Head Office or Main site in relation to the Certified scope with URS. A certificate number of 0002, or greater (e.g.: xxxx/B/0002/UK/En) refers to a client that has more than one site certified with URS, as such, the following statement shall apply - 'The validity of this certificate depends on the validity of the main certificate'.

Date of Issue of Certification Cycle	Issue Number	Certificate Expiry Date	Certification Cycle
16 September 2023	**17**	**15 September 2026**	**7**
Revision Date	Revision Number	Original Certificate Issue Date	Scheme Number
05 September 2023	**2**	**16 September 2003**	**n/a**

For detailed explanation for the data fields above, refer to http://www.urs-holdings.com/logos-and-regulations

Issued by

Mukesh Singhal - On behalf of the Schemes Manager

6.10. Appendix J – Considerate Constructors Scheme Certificate

MONITOR'S REPORT

SITE DETAILS

SITE NAME	CONTRACTOR	SITE CONTACT	PROJECT DATES
Ancoats Dispensary	Eric Wright Construction Ltd	James Friedmann (Project Manager)	31/01/2022 - 01/12/2023
MONITOR	**SITE ID**	**VISIT DATE**	**VISIT TYPE**
Phil Power	134009 SI-22/118586/23	17/05/2023	Site 1 (On-site)

PROJECT DESCRIPTION, CONTEXT, LOCATION AND RELEVANT CONSTRAINTS

The project is for the stabilisation and partial reconstruction of the Grade 2 Listed façade of the Ancoats Dispensary followed by the construction of 39 affordable homes on the footprint of the original building. The area is east of Manchester city centre.

Constraints

The Hospital was closed in 1989 and had progressively fallen into decay with substantial amounts of collapse, comprehensive method statements have been developed to enable access into the building, carry out surveys, partial demolition and new foundations. There are residential neighbours around the site and the ground floor of and adjacent residential block is being utilised as the office and welfare facilities for the site. A section of the road to the front of the site has been closed to general traffic and encompassed within the hoarding line.

SCORING

Respect the Community	**Excellent - 15** / 15
Care for the Environment	**Excellent - 15** / 15
Value their Workforce	**Excellent - 15** / 15
Total Report Score	**Excellent - 45** / 45

- A score of 9 in a Section or 27 for the Total Report Score reflects a conforming score for the Code of Considerate Practice
- For more information on the Monitor Checklist, scoring descriptors, the Scheme's definition of innovation and report writing standards, visit www.ccscheme.org.uk.

EXECUTIVE SUMMARY

This is the second registration period for the project and to gain a full appreciation of how the project has addressed the Scheme and particularly the community it is advisable to read the first report.
Engagement with the community continues at excellent levels and in particular with the, Ancoats Dispensary Trust, who can now see the benefits of the initial enthusiasm to save the building to see it brought back to its former glory. Trade students from the Manchester College engaged in the project to design and construct sustainable timber planters with guidance and support from the site team.
The artefacts and components salvaged from the initial selected demolition are now being incorporated into the reconstruction of the façade and tower with specialist input in providing new bespoke components to match the existing. There have been no environmental issues in the period on site continue to follow excellent environmental procedures. Achievements promoted on the 'dashboard' for the benefit of the passing public.
Over the period there has been a focus on the well-being of the workforce with particular dates recognised for, International Woman's Day, Ramadan and Mental Health week. Site personnel attended a presentation on mental health experience related by two professional rugby players.
My thanks to James once more for the sterling efforts expended in the period and for the provision of information relative to the progress in the period.

RESPECT THE COMMUNITY — EXCELLENT 15 / 15

Extensive community activities continue with achievements logged as part of the overall Social Values monitoring. Engagement continues with both St Anne's Primary School and The Manchester College, trade students successfully completing the project to construct sustainable planters with the assistance and guidance from the site team.

Good practice observed

1.1.1 How has the Registered Activity engaged with the impacted community to understand and address concerns prior to the start of site activity?

Regular newsletters continue to be available in electronic format and distributed to the interested parties and concierges of adjacent residential blocks.

1.1.3 How are compliments, comments and complaints sought, recorded and proactively managed?

CCS log utilised for recording comments, compliments and complaints.

1.2.1 How is the Registered Activity keeping the perimeter safe and secure, and surrounding areas clean, tidy and free of litter, mud and dust; to protect the community and passers-by?

The full-time gateman carries out regular checks of the surroundings outside the hoarding line and maintains the hoarding in a pristine manner.

1.2.3 How is the Registered Activity identifying and reducing the effects of nuisance, disturbance, and intrusion on potentially impacted communities?

Suppliers and subcontractors are provided with a specific route to be taken to site.

1.3.1 How is the Registered Activity ensuring that all those potentially impacted by construction activity are treated with consideration, courtesy, and respect?

Regular contact is maintained with the Dispensary Trust, provided with updates and opportunities to visit site. Andy Burnham has recently visited the site.

1.3.2 How is the Registered Activity promoting construction positively within the local community, including promoting local employment?

The comprehensive plan for engagement with the community and providing opportunities is regularly updated with achievements., which include 16 apprentice starts, two work experience and three directly employed, ex-Plan B apprentices. Further engagement with pupils from St Anne's Primary School with their artwork displayed at the adjacent facility. Students from The Manchester College participated in a project to build sustainable planters.

1.3.3 How is the Registered Activity supporting positive impact within the local community?

The extensive site CSR plan is monitored monthly against the targets set and reported back to the Client. Work continues with the local historian commissioned to work on a book centred on the refurbishment of the Dispensary.

CARE FOR THE ENVIRONMENT — EXCELLENT 15 / 15

Site continue to follow the well established environmental practices and procedures. The former tower is close to reconstruction utilising existing salvaged masonry and supplemented with replicated specialist components. Sustainable timber planters have now been constructed by Manchester College trade students in readiness for planting. Site teams are regularly updated on the progress towards the corporate initiative to achieve Net Zero.

Good practice observed

2.1.1 How does the Registered Activity identify and manage environmental concerns?

EWC hold a 14001 certification, the Environmental Plan is being followed and continues to have specialist input and local consultation.

2.1.2 How is the Registered Activity communicating environmental plans, controls and performance to the workforce, community and general public?

Environmental achievements are updated and promoted on bespoke dashboards on display in the community information board and on internal notice boards.

2.2.1 How is the Registered Activity planning to reduce its carbon footprint, including measurement, recording and publication of performance

EWC have a commitment to achieve Net Zero by 2030 along with the commitment to have 50% company vehicles all electric by 2025. The strategy has three phases, short, medium and long-term goals with employees trained in the manner of achievement.

2.2.2 How is the Registered Activity optimising the use of resources, energy and waste?

The social enterprise, Kenny Waste are committed to Net Zero and have carried out out tool box talks with the site operatives on waste management.

2.2.3 How is the Registered Activity ensuring supply chain involvement in the reduction of carbon?

Subcontractors are required to demonstrate their commitment to carbon reduction and Net Zero

2.3.1 How is the Registered Activity identifying, assessing and planning to maintain or improve the natural environment locally?

Part of the initial Environmental Impact Assessment has been input from an ecologist relative to nesting birds and bats, no issues to date.

2.3.2 How is the Registered Activity delivering its plans relating to the natural environment?

The sustainable timber planters will soon be positioned and populated with suitable planting.

2.3.3 How is the Registered Activity proactively promoting improvements realised for the natural environment?

Newsletters and postings on the community information display include environmental achievements.

VALUE THEIR WORKFORCE — EXCELLENT 15 / 15

The well-being of the workforce has been a focus during both April and May, April being stress awareness month and May has mental health week. With respect to the latter two professional rugby players are given an awareness presentation of their experiences of MH. Safety of the workforce and all affected by the site presence and activities continues to be a priority with first class results.

Good practice observed

3.1.1 How is the Registered Activity ensuring the competency and legitimacy of the workforce?

Operatives qualifications, right to work and cards are recorded on the system controlling the turnstiles.

3.1.2 How is the Registered Activity planning and delivering learning and development to encourage construction as a career choice, improving representation from poorly represented groups?

