

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.53
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Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 64.88m²

Site Reference : 43 Belmont Road LEAN

Plot Reference: FLAT 1

Address :

Client Details:

Name:

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 19.85 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.52 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 50.7 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.42 kWh/day	
	Permitted by DBSCG: 2.03 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	OK
Hot water controls:	Cylinderstat	OK

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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 (Thames valley):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: West	1.4m ²
Windows facing: North West	6.99m ²
Windows facing: North East	2.79m ²
Windows facing: South West	8.82m ²
Windows facing: South East	2.04m ²
Windows facing: South	1.4m ²
Ventilation rate:	6.00

10 Key features

Roofs U-value	0.12 W/m ² K
Party Walls U-value	0 W/m ² K
Community heating, heat from boilers – mains gas	

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham **Stroma Number:** STRO010943
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.53

Property Address: FLAT 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a)	2.6 (2a)	168.69 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	168.69 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
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 <i>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</i>			0 (11)
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)			0.37 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

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

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (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
Windows Type 1			0.97	$x1/[1/(1.4)+0.04] =$	1.29		(27)
Windows Type 2			4.84	$x1/[1/(1.4)+0.04] =$	6.42		(27)
Windows Type 3			1.93	$x1/[1/(1.4)+0.04] =$	2.56		(27)
Windows Type 4			6.1	$x1/[1/(1.4)+0.04] =$	8.09		(27)
Windows Type 5			1.41	$x1/[1/(1.4)+0.04] =$	1.87		(27)
Windows Type 6			0.97	$x1/[1/(1.4)+0.04] =$	1.29		(27)
Walls Type1	70.53	16.22	54.31	x 0.18 =	9.78		(29)
Walls Type2	17.32	0	17.32	x 0.18 =	3.12		(29)
Roof	38.87	0	38.87	x 0.13 =	5.05		(30)
Total area of elements, m²			126.72				(31)
Party wall			9.14	x 0 =	0		(32)
Party floor			64.88				(32a)
Party ceiling			26.01				(32b)
Internal wall **			91.57				(32c)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 39.45 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9258.56 (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

11.7 (36)

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

Total fabric heat loss

(33) + (36) =

51.15 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
33.98	33.74	33.51	32.41	32.2	31.25	31.25	31.07	31.61	32.2	32.62	33.05

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

85.13	84.89	84.66	83.56	83.35	82.4	82.4	82.22	82.77	83.35	83.77	84.2
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Average = Sum(39)_{1...12} /12=

83.56 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.31	1.31	1.3	1.29	1.28	1.27	1.27	1.27	1.28	1.28	1.29	1.3
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Average = Sum(40)_{1...12} /12=

1.29 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.12

(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

84.45

(43)

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

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

(44)m=

92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89
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Total = Sum(44)_{1...12} =

1013.38 (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=

137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41
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Total = Sum(45)_{1...12} =

1328.7 (45)

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

(46)m=

20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01
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(46)

Water storage loss:

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

150

(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):

1.5

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.81

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.81

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
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(56)

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

(57)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
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(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
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(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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=	186.14	164.18	172.71	155.21	152.38	136.57	131.54	143.81	143.39	160.92	169.67	181.79
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(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
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(63)

FHRS	0	0	0	0	0	0	0	0	0	0	0	0
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(63) (G2)

Output from water heater

(64)m=	186.14	164.18	172.71	155.21	152.38	136.57	131.54	143.81	143.39	160.92	169.67	181.79
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Output from water heater (annual)_{1...12}

1898.31

(64)

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

(65)m=	84.51	75.02	80.04	73.49	73.28	67.3	66.35	70.43	69.56	76.12	78.3	83.06
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(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=	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79

(66)

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

(67)m=	16.5	14.65	11.92	9.02	6.74	5.69	6.15	8	10.73	13.63	15.91	16.96
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(67)

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

(68)m=	185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9
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(68)

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

(69)m=	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58
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(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63
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(71)

Water heating gains (Table 5)

(72)m=	113.58	111.63	107.58	102.08	98.5	93.47	89.19	94.67	96.62	102.32	108.75	111.64
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(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	372.88	371.01	359.38	340.68	321.82	303.51	291.53	296.93	306.46	325.35	347.07	363.24
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(73)

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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	1.93	x	11.28	x	0.63	x	0.7	=	6.66	(75)
Northeast 0.9x	0.77	x	1.93	x	22.97	x	0.63	x	0.7	=	13.55	(75)
Northeast 0.9x	0.77	x	1.93	x	41.38	x	0.63	x	0.7	=	24.41	(75)
Northeast 0.9x	0.77	x	1.93	x	67.96	x	0.63	x	0.7	=	40.08	(75)
Northeast 0.9x	0.77	x	1.93	x	91.35	x	0.63	x	0.7	=	53.88	(75)
Northeast 0.9x	0.77	x	1.93	x	97.38	x	0.63	x	0.7	=	57.44	(75)
Northeast 0.9x	0.77	x	1.93	x	91.1	x	0.63	x	0.7	=	53.73	(75)
Northeast 0.9x	0.77	x	1.93	x	72.63	x	0.63	x	0.7	=	42.84	(75)
Northeast 0.9x	0.77	x	1.93	x	50.42	x	0.63	x	0.7	=	29.74	(75)
Northeast 0.9x	0.77	x	1.93	x	28.07	x	0.63	x	0.7	=	16.55	(75)
Northeast 0.9x	0.77	x	1.93	x	14.2	x	0.63	x	0.7	=	8.37	(75)
Northeast 0.9x	0.77	x	1.93	x	9.21	x	0.63	x	0.7	=	5.43	(75)
Southeast 0.9x	0.77	x	1.41	x	36.79	x	0.63	x	0.7	=	15.85	(77)
Southeast 0.9x	0.77	x	1.41	x	62.67	x	0.63	x	0.7	=	27.01	(77)
Southeast 0.9x	0.77	x	1.41	x	85.75	x	0.63	x	0.7	=	36.95	(77)
Southeast 0.9x	0.77	x	1.41	x	106.25	x	0.63	x	0.7	=	45.79	(77)
Southeast 0.9x	0.77	x	1.41	x	119.01	x	0.63	x	0.7	=	51.28	(77)
Southeast 0.9x	0.77	x	1.41	x	118.15	x	0.63	x	0.7	=	50.91	(77)
Southeast 0.9x	0.77	x	1.41	x	113.91	x	0.63	x	0.7	=	49.09	(77)
Southeast 0.9x	0.77	x	1.41	x	104.39	x	0.63	x	0.7	=	44.98	(77)
Southeast 0.9x	0.77	x	1.41	x	92.85	x	0.63	x	0.7	=	40.01	(77)
Southeast 0.9x	0.77	x	1.41	x	69.27	x	0.63	x	0.7	=	29.85	(77)
Southeast 0.9x	0.77	x	1.41	x	44.07	x	0.63	x	0.7	=	18.99	(77)
Southeast 0.9x	0.77	x	1.41	x	31.49	x	0.63	x	0.7	=	13.57	(77)
South 0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South 0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South 0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South 0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South 0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South 0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South 0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South 0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South 0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South 0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South 0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South 0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.1	x	36.79		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	6.1	x	62.67		0.63	x	0.7	=	116.84	(79)
Southwest	0.9x	0.77	x	6.1	x	85.75		0.63	x	0.7	=	159.86	(79)
Southwest	0.9x	0.77	x	6.1	x	106.25		0.63	x	0.7	=	198.08	(79)
Southwest	0.9x	0.77	x	6.1	x	119.01		0.63	x	0.7	=	221.86	(79)
Southwest	0.9x	0.77	x	6.1	x	118.15		0.63	x	0.7	=	220.26	(79)
Southwest	0.9x	0.77	x	6.1	x	113.91		0.63	x	0.7	=	212.35	(79)
Southwest	0.9x	0.77	x	6.1	x	104.39		0.63	x	0.7	=	194.61	(79)
Southwest	0.9x	0.77	x	6.1	x	92.85		0.63	x	0.7	=	173.1	(79)
Southwest	0.9x	0.77	x	6.1	x	69.27		0.63	x	0.7	=	129.13	(79)
Southwest	0.9x	0.77	x	6.1	x	44.07		0.63	x	0.7	=	82.16	(79)
Southwest	0.9x	0.77	x	6.1	x	31.49		0.63	x	0.7	=	58.7	(79)
West	0.9x	0.77	x	0.97	x	19.64	x	0.63	x	0.7	=	5.82	(80)
West	0.9x	0.77	x	0.97	x	38.42	x	0.63	x	0.7	=	11.39	(80)
West	0.9x	0.77	x	0.97	x	63.27	x	0.63	x	0.7	=	18.76	(80)
West	0.9x	0.77	x	0.97	x	92.28	x	0.63	x	0.7	=	27.36	(80)
West	0.9x	0.77	x	0.97	x	113.09	x	0.63	x	0.7	=	33.53	(80)
West	0.9x	0.77	x	0.97	x	115.77	x	0.63	x	0.7	=	34.32	(80)
West	0.9x	0.77	x	0.97	x	110.22	x	0.63	x	0.7	=	32.67	(80)
West	0.9x	0.77	x	0.97	x	94.68	x	0.63	x	0.7	=	28.07	(80)
West	0.9x	0.77	x	0.97	x	73.59	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	0.97	x	45.59	x	0.63	x	0.7	=	13.51	(80)
West	0.9x	0.77	x	0.97	x	24.49	x	0.63	x	0.7	=	7.26	(80)
West	0.9x	0.77	x	0.97	x	16.15	x	0.63	x	0.7	=	4.79	(80)
Northwest	0.9x	0.77	x	4.84	x	11.28	x	0.63	x	0.7	=	16.69	(81)
Northwest	0.9x	0.77	x	4.84	x	22.97	x	0.63	x	0.7	=	33.97	(81)
Northwest	0.9x	0.77	x	4.84	x	41.38	x	0.63	x	0.7	=	61.21	(81)
Northwest	0.9x	0.77	x	4.84	x	67.96	x	0.63	x	0.7	=	100.52	(81)
Northwest	0.9x	0.77	x	4.84	x	91.35	x	0.63	x	0.7	=	135.12	(81)
Northwest	0.9x	0.77	x	4.84	x	97.38	x	0.63	x	0.7	=	144.05	(81)
Northwest	0.9x	0.77	x	4.84	x	91.1	x	0.63	x	0.7	=	134.75	(81)
Northwest	0.9x	0.77	x	4.84	x	72.63	x	0.63	x	0.7	=	107.43	(81)
Northwest	0.9x	0.77	x	4.84	x	50.42	x	0.63	x	0.7	=	74.58	(81)
Northwest	0.9x	0.77	x	4.84	x	28.07	x	0.63	x	0.7	=	41.52	(81)
Northwest	0.9x	0.77	x	4.84	x	14.2	x	0.63	x	0.7	=	21	(81)
Northwest	0.9x	0.77	x	4.84	x	9.21	x	0.63	x	0.7	=	13.63	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 127.47 225.45 330.1 444.5 529.72 539.75 514.62 449.02 369.45 255.05 154.21 108.1 (83)

