Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 01 July 2022 at 09:53:47

Project Information:

Assessed By: Ben Tunningley (STRO027495) **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 87.34m²

Site Reference : Chain Road **Plot Reference:** Plot 004

Address : Plot 004, Chain Road, Manchester, M9

Client Details:

Name: Great Places

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	44.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	**OK**
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	**OK**
Openings	1.31 (max. 2.00)	1.40 (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	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Database: (rev 500, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

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5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	Programmer, room thermostat and TRVs	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK

Based on:

Overshading:	Very Little
Windows facing: North East	5.83m²
Windows facing: South West	7.13m²
Ventilation rate:	2.50
Blinds/curtains:	None

10 Key features

Roofs U-value	0.09 W/m²K
Party Walls U-value	0 W/m²K

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Ben Tunningley
Assessor Number: STRO027495
Property Address: Plot 004
Chain Road
Manchester
M9

Buiding regulation assessment

	kg/m²/year
TER	17.7
DER	17.1

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		17.1	*(ZC1)*
TER		17.7	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		17.1	
% improvement DER/TER	3.4		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	17.1	*(ZC1)*
CO2 emissions from appliances, equation (L14)	15.82	*(ZC2)*
CO2 emissions from cooking, equation (L16)	2.07	*(ZC3)*
Net CO2 emissions	36.1	*(ZC8)*

Result:

Credits awarded for ENE 1 = 0.5

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 44.24
Credits awarded for ENE 2 = 7.4

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		36.09
Standard DER		18.19
Actual Case CO2 emissions		36.09
Actual DER		18.19
Reduction in CO2 emissions	0	

Credits awarded for ENE 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Ben Tunningley	**Stroma Number:**	STRO027495
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Plot 004

Address : Plot 004, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68	(3a)
First floor	43.67	(1b) x	2.67	(2b) =	116.6	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.28	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.4	=	3.01			(26)
Windows Type 1			5.83	x1/[1/(1.3)+ 0.04]		=	7.2			(27)
Windows Type 2			7.13	x1/[1/(1.3)+ 0.04]		=	8.81			(27)
Floor			43.67	x	0.15	=	6.5505	75	3275.25	(28)
Walls	95.39	15.11	80.28	x	0.2	=	16.06	60	4816.8	(29)
Roof	43.67	0	43.67	x	0.09	=	3.93	9	393.03	(30)
Total area of elements, m²			182.73							(31)
Party wall			43.63	x	0	=	0	70	3054.1	(32)
Internal wall **			82					9	738	(32c)
Internal wall **			105					9	945	(32c)
Internal floor			43.67					18	786.0599	(32d)
Internal ceiling			43.67					9	393.03	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.89 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 12.88 | (36)

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

Total fabric heat loss (33) + (36) = | 58.44 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1	(38)

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

(39)m=	101.5	101.25	101.01	99.87	99.65	98.66	98.66	98.47	99.04	99.65	100.08	100.54	

Average = Sum(39)$_{1...12}$ /12= | 99.86 | (39)

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

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	

Average = Sum(40)$_{1...12}$ /12= | 1.14 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.59 | (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 95.65 | (43)

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

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

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

(44)m=	105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22	

Total = Sum(44)$_{1...12}$ = | 1147.85 | (44)

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

(45)m=	156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11	

Total = Sum(45)$_{1...12}$ = | 1505.01 | (45)

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

(46)m=	23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

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

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

(61)m=	18.76	16.9	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71	(61)

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

(62)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83	(62)

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

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

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

Output from water heater

(64)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Output from water heater (annual)$_{1...12}$ | 1721.87 | (64)

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

(65)m=	56.57	49.6	51.47	45.27	43.73	38.18	35.82	40.48	40.79	47	50.78	54.92	(65)

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

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=	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	(66)

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

(67)m=	53.35	47.38	38.53	29.17	21.81	18.41	19.89	25.86	34.71	44.07	51.43	54.83	(67)

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

(68)m=	349.4	353.03	343.89	324.44	299.89	276.81	261.39	257.77	266.9	286.35	310.91	333.98	(68)

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

(69)m=	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	(71)

Water heating gains (Table 5)

(72)m=	76.04	73.81	69.18	62.88	58.78	53.03	48.15	54.41	56.65	63.17	70.53	73.82	(72)

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

(73)m=	586.65	582.09	559.47	524.35	488.34	456.11	437.3	445.9	466.12	501.46	540.73	570.5	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	1	x	5.83	x	11.28	x	0.46	x	1.11	=	30.26	(75)
Northeast 0.9x	1	x	5.83	x	22.97	x	0.46	x	1.11	=	61.59	(75)
Northeast 0.9x	1	x	5.83	x	41.38	x	0.46	x	1.11	=	110.97	(75)
Northeast 0.9x	1	x	5.83	x	67.96	x	0.46	x	1.11	=	182.24	(75)
Northeast 0.9x	1	x	5.83	x	91.35	x	0.46	x	1.11	=	244.97	(75)
Northeast 0.9x	1	x	5.83	x	97.38	x	0.46	x	1.11	=	261.17	(75)
Northeast 0.9x	1	x	5.83	x	91.1	x	0.46	x	1.11	=	244.32	(75)
Northeast 0.9x	1	x	5.83	x	72.63	x	0.46	x	1.11	=	194.77	(75)
Northeast 0.9x	1	x	5.83	x	50.42	x	0.46	x	1.11	=	135.22	(75)
Northeast 0.9x	1	x	5.83	x	28.07	x	0.46	x	1.11	=	75.27	(75)
Northeast 0.9x	1	x	5.83	x	14.2	x	0.46	x	1.11	=	38.07	(75)
Northeast 0.9x	1	x	5.83	x	9.21	x	0.46	x	1.11	=	24.71	(75)
Southwest 0.9x	1	x	7.13	x	36.79		0.46	x	1.11	=	120.68	(79)
Southwest 0.9x	1	x	7.13	x	62.67		0.46	x	1.11	=	205.56	(79)
Southwest 0.9x	1	x	7.13	x	85.75		0.46	x	1.11	=	281.25	(79)
Southwest 0.9x	1	x	7.13	x	106.25		0.46	x	1.11	=	348.48	(79)
Southwest 0.9x	1	x	7.13	x	119.01		0.46	x	1.11	=	390.33	(79)
Southwest 0.9x	1	x	7.13	x	118.15		0.46	x	1.11	=	387.51	(79)
Southwest 0.9x	1	x	7.13	x	113.91		0.46	x	1.11	=	373.6	(79)
Southwest 0.9x	1	x	7.13	x	104.39		0.46	x	1.11	=	342.38	(79)
Southwest 0.9x	1	x	7.13	x	92.85		0.46	x	1.11	=	304.54	(79)
Southwest 0.9x	1	x	7.13	x	69.27		0.46	x	1.11	=	227.18	(79)
Southwest 0.9x	1	x	7.13	x	44.07		0.46	x	1.11	=	144.54	(79)
Southwest 0.9x	1	x	7.13	x	31.49		0.46	x	1.11	=	103.27	(79)