As noted In Community, there have been 16 apprentice starts with the supply chain, pre-directly employed apprentices from the Plan B scheme along with to work experience candidates shadowing members of the staff.

3.1.3 How is the Registered Activity ensuring the workforce is treated fairly and with respect?

EDI policies are promoted alongside anti-bullying and harassment. A mobile phone app is available for observation reporting, comments are acknowledged on a,

'you said, we did' board.

3.2.1 How is the Registered Activity assessing the needs of the workforce to drive an improvement in wellbeing?

EWC have a 45001 certification. To ex-professional rugby players gave a MH awareness talk during MH awareness week.

3.2.2 How is the Registered Activity proactively addressing safety requirements for the workforce and visitors?

Notices remain on the hoarding promoting the availability of the site AED in case of emergency.

3.2.3 How is the Registered Activity embedding a culture of continuous improvement in health and safety performance?

The H&SM continues to carry out visits site every two weeks, one the for informal chats and coaching, the second for formal site safety audits.

3.3.1 How is the Registered Activity ensuring suitable, hygienic and well maintained welfare facilities are provided?

The bespoke welfare facilities within the adjacent apartment block continue to provide for all eventualities,

3.3.2 How has the Registered Activity identified and assessed biological hazards, and are the hazards effectively managed?

Caution continues to be exercised relative to the coronavirus.

3.3.3 How has the Registered Activity supported other workforce needs?

Flexible working hours continue to be available for employees where relevant along with working from home days.

DISCLAIMER

The opinions and scores presented in this report are the result of observations made by the Considerate Constructors Scheme's (the Scheme's) appointed Monitor during a visit to assess compliance with the Code of Considerate Practice (the Code). The findings detailed in this report do not represent compliance with any standard or regulatory requirement, nor can any reliance be placed on the findings contained within the report in legal proceedings, except in relation to compliance with the Code.

MONITOR'S REPORT

SITE DETAILS

SITE NAME	CONTRACTOR	SITE CONTACT	PROJECT DATES
Ancoats Dispensary	Eric Wright Construction Ltd	James Friedmann (Project Manager)	31/01/2022 - 01/12/2023
MONITOR	**SITE ID**	**VISIT DATE**	**VISIT TYPE**
Phil Power	134009 SI-22/118586/23	17/08/2023	Site 2 (On-Site)

PROJECT DESCRIPTION, CONTEXT, LOCATION AND RELEVANT CONSTRAINTS

The project is for the stabilisation and partial reconstruction of the Grade 2 Listed façade of the Ancoats Dispensary followed by the construction of 39 affordable homes on the footprint of the original building. The area is east of Manchester city centre.

Constraints

The Hospital was closed in 1989 and had progressively fallen into decay with substantial amounts of collapse, initially comprehensive method statements developed to enable access into the building, carry out surveys, partial demolition and new foundations. Reconstruction of the tower and façades now complete.There are residential neighbours around the site and the ground floor of and adjacent residential block is being utilised as the office and welfare facilities for the site. A section of the road to the front of the site has been closed to general traffic and encompassed within the hoarding line.

SCORING

Respect the Community	**Excellent - 15** / 15
Care for the Environment	**Excellent - 15** / 15
Value their Workforce	**Excellent - 15** / 15
Total Report Score	**Excellent - 45** / 45

- A score of 9 in a Section or 27 for the Total Report Score reflects a conforming score for the Code of Considerate Practice
- For more information on the Monitor Checklist, scoring descriptors, the Scheme's definition of innovation and report writing standards, visit www.ccscheme.org.uk.

EXECUTIVE SUMMARY

Excellent to learn that the members of the Ancoats Dispensary Trust have recently visited site to view the reconstructed tower and completed repairs to the listed building, a direct result of their diligence, resulting in saving the iconic building and further benefit of providing affordable homes in the community. The site continue with the first class support for the community, results measured and promoted relative to local employment.
Environmentally there have been no incidents in the period and the site continue to follow established practices and disciplines. Corporate progress towards the Net Zero objective is promoted in the quarterly Social Value Report.
Focus on the well-being of the workforce continues and in return they have carried out volunteer days and sponsored walk to raise funds for Holly's Hearts charity. Previously recognised, has been, International Woman's Day, Ramadan and Mental Health week.
My thanks to James once more for the sterling efforts expended in the period and for the provision of information relative to the progress in the period.

RESPECT THE COMMUNITY — EXCELLENT 15 / 15

As work to the external façade and tower nears completion considerable interest is being shown by the community along with specific groups, resulting in site tours presentations and explanations of the tasks carried out. All KPI targets relative to community have been exceeded, an interesting additional service has been the identification of Work Trials, as opposed to Work Experience. Work Trials are predominantly for individuals of all ages, striving to get back into the work ethic. Candidates put forward by Great Places and completing the course entitles them to reduce rental rates.

Good practice observed

1.1.1 How has the Registered Activity engaged with the impacted community to understand and address concerns prior to the start of site activity?
Regular newsletters for details of future key dates, response to community questions and in one instance identified potential noise levels during the current works.

Newsletters distributed electronically, paper copies with the concierge the adjacent apartment building and displayed on the community information board.

1.1.3 How are compliments, comments and complaints sought, recorded and proactively managed?

CCS log utilised for recording comments, compliments and complaints.

1.2.1 How is the Registered Activity keeping the perimeter safe and secure, and surrounding areas clean, tidy and free of litter, mud and dust; to protect the community and passers-by?

The promotional hoardings remain pristine.

1.2.3 How is the Registered Activity identifying and reducing the effects of nuisance, disturbance, and intrusion on potentially impacted communities?

Suppliers and subcontractors are provided with a specific route to be taken to site.

1.3.1 How is the Registered Activity ensuring that all those potentially impacted by construction activity are treated with consideration, courtesy, and respect?

Regular contact is maintained with the Ancoats Dispensary Trust and site tour recently undertaken.

1.3.2 How is the Registered Activity promoting construction positively within the local community, including promoting local employment?

The comprehensive plan for engagement with the community continues to be updated with recent events. A current feature is, Work Trials, a facility to entice people back into work, candidates forwarded by Great Places, successful completion entitles the candidate to a reduced rental rate. A presentation and site tour carried out to a contingent from, Women in Construction.

1.3.3 How is the Registered Activity supporting positive impact within the local community?

The extensive site CSR plan is monitored monthly against the targets, social values identified and promoted chart and animated format, selected information displayed on the community information display board . A sponsored walk has been carried out to raise funds for Holly's Hearts Charity.

CARE FOR THE ENVIRONMENT — EXCELLENT 15 / 15

The site tour and presentation to attendees from, Women in Construction, explained how he masonry components have been rescued from the debris within the building, identified for their location in the façade and set-aside for reuse, likewise attendees visited the production facility for the terracotta replacement manufacture. Environmental performance continues to be monitored across a spectrum of headings, achievements identified and presented in both technical and animated format for the benefit of interested parties on and off site. Corporate progress on the journey to net zero promoted in the quarterly issue Social Values Report.

Good practice observed

2.1.1 How does the Registered Activity identify and manage environmental concerns?

EWC hold a 14001 certification, the Environmental Plan is being followed and continues to have specialist input and local consultation.

2.1.2 How is the Registered Activity communicating environmental plans, controls and performance to the workforce, community and general public?

Potential noise levels of specific site works with potential to impact on neighbours are posted in the newsletters. Environmental achievements continue to be promoted on bespoke dashboards on display on the community information board and on internal notice boards.

2.2.1 How is the Registered Activity planning to reduce its carbon footprint, including measurement, recording and publication of performance

Updates on the corporate commitment to achieve Net Zero by 2030 our promoted in the quarterly Social Values Report.

2.2.2 How is the Registered Activity optimising the use of resources, energy and waste?

The social enterprise, Kenny Waste are committed to Net Zero and have carried out out tool box talks with the site operatives on waste management.

2.2.3 How is the Registered Activity ensuring supply chain involvement in the reduction of carbon?

Subcontractors are required to demonstrate their commitment to carbon reduction and Net Zero

2.3.2 How is the Registered Activity delivering its plans relating to the natural environment?

Sustainable timber planters will soon be positioned and populated with suitable planting.