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

(84)m= 500.36 596.46 689.48 785.18 851.54 843.26 806.15 745.95 675.91 580.4 501.28 471.33 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.44	0.5	0.75	0.94	0.99	1	(86)
--------	------	------	------	------	------	-----	------	-----	------	------	------	---	------

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

(87)m=	19.7	19.91	20.21	20.58	20.84	20.97	20.99	20.99	20.91	20.55	20.06	19.67	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.83	19.83	19.84	19.85	19.85	19.86	19.86	19.87	19.86	19.85	19.85	19.84	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.88	0.72	0.5	0.33	0.38	0.66	0.92	0.98	0.99	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(90)m=	18.13	18.43	18.87	19.38	19.71	19.84	19.86	19.86	19.79	19.36	18.66	18.09	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.44	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.07	19.45	19.9	20.21	20.33	20.35	20.35	20.28	19.88	19.27	18.78	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.81	19.07	19.45	19.9	20.21	20.33	20.35	20.35	20.28	19.88	19.27	18.78	(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
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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.74	0.54	0.38	0.43	0.69	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	495.36	583.75	655.9	690.54	629.41	457.73	307.14	321.13	468.12	532.06	491.26	467.65	(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)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1235.64	1203.1	1096.54	919.49	708.97	472.36	309.38	325.01	511.3	773.15	1019.26	1227.48	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	550.77	416.2	327.84	164.84	59.19	0	0	0	0	179.37	380.16	565.31	(98)
--------	--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2643.69	(98)
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Space heating requirement in kWh/m²/year

40.75	(99)
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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 93.5 (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)

550.77	416.2	327.84	164.84	59.19	0	0	0	0	179.37	380.16	565.31
--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = [(98)m x (204)] ÷ (206) (211)

589.06	445.14	350.63	176.3	63.31	0	0	0	0	191.84	406.59	604.61
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	2827.48	(211)
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TER WorkSheet: New dwelling design stage

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)

	186.14	164.18	172.71	155.21	152.38	136.57	131.54	143.81	143.39	160.92	169.67	181.79		
Efficiency of water heater													79.8	(216)
(217)m=	87.54	87.19	86.5	84.97	82.53	79.8	79.8	79.8	79.8	85.1	86.9	87.64		(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	212.64	188.3	199.67	182.65	184.64	171.14	164.84	180.21	179.69	189.09	195.24	207.43		
Total = Sum(219a) _{1...12} =													2255.53	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2827.48
Water heating fuel used		2255.53
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
Electricity for lighting		291.37
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5449.39

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	= 610.74
Space heating (secondary)	(215) x	0.519	= 0
Water heating	(219) x	0.216	= 487.2
Space and water heating	(261) + (262) + (263) + (264) =		1097.93
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93
Electricity for lighting	(232) x	0.519	= 151.22
Total CO2, kg/year	sum of (265)...(271) =		1288.08

TER = 19.85 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.53
Printed on 20 July 2022 at 15:44:11

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 65.81m²

Site Reference : 43 Belmont Road LEAN

Plot Reference: FLAT 2

Address :

Client Details:

Name:

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 18.98 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.42 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 45.6 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.42 kWh/day	
	Permitted by DBSCG: 2.03 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

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 (Thames valley):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: West	1.4m ²
Windows facing: North East	4.19m ²
Windows facing: South West	8.82m ²
Windows facing: South East	2.04m ²
Windows facing: South	1.4m ²
Roof windows facing: Horizontal	0.7m ²
Ventilation rate:	6.00

10 Key features

Roofs U-value	0.12 W/m ² K
Party Walls U-value	0 W/m ² K
Community heating, heat from boilers – mains gas	

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham **Stroma Number:** STRO010943
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.53

Property Address: FLAT 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.81 (1a)	2.6 (2a)	171.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.11 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
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 <i>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</i>			0 (11)
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)			0.37 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
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TER WorkSheet: New dwelling design stage

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

0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43
------	------	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

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

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (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
Windows Type 1			1.24	$x1/[1/(1.4) + 0.04] =$	1.64		(27)
Windows Type 2			3.72	$x1/[1/(1.4) + 0.04] =$	4.93		(27)
Windows Type 3			7.82	$x1/[1/(1.4) + 0.04] =$	10.37		(27)
Windows Type 4			1.81	$x1/[1/(1.4) + 0.04] =$	2.4		(27)
Windows Type 5			1.24	$x1/[1/(1.4) + 0.04] =$	1.64		(27)
Rooflights			0.620849	$x1/[1/(1.7) + 0.04] =$	1.055443		(27b)
Walls Type1	69.96	15.83	54.13	x 0.18 =	9.74		(29)
Walls Type2	16.03	0	16.03	x 0.18 =	2.89		(29)
Roof	34.97	0.62	34.35	x 0.13 =	4.47		(30)
Total area of elements, m²			120.96				(31)
Party wall			9.14	x 0 =	0		(32)
Party floor			65.81				(32a)
Party ceiling			30.84				(32b)
Internal wall **			95.68				(32c)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 39.07 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9348.76 (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

10.8 (36)

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

Total fabric heat loss

(33) + (36) =

49.87 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
34.41	34.17	33.94	32.83	32.62	31.66	31.66	31.48	32.03	32.62	33.04	33.48

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

84.28	84.04	83.8	82.7	82.49	81.53	81.53	81.35	81.9	82.49	82.91	83.35
-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	-------

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

82.7 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.28	1.28	1.27	1.26	1.25	1.24	1.24	1.24	1.24	1.25	1.26	1.27
------	------	------	------	------	------	------	------	------	------	------	------

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

1.26 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.14

(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

85.03

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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=

93.53	90.13	86.73	83.33	79.93	76.53	76.53	79.93	83.33	86.73	90.13	93.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

1020.38 (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=

138.71	121.32	125.19	109.14	104.72	90.37	83.74	96.09	97.24	113.32	123.7	134.33
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	-------	--------

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

1337.88 (45)

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

(46)m=

20.81	18.2	18.78	16.37	15.71	13.56	12.56	14.41	14.59	17	18.56	20.15
-------	------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------

(46)

Water storage loss:

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

150

(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):

1.5

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.81

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.81

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

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

(57)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

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

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

(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=	187.09	165.01	173.56	155.96	153.1	137.19	132.12	144.47	144.06	161.7	170.52	182.71
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	--------

(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)

FHRS	0	0	0	0	0	0	0	0	0	0	0	0
------	---	---	---	---	---	---	---	---	---	---	---	---

(63) (G2)

Output from water heater

(64)m=	187.09	165.01	173.56	155.96	153.1	137.19	132.12	144.47	144.06	161.7	170.52	182.71
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	--------

Output from water heater (annual)_{1...12}

1907.49

(64)

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

(65)m=	84.82	75.29	80.33	73.74	73.52	67.5	66.55	70.65	69.79	76.38	78.58	83.37
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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=	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01

(66)

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

(67)m=	16.7	14.83	12.06	9.13	6.83	5.76	6.23	8.09	10.86	13.8	16.1	17.16
--------	------	-------	-------	------	------	------	------	------	-------	------	------	-------

(67)

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

(68)m=	187.33	189.27	184.37	173.94	160.78	148.41	140.14	138.2	143.1	153.53	166.69	179.06
--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------

(68)

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

(69)m=	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7
--------	------	------	------	------	------	------	------	------	------	------	------	------