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

(83)m=	150.93	267.15	392.22	530.73	635.3	648.67	617.91	537.15	439.75	302.45	182.62	127.98	(83)

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

(84)m=	737.59	849.23	951.69	1055.08	1123.64	1104.79	1055.21	983.05	905.88	803.91	723.35	698.48	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.92	0.84	0.7	0.54	0.4	0.45	0.67	0.87	0.95	0.98	(86)

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

(87)m=	19.57	19.8	20.13	20.52	20.8	20.95	20.99	20.98	20.88	20.51	19.97	19.52	(87)

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

(88)m=	19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96	(88)

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

(89)m=	0.97	0.94	0.9	0.8	0.65	0.46	0.31	0.35	0.59	0.84	0.94	0.97	(89)

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

(90)m=	18.67	18.89	19.21	19.59	19.83	19.95	19.97	19.97	19.9	19.59	19.07	18.63	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.13	20.05	19.73	19.21	18.76	(92)

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

(93)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.13	20.05	19.73	19.21	18.76	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.93	0.89	0.8	0.65	0.47	0.33	0.37	0.6	0.83	0.93	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	706.3	792.29	844.26	839.31	732.96	522.18	344.13	360.84	541.04	668.73	674.99	673.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1472.04	1430.65	1298.43	1081.48	825.18	542.77	347.99	366.84	589.7	909.65	1211.95	1464.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	569.71	428.98	337.91	174.36	68.62	0	0	0	0	179.25	386.61	588.45	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2733.88 (98)

Space heating requirement in kWh/m²/year 31.3 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	569.71	428.98	337.91	174.36	68.62	0	0	0	0	179.25	386.61	588.45	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	612.59	461.26	363.34	187.49	73.78	0	0	0	0	192.74	415.71	632.74	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2939.65 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Efficiency of water heater 87 (216)

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(217)m=	89.28	89.19	89.02	88.64	87.98	87	87	87	87	88.63	89.11	89.31	(217)

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

(219)m=	195.8	171.96	179.07	158.59	154.65	136.98	128.97	145.13	146.04	164.65	176.4	190.15

Total = Sum(219a)$_{1...12}$ = 1948.41 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2939.65	
Water heating fuel used		1948.41	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		376.86	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5339.92	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	102.3	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	67.8	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	49.71	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	349.7	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.11	(257)
SAP rating (Section 12)		84.52	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	634.96	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	420.86	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1055.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	195.59	(268)
Total CO2, kg/year		sum of (265)…(271) =		1290.33	(272)
CO2 emissions per m²		(272) ÷ (4) =		14.77	(273)
EI rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3586.37	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2377.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5963.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1156.95	(268)
'Total Primary Energy		sum of (265)…(271) =		7350.63	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		84.16	(273)

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User Details:

Assessor Name:	Ben Tunningley	**Stroma Number:**	STRO027495
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Plot 004

Address : Plot 004, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68	(3a)
First floor	43.67	(1b) x	2.67	(2b) =	116.6	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.28	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.4	=	3.01			(26)
Windows Type 1			5.83	x1/[1/(1.3)+ 0.04]		=	7.2			(27)
Windows Type 2			7.13	x1/[1/(1.3)+ 0.04]		=	8.81			(27)
Floor			43.67	x	0.15	=	6.5505	75	3275.25	(28)
Walls	95.39	15.11	80.28	x	0.2	=	16.06	60	4816.8	(29)
Roof	43.67	0	43.67	x	0.09	=	3.93	9	393.03	(30)
Total area of elements, m²			182.73							(31)
Party wall			43.63	x	0	=	0	70	3054.1	(32)
Internal wall **			82					9	738	(32c)
Internal wall **			105					9	945	(32c)
Internal floor			43.67					18	786.0599	(32d)
Internal ceiling			43.67					9	393.03	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.89 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 12.88 | (36)

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

Total fabric heat loss (33) + (36) = | 58.44 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1	(38)

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

(39)m=	101.5	101.25	101.01	99.87	99.65	98.66	98.66	98.47	99.04	99.65	100.08	100.54	

Average = Sum(39)$_{1...12}$ /12= | 99.86 | (39)

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

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	

Average = Sum(40)$_{1...12}$ /12= | 1.14 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.59 | (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 95.65 | (43)

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

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

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

(44)m=	105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22	

Total = Sum(44)$_{1...12}$ = | 1147.85 | (44)

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

(45)m=	156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11	

Total = Sum(45)$_{1...12}$ = | 1505.01 | (45)

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

(46)m=	23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

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

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

(61)m=	18.76	16.9	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71	(61)

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

(62)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83	(62)

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

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

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

Output from water heater

(64)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Output from water heater (annual)$_{1...12}$ | 1721.87 | (64)

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

(65)m=	56.57	49.6	51.47	45.27	43.73	38.18	35.82	40.48	40.79	47	50.78	54.92	(65)

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

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=	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	(66)

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

(67)m=	22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73	(67)

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

(68)m=	234.1	236.53	230.41	217.37	200.92	185.46	175.13	172.7	178.83	191.86	208.31	223.77	(68)

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

(69)m=	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	(71)

Water heating gains (Table 5)