2.3.3 How is the Registered Activity proactively promoting improvements realised for the natural environment?

Newsletters and postings on the community information display include environmental achievements.

VALUE THEIR WORKFORCE — EXCELLENT 15 / 15

The site team continue to carry out sterling work in the promotion of potential careers in construction both to school and college leavers and the less fortunate unemployed, the latter having the added advantage of reduced rental rate promoted by Great Places. The welfare facilities continue to cater for all needs, maintained clean and hygienic. The July, Business Update, has a section dedicated to employees their performance and achievements. No reported accidents in the period.

Good practice observed

3.1.1 How is the Registered Activity ensuring the competency and legitimacy of the workforce?

Operatives qualifications, right to work and cards are recorded on the system controlling the turnstiles.

3.1.2 How is the Registered Activity planning and delivering learning and development to encourage construction as a career choice, improving representation from poorly represented groups?

3 Work Trials have taken place with unemployed individuals to reintroduce them into the work ethic. Similarly work experience given to school and college leavers and a number of careers workshops held.

3.1.3 How is the Registered Activity ensuring the workforce is treated fairly and with respect?

EDI policies are promoted alongside anti-bullying and harassment. A mobile phone app is available for observation reporting, comments are acknowledged on a, 'you said, we did' board.

3.2.1 How is the Registered Activity assessing the needs of the workforce to drive an improvement in wellbeing?

EWC have a 45001 certification.

3.2.2 How is the Registered Activity proactively addressing safety requirements for the workforce and visitors?

Notices remain on the hoarding promoting the availability of the site AED in case of emergency.

3.2.3 How is the Registered Activity embedding a culture of continuous improvement in health and safety performance?

The H&SM continues to carry out visits site every two weeks, one the for informal chats and coaching, the second for formal site safety audits.

3.3.3 How has the Registered Activity supported other workforce needs?

Flexible working hours continue to be available for employees where relevant along with working from home days.

DISCLAIMER

The opinions and scores presented in this report are the result of observations made by the Considerate Constructors Scheme's (the Scheme's) appointed Monitor during a visit to assess compliance with the Code of Considerate Practice (the Code). The findings detailed in this report do not represent compliance with any standard or regulatory requirement, nor can any reliance be placed on the findings contained within the report in legal proceedings, except in relation to compliance with the Code.

6.11. Appendix K– Commissioning Schedule

Dispensary Commissioning Programme

	Action after 7 days
	Complete
7	To be actioned within 7 days
	Overdue

TODAY'S DATE	20/06/2024	All Levels

Item	Trade	Activity	Start		Finish		Comments
1	**M&E**	**Level 0 (Plots 1, 2, 3 ,4 , 5, 6, 7, 8 & 9)**	x	25-Sep	x	04-Dec	
2	Electrical	Electrical Dead and Live Test	x	25-Sep	x	09-Oct	
3	Electrical	Electrical Function Test	x	25-Sep	x	09-Oct	
4	Mechanical	Cylinder Commissioning	x	23-Oct	x	01-Jan	
5	Mechanical	Hot and Cold Water Function Testing Including Temperature Checks	x	20-Nov	x	04-Dec	
6	Electrical	Heating Control including Towel Rail	x	30-Nov	x	13-Nov	
7	Electrical	Door Access/Intercom	x	30-Oct	x		
8	Electrical	Fire Detection Links to All Room (Function Test)	x	25-Sep	x	09-Oct	
9	Electrical	TV System	x	27-Nov	x	04-Dec	
10	Mechanical	MVHR Commissioning and Air Balance Supply & Extract	x	06-Nov	x	13-Nov	
11	Mechanical	Sprinkler Set Up	x	27-Nov	x	04-Dec	
12	**M&E**	**Level 1 (Plots 10,11,12 & 13)**	x	09-Oct	x	04-Dec	
13	Electrical	Electrical Dead and Live Test	x	09-Oct	x	23-Oct	
14	Electrical	Electrical Function Test	x	09-Oct	x	23-Oct	
15	Mechanical	Cylinder Commissioning	x	23-Oct	x	06-Nov	
16	Mechanical	Hot and Cold Water Function Testing Including Temperature Checks	x	20-Nov	x	04-Dec	
17	Electrical	Heating Control including Towel Rail	x	30-Oct	x	13-Nov	
18	Electrical	Door Access/Intercom	x	30-Oct	x	13-Nov	
19	Electrical	Fire Detection Links to All Room (Function Test)	x	09-Oct	x	23-Oct	
20	Electrical	TV System	x	27-Nov	x	04-Dec	
21	Mechanical	MVHR Commissioning and Air Balance Supply & Extract	x	06-Nov	x	13-Nov	
22	Mechanical	Sprinkler Set Up	x	27-Nov	x	04-Dec	
23	**M&E**	**Level 2 (Plots 14, 15, 16, 17, 18, 19, 20 & 21)**	x	09-Oct	x	04-Dec	
24	Electrical	Electrical Dead and Live Test	x	09-Oct	x	23-Oct	
25	Electrical	Electrical Function Test	x	09-Oct	x	23-Oct	
26	Mechanical	Cylinder Commissioning	x	30-Oct	x	13-Nov	
27	Mechanical	Hot and Cold Water Function Testing Including Temperature Checks	x	20-Nov	x	04-Dec	
28	Electrical	Heating Control including Towel Rail	x	30-Oct	x	13-Nov	
29	Electrical	Door Access/Intercom	x	30-Oct	x	13-Nov	
30	Electrical	Fire Detection Links to All Room (Function Test)	x	09-Oct	x	23-Oct	
31	Electrical	TV System	x	27-Nov	x	04-Dec	
32	Mechanical	MVHR Commissioning and Air Balance Supply & Extract	x	06-Nov	x	13-Nov	
33	Mechanical	Sprinkler Set Up	x	27-Nov	x	04-Dec	
34	**M&E**	**Level 3 (Plots 23, 23, 24, 25, 26, 27, 28 & 29)**	x	30-Oct	x	04-Dec	
35	Electrical	Electrical Dead and Live Test	x	30-Oct	x	13-Nov	
36	Electrical	Electrical Function Test	x	30-Oct	x	13-Nov	
37	Mechanical	Cylinder Commissioning	x	30-Oct	x	13-Nov	
38	Mechanical	Hot and Cold Water Function Testing Including Temperature Checks	x	20-Nov	x	04-Dec	
39	Electrical	Heating Control including Towel Rail	x	30-Oct	x	13-Nov	
40	Electrical	Door Access/Intercom	x	30-Oct	x	13-Nov	
41	Electrical	Fire Detection Links to All Room (Function Test)	x	30-Oct	x	13-Nov	
42	Electrical	TV System	x	27-Nov	x	04-Dec	
43	Mechanical	MVHR Commissioning and Air Balance Supply & Extract	x	27-Nov	x	06-Dec	
44	Mechanical	Sprinkler Set Up	x	27-Nov	x	04-Dec	
45	**M&E**	**Level 4 (Plots 30, 31, 32, 33, 34 & 35)**	x	30-Oct	x	04-Dec	
46	Electrical	Electrical Dead and Live Test	x	30-Oct	x	13-Nov	
47	Electrical	Electrical Function Test	x	30-Oct	x	13-Nov	
48	Mechanical	Cylinder Commissioning	x	06-Nov	x	13-Nov	
49	Mechanical	Hot and Cold Water Function Testing Including Temperature Checks	x	20-Nov	x	04-Dec	
50	Electrical	Heating Control including Towel Rail	x	30-Oct	x	13-Nov	
51	Electrical	Door Access/Intercom	x	30-Oct	x	13-Nov	
52	Electrical	Fire Detection Links to All Room (Function Test)	x	30-Oct	x	13-Nov	
53	Electrical	TV System	x	27-Nov	x	04-Dec	
54	Mechanical	MVHR Commissioning and Air Balance Supply & Extract	x	27-Nov	x	06-Dec	
55	Mechanical	Sprinkler Set Up	x	27-Nov	x	04-Dec	
56	**M&E**	**Level 5 (Plots 36, 37, 38 & 39)**	x	30-Oct	x	04-Dec	
57	Electrical	Electrical Dead and Live Test	x	13-Nov	x	27-Nov	
58	Electrical	Electrical Function Test	x	13-Nov	x	27-Nov	
59	Mechanical	Cylinder Commissioning	x	13-Nov	x	27-Nov	
60	Mechanical	Hot and Cold Water Function Testing Including Temperature Checks	x	20-Nov	x	04-Dec	
61	Electrical	Heating Control including Towel Rail	x	30-Oct	x	13-Nov	
62	Electrical	Door Access/Intercom	x	30-Oct	x	13-Nov	
63	Electrical	Fire Detection Links to All Room (Function Test)	x	13-Nov	x	27-Nov	
64	Electrical	TV System	x	27-Nov	x	04-Dec	
65	Mechanical	MVHR Commissioning and Air Balance Supply & Extract	x	27-Nov	x	06-Dec	
66	Mechanical	Sprinkler Set Up	x	27-Nov	x	04-Dec	
67	**M&E**	**Communal Areas All Levels including Plantroom**	x	04-Sep	x	04-Dec	
68	Electrical	Electrical Dead and Live Test Power and Lighting including Landlords Panel	x	13-Nov	x	27-Nov	
69	Electrical	Lighting Function Test including Emergency Lighting Check	x	13-Nov	x	27-Nov	
70	Electrical	Fire Alarm Function Test	x	13-Nov	x	27-Nov	
71	Electrical	Fire Alarm Cause and Effect	x	27-Nov	x	04-Dec	
72	Electrical	AOV Function Testing and Interface with Fire Alarm	x	27-Nov	x	29-Nov	
73	Electrical	Dry Riser	x	04-Sep	x	04-Sep	
74	Electrical	Door Access/Intercom	x	13-Nov	x	27-Nov	
75	Mechanical	Water Tank and Booster Set	x	27-Nov	x	04-Dec	
76	Electrical	Electrical Testing of Isolator to Apartments	x	25-Sep	x	27-Nov	
77	Mechanical	Sprinkler Priority Switch	x	27-Nov	x	04-Dec	
78	**M&E**	**External Services Including Bike and Bin Store**	x	04-Dec	x	12-Dec	
79	Electrical	Dead and Live Test Lighting and Power	x	04-Dec	x	11-Dec	
80	Mechanical	CAT V Water Tank	x	11-Dec	x	11-Dec	
81	Electrical	Lightning Protection	x	04-Dec	x	04-Dec	
82	Electrical	Fire Alarm System Including all Links to the Site Wide System	x	12-Dec	x	12-Dec	
83	**M&E**	**Witnessing, Client Demonstration and End User Training**	x	05-Dec	x	19-Dec	
84	M&E	Apartment Witnessing of Systems EWC Prior to Client	x	05-Dec	x	08-Dec	
85	Electrical	Witnessing of the Fire Alarm Cause and Effect EWC Prior to Client	x	14-Dec	x	14-Dec	
86	Electrical	Emergency Lighting EWC Prior to Client	x	14-Dec	x	14-Dec	
87	M&E	Client and End User Training within Apartments and Communal Areas	x	19-Dec	x	19-Dec	
88	M&E	Demonstrations to the Fire Officer and Building Control for Sign Off	x	22-Dec	x	22-Dec	
89	M&E	O&M's Including Test Certification	x	15-Dec	x	15-Dec	