(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=	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	114.01	112.05	107.97	102.42	98.82	93.75	89.44	94.96	96.93	102.66	109.15	112.05
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	--------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	376.14	374.25	362.51	343.6	324.53	306.03	293.92	299.36	308.99	328.09	350.04	366.38
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Northeast 0.9x	0.77	x	3.72	x	11.28	x	0.63	x	0.7	=	12.83 (75)
Northeast 0.9x	0.77	x	3.72	x	22.97	x	0.63	x	0.7	=	26.11 (75)
Northeast 0.9x	0.77	x	3.72	x	41.38	x	0.63	x	0.7	=	47.04 (75)
Northeast 0.9x	0.77	x	3.72	x	67.96	x	0.63	x	0.7	=	77.26 (75)
Northeast 0.9x	0.77	x	3.72	x	91.35	x	0.63	x	0.7	=	103.85 (75)
Northeast 0.9x	0.77	x	3.72	x	97.38	x	0.63	x	0.7	=	110.71 (75)
Northeast 0.9x	0.77	x	3.72	x	91.1	x	0.63	x	0.7	=	103.57 (75)
Northeast 0.9x	0.77	x	3.72	x	72.63	x	0.63	x	0.7	=	82.57 (75)
Northeast 0.9x	0.77	x	3.72	x	50.42	x	0.63	x	0.7	=	57.32 (75)
Northeast 0.9x	0.77	x	3.72	x	28.07	x	0.63	x	0.7	=	31.91 (75)
Northeast 0.9x	0.77	x	3.72	x	14.2	x	0.63	x	0.7	=	16.14 (75)
Northeast 0.9x	0.77	x	3.72	x	9.21	x	0.63	x	0.7	=	10.48 (75)
Southeast 0.9x	0.77	x	1.81	x	36.79	x	0.63	x	0.7	=	20.35 (77)
Southeast 0.9x	0.77	x	1.81	x	62.67	x	0.63	x	0.7	=	34.67 (77)
Southeast 0.9x	0.77	x	1.81	x	85.75	x	0.63	x	0.7	=	47.43 (77)
Southeast 0.9x	0.77	x	1.81	x	106.25	x	0.63	x	0.7	=	58.77 (77)
Southeast 0.9x	0.77	x	1.81	x	119.01	x	0.63	x	0.7	=	65.83 (77)
Southeast 0.9x	0.77	x	1.81	x	118.15	x	0.63	x	0.7	=	65.36 (77)
Southeast 0.9x	0.77	x	1.81	x	113.91	x	0.63	x	0.7	=	63.01 (77)
Southeast 0.9x	0.77	x	1.81	x	104.39	x	0.63	x	0.7	=	57.74 (77)
Southeast 0.9x	0.77	x	1.81	x	92.85	x	0.63	x	0.7	=	51.36 (77)
Southeast 0.9x	0.77	x	1.81	x	69.27	x	0.63	x	0.7	=	38.32 (77)
Southeast 0.9x	0.77	x	1.81	x	44.07	x	0.63	x	0.7	=	24.38 (77)
Southeast 0.9x	0.77	x	1.81	x	31.49	x	0.63	x	0.7	=	17.42 (77)
South 0.9x	0.77	x	1.24	x	46.75	x	0.63	x	0.7	=	17.72 (78)
South 0.9x	0.77	x	1.24	x	76.57	x	0.63	x	0.7	=	29.02 (78)
South 0.9x	0.77	x	1.24	x	97.53	x	0.63	x	0.7	=	36.96 (78)
South 0.9x	0.77	x	1.24	x	110.23	x	0.63	x	0.7	=	41.77 (78)
South 0.9x	0.77	x	1.24	x	114.87	x	0.63	x	0.7	=	43.53 (78)
South 0.9x	0.77	x	1.24	x	110.55	x	0.63	x	0.7	=	41.89 (78)
South 0.9x	0.77	x	1.24	x	108.01	x	0.63	x	0.7	=	40.93 (78)
South 0.9x	0.77	x	1.24	x	104.89	x	0.63	x	0.7	=	39.75 (78)
South 0.9x	0.77	x	1.24	x	101.89	x	0.63	x	0.7	=	38.61 (78)
South 0.9x	0.77	x	1.24	x	82.59	x	0.63	x	0.7	=	31.3 (78)
South 0.9x	0.77	x	1.24	x	55.42	x	0.63	x	0.7	=	21 (78)
South 0.9x	0.77	x	1.24	x	40.4	x	0.63	x	0.7	=	15.31 (78)

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Southwest	0.9x	0.77	x	7.82	x	36.79		0.63	x	0.7	=	87.93	(79)
Southwest	0.9x	0.77	x	7.82	x	62.67		0.63	x	0.7	=	149.78	(79)
Southwest	0.9x	0.77	x	7.82	x	85.75		0.63	x	0.7	=	204.94	(79)
Southwest	0.9x	0.77	x	7.82	x	106.25		0.63	x	0.7	=	253.93	(79)
Southwest	0.9x	0.77	x	7.82	x	119.01		0.63	x	0.7	=	284.42	(79)
Southwest	0.9x	0.77	x	7.82	x	118.15		0.63	x	0.7	=	282.37	(79)
Southwest	0.9x	0.77	x	7.82	x	113.91		0.63	x	0.7	=	272.23	(79)
Southwest	0.9x	0.77	x	7.82	x	104.39		0.63	x	0.7	=	249.48	(79)
Southwest	0.9x	0.77	x	7.82	x	92.85		0.63	x	0.7	=	221.91	(79)
Southwest	0.9x	0.77	x	7.82	x	69.27		0.63	x	0.7	=	165.54	(79)
Southwest	0.9x	0.77	x	7.82	x	44.07		0.63	x	0.7	=	105.32	(79)
Southwest	0.9x	0.77	x	7.82	x	31.49		0.63	x	0.7	=	75.25	(79)
West	0.9x	0.77	x	1.24	x	19.64	x	0.63	x	0.7	=	7.44	(80)
West	0.9x	0.77	x	1.24	x	38.42	x	0.63	x	0.7	=	14.56	(80)
West	0.9x	0.77	x	1.24	x	63.27	x	0.63	x	0.7	=	23.98	(80)
West	0.9x	0.77	x	1.24	x	92.28	x	0.63	x	0.7	=	34.97	(80)
West	0.9x	0.77	x	1.24	x	113.09	x	0.63	x	0.7	=	42.86	(80)
West	0.9x	0.77	x	1.24	x	115.77	x	0.63	x	0.7	=	43.87	(80)
West	0.9x	0.77	x	1.24	x	110.22	x	0.63	x	0.7	=	41.77	(80)
West	0.9x	0.77	x	1.24	x	94.68	x	0.63	x	0.7	=	35.88	(80)
West	0.9x	0.77	x	1.24	x	73.59	x	0.63	x	0.7	=	27.89	(80)
West	0.9x	0.77	x	1.24	x	45.59	x	0.63	x	0.7	=	17.28	(80)
West	0.9x	0.77	x	1.24	x	24.49	x	0.63	x	0.7	=	9.28	(80)
West	0.9x	0.77	x	1.24	x	16.15	x	0.63	x	0.7	=	6.12	(80)
Rooflights	0.9x	1	x	0.62	x	26	x	0.63	x	0.7	=	6.41	(82)
Rooflights	0.9x	1	x	0.62	x	54	x	0.63	x	0.7	=	13.31	(82)
Rooflights	0.9x	1	x	0.62	x	96	x	0.63	x	0.7	=	23.66	(82)
Rooflights	0.9x	1	x	0.62	x	150	x	0.63	x	0.7	=	36.96	(82)
Rooflights	0.9x	1	x	0.62	x	192	x	0.63	x	0.7	=	47.31	(82)
Rooflights	0.9x	1	x	0.62	x	200	x	0.63	x	0.7	=	49.28	(82)
Rooflights	0.9x	1	x	0.62	x	189	x	0.63	x	0.7	=	46.57	(82)
Rooflights	0.9x	1	x	0.62	x	157	x	0.63	x	0.7	=	38.69	(82)
Rooflights	0.9x	1	x	0.62	x	115	x	0.63	x	0.7	=	28.34	(82)
Rooflights	0.9x	1	x	0.62	x	66	x	0.63	x	0.7	=	16.26	(82)
Rooflights	0.9x	1	x	0.62	x	33	x	0.63	x	0.7	=	8.13	(82)
Rooflights	0.9x	1	x	0.62	x	21	x	0.63	x	0.7	=	5.17	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 152.68 267.44 384.01 503.67 587.8 593.48 568.09 504.11 425.43 300.6 184.25 129.75 (83)

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

(84)m= 528.82 641.7 746.52 847.27 912.34 899.51 862 803.47 734.42 628.69 534.3 496.13 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	0.99	0.98	0.96	0.89	0.75	0.56	0.41	0.46	0.7	0.93	0.99	0.99	(86)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(87)m=	19.77	19.99	20.3	20.65	20.88	20.98	21	20.99	20.93	20.61	20.12	19.73	(87)
--------	-------	-------	------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	19.86	19.86	19.86	19.87	19.88	19.89	19.89	19.88	19.88	19.87	19.87	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.94	0.85	0.68	0.47	0.31	0.35	0.61	0.89	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.25	18.57	19.01	19.49	19.77	19.87	19.89	19.89	19.84	19.46	18.77	18.2	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =	0.44	(91)
---------------------------	------	------

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

(92)m=	18.92	19.2	19.58	20.01	20.26	20.36	20.38	20.38	20.32	19.97	19.37	18.88	(92)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.92	19.2	19.58	20.01	20.26	20.36	20.38	20.38	20.32	19.97	19.37	18.88	(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=	0.99	0.97	0.94	0.86	0.71	0.51	0.36	0.4	0.65	0.9	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	-----	------	-----	------	------	------