(72)m=	76.04	73.81	69.18	62.88	58.78	53.03	48.15	54.41	56.65	63.17	70.53	73.82	(72)

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

(73)m=	397.06	394.79	380.37	357.16	333.56	310.93	296.34	302.65	314.67	338.11	364.97	385.13	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.83	x	11.28	x	0.46	x	1.11	=	23.3	(75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.46	x	1.11	=	47.43	(75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.46	x	1.11	=	85.45	(75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.46	x	1.11	=	140.33	(75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.46	x	1.11	=	188.63	(75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.46	x	1.11	=	201.1	(75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.46	x	1.11	=	188.12	(75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.46	x	1.11	=	149.97	(75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.46	x	1.11	=	104.12	(75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.46	x	1.11	=	57.96	(75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.46	x	1.11	=	29.32	(75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.46	x	1.11	=	19.03	(75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.46	x	1.11	=	92.92	(79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.46	x	1.11	=	158.28	(79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.46	x	1.11	=	216.56	(79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.46	x	1.11	=	268.33	(79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.46	x	1.11	=	300.56	(79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.46	x	1.11	=	298.38	(79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.46	x	1.11	=	287.67	(79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.46	x	1.11	=	263.63	(79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.46	x	1.11	=	234.49	(79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.46	x	1.11	=	174.93	(79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.46	x	1.11	=	111.3	(79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.46	x	1.11	=	79.52	(79)

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

(83)m=	116.22	205.7	302.01	408.66	489.18	499.48	475.79	413.61	338.61	232.89	140.61	98.55	(83)

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

(84)m=	513.28	600.5	682.38	765.82	822.74	810.41	772.14	716.26	653.29	571	505.58	483.68	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.92	0.83	0.68	0.53	0.58	0.8	0.95	0.98	0.99	(86)

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

(87)m=	19.26	19.47	19.82	20.26	20.64	20.88	20.96	20.95	20.77	20.27	19.68	19.22	(87)

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

(88)m=	19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96	(88)

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

(89)m=	0.99	0.98	0.96	0.9	0.79	0.6	0.42	0.47	0.74	0.93	0.98	0.99	(89)

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

(90)m=	18.36	18.58	18.92	19.36	19.71	19.91	19.96	19.96	19.83	19.37	18.8	18.33	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.5	18.72	19.06	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(92)

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

(93)m=	18.5	18.72	19.06	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.95	0.89	0.78	0.61	0.44	0.49	0.74	0.92	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	505.41	584.31	647.39	682.91	642.59	492.04	336.88	349.97	482.71	524.95	492.53	477.6	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1441.45	1398.84	1268.26	1057.98	812.17	538.67	347	365.37	581.47	887.94	1184.29	1434.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	696.42	547.36	461.93	270.05	126.16	0	0	0	0	270.07	498.06	712.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3582.08 (98)

Space heating requirement in kWh/m²/year 41.01 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	696.42	547.36	461.93	270.05	126.16	0	0	0	0	270.07	498.06	712.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	748.83	588.56	496.7	290.38	135.66	0	0	0	0	290.4	535.55	765.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3851.7 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Efficiency of water heater 87 (216)

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(217)m=	89.38	89.33	89.21	88.95	88.42	87	87	87	87	88.92	89.26	89.41	(217)

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

(219)m=	195.57	171.7	178.68	158.03	153.89	136.98	128.97	145.13	146.04	164.1	176.11	189.95

Total = Sum(219a)$_{1...12}$ = 1945.16 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3851.7	
Water heating fuel used		1945.16	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		390.5	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6262.36	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	831.97	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	420.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1252.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		1493.72	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.1	(273)
EI rating (section 14)				85	(274)

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User Details:

Assessor Name:	Ben Tunningley	**Stroma Number:**	STRO027495
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Plot 004

Address : Plot 004, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68	(3a)
First floor	43.67	(1b) x	2.67	(2b) =	116.6	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.28	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1	=	2.15			(26)
Windows Type 1			5.83	x1/[1/(1.4)+ 0.04]		=	7.73			(27)
Windows Type 2			7.13	x1/[1/(1.4)+ 0.04]		=	9.45			(27)
Floor			43.67	x	0.13	=	5.6771			(28)
Walls	95.39	15.11	80.28	x	0.18	=	14.45			(29)
Roof	43.67	0	43.67	x	0.13	=	5.68			(30)
Total area of elements, m²			182.73							(31)
Party wall			43.63	x	0	=	0			(32)
Internal wall **			82							(32c)
Internal wall **			105							(32c)
Internal floor			43.67							(32d)
Internal ceiling			43.67							(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14401.27 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 9.41 | (36)

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

Total fabric heat loss (33) + (36) = | 54.55 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1	(38)

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

(39)m=	97.61	97.36	97.12	95.98	95.77	94.77	94.77	94.59	95.15	95.77	96.2	96.65	

Average = Sum(39)$_{1...12}$ /12= | 95.98 | (39)

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

(40)m=	1.12	1.11	1.11	1.1	1.1	1.09	1.09	1.08	1.09	1.1	1.1	1.11	

Average = Sum(40)$_{1...12}$ /12= | 1.1 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.59 | (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 95.65 | (43)

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

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

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

(44)m=	105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22	

Total = Sum(44)$_{1...12}$ = | 1147.85 | (44)

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

(45)m=	156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11	

Total = Sum(45)$_{1...12}$ = | 1505.01 | (45)

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

(46)m=	23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

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

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

(61)m=	50.96	46.03	49.72	46.23	45.82	42.45	43.87	45.82	46.23	49.72	49.32	50.96	(61)

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

(62)m=	207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07	(62)

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

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

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

Output from water heater

(64)m=	207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07

Output from water heater (annual)$_{1...12}$ | 2072.13 | (64)

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

(65)m=	64.62	56.88	59.25	52.38	50.63	44.41	42.29	47.4	47.93	54.82	58.6	62.99	(65)

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

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=	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	(66)

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

(67)m=	22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73	(67)

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

(68)m=	234.1	236.53	230.41	217.37	200.92	185.46	175.13	172.7	178.83	191.86	208.31	223.77	(68)