6.12. Appendix L – Bat and Bird Survey

Ancoats Dispensary, Old Mill Street, Manchester M4 6FL

LICENSED BAT AND BIRD SURVEY AND ASSESSMENT

October 2020

[ERAP (Consultant Ecologists) Ltd ref: 2020-194]

ERAP (Consultant Ecologists) Ltd
49a Manor Lane
Penwortham
Preston
Lancashire
PR1 0TA

Tel: 01772 750502

mail@erap.co.uk
www.erap.co.uk

CONTENTS

Summary 3

1.0 Introduction 4
1.1 Background and Rationale 4
1.2 Scope of Works 4

2.0 Method of Survey 4
2.1 Desktop Study and Data Search 4
2.2 Vegetation and Habitats 4
2.3 Daylight Licensed Bat Survey 5
2.4 Bat Activity Presence / Absence Survey 6
2.5 Survey and Reporting Limitations 7
2.6 Evaluation Methods 7

3.0 Survey Results 7
3.1 Desktop Study and Data Search 7
3.2 Vegetation and Habitats 9
3.3 Daylight Licensed Bat Survey 9
3.4 Dawn Re-entry Survey 10

4.0 Evaluation and Assessment 10
4.1 Description of Proposals 10
4.2 Designated Sites for Nature Conservation 10
4.3 Vegetation and Habitats 10
4.4 Protected Species and Other Wildlife 10

5.0 Recommendations 11
5.1 Introduction 11
5.2 Best Practice Measures to be Applied During Works 11
5.3 Nesting Birds 11
5.4 Lighting 11
5.5 Provision of Opportunities for Nesting Birds 11

6.0 Conclusion 12

7.0 References 12

8.0 Appendix 1: Table 14

9.0 Appendix 2: Figure 18

List of Tables

Table 2.1: Consideration of Suitability of Foraging and Commuting Habitat for Bats 5
Table 2.2: Survey Equipment Used / Available for Use During Daylight Bat Survey 6
Table 2.3: Dawn Re-entry Survey Date, Weather Conditions and Surveyors 6
Table 3.1: Records of Protected Species Within a 1 Kilometre Radius of the Site 8
Table 8.1: Photographs 14
Table 8.2: Activity Survey 1, Date: 14th September 2020, Sunrise time: 06:42 Start time: 05:00 17

List of Figures

Figure 1: Google Earth Image to Show Site and Surveyor Positions During Bat Activity and Dawn Re-entry Survey 18

Document Control

Survey Type:	**Surveyors[1]**	**Survey Date(s)**
Daylight survey and assessment	Victoria Burrows	11th September 2020
Dawn re-entry survey	Victoria Burrows, Sue Lonsdale and Richard Lowe	14th September 2020
Reporting	**Personnel**	**Date**
Author	Victoria Burrows B.Sc. (Hons) M.Sc. CEnv MCIEEM Principal Ecologist	13th October 2020
Signature(s)		
Checked by	Luke Atherton B.Sc. (Hons) M.Sc. Graduate Ecologist	14th October 2020
Revised and issued by	Victoria Burrows	14th October 2020
Report issued to	Great Places Housing Group	
Version Number	1	

[1] *Licence reference numbers*

Bats

Victoria Burrows, Natural England Class Survey Licence (bats, Level 2) Registration Number 2015-10390-CLS-CLS

Barn owl

Victoria Burrows Natural England Class Survey Licence Registration Number CL29/00061

SUMMARY

Introduction and Scope

i. ERAP (Consultant Ecologists) Ltd was commissioned to carry out a licensed bat and bird survey and assessment of the Ancoats Dispensary building off Old Mill Street, Manchester in September 2020. The survey and assessment are required in connection with a planning application proposing the restoration of the dilapidated Grade II listed building and redevelopment for residential use.

ii. This report presents the results of a desktop study and data search, a daylight licensed bat survey and assessment, including a dawn re-entry survey, carried out in September 2020. The survey was carried out by a licensed, qualified and experienced ecologist with assistants. The scope of survey undertaken is appropriate to identify potential ecological constraints, the remit of mitigation required and opportunities for biodiversity associated with the proposals.