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

(95)m=	522.69	624.79	701.24	724.91	643.79	459.26	306.59	321.04	477.92	564.39	521.48	491.7	(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=	1232.49	1201.96	1096.49	918.43	706.35	469.87	308.11	323.64	509.65	773.14	1017.58	1223.69	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	528.09	387.86	294.07	139.33	46.54	0	0	0	0	155.31	357.2	544.6	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2453	(98)
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Space heating requirement in kWh/m²/year

37.27	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
--	-------------------------------	---	-------

Efficiency of main space heating system 1	93.5	(206)
---	------	-------

Efficiency of secondary/supplementary heating system, %	0	(208)
---	---	-------

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

528.09	387.86	294.07	139.33	46.54	0	0	0	0	155.31	357.2	544.6
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(211)m = {[(98)m x (204)] } x 100 ÷ (206)	(211)
---	-------

564.81	414.82	314.51	149.02	49.78	0	0	0	0	166.11	382.03	582.46
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	2623.53	(211)
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TER WorkSheet: New dwelling design stage

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)

	187.09	165.01	173.56	155.96	153.1	137.19	132.12	144.47	144.06	161.7	170.52	182.71	
Efficiency of water heater													79.8 (216)
(217)m=	87.43	87.02	86.21	84.51	82.06	79.8	79.8	79.8	79.8	84.71	86.74	87.55	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	213.98	189.63	201.33	184.53	186.57	171.91	165.56	181.04	180.52	190.9	196.58	208.69	
Total = Sum(219a) _{1...12} =													2271.24 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

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 294.93 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 5264.71 (238)

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	=	566.68 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	490.59 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1057.27 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	153.07 (268)
Total CO2, kg/year	sum of (265)...(271) =			1249.27 (272)

TER = 18.98 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.53
Printed on 20 July 2022 at 15:44:10

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 64.88m²

Site Reference : 43 Belmont Road LEAN

Plot Reference: FLAT 3

Address :

Client Details:

Name:

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 21.79 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 20.10 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 66.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 61.3 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.42 kWh/day	
	Permitted by DBSCG: 2.03 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

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 (Thames valley):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: West	1.4m ²
Windows facing: North West	6.99m ²
Windows facing: North East	2.79m ²
Windows facing: South West	8.82m ²
Windows facing: South East	2.04m ²
Windows facing: South	1.4m ²
Ventilation rate:	3.00

10 Key features

Roofs U-value	0.12 W/m ² K
Party Walls U-value	0 W/m ² K
Community heating, heat from boilers – mains gas	

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham **Stroma Number:** STRO010943
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.53

Property Address: FLAT 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64.88 (1a) x	2.6 (2a) =	168.69 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.88 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	168.69 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				2 x 10 =	20 (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) =	20 ÷ (5) =	0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
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 <i>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</i>		0 (11)
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)		0.37 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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TER WorkSheet: New dwelling design stage

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

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43
------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

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

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (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
Windows Type 1			0.97	$\times 1/[1/(1.4) + 0.04] =$	1.29		(27)
Windows Type 2			4.84	$\times 1/[1/(1.4) + 0.04] =$	6.42		(27)
Windows Type 3			1.93	$\times 1/[1/(1.4) + 0.04] =$	2.56		(27)
Windows Type 4			6.1	$\times 1/[1/(1.4) + 0.04] =$	8.09		(27)
Windows Type 5			1.41	$\times 1/[1/(1.4) + 0.04] =$	1.87		(27)
Windows Type 6			0.97	$\times 1/[1/(1.4) + 0.04] =$	1.29		(27)
Floor			64.88	x 0.13 =	8.4344		(28)
Walls Type1	70.53	16.22	54.31	x 0.18 =	9.78		(29)
Walls Type2	17.32	0	17.32	x 0.18 =	3.12		(29)
Roof	38.87	0	38.87	x 0.13 =	5.05		(30)
Total area of elements, m²			191.6				(31)
Party wall			9.14	x 0 =	0		(32)
Party ceiling			26.01				(32b)
Internal wall **			91.57				(32c)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 47.88 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13800.16 (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

TER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

13.53 (36)

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

Total fabric heat loss

(33) + (36) =

61.42 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
33.98	33.74	33.51	32.41	32.2	31.25	31.25	31.07	31.61	32.2	32.62	33.05

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

95.4	95.16	94.93	93.83	93.62	92.67	92.67	92.49	93.03	93.62	94.04	94.47
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Average = Sum(39)_{1...12} /12=

93.83 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.47	1.47	1.46	1.45	1.44	1.43	1.43	1.43	1.43	1.44	1.45	1.46
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Average = Sum(40)_{1...12} /12=

1.45 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.12

(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

84.45

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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=

92.89	89.52	86.14	82.76	79.38	76	76	79.38	82.76	86.14	89.52	92.89
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Total = Sum(44)_{1...12} =

1013.38 (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=

137.76	120.48	124.33	108.39	104.01	89.75	83.17	95.43	96.57	112.55	122.85	133.41
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Total = Sum(45)_{1...12} =

1328.7 (45)

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

(46)m=

20.66	18.07	18.65	16.26	15.6	13.46	12.47	14.32	14.49	16.88	18.43	20.01
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(46)

Water storage loss:

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

150

(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):

1.5

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.81

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0.81

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
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(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=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
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(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
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(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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=	186.14	164.18	172.71	155.21	152.38	136.57	131.54	143.81	143.39	160.92	169.67	181.79
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(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
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(63)

FHRS	0	0	0	0	0	0	0	0	0	0	0	0
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(63) (G2)

Output from water heater

(64)m=	186.14	164.18	172.71	155.21	152.38	136.57	131.54	143.81	143.39	160.92	169.67	181.79
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Output from water heater (annual)_{1...12}

1898.31

(64)

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

(65)m=	84.51	75.02	80.04	73.49	73.28	67.3	66.35	70.43	69.56	76.12	78.3	83.06
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(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=	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79	105.79

(66)

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

(67)m=	16.5	14.65	11.92	9.02	6.74	5.69	6.15	8	10.73	13.63	15.91	16.96
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(67)

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

(68)m=	185.07	186.99	182.15	171.84	158.84	146.62	138.45	136.53	141.37	151.67	164.68	176.9
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58	33.58
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63	-84.63
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(71)

Water heating gains (Table 5)

(72)m=	113.58	111.63	107.58	102.08	98.5	93.47	89.19	94.67	96.62	102.32	108.75	111.64
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(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	372.88	371.01	359.38	340.68	321.82	303.51	291.53	296.93	306.46	325.35	347.07	363.24
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(73)