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

(69)m=	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	(71)

Water heating gains (Table 5)

(72)m=	86.86	84.65	79.64	72.75	68.04	61.69	56.84	63.71	66.57	73.68	81.39	84.66	(72)

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

(73)m=	407.88	405.63	390.83	367.03	342.82	319.59	305.03	311.94	324.59	348.61	375.83	395.97	(73)

6. Solar gains:

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

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.83	x	11.28	x	0.63	x	0.7	=	20.1	(75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.63	x	0.7	=	40.92	(75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.63	x	0.7	=	73.73	(75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.63	x	0.7	=	121.08	(75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.63	x	0.7	=	162.75	(75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.63	x	0.7	=	173.51	(75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.63	x	0.7	=	162.32	(75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.63	x	0.7	=	129.4	(75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.63	x	0.7	=	89.84	(75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.63	x	0.7	=	50.01	(75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.63	x	0.7	=	25.29	(75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.63	x	0.7	=	16.42	(75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.63	x	0.7	=	80.17	(79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.63	x	0.7	=	136.57	(79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.63	x	0.7	=	186.86	(79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.63	x	0.7	=	231.52	(79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.63	x	0.7	=	259.33	(79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.63	x	0.7	=	257.45	(79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.63	x	0.7	=	248.21	(79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.63	x	0.7	=	227.47	(79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.63	x	0.7	=	202.33	(79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.63	x	0.7	=	150.94	(79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.63	x	0.7	=	96.03	(79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.63	x	0.7	=	68.61	(79)

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

(83)m=	100.28	177.49	260.58	352.6	422.08	430.96	410.53	356.87	292.16	200.94	121.33	85.03	(83)

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

(84)m=	508.16	583.12	651.42	719.63	764.9	750.56	715.56	668.81	616.75	549.56	497.15	481	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.74	0.57	0.63	0.87	0.98	1	1	(86)

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

(87)m=	19.79	19.93	20.17	20.49	20.78	20.94	20.99	20.98	20.87	20.5	20.09	19.76	(87)

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

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

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

(89)m=	1	0.99	0.99	0.95	0.86	0.65	0.45	0.5	0.8	0.97	0.99	1	(89)

TER WorkSheet: New dwelling design stage

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

(90)m=	18.36	18.58	18.93	19.4	19.78	19.97	20.01	20.01	19.9	19.42	18.81	18.33	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.58	18.79	19.12	19.57	19.93	20.12	20.16	20.16	20.05	19.58	19.01	18.55	(92)

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

(93)m=	18.58	18.79	19.12	19.57	19.93	20.12	20.16	20.16	20.05	19.58	19.01	18.55	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.85	0.66	0.47	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	506.35	578.74	639.51	681.31	651.45	496.92	333.84	349.25	494.47	529.2	493.47	479.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1394.03	1352.05	1225.85	1023.8	788.34	523.42	337.26	355.28	565.85	860.39	1145.58	1387.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	660.43	519.66	436.23	246.59	101.85	0	0	0	0	246.41	469.51	675.15	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3355.84 (98)

Space heating requirement in kWh/m²/year 38.42 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	660.43	519.66	436.23	246.59	101.85	0	0	0	0	246.41	469.51	675.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	707.1	556.39	467.06	264.02	109.04	0	0	0	0	263.82	502.69	722.86	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3592.98 (211)

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

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

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

Water heating

Output from water heater (calculated above)													
	207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07	

Efficiency of water heater 80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=	87.77	87.54	87.07	86	83.9	80.3	80.3	80.3	80.3	85.88	87.26	87.85	(217)

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

(219)m=	235.85	208.48	218.84	196.51	195.03	179.47	171.94	191.68	193.79	206.33	216	230.01

Total = Sum(219a)$_{1...12}$ = 2443.93 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3592.98	
Water heating fuel used		2443.93	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		390.5	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6502.41	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	776.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	527.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1303.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		1545.57	(272)

TER = 17.7 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 01 July 2022

Property Details: Plot 004

Dwelling type:	End-terrace House
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	2
Front of dwelling faces:	North East
Overshading:	Very Little
Overhangs:	None
Thermal mass parameter:	Calculated 164.89
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	2.5 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	183.38	**(P1)**
Transmission heat loss coefficient:	58.4	
Summer heat loss coefficient:	241.82	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (front)	0	1
South West (rear)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (front)	1	1	1	1	**(P8)**
South West (rear)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (front)	1 x	5.83	89.66	0.46	0	1	240.44	
South West (rear)	1 x	7.13	112.1	0.46	0	1	367.67	
						Total	608.11	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	453.11	434.3	442.9	
Total summer gains	1111.52	1042.41	962.95	**(P5)**
Summer gain/loss ratio	4.6	4.31	3.98	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	0.85	0.85	0.85	
Threshold temperature	20.14	21.56	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 01 July 2022 at 09:53:47

Project Information:

Assessed By: Ben Tunningley (STRO027495) **Building Type:** End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 87.34m²

Site Reference : Chain Road **Plot Reference:** Plot 004

Address : Plot 004, Chain Road, Manchester, M9

Client Details:

Name: Great Places

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	17.7 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.10 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	44.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	**OK**
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	**OK**
Openings	1.31 (max. 2.00)	1.40 (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	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Database: (rev 500, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	Programmer, room thermostat and TRVs	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK

Based on:

Overshading:	Very Little
Windows facing: North East	5.83m²
Windows facing: South West	7.13m²
Ventilation rate:	2.50
Blinds/curtains:	None

10 Key features

Roofs U-value	0.09 W/m²K
Party Walls U-value	0 W/m²K

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Ben Tunningley
Assessor Number: STRO027495
Property Address: Plot 004
Chain Road
Manchester
M9

Buiding regulation assessment

	kg/m²/year
TER	17.7
DER	17.1

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		17.1	*(ZC1)*
TER		17.7	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		17.1	
% improvement DER/TER	3.4		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	17.1	*(ZC1)*
CO2 emissions from appliances, equation (L14)	15.82	*(ZC2)*
CO2 emissions from cooking, equation (L16)	2.07	*(ZC3)*
Net CO2 emissions	36.1	*(ZC8)*