Results of Survey and Assessment

iii. The Ancoats Dispensary Grade II listed building is located within the Ancoats area of Manchester city centre and comprises a brick building with no roof supported by extensive scaffolding. Old Mill Street and associated residential and office buildings are present to the north-west. Land to the south-west and south-east is currently occupied by an operational construction site. Bare ground / a former site compound and residential buildings are present to the north-east. Within 100 metres of the building are the Ashton Canal and the Rochdale Canal and associated locks and wharfs.

iv. The site has no statutory or non-statutory designation for nature conservation. Direct and indirect adverse effects on statutory and non-statutory designated sites for nature conservation are reasonably discounted, refer to **Section 4.2**.

v. Vegetation at the site is limited to self-seeded ruderal herbs and grasses of common and widespread species within the floors and curtilage of the building and occasional rupestral herbs on the elevation walls of the building. No invasive plant species listed on Schedule 9 of the *Wildlife and Countryside Act 1981* (as amended) were detected.

vi. The extensive scaffolding and walkways at eaves height around the building were accessed during the daylight licensed bat survey and assessment. No evidence of current or previous use of the building by roosting bats was detected. Owing to the exposed condition of the dilapidated building and its location on a well-illuminated urban street, the building is assessed to be of negligible to low suitability for use by roosting bats.

vii. To comply with the guidance at Table 7.3 of *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn) (Collins, J. (ed), 2016) and to address the safety access limitations experienced during the daylight survey one bat activity survey was carried out. No bat emergence or re-entry activity was detected. The only bat activity detected was two brief common pipistrelle passes over the land to the west of the site at approximately 30 minutes before sunrise.

viii. With the exception of feral pigeon, no evidence of use of the building by nesting birds was detected.

ix. It is considered that an appropriate and proportionate level of survey has been applied to determine the presence / likely absence of roosting bats. No further surveys for roosting bats or other protected species are required to comply with the relevant survey guidelines and inform the planning application and decision.

Conclusion

x. The restoration and redevelopment proposals at Ancoats Dispensary can be achieved with no adverse effect on designated sites for nature conservation, ecologically valuable habitats and roosting bats. Mitigation and actions to be applied for the protection of nesting birds will be implemented.

xi. Other actions to ensure compliance with wildlife legislation, relevant planning policy and best practice will be implemented and are described in **Section 5.0**.

1.0 INTRODUCTION

1.1 Background and Rationale

1.1.1 ERAP (Consultant Ecologists) Ltd was commissioned to carry out a licensed bat and bird survey and assessment of the Ancoats Dispensary building off Old Mill Street, Manchester, M4 6FL (hereafter referred to as the 'site') in September 2020. The Ordnance Survey (OS) grid reference at the centre of the site is SJ 85442 98432.

1.1.2 The survey and assessment are required in connection with a planning application proposing the restoration of the dilapidated Grade II listed building and redevelopment for residential use.

1.2 Scope of Works

1.2.1 The scope of ecological works undertaken in September 2020 comprised:

a. A desktop study and data search for known ecological information at the site and the local area;

b. Assessment of the ecological value of the habitats within the site with the use of the National Vegetation Classification (NVC) and the Ratcliffe criteria, as presented in *A Nature Conservation Review* (Ratcliffe, 1977);

c. A daylight licensed bat survey of the building and trees followed by a dawn re-entry survey;

d. Survey and assessment of the suitability of the building for use by nesting birds, including species listed on Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended);

e. The identification of any potential ecological constraints on the proposals and the specification of the scope of mitigation and ecological enhancement required in accordance with wildlife legislation, planning policy guidance and other relevant guidance; and

f. The identification of any further surveys or precautionary actions that may be required prior to the commencement of works.

2.0 METHOD OF SURVEY

2.1 Desktop Study and Data Search

2.1.1 The following sources of information and ecological records were consulted:

a. MAGiC: A web-based interactive map which brings together geographic information on key environmental schemes and designations, including details of statutory nature conservation sites;

b. Greater Manchester Local Record Centre (GMLRC); and

c. Greater Manchester Biodiversity Action Plans (BAP).

2.2 Vegetation and Habitats

2.2.1 The self-seeded plant species within the damp interior of the building were viewed from the scaffold with the assistance of binoculars.

2.2.2 Searches were made for uncommon, rare and statutorily protected plant species, those species listed as protected in the *Wildlife and Countryside Act 1981* (as amended) and species which are indicators of important and uncommon plant communities. Plant nomenclature follows *New Flora of the British Isles 3rd Edition* (Stace, 2010).

2.2.3 Searches were carried out for the presence of invasive species, including those listed on Schedule 9 of the *Wildlife and Countryside Act 1981* (as amended), including Japanese Knotweed (*Fallopia japonica*), Indian Balsam (*Impatiens glandulifera*) and Giant Hogweed (*Heracleum mantegazzianum*).

2.3 Daylight Licensed Bat Survey

Surveyor, Survey Date and Weather Conditions

2.3.1 The daylight licensed bat survey and assessment was carried out by Victoria Burrows, Natural England Class Survey Licence WML CL18 (Bat Survey Level 2), Registration Number 2015-10390-CLS-CLS, on 11th September 2020. The weather conditions were dry, sunny with a light air (Beaufort scale 1) and an air temperature of 17ºC.

2.3.2 Victoria's qualifications and experience meet the criteria as defined in the *Technical Guidance Series Competencies for Species Survey: Bats* (CIEEM, 2013).

Habitat Assessment for Commuting / Foraging Bats

2.3.3 Habitats within and adjacent to the site were assessed for their value and suitability for commuting and foraging bats in accordance with Table 4.1 of *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn),* (Collins, J. (ed), 2016). Reference has been made to the categories and descriptions / examples, presented below.

Table 2.1: Consideration of Suitability of Foraging and Commuting Habitat for Bats

Suitability	Commuting Habitat	Foraging Habitat
Negligible	Negligible habitat features on site likely to be used by commuting bats.	Negligible habitat features on site likely to be used by foraging bats.
Low	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated i.e. not very well connected to the surrounding landscape by other habitat.	Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree or patch of scrub.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens.	Habitat that is linked to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	Continuous, high-quality habitat that is well connected to the wider landscape and is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. Habitats close to and connected to known roosts.	High-quality habitat that is well-connected to the wider landscape and is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Habitats close to and connected to known roosts.

Daylight Survey and Inspection: Building

2.3.4 The survey was carried out in accordance with standard methodology described in the *Bat Mitigation Guidelines* (Mitchell-Jones, 2004), the *Bat Workers' Manual* 3rd Edition (Mitchell-Jones & Mcleish, 2004) and *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn) (Collins, J. (ed), 2016).

2.3.5 The extensive scaffolding and walkways at eaves height around the building were accessed during the daylight licensed bat survey and assessment and an inspection of the external surfaces and walls was carried out to find potential bat roosting habitat or accesses into crevices areas where roosts may be present. Searches for evidence of bat presence in the form of droppings, urine stains, feeding signs, grease marks and other evidence were also carried out.

2.3.6 There is no roof covering at the building and the internal areas could only be viewed from above from the elevated walkways. No other access was possible for health and safety reasons. Despite the access limitations it is confirmed that inspections of areas such as gaps around the window frames and inspections

of representative gaps in the brick elevations walls with a torch and endoscope were achieved to inform the assessment.

2.3.7 A list of equipment used is provided below.

Table 2.2: Survey Equipment Used / Available for Use During Daylight Bat Survey

Ladders
LED Lenser P14 torch
Canon Ixus digital camera
8x20 binoculars
Ridgid Micro Inspection Camera Borescope CA-300

2.3.8 The suitability of the building for use by roosting bats has been assessed in accordance with Table 4.1 of *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn),* (Collins, J. (ed), 2016), taking into account any presence of gaps suitable for access by bats, features suitable for use by roosting bats within the building (including crevice dwelling species and species which can roost in the open in roof voids), and the suitability of the surrounding habitats for use by foraging and commuting bats.

2.4 Bat Activity Presence / Absence Survey

2.4.1 To comply with the guidance at Table 7.3 of *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn) (Collins, J. (ed), 2016) and to address the safety access limitations experienced during the daylight survey one dawn re-entry bat activity survey was carried out.

2.4.2 Three surveyors, experienced in conducting bat surveys, were positioned at suitable locations to maximise the coverage of the building and identified features to determine any entry into or exit from the building by roosting bats, refer to **Figure 1**, appended.

2.4.3 Heterodyne detectors were used to determine any bat detected to species or group (*Myotis* species often cannot be reliably separated to species via their echolocation calls, for example). Recording bat detectors units (Anabat Express and Anabat SD2) were also used to record and analyse echolocation calls after the survey using AnalookW call analysis software.

2.4.4 The dawn re-entry survey commenced at least 1.5 hours before sunrise and continued until around 15 minutes after sunrise provided any bat activity had ceased. Any bat emergence or re-entry activity was recorded. The survey was carried out under suitable conditions. The survey information is presented below.