TER WorkSheet: New dwelling design stage

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	1.93	x	11.28	x	0.63	x	0.7	=	6.66	(75)
Northeast 0.9x	0.77	x	1.93	x	22.97	x	0.63	x	0.7	=	13.55	(75)
Northeast 0.9x	0.77	x	1.93	x	41.38	x	0.63	x	0.7	=	24.41	(75)
Northeast 0.9x	0.77	x	1.93	x	67.96	x	0.63	x	0.7	=	40.08	(75)
Northeast 0.9x	0.77	x	1.93	x	91.35	x	0.63	x	0.7	=	53.88	(75)
Northeast 0.9x	0.77	x	1.93	x	97.38	x	0.63	x	0.7	=	57.44	(75)
Northeast 0.9x	0.77	x	1.93	x	91.1	x	0.63	x	0.7	=	53.73	(75)
Northeast 0.9x	0.77	x	1.93	x	72.63	x	0.63	x	0.7	=	42.84	(75)
Northeast 0.9x	0.77	x	1.93	x	50.42	x	0.63	x	0.7	=	29.74	(75)
Northeast 0.9x	0.77	x	1.93	x	28.07	x	0.63	x	0.7	=	16.55	(75)
Northeast 0.9x	0.77	x	1.93	x	14.2	x	0.63	x	0.7	=	8.37	(75)
Northeast 0.9x	0.77	x	1.93	x	9.21	x	0.63	x	0.7	=	5.43	(75)
Southeast 0.9x	0.77	x	1.41	x	36.79	x	0.63	x	0.7	=	15.85	(77)
Southeast 0.9x	0.77	x	1.41	x	62.67	x	0.63	x	0.7	=	27.01	(77)
Southeast 0.9x	0.77	x	1.41	x	85.75	x	0.63	x	0.7	=	36.95	(77)
Southeast 0.9x	0.77	x	1.41	x	106.25	x	0.63	x	0.7	=	45.79	(77)
Southeast 0.9x	0.77	x	1.41	x	119.01	x	0.63	x	0.7	=	51.28	(77)
Southeast 0.9x	0.77	x	1.41	x	118.15	x	0.63	x	0.7	=	50.91	(77)
Southeast 0.9x	0.77	x	1.41	x	113.91	x	0.63	x	0.7	=	49.09	(77)
Southeast 0.9x	0.77	x	1.41	x	104.39	x	0.63	x	0.7	=	44.98	(77)
Southeast 0.9x	0.77	x	1.41	x	92.85	x	0.63	x	0.7	=	40.01	(77)
Southeast 0.9x	0.77	x	1.41	x	69.27	x	0.63	x	0.7	=	29.85	(77)
Southeast 0.9x	0.77	x	1.41	x	44.07	x	0.63	x	0.7	=	18.99	(77)
Southeast 0.9x	0.77	x	1.41	x	31.49	x	0.63	x	0.7	=	13.57	(77)
South 0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South 0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South 0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South 0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South 0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South 0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South 0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South 0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South 0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South 0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South 0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South 0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.1	x	36.79		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	6.1	x	62.67		0.63	x	0.7	=	116.84	(79)
Southwest	0.9x	0.77	x	6.1	x	85.75		0.63	x	0.7	=	159.86	(79)
Southwest	0.9x	0.77	x	6.1	x	106.25		0.63	x	0.7	=	198.08	(79)
Southwest	0.9x	0.77	x	6.1	x	119.01		0.63	x	0.7	=	221.86	(79)
Southwest	0.9x	0.77	x	6.1	x	118.15		0.63	x	0.7	=	220.26	(79)
Southwest	0.9x	0.77	x	6.1	x	113.91		0.63	x	0.7	=	212.35	(79)
Southwest	0.9x	0.77	x	6.1	x	104.39		0.63	x	0.7	=	194.61	(79)
Southwest	0.9x	0.77	x	6.1	x	92.85		0.63	x	0.7	=	173.1	(79)
Southwest	0.9x	0.77	x	6.1	x	69.27		0.63	x	0.7	=	129.13	(79)
Southwest	0.9x	0.77	x	6.1	x	44.07		0.63	x	0.7	=	82.16	(79)
Southwest	0.9x	0.77	x	6.1	x	31.49		0.63	x	0.7	=	58.7	(79)
West	0.9x	0.77	x	0.97	x	19.64	x	0.63	x	0.7	=	5.82	(80)
West	0.9x	0.77	x	0.97	x	38.42	x	0.63	x	0.7	=	11.39	(80)
West	0.9x	0.77	x	0.97	x	63.27	x	0.63	x	0.7	=	18.76	(80)
West	0.9x	0.77	x	0.97	x	92.28	x	0.63	x	0.7	=	27.36	(80)
West	0.9x	0.77	x	0.97	x	113.09	x	0.63	x	0.7	=	33.53	(80)
West	0.9x	0.77	x	0.97	x	115.77	x	0.63	x	0.7	=	34.32	(80)
West	0.9x	0.77	x	0.97	x	110.22	x	0.63	x	0.7	=	32.67	(80)
West	0.9x	0.77	x	0.97	x	94.68	x	0.63	x	0.7	=	28.07	(80)
West	0.9x	0.77	x	0.97	x	73.59	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	0.97	x	45.59	x	0.63	x	0.7	=	13.51	(80)
West	0.9x	0.77	x	0.97	x	24.49	x	0.63	x	0.7	=	7.26	(80)
West	0.9x	0.77	x	0.97	x	16.15	x	0.63	x	0.7	=	4.79	(80)
Northwest	0.9x	0.77	x	4.84	x	11.28	x	0.63	x	0.7	=	16.69	(81)
Northwest	0.9x	0.77	x	4.84	x	22.97	x	0.63	x	0.7	=	33.97	(81)
Northwest	0.9x	0.77	x	4.84	x	41.38	x	0.63	x	0.7	=	61.21	(81)
Northwest	0.9x	0.77	x	4.84	x	67.96	x	0.63	x	0.7	=	100.52	(81)
Northwest	0.9x	0.77	x	4.84	x	91.35	x	0.63	x	0.7	=	135.12	(81)
Northwest	0.9x	0.77	x	4.84	x	97.38	x	0.63	x	0.7	=	144.05	(81)
Northwest	0.9x	0.77	x	4.84	x	91.1	x	0.63	x	0.7	=	134.75	(81)
Northwest	0.9x	0.77	x	4.84	x	72.63	x	0.63	x	0.7	=	107.43	(81)
Northwest	0.9x	0.77	x	4.84	x	50.42	x	0.63	x	0.7	=	74.58	(81)
Northwest	0.9x	0.77	x	4.84	x	28.07	x	0.63	x	0.7	=	41.52	(81)
Northwest	0.9x	0.77	x	4.84	x	14.2	x	0.63	x	0.7	=	21	(81)
Northwest	0.9x	0.77	x	4.84	x	9.21	x	0.63	x	0.7	=	13.63	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 127.47 225.45 330.1 444.5 529.72 539.75 514.62 449.02 369.45 255.05 154.21 108.1 (83)

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

(84)m= 500.36 596.46 689.48 785.18 851.54 843.26 806.15 745.95 675.91 580.4 501.28 471.33 (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
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TER WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.97	0.92	0.82	0.65	0.49	0.55	0.79	0.95	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.5	19.71	20.03	20.44	20.76	20.94	20.98	20.98	20.85	20.42	19.89	19.47	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.71	19.71	19.72	19.73	19.73	19.74	19.74	19.74	19.73	19.73	19.72	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.9	0.75	0.54	0.36	0.41	0.69	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=	17.76	18.06	18.53	19.1	19.51	19.7	19.74	19.74	19.63	19.09	18.33	17.72	(90)
--------	-------	-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.44	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.52	18.78	19.18	19.68	20.05	20.24	20.28	20.28	20.16	19.67	19.01	18.48	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.52	18.78	19.18	19.68	20.05	20.24	20.28	20.28	20.16	19.67	19.01	18.48	(93)
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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
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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.89	0.77	0.59	0.42	0.47	0.73	0.93	0.98	0.99	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	495.29	584.25	658.84	702.41	657.57	494.16	335.84	349.97	492.85	537.46	491.62	467.53	(95)
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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)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1356.42	1320.86	1203.97	1011.62	782.18	522.59	341.01	358.43	563.72	849.29	1119.82	1349.01	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	640.68	495	405.58	222.63	92.71	0	0	0	0	232	452.3	655.82	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3196.72	(98)
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Space heating requirement in kWh/m²/year

49.27	(99)
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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 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

640.68	495	405.58	222.63	92.71	0	0	0	0	232	452.3	655.82
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(211)m = [(98)m x (204)] } x 100 ÷ (206) (211)

685.22	529.41	433.77	238.11	99.16	0	0	0	0	248.12	483.75	701.41
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	3418.95	(211)
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TER WorkSheet: New dwelling design stage

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)

	186.14	164.18	172.71	155.21	152.38	136.57	131.54	143.81	143.39	160.92	169.67	181.79	
Efficiency of water heater													79.8 (216)
(217)m=	87.85	87.58	87.02	85.78	83.54	79.8	79.8	79.8	79.8	85.79	87.31	87.94	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	211.88	187.47	198.48	180.95	182.42	171.14	164.84	180.21	179.69	187.58	194.34	206.72	
Total = Sum(219a) _{1...12} =													2245.72 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3418.95
Water heating fuel used		2245.72
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		291.37 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6031.05 (238)

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	=	738.49 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	485.08 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1223.57 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	151.22 (268)
Total CO2, kg/year		sum of (265)...(271) =		1413.72 (272)

TER = 21.79 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.53
Printed on 20 July 2022 at 15:44:08

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 65.81m²

Site Reference : 43 Belmont Road LEAN

Plot Reference: FLAT 4

Address :

Client Details:

Name:

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 20.91 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 18.99 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 56.0 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.42 kWh/day	
	Permitted by DBSCG: 2.03 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	Charging system linked to use of community heating, programmer and at least two room thermostats	OK
Hot water controls:	Cylinderstat	OK

Regulations Compliance Report

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 (Thames valley):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: West	1.4m ²
Windows facing: North East	4.19m ²
Windows facing: South West	8.82m ²
Windows facing: South East	2.04m ²
Windows facing: South	1.4m ²
Ventilation rate:	3.00

10 Key features

Roofs U-value	0.12 W/m ² K
Party Walls U-value	0 W/m ² K
Community heating, heat from boilers – mains gas	

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham **Stroma Number:** STRO010943
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.53

Property Address: FLAT 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.81 (1a)	2.6 (2a)	171.11 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	171.11 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
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 <i>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</i>			0 (11)
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)			0.37 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.37 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43
------	------	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (24d)

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

(25)m= 0.61 0.61 0.6 0.58 0.58 0.56 0.56 0.56 0.57 0.58 0.59 0.59 (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
Windows Type 1			1.29	$\times 1/[1/(1.4) + 0.04] =$	1.71		(27)
Windows Type 2			3.86	$\times 1/[1/(1.4) + 0.04] =$	5.12		(27)
Windows Type 3			8.13	$\times 1/[1/(1.4) + 0.04] =$	10.78		(27)
Windows Type 4			1.88	$\times 1/[1/(1.4) + 0.04] =$	2.49		(27)
Windows Type 5			1.29	$\times 1/[1/(1.4) + 0.04] =$	1.71		(27)
Floor			65.81	$\times$ 0.13	= 8.5553		(28)
Walls Type1	69.96	16.45	53.51	$\times$ 0.18	= 9.63		(29)
Walls Type2	16.03	0	16.03	$\times$ 0.18	= 2.89		(29)
Roof	34.97	0	34.97	$\times$ 0.13	= 4.55		(30)
Total area of elements, m²			186.77				(31)
Party wall			9.14	$\times$ 0	= 0		(32)
Party ceiling			30.84				(32b)
Internal wall **			95.68				(32c)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 47.43 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13923.85 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.47 (36)