Result:

Credits awarded for ENE 1 = 0.5

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 44.24
Credits awarded for ENE 2 = 7.4

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		36.09
Standard DER		18.19
Actual Case CO2 emissions		36.09
Actual DER		18.19
Reduction in CO2 emissions	0	

Credits awarded for ENE 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Ben Tunningley	**Stroma Number:**	STRO027495
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Plot 004

Address : Plot 004, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68	(3a)
First floor	43.67	(1b) x	2.67	(2b) =	116.6	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.28	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.4	=	3.01			(26)
Windows Type 1			5.83	x1/[1/(1.3)+ 0.04]		=	7.2			(27)
Windows Type 2			7.13	x1/[1/(1.3)+ 0.04]		=	8.81			(27)
Floor			43.67	x	0.15	=	6.5505	75	3275.25	(28)
Walls	95.39	15.11	80.28	x	0.2	=	16.06	60	4816.8	(29)
Roof	43.67	0	43.67	x	0.09	=	3.93	9	393.03	(30)
Total area of elements, m²			182.73							(31)
Party wall			43.63	x	0	=	0	70	3054.1	(32)
Internal wall **			82					9	738	(32c)
Internal wall **			105					9	945	(32c)
Internal floor			43.67					18	786.0599	(32d)
Internal ceiling			43.67					9	393.03	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.89 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 12.88 | (36)

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

Total fabric heat loss (33) + (36) = | 58.44 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1	(38)

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

(39)m=	101.5	101.25	101.01	99.87	99.65	98.66	98.66	98.47	99.04	99.65	100.08	100.54	

Average = Sum(39)$_{1...12}$ /12= | 99.86 | (39)

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

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	

Average = Sum(40)$_{1...12}$ /12= | 1.14 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.59 | (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 95.65 | (43)

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

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

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

(44)m=	105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22	

Total = Sum(44)$_{1...12}$ = | 1147.85 | (44)

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

(45)m=	156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11	

Total = Sum(45)$_{1...12}$ = | 1505.01 | (45)

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

(46)m=	23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

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

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

(61)m=	18.76	16.9	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71	(61)

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

(62)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83	(62)

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

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

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

Output from water heater

(64)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Output from water heater (annual)$_{1...12}$ | 1721.87 | (64)

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

(65)m=	56.57	49.6	51.47	45.27	43.73	38.18	35.82	40.48	40.79	47	50.78	54.92	(65)

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

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=	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	(66)

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

(67)m=	53.35	47.38	38.53	29.17	21.81	18.41	19.89	25.86	34.71	44.07	51.43	54.83	(67)

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

(68)m=	349.4	353.03	343.89	324.44	299.89	276.81	261.39	257.77	266.9	286.35	310.91	333.98	(68)

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

(69)m=	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	(71)

Water heating gains (Table 5)

(72)m=	76.04	73.81	69.18	62.88	58.78	53.03	48.15	54.41	56.65	63.17	70.53	73.82	(72)

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

(73)m=	586.65	582.09	559.47	524.35	488.34	456.11	437.3	445.9	466.12	501.46	540.73	570.5	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	1	x	5.83	x	11.28	x	0.46	x	1.11	=	30.26	(75)
Northeast 0.9x	1	x	5.83	x	22.97	x	0.46	x	1.11	=	61.59	(75)
Northeast 0.9x	1	x	5.83	x	41.38	x	0.46	x	1.11	=	110.97	(75)
Northeast 0.9x	1	x	5.83	x	67.96	x	0.46	x	1.11	=	182.24	(75)
Northeast 0.9x	1	x	5.83	x	91.35	x	0.46	x	1.11	=	244.97	(75)
Northeast 0.9x	1	x	5.83	x	97.38	x	0.46	x	1.11	=	261.17	(75)
Northeast 0.9x	1	x	5.83	x	91.1	x	0.46	x	1.11	=	244.32	(75)
Northeast 0.9x	1	x	5.83	x	72.63	x	0.46	x	1.11	=	194.77	(75)
Northeast 0.9x	1	x	5.83	x	50.42	x	0.46	x	1.11	=	135.22	(75)
Northeast 0.9x	1	x	5.83	x	28.07	x	0.46	x	1.11	=	75.27	(75)
Northeast 0.9x	1	x	5.83	x	14.2	x	0.46	x	1.11	=	38.07	(75)
Northeast 0.9x	1	x	5.83	x	9.21	x	0.46	x	1.11	=	24.71	(75)
Southwest 0.9x	1	x	7.13	x	36.79		0.46	x	1.11	=	120.68	(79)
Southwest 0.9x	1	x	7.13	x	62.67		0.46	x	1.11	=	205.56	(79)
Southwest 0.9x	1	x	7.13	x	85.75		0.46	x	1.11	=	281.25	(79)
Southwest 0.9x	1	x	7.13	x	106.25		0.46	x	1.11	=	348.48	(79)
Southwest 0.9x	1	x	7.13	x	119.01		0.46	x	1.11	=	390.33	(79)
Southwest 0.9x	1	x	7.13	x	118.15		0.46	x	1.11	=	387.51	(79)
Southwest 0.9x	1	x	7.13	x	113.91		0.46	x	1.11	=	373.6	(79)
Southwest 0.9x	1	x	7.13	x	104.39		0.46	x	1.11	=	342.38	(79)
Southwest 0.9x	1	x	7.13	x	92.85		0.46	x	1.11	=	304.54	(79)
Southwest 0.9x	1	x	7.13	x	69.27		0.46	x	1.11	=	227.18	(79)
Southwest 0.9x	1	x	7.13	x	44.07		0.46	x	1.11	=	144.54	(79)
Southwest 0.9x	1	x	7.13	x	31.49		0.46	x	1.11	=	103.27	(79)

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

(83)m=	150.93	267.15	392.22	530.73	635.3	648.67	617.91	537.15	439.75	302.45	182.62	127.98	(83)

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

(84)m=	737.59	849.23	951.69	1055.08	1123.64	1104.79	1055.21	983.05	905.88	803.91	723.35	698.48	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.92	0.84	0.7	0.54	0.4	0.45	0.67	0.87	0.95	0.98	(86)