Table 2.3: Dawn Re-entry Survey Date, Weather Conditions and Surveyors

Date	**14th September 2020**
Sunrise	06:42
Start time	05:00
End time	06:57
Wind	Beaufort scale 0 (calm) throughout
Precipitation	Dry
Air temperatures	11°C throughout
Surveyor Position	**Surveyor and Detector**
1	Sue Lonsdale Batbox Duet and Anabat Express
2	Victoria Burrows Batbox Duet and Anabat SD2
3	Richard Lowe EchoMeter Touch 2 Pro and Anabat Express

Bird Species

2.4.5 Bird species observed and heard during the survey were recorded.

2.4.6 Habitats throughout the site and in the immediate surrounding area were assessed for their value to roosting, feeding and nesting birds, including species listed on Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended).

2.5 Survey and Reporting Limitations

2.5.1 The health and safety access restrictions and completion of a presence / absence bat activity just outside the recognised optimum time of year (June to August inclusive) are recognised. However, in consideration of the exposed condition of the dilapidated building, its location on a well-illuminated urban street with an absence of vegetation such as street trees (refer to **Photos 17** and **18**) and the very low level of bat activity actually detected on the bat activity survey which was completed during favourable conditions, it is concluded that reasonable survey efforts have been applied to assess the building and determine the presence / absence of roosting bats.

2.5.2 All measurements within this report are approximate only, and have been either estimated whilst on site or calculated using mapping software (QGIS) or internet-based mapping services such as MAGiC and Google Earth.

2.6 Evaluation Methods

2.6.1 Government advice on wildlife, as set out in the *National Planning Policy Framework* (Ministry of Housing, Communities and Local Government, 2019) and associated government circulars has been taken into consideration. Legislation relating to protected species, such as those listed under Schedules 1, 5, 6 and 8 of the *Wildlife and Countryside Act 1981* (as amended) and *The Conservation of Habitats and Species Regulations 2017*, is referenced where applicable, and any impacts to protected species are evaluated in accordance with current guidance.

2.6.2 The presence of any Priority Species, as listed under Section 41 of the *Natural Environment and Rural Communities (NERC) Act 2006* is noted, and habitats are assessed in terms of their suitability and value for these species. The presence of habitats and / or species listed by the Greater Manchester Biodiversity Action Plans has been taken into account in the evaluation of the site.

3.0 SURVEY RESULTS

3.1 Desktop Study and Data Search

Statutory Designated Sites for Nature Conservation

3.1.1 The site has no statutory designation for nature conservation.

3.1.2 The site lies 4.4 kilometres to the south-west of Rochdale Canal Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC). Rochdale Canal SSSI and SAC is designated for its important habitats for submerged aquatic plants and emergent vegetation, including extensive colonies of the nationally scarce SAC species Floating Water-plantain (*Luronium natans*). The site also supports a diverse assemblage of aquatic flora, notably its assemblage of pondweeds, *Potamogeton* species.

3.1.3 The site lies within a SSSI Impact Risk Zone for the Rochdale Canal SSSI. The SSSI Impact Risk Zone requires the Local Planning Authority to consult with Natural England on likely risks from the following development categories (Ordnance Survey, 2020):

Airports, helipads and other aviation proposals;

Any industrial / agricultural development that could cause air pollution including industrial processes, livestock and poultry units with floorspace greater than 500m^2, slurry lagoons greater than 750m^2 and manure stores greater than 3500 tonnes; and

General combustion processes greater than 50 megawatt energy input, including energy from waste incineration, other incineration landfill gas generation plant, pyrolysis / gasification, anaerobic digestion, sewage treatment works, other incineration / combustion.

3.1.4 The proposals at the site do not meet any of these criteria.

3.1.5 Clayton Vale Local Nature Reserve (LNR) lies 2.1 kilometres to the east of the site and is separated from the site by extensive urban development.

Non-statutory Designated Sites for Nature Conservation

3.1.6 The site has no non-statutory designation for nature conservation.

3.1.7 The site lies within 200 metres to two Sites of Biological Interest (SBIs), namely Rochdale Canal Stott's Lane - Ducie Street Basin SBI and Ashton Canal (West) SBI. Both SBI's are important for their aquatic flora, including internationally important populations of Floating Water-plantain.

Protected and Notable Species

3.1.8 GMLRC hold no records of protected and notable species for the site.

3.1.9 Records of protected and notable species for a 1 kilometre radius of the site are summarised below.

Table 3.1: Records of Protected Species Within a 1 Kilometre Radius of the Site

Taxon Group	Species Name and Designations[1] and Notes
Birds	**WCAs1** Black redstart (*Phoenicurus ochruros*), kingfisher (*Alcedo atthis*), little ringed plover (*Chadardrius dubius*) and peregrine (*Falco peregrinus*).
	PS Bullfinch (*Pyrrhula pyrrhula*), dunnock (*Prunella modularis*), house sparrow (*Passer domesticus*), lapwing (*Vanellus vanellus*), lesser redpoll (*Carduelis cabaret*), song thrush (*Turdus philomelos*), spotted flycatcher (*Muscicapa striata*), starling (*Sturnus vulgaris*) and yellow wagtail (*Motacilla flava*).
Invertebrates (moths)	Unidentified moth (PS)
Flowering plants	**WCAs8** Floating Water-plantain (*Luronium natans*)
Terrestrial mammals	Badger (*Meles meles*) PBA92. Four signs of badger, clustered 680 metres to the east of the site.
	Unidentified bat (Order *Chiroptera*) EPS, WCAs5 & GMBAP. 1 sign 840 metres from the site.
	Common pipistrelle (*Pipistrellus pipistrellus*) EPS, WCAs5 & GMBAP. 12 recorded roosts, the closest of which is 75 metres from the site; and a total of 25 other signs.
	Pipistrelle (*Pipistrellus* species) EPS, WCAs5 & GMBAP. 2 recorded roosts, the closest at 700 metres from the site; and a total of 3 other signs, the closest of which is 70 metres from the site.
	Myotis (*Myotis* species) EPS, WCAs5 & GMBAP. 1 recorded roost, 730 metres from the site.
	Soprano pipistrelle (*Pipistrellus pygmaeus*) EPS, PS, WCAs5 & GMBAP. 1 sign of a roost, and 1 other sign; the closest of which is 820 metres from the site.

[1]Key to Designation Codes:
EPS = European Protected Species under the *Conservation of Habitats and Species Regulations 2017.*
PBA92 = Protection of Badgers Act 1992.
WCAs1 = Species receives full protection under Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended).
WCAs5 = Species receives full protection under Schedule 5 of the *Wildlife and Countryside Act 1981* (as amended).
WCAs8 = Species receives full protection under Schedule 8 of the *Wildlife and Countryside Act 1981* (as amended).
PS = Priority Species listed under Section 41 of the NERC Act 2006.
GMBAP = Species listed on the Greater Manchester Biodiversity Action Plan.

3.1.10 The presence of these protected and notable species within the wider area has been taken into account throughout this report.

3.2 Vegetation and Habitats

3.2.1 Vegetation at the site is limited to self-seeded ruderal herbs and grasses of common and widespread species such as frequent Butterfly Bush (*Buddleia davidii*), Herb-Robert (*Geranium robertianium*) and occasional Bramble (*Rubus fruticosus* agg.) and Elder (*Sambucus nigra*) within the floors and curtilage of the building.

3.2.2 Rupestral herbs such as occasional Hart's-tongue Fern (*Asplenium scolopendrium*) were noted growing in the mortar at repaired sections of the building, refer to **Photo 13**.

Invasive Plant Species

3.2.3 No Japanese Knotweed or other invasive plant species listed on Schedule 9 of the *Wildlife and Countryside Act 1981* (as amended) were detected.

3.3 Daylight Licensed Bat Survey

Habitat Assessment for Commuting / Foraging Bats

3.3.1 The site and its immediate surrounds are of negligible to low suitability for use by roosting bats owing to the absence of vegetation and the presence of significant illumination along Old Mill Street, refer to **Photos 17** and **18**.