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

Total fabric heat loss (33) + (36) = 59.89 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.41	34.17	33.94	32.83	32.62	31.66	31.66	31.48	32.03	32.62	33.04	33.48	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	94.3	94.06	93.83	92.72	92.52	91.56	91.56	91.38	91.93	92.52	92.94	93.37	
Average = Sum(39) _{1...12} / 12 =												92.72	(39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.43	1.43	1.43	1.41	1.41	1.39	1.39	1.39	1.4	1.41	1.41	1.42	
Average = Sum(40) _{1...12} / 12 =												1.41	(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 2.14 (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 85.03 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	93.53	90.13	86.73	83.33	79.93	76.53	76.53	79.93	83.33	86.73	90.13	93.53	
Total = Sum(44) _{1...12} =												1020.38	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	138.71	121.32	125.19	109.14	104.72	90.37	83.74	96.09	97.24	113.32	123.7	134.33	
Total = Sum(45) _{1...12} =												1337.88	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	20.81	18.2	18.78	16.37	15.71	13.56	12.56	14.41	14.59	17	18.56	20.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.5 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.81 (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)

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

Enter (50) or (54) in (55) 0.81 (55)

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Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

187.09	165.01	173.56	155.96	153.1	137.19	132.12	144.47	144.06	161.7	170.52	182.71
--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	--------

 (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)

FHRS

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63) (G2)

Output from water heater

(64)m=

187.09	165.01	173.56	155.96	153.1	137.19	132.12	144.47	144.06	161.7	170.52	182.71
--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	--------

Output from water heater (annual) _{1...12}	1907.49
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

84.82	75.29	80.33	73.74	73.52	67.5	66.55	70.65	69.79	76.38	78.58	83.37
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01	107.01

 (66)

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

(67)m=

16.7	14.83	12.06	9.13	6.83	5.76	6.23	8.09	10.86	13.8	16.1	17.16
------	-------	-------	------	------	------	------	------	-------	------	------	-------

 (67)

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

(68)m=

187.33	189.27	184.37	173.94	160.78	148.41	140.14	138.2	143.1	153.53	166.69	179.06
--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------

 (68)

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

(69)m=

33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61	-85.61
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

114.01	112.05	107.97	102.42	98.82	93.75	89.44	94.96	96.93	102.66	109.15	112.05
--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	--------

 (72)

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

(73)m=

376.14	374.25	362.51	343.6	324.53	306.03	293.92	299.36	308.99	328.09	350.04	366.38
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.86	x	11.28	x	0.63	x	0.7	=	13.31	(75)
Northeast 0.9x	0.77	x	3.86	x	22.97	x	0.63	x	0.7	=	27.09	(75)
Northeast 0.9x	0.77	x	3.86	x	41.38	x	0.63	x	0.7	=	48.81	(75)
Northeast 0.9x	0.77	x	3.86	x	67.96	x	0.63	x	0.7	=	80.17	(75)
Northeast 0.9x	0.77	x	3.86	x	91.35	x	0.63	x	0.7	=	107.76	(75)
Northeast 0.9x	0.77	x	3.86	x	97.38	x	0.63	x	0.7	=	114.88	(75)
Northeast 0.9x	0.77	x	3.86	x	91.1	x	0.63	x	0.7	=	107.47	(75)
Northeast 0.9x	0.77	x	3.86	x	72.63	x	0.63	x	0.7	=	85.68	(75)
Northeast 0.9x	0.77	x	3.86	x	50.42	x	0.63	x	0.7	=	59.48	(75)
Northeast 0.9x	0.77	x	3.86	x	28.07	x	0.63	x	0.7	=	33.11	(75)
Northeast 0.9x	0.77	x	3.86	x	14.2	x	0.63	x	0.7	=	16.75	(75)
Northeast 0.9x	0.77	x	3.86	x	9.21	x	0.63	x	0.7	=	10.87	(75)
Southeast 0.9x	0.77	x	1.88	x	36.79	x	0.63	x	0.7	=	21.14	(77)
Southeast 0.9x	0.77	x	1.88	x	62.67	x	0.63	x	0.7	=	36.01	(77)
Southeast 0.9x	0.77	x	1.88	x	85.75	x	0.63	x	0.7	=	49.27	(77)
Southeast 0.9x	0.77	x	1.88	x	106.25	x	0.63	x	0.7	=	61.05	(77)
Southeast 0.9x	0.77	x	1.88	x	119.01	x	0.63	x	0.7	=	68.38	(77)
Southeast 0.9x	0.77	x	1.88	x	118.15	x	0.63	x	0.7	=	67.88	(77)
Southeast 0.9x	0.77	x	1.88	x	113.91	x	0.63	x	0.7	=	65.45	(77)
Southeast 0.9x	0.77	x	1.88	x	104.39	x	0.63	x	0.7	=	59.98	(77)
Southeast 0.9x	0.77	x	1.88	x	92.85	x	0.63	x	0.7	=	53.35	(77)
Southeast 0.9x	0.77	x	1.88	x	69.27	x	0.63	x	0.7	=	39.8	(77)
Southeast 0.9x	0.77	x	1.88	x	44.07	x	0.63	x	0.7	=	25.32	(77)
Southeast 0.9x	0.77	x	1.88	x	31.49	x	0.63	x	0.7	=	18.09	(77)
South 0.9x	0.77	x	1.29	x	46.75	x	0.63	x	0.7	=	18.43	(78)
South 0.9x	0.77	x	1.29	x	76.57	x	0.63	x	0.7	=	30.19	(78)
South 0.9x	0.77	x	1.29	x	97.53	x	0.63	x	0.7	=	38.45	(78)
South 0.9x	0.77	x	1.29	x	110.23	x	0.63	x	0.7	=	43.46	(78)
South 0.9x	0.77	x	1.29	x	114.87	x	0.63	x	0.7	=	45.29	(78)
South 0.9x	0.77	x	1.29	x	110.55	x	0.63	x	0.7	=	43.58	(78)
South 0.9x	0.77	x	1.29	x	108.01	x	0.63	x	0.7	=	42.58	(78)
South 0.9x	0.77	x	1.29	x	104.89	x	0.63	x	0.7	=	41.35	(78)
South 0.9x	0.77	x	1.29	x	101.89	x	0.63	x	0.7	=	40.17	(78)
South 0.9x	0.77	x	1.29	x	82.59	x	0.63	x	0.7	=	32.56	(78)
South 0.9x	0.77	x	1.29	x	55.42	x	0.63	x	0.7	=	21.85	(78)
South 0.9x	0.77	x	1.29	x	40.4	x	0.63	x	0.7	=	15.93	(78)
Southwest 0.9x	0.77	x	8.13	x	36.79		0.63	x	0.7	=	91.42	(79)
Southwest 0.9x	0.77	x	8.13	x	62.67		0.63	x	0.7	=	155.72	(79)
Southwest 0.9x	0.77	x	8.13	x	85.75		0.63	x	0.7	=	213.06	(79)

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Southwest	0.9x	0.77	x	8.13	x	106.25		0.63	x	0.7	=	264	(79)
Southwest	0.9x	0.77	x	8.13	x	119.01		0.63	x	0.7	=	295.7	(79)
Southwest	0.9x	0.77	x	8.13	x	118.15		0.63	x	0.7	=	293.56	(79)
Southwest	0.9x	0.77	x	8.13	x	113.91		0.63	x	0.7	=	283.02	(79)
Southwest	0.9x	0.77	x	8.13	x	104.39		0.63	x	0.7	=	259.37	(79)
Southwest	0.9x	0.77	x	8.13	x	92.85		0.63	x	0.7	=	230.7	(79)
Southwest	0.9x	0.77	x	8.13	x	69.27		0.63	x	0.7	=	172.1	(79)
Southwest	0.9x	0.77	x	8.13	x	44.07		0.63	x	0.7	=	109.5	(79)
Southwest	0.9x	0.77	x	8.13	x	31.49		0.63	x	0.7	=	78.24	(79)
West	0.9x	0.77	x	1.29	x	19.64	x	0.63	x	0.7	=	7.74	(80)
West	0.9x	0.77	x	1.29	x	38.42	x	0.63	x	0.7	=	15.15	(80)
West	0.9x	0.77	x	1.29	x	63.27	x	0.63	x	0.7	=	24.94	(80)
West	0.9x	0.77	x	1.29	x	92.28	x	0.63	x	0.7	=	36.38	(80)
West	0.9x	0.77	x	1.29	x	113.09	x	0.63	x	0.7	=	44.59	(80)
West	0.9x	0.77	x	1.29	x	115.77	x	0.63	x	0.7	=	45.64	(80)
West	0.9x	0.77	x	1.29	x	110.22	x	0.63	x	0.7	=	43.45	(80)
West	0.9x	0.77	x	1.29	x	94.68	x	0.63	x	0.7	=	37.33	(80)
West	0.9x	0.77	x	1.29	x	73.59	x	0.63	x	0.7	=	29.01	(80)
West	0.9x	0.77	x	1.29	x	45.59	x	0.63	x	0.7	=	17.97	(80)
West	0.9x	0.77	x	1.29	x	24.49	x	0.63	x	0.7	=	9.65	(80)
West	0.9x	0.77	x	1.29	x	16.15	x	0.63	x	0.7	=	6.37	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

152.04	264.16	374.54	485.05	561.71	565.55	541.97	483.7	412.71	295.54	183.07	129.49
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 (83)