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

(87)m=	19.57	19.8	20.13	20.52	20.8	20.95	20.99	20.98	20.88	20.51	19.97	19.52	(87)

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

(88)m=	19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96	(88)

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

(89)m=	0.97	0.94	0.9	0.8	0.65	0.46	0.31	0.35	0.59	0.84	0.94	0.97	(89)

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

(90)m=	18.67	18.89	19.21	19.59	19.83	19.95	19.97	19.97	19.9	19.59	19.07	18.63	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.13	20.05	19.73	19.21	18.76	(92)

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

(93)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.13	20.05	19.73	19.21	18.76	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.93	0.89	0.8	0.65	0.47	0.33	0.37	0.6	0.83	0.93	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	706.3	792.29	844.26	839.31	732.96	522.18	344.13	360.84	541.04	668.73	674.99	673.21	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1472.04	1430.65	1298.43	1081.48	825.18	542.77	347.99	366.84	589.7	909.65	1211.95	1464.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	569.71	428.98	337.91	174.36	68.62	0	0	0	0	179.25	386.61	588.45	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2733.88 (98)

Space heating requirement in kWh/m²/year 31.3 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	569.71	428.98	337.91	174.36	68.62	0	0	0	0	179.25	386.61	588.45	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	612.59	461.26	363.34	187.49	73.78	0	0	0	0	192.74	415.71	632.74	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2939.65 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Efficiency of water heater 87 (216)

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(217)m=	89.28	89.19	89.02	88.64	87.98	87	87	87	87	88.63	89.11	89.31	(217)

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

(219)m=	195.8	171.96	179.07	158.59	154.65	136.98	128.97	145.13	146.04	164.65	176.4	190.15

Total = Sum(219a)$_{1...12}$ = 1948.41 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2939.65	
Water heating fuel used		1948.41	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		376.86	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5339.92	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	102.3	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	67.8	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	49.71	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	349.7	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.11	(257)
SAP rating (Section 12)		84.52	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	634.96	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	420.86	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1055.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	195.59	(268)
Total CO2, kg/year		sum of (265)…(271) =		1290.33	(272)
CO2 emissions per m²		(272) ÷ (4) =		14.77	(273)
EI rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3586.37	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2377.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5963.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1156.95	(268)
'Total Primary Energy		sum of (265)…(271) =		7350.63	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		84.16	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Ben Tunningley	**Stroma Number:**	STRO027495
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Plot 004

Address : Plot 004, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68	(3a)
First floor	43.67	(1b) x	2.67	(2b) =	116.6	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.28	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.4	=	3.01			(26)
Windows Type 1			5.83	x1/[1/(1.3)+ 0.04]		=	7.2			(27)
Windows Type 2			7.13	x1/[1/(1.3)+ 0.04]		=	8.81			(27)
Floor			43.67	x	0.15	=	6.5505	75	3275.25	(28)
Walls	95.39	15.11	80.28	x	0.2	=	16.06	60	4816.8	(29)
Roof	43.67	0	43.67	x	0.09	=	3.93	9	393.03	(30)
Total area of elements, m²			182.73							(31)
Party wall			43.63	x	0	=	0	70	3054.1	(32)
Internal wall **			82					9	738	(32c)
Internal wall **			105					9	945	(32c)
Internal floor			43.67					18	786.0599	(32d)
Internal ceiling			43.67					9	393.03	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.89 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 12.88 | (36)

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

Total fabric heat loss (33) + (36) = | 58.44 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1	(38)

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

(39)m=	101.5	101.25	101.01	99.87	99.65	98.66	98.66	98.47	99.04	99.65	100.08	100.54	

Average = Sum(39)$_{1...12}$ /12= | 99.86 | (39)

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

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	

Average = Sum(40)$_{1...12}$ /12= | 1.14 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.59 | (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 95.65 | (43)

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

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

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

(44)m=	105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22	

Total = Sum(44)$_{1...12}$ = | 1147.85 | (44)

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

(45)m=	156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11	

Total = Sum(45)$_{1...12}$ = | 1505.01 | (45)

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

(46)m=	23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

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

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

(61)m=	18.76	16.9	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71	(61)

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

(62)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83	(62)

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

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

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

Output from water heater

(64)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Output from water heater (annual)$_{1...12}$ | 1721.87 | (64)

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

(65)m=	56.57	49.6	51.47	45.27	43.73	38.18	35.82	40.48	40.79	47	50.78	54.92	(65)

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

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=	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	(66)

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

(67)m=	22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73	(67)

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

(68)m=	234.1	236.53	230.41	217.37	200.92	185.46	175.13	172.7	178.83	191.86	208.31	223.77	(68)

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

(69)m=	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	(71)

Water heating gains (Table 5)

(72)m=	76.04	73.81	69.18	62.88	58.78	53.03	48.15	54.41	56.65	63.17	70.53	73.82	(72)

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

(73)m=	397.06	394.79	380.37	357.16	333.56	310.93	296.34	302.65	314.67	338.11	364.97	385.13	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.83	x	11.28	x	0.46	x	1.11	=	23.3	(75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.46	x	1.11	=	47.43	(75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.46	x	1.11	=	85.45	(75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.46	x	1.11	=	140.33	(75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.46	x	1.11	=	188.63	(75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.46	x	1.11	=	201.1	(75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.46	x	1.11	=	188.12	(75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.46	x	1.11	=	149.97	(75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.46	x	1.11	=	104.12	(75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.46	x	1.11	=	57.96	(75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.46	x	1.11	=	29.32	(75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.46	x	1.11	=	19.03	(75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.46	x	1.11	=	92.92	(79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.46	x	1.11	=	158.28	(79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.46	x	1.11	=	216.56	(79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.46	x	1.11	=	268.33	(79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.46	x	1.11	=	300.56	(79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.46	x	1.11	=	298.38	(79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.46	x	1.11	=	287.67	(79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.46	x	1.11	=	263.63	(79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.46	x	1.11	=	234.49	(79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.46	x	1.11	=	174.93	(79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.46	x	1.11	=	111.3	(79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.46	x	1.11	=	79.52	(79)