3.3.2 As illustrated on **Figure 1**, appended, land in the wider area comprises the canal corridors and associated green corridors which are considered to provide opportunities for foraging bats and commuting bats within the context of the urban environment.

Daylight Survey: Building

3.3.3 Refer to **Photos 1** to **16**. The Ancoats Dispensary Grade II listed building extends a length of approximately 36 metres and is 13 metres wide and comprises a brick building with no roof supported by extensive scaffolding.

3.3.4 Old Mill Street and associated residential and office buildings are present to the north-west. Land to the south-west and south-east is occupied by an operational construction site. Bare ground / a former site compound and residential buildings are present to the north-east. Within 100 metres of the building are the Ashton Canal and the Rochdale Canal and associated locks and wharfs.

3.3.5 The building is dilapidated and exposed with local areas of collapse, particularly at internal dividing walls.

3.3.6 The complexity of the scaffold around the external elevations create a level of obstruction and limit the suitability for the attraction of roosting bats. Examination of accessible features such as gaps around the rotten timber window (refer to **Photos 11** and **12**) with an endoscope did not detect any bats or signs of previous use by bats such as droppings. No bat droppings were found on the sections of building that could be observed or the associated scaffold and elevated walkways.

3.3.7 Other features with suitability for bat access comprise gaps between the bricks at the cavity walls and beneath brick arches / doorways, particularly where minor areas of mortar are missing.

3.3.8 It is considered that the building may have extended to three storeys. The dividing timber floors are no longer present and the ground floor of the building and associated debris can be viewed from the elevated walkover around the eaves height of the building.

3.3.9 Owing to the exposed condition of the dilapidated building and its location on a well-illuminated urban street, the building is assessed to be of negligible to low suitability for use by roosting bats.

3.4 Dawn Re-entry Survey

3.4.1 No bat emergence or re-entry activity was observed or detected at the building on 14th September 2020.

3.4.2 It is accepted that the gaps and potential roost features on the internal side of the building (as observed during the daylight survey and assessment and described above) were not observed during the dawn survey as access to the scaffold by a number of surveyors and in the dark was not permitted for health and safety reasons. This is one of the reasons why a dawn re-entry survey was selected as an appropriate survey method as this would enable surveyors to track any bats returning to the area and this would enable an assessment to be made in relation to likelihood of bats returning to roosts at the building.

3.4.3 No bat activity was detected by Surveyors 1 and 2 (or the associated recording bat detectors). Surveyor 3 at the western corner of the building detected two off-site passes of common pipistrelle (*Pipistrellus pipistrellus*) at 06:07 and 06:13 only. The bats were not recorded flying over or near to the Ancoats Dispensary building.

Bird Species

3.4.4 Evidence of use of the building by roosting and possibly nesting feral pigeon (*Columba livia domestica*) was found.

3.4.5 With the exception of a magpie (*Pica pica*) resting on the scaffold and a robin (*Erithacus rubecula*) foraging beneath a street light during the dawn bat survey no other birds were detected at the site.

4.0 EVALUATION AND ASSESSMENT

4.1 Description of Proposals

4.1.1 It is proposed to restore and redevelop the Ancoats Dispensary building comprising extensive structural works including the retention of the external facades. Owing to the fragile condition of the building the works will be carried out in accordance with a detailed structural assessment.

4.2 Designated Sites for Nature Conservation

4.2.1 Owing to the small scale nature of the proposals, the enclosed status of the site and the absence of hydrological connectivity between the site and the designated sites in the wider area, direct and indirect adverse effects on any statutory and non-statutory designated sites are reasonably discounted.

4.3 Vegetation and Habitats

4.3.1 None of the habitats within the site are of significant interest in terms of their plant species composition. None of the habitats present are representative of semi-natural habitat or Priority Habitat.

4.4 Protected Species and Other Wildlife

Bats

4.4.1 No evidence of current or previous use of the building by roosting bats was detected during the daylight survey and dawn re-entry survey carried out in September 2020.

4.4.2 It is considered that an appropriate and proportionate level of survey has been applied to determine the presence / likely absence of roosting bats. No further surveys for roosting bats or other protected species are required to comply with the relevant survey guidelines and inform the planning application and decision.

4.4.3 The best practice measures to be applied during the works are described at **Section 5.2**.

4.4.4 The building provides limited opportunities for nesting birds. Consideration of birds (including protection of breeding birds and recommended enhancements for Priority Species) are presented at **Section 5.3**.

5.0 RECOMMENDATIONS

5.1 Introduction

5.1.1 The recommendations described below aim to ensure that the proposals are implemented in accordance with relevant wildlife legislation, Natural England guidance, the principles of the National Planning Policy Framework (NPPF), local planning policy and best practice.

5.1.2 The recommendations are appropriate and proportionate to the scale of the proposals and the ecological baseline conditions. Where possible, opportunities to enhance the value of the site for urban wildlife have been identified, as required by Chapter 15, paragraph 175 point 'd' of the NPPF and other relevant planning documents.

5.2 Best Practice Measures to be Applied During Works

Demolition and Renovation Works

5.2.1 Prior to the commencement of works it is recommended that a Toolbox Talk in relation to bats is issued to the contractor. This can be delivered by the licensed ecologist either at a pre-commencement meeting or site, as a written document for inclusion in the site manager's induction pack or via a telephone conference.

5.2.2 During the works it is recommended that the features such as timber window frames and copings are removed carefully by hand. The copings should be lifted, rather than slid, and the underside must be checked for bats prior to stacking or discarding.

Discovery of a Bat

5.2.3 If at any time during the works a bat is discovered or suspected all contractors must withdraw from the area and ERAP (Consultant Ecologists) Ltd (01772 750502) or the Bat Conservation Trust must be contacted for further guidance.

5.3 Nesting Birds

Protection

5.3.1 All wild birds are protected under the *Wildlife and Countryside Act 1981* (as amended) while they are breeding. It is advised that the works are scheduled to commence outside the bird nesting season unless it is appropriately demonstrated that no nesting birds are present. The bird breeding season typically extends between March to August inclusive.

5.3.2 If nesting birds are present an ecologist can provide guidance in relation to the protection of the nesting birds in conjunction with the scheduled works. This may involve cordoning off an area of the site until the young birds have fledged.

Provision of Opportunities for Nesting Birds

5.3.3 In accordance with best practice it is recommended that opportunities for nesting birds are accommodated at the renovated building. The provisions will need to be in accordance with any considerations relating to the listed status of the building but may comprise wall mounted or integrated provisions for house sparrow (a Priority Species) and / or swift. Examples are provided below.





Insert 1: Schwegler 1SP House Sparrow Nesting Terrace (left) or Ibstock Eco-habitat for Swifts (right)

5.4 Lighting

5.4.1 Paragraph 180, bullet point 'c' in Chapter 15 (conserving and enhancing the natural environment) of the NPPF states that development should:

'limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'

5.4.2 The lighting scheme to be implemented at the site must involve the use of appropriate products and screening, where necessary, to ensure no excessive artificial lighting is installed at the site.

5.4.3 The lighting scheme will be designed with reference to current guidance, namely:

a. *Guidance Note 8: Bats and Artificial Lighting in the UK* (Institution of Lighting Professionals & Bat Conservation Trust, 2018); and

b. *Bats and lighting: Overview of current evidence and mitigation guidance* (Stone, 2014).

6.0 CONCLUSION

6.1 The restoration and redevelopment proposals at Ancoats Dispensary can be achieved with no adverse effect on designated sites for nature conservation, ecologically valuable habitats, roosting bats and other relevant protected species.

6.2 Actions to ensure compliance with wildlife legislation, relevant planning policy and best practice will be implemented and are described in **Section 5.0**.

7.0 REFERENCES

CIEEM, 2013. *Technical Guidance Series Competencies for Species: Bats.* Winchester: Chartered Institute of Ecology and Environmental Management.

CIEEM, 2016. *Guidelines for Accessing and Using Biodiversity Data,* Winchester: Chartered Institute of Ecology and Environmental Management (CIEEM).

CIEEM, 2018. *Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine,* Winchester: Chartered Institute of Ecology and Environmental Management.