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

(84)m=

528.19	638.41	737.05	828.65	886.24	871.58	835.89	783.07	721.7	623.63	533.11	495.88
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 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.96	0.91	0.8	0.63	0.47	0.52	0.76	0.94	0.99	0.99

 (86)

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

(87)m=

19.57	19.8	20.12	20.5	20.79	20.95	20.99	20.98	20.88	20.49	19.96	19.54
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 (87)

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

(88)m=

19.74	19.74	19.74	19.76	19.76	19.77	19.77	19.77	19.77	19.76	19.75	19.75
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.98	0.95	0.88	0.74	0.52	0.34	0.39	0.66	0.91	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

(90)m=

17.88	18.21	18.67	19.2	19.57	19.74	19.77	19.77	19.68	19.2	18.45	17.84
-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.44

 (91)

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

TER WorkSheet: New dwelling design stage

(92)m=

18.63	18.91	19.31	19.78	20.11	20.27	20.31	20.31	20.21	19.77	19.12	18.59
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.63	18.91	19.31	19.78	20.11	20.27	20.31	20.31	20.21	19.77	19.12	18.59
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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=

0.99	0.98	0.95	0.88	0.76	0.57	0.4	0.45	0.7	0.91	0.98	0.99
------	------	------	------	------	------	-----	------	-----	------	------	------

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

522.1	622.83	698.37	730.11	669.14	495.63	335.38	350.29	504.4	568.84	521.1	491.39
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------

 (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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=

1351.83	1318.18	1202.06	1008.7	778.35	519.51	339.5	356.83	561.83	848.59	1117.04	1343.78
---------	---------	---------	--------	--------	--------	-------	--------	--------	--------	---------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

617.31	467.27	374.75	200.58	81.25	0	0	0	0	208.13	429.08	634.18
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3012.55

 (98)

Space heating requirement in $kWh/m^2/year$

45.78

 (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) = $(202) \times [1 - (203)]$ =

1

 (204)

Efficiency of main space heating system 1

93.5

 (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)

617.31	467.27	374.75	200.58	81.25	0	0	0	0	208.13	429.08	634.18
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

660.23	499.76	400.8	214.53	86.9	0	0	0	0	222.6	458.9	678.27
--------	--------	-------	--------	------	---	---	---	---	-------	-------	--------

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

3221.98

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(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)

187.09	165.01	173.56	155.96	153.1	137.19	132.12	144.47	144.06	161.7	170.52	182.71
--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

79.8

 (216)

(217)m=

87.76	87.44	86.82	85.49	83.21	79.8	79.8	79.8	79.8	85.49	87.18	87.86
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

213.17	188.71	199.92	182.44	183.99	171.91	165.56	181.04	180.52	189.15	195.6	207.94
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

2259.98

 (219)

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Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3221.98
Water heating fuel used		2259.98
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		294.93 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5851.89 (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	=	695.95 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	488.15 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1184.1 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	153.07 (268)
Total CO2, kg/year		sum of (265)...(271) =		1376.1 (272)
TER =				20.91 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.53
Printed on 20 July 2022 at 15:44:06

Project Information:

Assessed By: Neil Ingham (STRO010943)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 74.38m²

Site Reference : 43 Belmont Road LEAN

Plot Reference: FLAT 5

Address :

Client Details:

Name:

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 (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER)

20.58 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

17.65 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

64.4 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

53.7 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.16 (max. 0.30)

0.17 (max. 0.70)

OK

Floor

0.14 (max. 0.25)

0.14 (max. 0.70)

OK

Roof

0.12 (max. 0.20)

0.12 (max. 0.35)

OK

Openings

1.20 (max. 2.00)

1.20 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

4.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Community heating schemes - mains gas

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.42 kWh/day

Permitted by DBSCG: 2.03 kWh/day

OK

Primary pipework insulated:

Yes

OK

6 Controls

Space heating controls

Charging system linked to use of community heating,
programmer and at least two room thermostats

OK

Hot water controls:

Cylinderstat

OK

Regulations Compliance Report

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 (Thames valley):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: West	5.59m ²
Windows facing: East	1.4m ²
Windows facing: South West	2.79m ²
Windows facing: North West	1.4m ²
Windows facing: South	8.39m ²
Roof windows facing: Horizontal	1.12m ²
Ventilation rate:	6.00

10 Key features

Roofs U-value	0.12 W/m ² K
Community heating, heat from boilers – mains gas	

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Neil Ingham
Software Name: Stroma FSAP 2012

Stroma Number: STRO010943
Software Version: Version: 1.0.5.53

Property Address: FLAT 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.38 (1a)	2.4 (2a)	178.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.38 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	178.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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) =	0.17 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
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 <i>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</i>			0 (11)
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)			0.42 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.42 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

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

0.53	0.52	0.51	0.46	0.45	0.4	0.4	0.39	0.42	0.45	0.47	0.49
------	------	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.64 0.64 0.63 0.61 0.6 0.58 0.58 0.57 0.59 0.6 0.61 0.62 (24d)

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

(25)m= 0.64 0.64 0.63 0.61 0.6 0.58 0.58 0.57 0.59 0.6 0.61 0.62 (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
Windows Type 1			5.02	$\times 1/[1/(1.4) + 0.04] =$	6.66		(27)
Windows Type 2			1.26	$\times 1/[1/(1.4) + 0.04] =$	1.67		(27)
Windows Type 3			2.51	$\times 1/[1/(1.4) + 0.04] =$	3.33		(27)
Windows Type 4			1.26	$\times 1/[1/(1.4) + 0.04] =$	1.67		(27)
Windows Type 5			7.54	$\times 1/[1/(1.4) + 0.04] =$	10		(27)
Rooflights			1.006593	$\times 1/[1/(1.7) + 0.04] =$	1.711207		(27b)
Floor			16.91	$\times$ 0.13 =	2.1983		(28)
Walls Type1	90.22	17.59	72.63	$\times$ 0.18 =	13.07		(29)
Walls Type2	40.8	0	40.8	$\times$ 0.18 =	7.34		(29)
Roof	74.38	1.01	73.37	$\times$ 0.13 =	9.54		(30)
Total area of elements, m²			222.31				(31)
Party floor			57.47				(32a)
Internal wall **			89.42				(32c)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 57.08 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11837.99 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.22 (36)

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

Total fabric heat loss (33) + (36) = 73.3 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	37.82	37.5	37.18	35.68	35.4	34.1	34.1	33.86	34.6	35.4	35.97	36.56	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	111.12	110.8	110.48	108.98	108.7	107.4	107.4	107.16	107.9	108.7	109.27	109.86	
Average = Sum(39) _{1...12} / 12 =												108.98	(39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.49	1.49	1.49	1.47	1.46	1.44	1.44	1.44	1.45	1.46	1.47	1.48	
Average = Sum(40) _{1...12} / 12 =												1.47	(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 2.35 (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 89.96 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.95	95.35	91.75	88.16	84.56	80.96	80.96	84.56	88.16	91.75	95.35	98.95	
Total = Sum(44) _{1...12} =												1079.47	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	146.74	128.34	132.44	115.46	110.79	95.6	88.59	101.66	102.87	119.89	130.87	142.11	
Total = Sum(45) _{1...12} =												1415.35	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.01	19.25	19.87	17.32	16.62	14.34	13.29	15.25	15.43	17.98	19.63	21.32	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.5 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.81 (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)

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

Enter (50) or (54) in (55) 0.81 (55)

TER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(57)m=	25.12	22.68	25.12	24.31	25.12	24.31	25.12	25.12	24.31	25.12	24.31	25.12	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(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=	195.12	172.04	180.81	162.28	159.17	142.42	136.97	150.03	149.69	168.26	177.68	190.49	(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)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
------	---	---	---	---	---	---	---	---	---	---	---	---	-----------

Output from water heater

(64)m=	195.12	172.04	180.81	162.28	159.17	142.42	136.97	150.03	149.69	168.26	177.68	190.49	
Output from water heater (annual) _{1...12}												1984.96	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	87.49	77.63	82.74	75.84	75.54	69.24	68.16	72.5	71.66	78.56	80.97	85.95	(65)
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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=	117.38	117.38	117.38	117.38	117.38	117.38	117.38	117.38	117.38	117.38	117.38	117.38	(66)

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

(67)m=	18.48	16.41	13.35	10.11	7.55	6.38	6.89	8.96	12.02	15.27	17.82	18.99	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.3	209.45	204.03	192.49	177.92	164.23	155.08	152.93	158.35	169.89	184.46	198.15	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	34.74	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	-93.9	(71)
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Water heating gains (Table 5)