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

(83)m=	116.22	205.7	302.01	408.66	489.18	499.48	475.79	413.61	338.61	232.89	140.61	98.55	(83)

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

(84)m=	513.28	600.5	682.38	765.82	822.74	810.41	772.14	716.26	653.29	571	505.58	483.68	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.92	0.83	0.68	0.53	0.58	0.8	0.95	0.98	0.99	(86)

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

(87)m=	19.26	19.47	19.82	20.26	20.64	20.88	20.96	20.95	20.77	20.27	19.68	19.22	(87)

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

(88)m=	19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96	(88)

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

(89)m=	0.99	0.98	0.96	0.9	0.79	0.6	0.42	0.47	0.74	0.93	0.98	0.99	(89)

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

(90)m=	18.36	18.58	18.92	19.36	19.71	19.91	19.96	19.96	19.83	19.37	18.8	18.33	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.5	18.72	19.06	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(92)

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

(93)m=	18.5	18.72	19.06	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.95	0.89	0.78	0.61	0.44	0.49	0.74	0.92	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	505.41	584.31	647.39	682.91	642.59	492.04	336.88	349.97	482.71	524.95	492.53	477.6	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1441.45	1398.84	1268.26	1057.98	812.17	538.67	347	365.37	581.47	887.94	1184.29	1434.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	696.42	547.36	461.93	270.05	126.16	0	0	0	0	270.07	498.06	712.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3582.08 (98)

Space heating requirement in kWh/m²/year 41.01 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	696.42	547.36	461.93	270.05	126.16	0	0	0	0	270.07	498.06	712.03	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	748.83	588.56	496.7	290.38	135.66	0	0	0	0	290.4	535.55	765.62	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3851.7 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83

Efficiency of water heater 87 (216)

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(217)m=	89.38	89.33	89.21	88.95	88.42	87	87	87	87	88.92	89.26	89.41	(217)

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

(219)m=	195.57	171.7	178.68	158.03	153.89	136.98	128.97	145.13	146.04	164.1	176.11	189.95

Total = Sum(219a)$_{1...12}$ = 1945.16 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3851.7	
Water heating fuel used		1945.16	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		390.5	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6262.36	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	831.97	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	420.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1252.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		1493.72	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.1	(273)
EI rating (section 14)				85	(274)

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User Details:

Assessor Name:	Ben Tunningley	**Stroma Number:**	STRO027495
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: Plot 004

Address : Plot 004, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68	(3a)
First floor	43.67	(1b) x	2.67	(2b) =	116.6	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		222.28	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.33	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1	=	2.15			(26)
Windows Type 1			5.83	x1/[1/(1.4)+ 0.04]		=	7.73			(27)
Windows Type 2			7.13	x1/[1/(1.4)+ 0.04]		=	9.45			(27)
Floor			43.67	x	0.13	=	5.6771			(28)
Walls	95.39	15.11	80.28	x	0.18	=	14.45			(29)
Roof	43.67	0	43.67	x	0.13	=	5.68			(30)
Total area of elements, m²			182.73							(31)
Party wall			43.63	x	0	=	0			(32)
Internal wall **			82							(32c)
Internal wall **			105							(32c)
Internal floor			43.67							(32d)
Internal ceiling			43.67							(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14401.27 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 9.41 | (36)

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

Total fabric heat loss (33) + (36) = | 54.55 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1	(38)

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

(39)m=	97.61	97.36	97.12	95.98	95.77	94.77	94.77	94.59	95.15	95.77	96.2	96.65	

Average = Sum(39)$_{1...12}$ /12= | 95.98 | (39)

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

(40)m=	1.12	1.11	1.11	1.1	1.1	1.09	1.09	1.08	1.09	1.1	1.1	1.11	

Average = Sum(40)$_{1...12}$ /12= | 1.1 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.59 | (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 95.65 | (43)

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

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

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

(44)m=	105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22	

Total = Sum(44)$_{1...12}$ = | 1147.85 | (44)

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

(45)m=	156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11	

Total = Sum(45)$_{1...12}$ = | 1505.01 | (45)

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

(46)m=	23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

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

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

(61)m=	50.96	46.03	49.72	46.23	45.82	42.45	43.87	45.82	46.23	49.72	49.32	50.96	(61)

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

(62)m=	207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07	(62)

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

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

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

Output from water heater

(64)m=	207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07

Output from water heater (annual)$_{1...12}$ | 2072.13 | (64)

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

(65)m=	64.62	56.88	59.25	52.38	50.63	44.41	42.29	47.4	47.93	54.82	58.6	62.99	(65)

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

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=	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	(66)

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

(67)m=	22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73	(67)

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

(68)m=	234.1	236.53	230.41	217.37	200.92	185.46	175.13	172.7	178.83	191.86	208.31	223.77	(68)

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

(69)m=	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	(71)

Water heating gains (Table 5)

(72)m=	86.86	84.65	79.64	72.75	68.04	61.69	56.84	63.71	66.57	73.68	81.39	84.66	(72)

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

(73)m=	407.88	405.63	390.83	367.03	342.82	319.59	305.03	311.94	324.59	348.61	375.83	395.97	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.83	x	11.28	x	0.63	x	0.7	=	20.1	(75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.63	x	0.7	=	40.92	(75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.63	x	0.7	=	73.73	(75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.63	x	0.7	=	121.08	(75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.63	x	0.7	=	162.75	(75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.63	x	0.7	=	173.51	(75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.63	x	0.7	=	162.32	(75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.63	x	0.7	=	129.4	(75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.63	x	0.7	=	89.84	(75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.63	x	0.7	=	50.01	(75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.63	x	0.7	=	25.29	(75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.63	x	0.7	=	16.42	(75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.63	x	0.7	=	80.17	(79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.63	x	0.7	=	136.57	(79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.63	x	0.7	=	186.86	(79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.63	x	0.7	=	231.52	(79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.63	x	0.7	=	259.33	(79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.63	x	0.7	=	257.45	(79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.63	x	0.7	=	248.21	(79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.63	x	0.7	=	227.47	(79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.63	x	0.7	=	202.33	(79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.63	x	0.7	=	150.94	(79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.63	x	0.7	=	96.03	(79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.63	x	0.7	=	68.61	(79)