Collins, J. (ed), 2016. *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn).* London: The Bat Conservation Trust.

Eaton, M. A. et al., 2015. Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. *British Birds,* Issue 108, pp. 708-746.

Great Britain, 1981. *Wildlife and Countryside Act.* London: H.M.S.O.

Great Britain, 2006. *Natural Environment and Rural Communities Act.* London: H.M.S.O.

Great Britain, 2017. *The Conservation of Habitats and Species Regulations.* London: H.M.S.O.

Institution of Lighting Professionals & Bat Conservation Trust, 2018. *Guidance Note 8: Bats and Artificial Lighting in the UK.* [Online]
Available at: https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/
[Accessed 18 October 2018].

JNCC, 2010. *Handbook for Phase 1 Habitat Survey: A technique for Environmental Audit.* Peterborough: NCC.

Maddock, A., 2008. *UK Biodiversity Action Plan; Priority Habitat Descriptions (Updated Dec 2011).* [Online]
Available at: http://jncc.defra.gov.uk/page-5706

Ministry of Housing, Communities & Local Government, 2005. *Circular 06/05: Biodiversity and Geological Conservation - Statutory Obligations and Their Impact Within The Planning System,* London: Office of the Deputy Prime Minister.

Ministry of Housing, Communities and Local Government, 2019. *National Planning Policy Framework.* London: H.M.S.O.

Ordnance Survey, 2020. *Site Check Report Centroid Grid Ref: SJ85449842.* [Online]
Available at: http://magic.defra.gov.uk/magicmap.aspx
[Accessed 22 September 2020].

Ratcliffe, D. A., 1977. *A Nature Conservation Review.* Cambridge: Cambridge University Press.

Stace, C. A., 2010. *New Flora of the British Isles 3rd Edition.* Cambridge: Cambridge University Press.

Stone, E. L., 2014. *Bats and Lighting: Overview of current evidence and mitigation guidance.* Bristol: University of Bristol.

8.0 APPENDIX 1: TABLE

Table 8.1: Photographs



Photo 1: South-eastern and north-eastern elevations



Photo 2: North-eastern elevation



Photo 3: North-western elevation along Old Mill Street



Photo 4: North-western elevation along Old Mill Street



Photo 5: Brick façade of building at north-western elevation



Photo 6: Extent of scaffold supporting the building



Photo 7: View of the building from above showing exposed condition and absence of a roof covering



Photo 8: View of the building from above showing exposed condition and absence of a roof covering. Butterfly Bush plans growing in brickwork



Photo 9: View of exposed brickwork at internal areas



Photo 10: Mortared gaps between brickwork and beneath copings



Photo 11: Gaps around the rotten timber window frames were examined with torches and an endoscope to search for bats and evidence of previous use by bats



Photo 12: Gaps around the rotten timber window frames were examined with torches and an endoscope to search for bats and evidence of previous use by bats



Photo 13: Hart's-tongue Fern growing in mortar



Photo 14: Large and well -mortared coping stones present

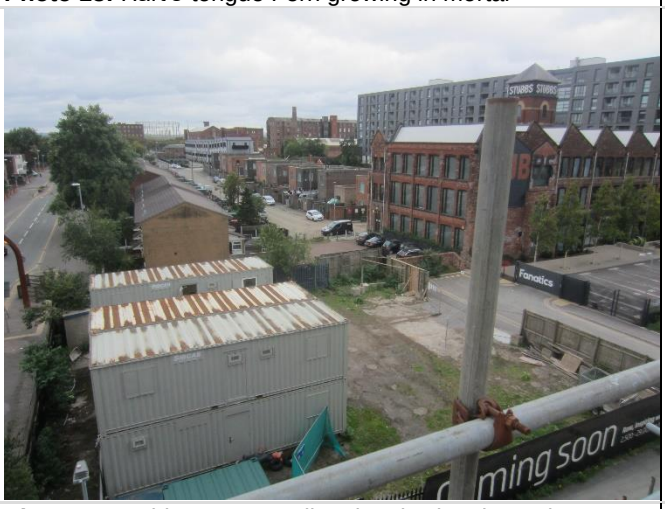


Photo 15: Habitats surrounding the site (north-east)



Photo 16: Extent of complex scaffold supporting the building

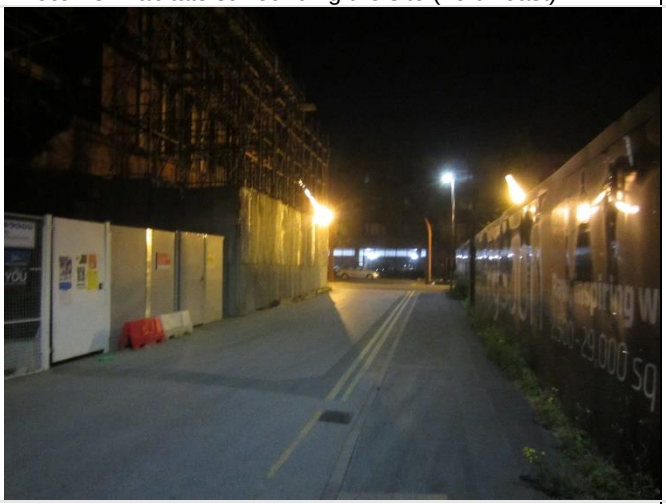


Photo 17: View of north-eastern elevation and lighting on Old Mill Street at start of dawn re-entry bat survey



Photo 18: View of north-eastern elevation and lighting on Old Mill Street at start of dawn re-entry bat survey

Table 8.2: Activity Survey 1, Date: 14th September 2020, Sunrise time: 06:42 Start time: 05:00

Surveyor Position 1: Sue Lonsdale

Time	Species	Number	Notes
-	-	-	No bat activity recorded
06:57	End		
No bat activity was recorded on the Anabat Express.			

Surveyor Position 2: Victoria Burrows

Time	Species	Number	Notes
-	-	-	No bat activity recorded
06:57	End		
No bat activity was recorded on the SD2.			

Surveyor Position 3: Richard Lowe

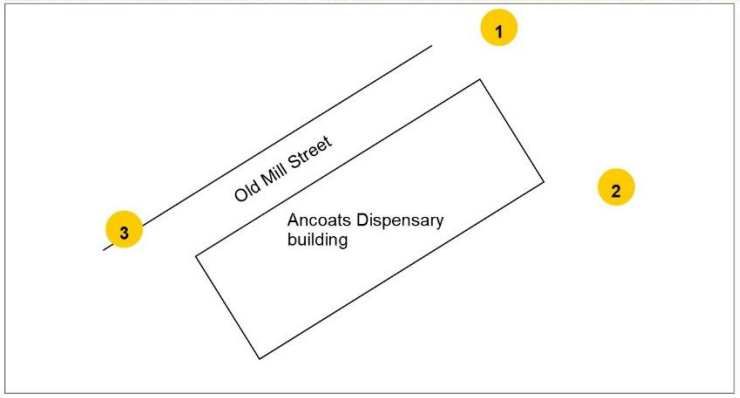
Time	Species	Number	Notes
06:07	Common pipistrelle	1	Brief pass off-site to the west
06:13	Common pipistrelle	1	Brief pass off-site to the west
06:57	End		
No bat activity was recorded on the Anabat Express.			

9.0 APPENDIX 2: FIGURE

Figure 1: Google Earth Image to Show Site and Surveyor Positions During Bat Activity and Dawn Re-entry Survey



Source image: Google Earth



2 Surveyor position

Ancoats Dispensary building

Project Name: Ancoats Dispensary, Old Mill Street, Manchester M4 6FL

Title: Google Earth Image to Show Site and Surveyor Positions During Bat Activity and Dawn Re-entry Survey

Scale:	Drawing No.	Date:
NTS	Figure 1	October 2020

Central Grid Ref:	Reference No.
SJ 85442 98432	ERAP Ltd 2020-194

Version: 1 (VB) 14.10.20

ERAP Ltd Consultant Ecologists
49a Manor Lane, Penwortham, Preston, Lancashire, PR1 0TA.
Tel: 01772 750502
E-mail: mail@erap.co.uk Website: www.erap.co.uk



RIDGE

www.ridge.co.uk