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

(83)m=	100.28	177.49	260.58	352.6	422.08	430.96	410.53	356.87	292.16	200.94	121.33	85.03	(83)

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

(84)m=	508.16	583.12	651.42	719.63	764.9	750.56	715.56	668.81	616.75	549.56	497.15	481	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.74	0.57	0.63	0.87	0.98	1	1	(86)

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

(87)m=	19.79	19.93	20.17	20.49	20.78	20.94	20.99	20.98	20.87	20.5	20.09	19.76	(87)

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

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

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

(89)m=	1	0.99	0.99	0.95	0.86	0.65	0.45	0.5	0.8	0.97	0.99	1	(89)

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

(90)m=	18.36	18.58	18.93	19.4	19.78	19.97	20.01	20.01	19.9	19.42	18.81	18.33	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.58	18.79	19.12	19.57	19.93	20.12	20.16	20.16	20.05	19.58	19.01	18.55	(92)

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

(93)m=	18.58	18.79	19.12	19.57	19.93	20.12	20.16	20.16	20.05	19.58	19.01	18.55	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.85	0.66	0.47	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	506.35	578.74	639.51	681.31	651.45	496.92	333.84	349.25	494.47	529.2	493.47	479.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1394.03	1352.05	1225.85	1023.8	788.34	523.42	337.26	355.28	565.85	860.39	1145.58	1387.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	660.43	519.66	436.23	246.59	101.85	0	0	0	0	246.41	469.51	675.15	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3355.84 (98)

Space heating requirement in kWh/m²/year 38.42 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	660.43	519.66	436.23	246.59	101.85	0	0	0	0	246.41	469.51	675.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	707.1	556.39	467.06	264.02	109.04	0	0	0	0	263.82	502.69	722.86	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3592.98 (211)

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

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

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

Water heating

Output from water heater (calculated above)													
	207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07	

Efficiency of water heater 80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=	87.77	87.54	87.07	86	83.9	80.3	80.3	80.3	80.3	85.88	87.26	87.85	(217)

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

(219)m=	235.85	208.48	218.84	196.51	195.03	179.47	171.94	191.68	193.79	206.33	216	230.01

Total = Sum(219a)$_{1...12}$ = 2443.93 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3592.98	
Water heating fuel used		2443.93	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		390.5	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6502.41	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	776.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	527.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1303.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		1545.57	(272)

TER = 17.7 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 01 July 2022

Property Details: Plot 004

Dwelling type:	End-terrace House
Located in:	England
Region:	West Pennines
Cross ventilation possible:	No
Number of storeys:	2
Front of dwelling faces:	North East
Overshading:	Very Little
Overhangs:	None
Thermal mass parameter:	Calculated 164.89
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	2.5 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	183.38	**(P1)**
Transmission heat loss coefficient:	58.4	
Summer heat loss coefficient:	241.82	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North East (front)	0	1
South West (rear)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North East (front)	1	1	1	1	**(P8)**
South West (rear)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North East (front)	1 x	5.83	89.66	0.46	0	1	240.44	
South West (rear)	1 x	7.13	112.1	0.46	0	1	367.67	
						Total	608.11	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	453.11	434.3	442.9	
Total summer gains	1111.52	1042.41	962.95	**(P5)**
Summer gain/loss ratio	4.6	4.31	3.98	**(P6)**
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	0.85	0.85	0.85	
Threshold temperature	20.14	21.56	21.13	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

Energy performance certificate (EPC)

62 Victoria Avenue Blackley MANCHESTER M9 0RE	Energy rating **B**	Valid until:	**17 June 2034**
		Certificate number:	**0360-3538-9360-2194-3915**

Property type	End-terrace house
Total floor area	87 square metres

Rules on letting this property

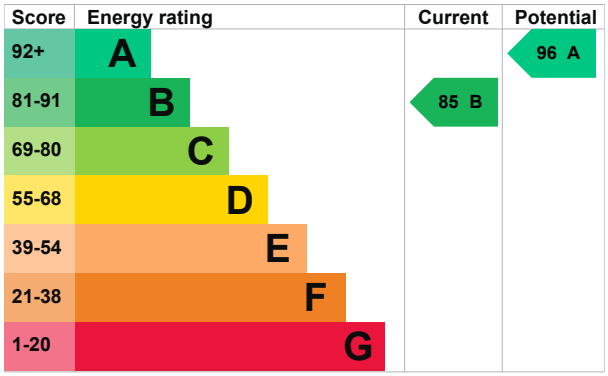
Properties can be let if they have an energy rating from A to E.

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 B. It has the potential to be A.

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 0.20 W/m²K	Very good
Roof	Average thermal transmittance 0.09 W/m²K	Very good
Floor	Average thermal transmittance 0.15 W/m²K	Very good
Windows	High performance glazing	Very good
Main heating	Boiler and radiators, mains gas	Good
Main heating control	Programmer, room thermostat and TRVs	Good
Hot water	From main system	Good
Lighting	Low energy lighting in all fixed outlets	Very good
Air tightness	Air permeability 5.0 m³/h.m² (as tested)	Good
Secondary heating	None	N/A

Primary energy use

The primary energy use for this property per year is 82 kilowatt hours per square metre (kWh/m2).

How this affects your energy bills

An average household would need to spend **£588 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 £56 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:

- 2,614 kWh per year for heating
- 1,722 kWh per year for hot water

Impact on the environment

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

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	1.3 tonnes of CO2
This property's potential production	0.3 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

Step	Typical installation cost	Typical yearly saving
1. Solar water heating	£4,000 - £6,000	£56
2. Solar photovoltaic panels	£3,500 - £5,500	£460

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	Patrick McGuigan
Telephone	01904 432 325
Email	technical@jspsustainability.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/027210
Telephone	01455 883 250
Email	enquiries@elmhurstenergy.co.uk

About this assessment

Assessor's declaration	No related party
Date of assessment	18 June 2024
Date of certificate	18 June 2024
Type of assessment	SAP