(72)m=	117.6	115.52	111.21	105.34	101.53	96.17	91.61	97.45	99.53	105.6	112.45	115.53	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	404.59	402.6	389.8	369.15	348.22	327.99	314.8	320.55	331.11	351.97	375.94	393.89	(73)
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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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	1.26	x	19.64	x	0.63	x	0.7	=	7.56 (76)
East	0.9x	0.77	x	1.26	x	38.42	x	0.63	x	0.7	=	14.79 (76)
East	0.9x	0.77	x	1.26	x	63.27	x	0.63	x	0.7	=	24.36 (76)
East	0.9x	0.77	x	1.26	x	92.28	x	0.63	x	0.7	=	35.53 (76)
East	0.9x	0.77	x	1.26	x	113.09	x	0.63	x	0.7	=	43.55 (76)
East	0.9x	0.77	x	1.26	x	115.77	x	0.63	x	0.7	=	44.58 (76)
East	0.9x	0.77	x	1.26	x	110.22	x	0.63	x	0.7	=	42.44 (76)
East	0.9x	0.77	x	1.26	x	94.68	x	0.63	x	0.7	=	36.46 (76)
East	0.9x	0.77	x	1.26	x	73.59	x	0.63	x	0.7	=	28.34 (76)
East	0.9x	0.77	x	1.26	x	45.59	x	0.63	x	0.7	=	17.56 (76)
East	0.9x	0.77	x	1.26	x	24.49	x	0.63	x	0.7	=	9.43 (76)
East	0.9x	0.77	x	1.26	x	16.15	x	0.63	x	0.7	=	6.22 (76)
South	0.9x	0.77	x	7.54	x	46.75	x	0.63	x	0.7	=	107.73 (78)
South	0.9x	0.77	x	7.54	x	76.57	x	0.63	x	0.7	=	176.44 (78)
South	0.9x	0.77	x	7.54	x	97.53	x	0.63	x	0.7	=	224.75 (78)
South	0.9x	0.77	x	7.54	x	110.23	x	0.63	x	0.7	=	254.02 (78)
South	0.9x	0.77	x	7.54	x	114.87	x	0.63	x	0.7	=	264.7 (78)
South	0.9x	0.77	x	7.54	x	110.55	x	0.63	x	0.7	=	254.74 (78)
South	0.9x	0.77	x	7.54	x	108.01	x	0.63	x	0.7	=	248.89 (78)
South	0.9x	0.77	x	7.54	x	104.89	x	0.63	x	0.7	=	241.71 (78)
South	0.9x	0.77	x	7.54	x	101.89	x	0.63	x	0.7	=	234.78 (78)
South	0.9x	0.77	x	7.54	x	82.59	x	0.63	x	0.7	=	190.3 (78)
South	0.9x	0.77	x	7.54	x	55.42	x	0.63	x	0.7	=	127.7 (78)
South	0.9x	0.77	x	7.54	x	40.4	x	0.63	x	0.7	=	93.09 (78)
Southwest	0.9x	0.77	x	2.51	x	36.79		0.63	x	0.7	=	28.22 (79)
Southwest	0.9x	0.77	x	2.51	x	62.67		0.63	x	0.7	=	48.08 (79)
Southwest	0.9x	0.77	x	2.51	x	85.75		0.63	x	0.7	=	65.78 (79)
Southwest	0.9x	0.77	x	2.51	x	106.25		0.63	x	0.7	=	81.5 (79)
Southwest	0.9x	0.77	x	2.51	x	119.01		0.63	x	0.7	=	91.29 (79)
Southwest	0.9x	0.77	x	2.51	x	118.15		0.63	x	0.7	=	90.63 (79)
Southwest	0.9x	0.77	x	2.51	x	113.91		0.63	x	0.7	=	87.38 (79)
Southwest	0.9x	0.77	x	2.51	x	104.39		0.63	x	0.7	=	80.08 (79)
Southwest	0.9x	0.77	x	2.51	x	92.85		0.63	x	0.7	=	71.23 (79)
Southwest	0.9x	0.77	x	2.51	x	69.27		0.63	x	0.7	=	53.13 (79)
Southwest	0.9x	0.77	x	2.51	x	44.07		0.63	x	0.7	=	33.81 (79)
Southwest	0.9x	0.77	x	2.51	x	31.49		0.63	x	0.7	=	24.15 (79)
West	0.9x	0.77	x	5.02	x	19.64	x	0.63	x	0.7	=	30.13 (80)
West	0.9x	0.77	x	5.02	x	38.42	x	0.63	x	0.7	=	58.94 (80)
West	0.9x	0.77	x	5.02	x	63.27	x	0.63	x	0.7	=	97.07 (80)

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West	0.9x	0.77	x	5.02	x	92.28	x	0.63	x	0.7	=	141.57	(80)
West	0.9x	0.77	x	5.02	x	113.09	x	0.63	x	0.7	=	173.5	(80)
West	0.9x	0.77	x	5.02	x	115.77	x	0.63	x	0.7	=	177.61	(80)
West	0.9x	0.77	x	5.02	x	110.22	x	0.63	x	0.7	=	169.09	(80)
West	0.9x	0.77	x	5.02	x	94.68	x	0.63	x	0.7	=	145.25	(80)
West	0.9x	0.77	x	5.02	x	73.59	x	0.63	x	0.7	=	112.9	(80)
West	0.9x	0.77	x	5.02	x	45.59	x	0.63	x	0.7	=	69.94	(80)
West	0.9x	0.77	x	5.02	x	24.49	x	0.63	x	0.7	=	37.57	(80)
West	0.9x	0.77	x	5.02	x	16.15	x	0.63	x	0.7	=	24.78	(80)
Northwest	0.9x	0.77	x	1.26	x	11.28	x	0.63	x	0.7	=	4.34	(81)
Northwest	0.9x	0.77	x	1.26	x	22.97	x	0.63	x	0.7	=	8.84	(81)
Northwest	0.9x	0.77	x	1.26	x	41.38	x	0.63	x	0.7	=	15.93	(81)
Northwest	0.9x	0.77	x	1.26	x	67.96	x	0.63	x	0.7	=	26.17	(81)
Northwest	0.9x	0.77	x	1.26	x	91.35	x	0.63	x	0.7	=	35.17	(81)
Northwest	0.9x	0.77	x	1.26	x	97.38	x	0.63	x	0.7	=	37.5	(81)
Northwest	0.9x	0.77	x	1.26	x	91.1	x	0.63	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.26	x	72.63	x	0.63	x	0.7	=	27.97	(81)
Northwest	0.9x	0.77	x	1.26	x	50.42	x	0.63	x	0.7	=	19.42	(81)
Northwest	0.9x	0.77	x	1.26	x	28.07	x	0.63	x	0.7	=	10.81	(81)
Northwest	0.9x	0.77	x	1.26	x	14.2	x	0.63	x	0.7	=	5.47	(81)
Northwest	0.9x	0.77	x	1.26	x	9.21	x	0.63	x	0.7	=	3.55	(81)
Rooflights	0.9x	1	x	1.01	x	26	x	0.63	x	0.7	=	10.39	(82)
Rooflights	0.9x	1	x	1.01	x	54	x	0.63	x	0.7	=	21.57	(82)
Rooflights	0.9x	1	x	1.01	x	96	x	0.63	x	0.7	=	38.35	(82)
Rooflights	0.9x	1	x	1.01	x	150	x	0.63	x	0.7	=	59.93	(82)
Rooflights	0.9x	1	x	1.01	x	192	x	0.63	x	0.7	=	76.71	(82)
Rooflights	0.9x	1	x	1.01	x	200	x	0.63	x	0.7	=	79.9	(82)
Rooflights	0.9x	1	x	1.01	x	189	x	0.63	x	0.7	=	75.51	(82)
Rooflights	0.9x	1	x	1.01	x	157	x	0.63	x	0.7	=	62.72	(82)
Rooflights	0.9x	1	x	1.01	x	115	x	0.63	x	0.7	=	45.94	(82)
Rooflights	0.9x	1	x	1.01	x	66	x	0.63	x	0.7	=	26.37	(82)
Rooflights	0.9x	1	x	1.01	x	33	x	0.63	x	0.7	=	13.18	(82)
Rooflights	0.9x	1	x	1.01	x	21	x	0.63	x	0.7	=	8.39	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 188.38 328.67 466.25 598.72 684.93 684.97 658.4 594.18 512.6 368.11 227.16 160.18 (83)

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

(84)m= 592.97 731.27 856.05 967.87 1033.15 1012.95 973.2 914.74 843.71 720.08 603.1 554.07 (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
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(86)m=	0.99	0.98	0.96	0.91	0.8	0.63	0.47	0.52	0.75	0.94	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.5	19.74	20.07	20.47	20.78	20.94	20.99	20.98	20.87	20.46	19.9	19.46	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.69	19.7	19.7	19.71	19.72	19.73	19.73	19.72	19.72	19.71	19.7	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.34	0.39	0.66	0.91	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=	17.74	18.09	18.58	19.14	19.52	19.69	19.73	19.72	19.63	19.13	18.34	17.69	(90)
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fLA = Living area ÷ (4) =	0.36	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.37	18.68	19.12	19.62	19.97	20.14	20.18	20.18	20.08	19.61	18.9	18.33	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.37	18.68	19.12	19.62	19.97	20.14	20.18	20.18	20.08	19.61	18.9	18.33	(93)
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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
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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.87	0.75	0.56	0.39	0.43	0.69	0.91	0.98	0.99	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	586.01	712.32	807.68	845.72	771.55	567.47	379.89	397.51	579.64	653.61	589.13	549.01	(95)
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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)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1563.89	1527.16	1393.98	1168.3	899.16	595.51	384.61	404.89	645.29	979.36	1289.52	1552.41	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	727.54	547.57	436.21	232.26	94.94	0	0	0	0	242.36	504.28	746.53	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3531.69	(98)
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Space heating requirement in kWh/m²/year

47.48	(99)
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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 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

727.54	547.57	436.21	232.26	94.94	0	0	0	0	242.36	504.28	746.53
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

778.12	585.64	466.53	248.41	101.54	0	0	0	0	259.21	539.33	798.43
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	3777.21	(211)
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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)

	195.12	172.04	180.81	162.28	159.17	142.42	136.97	150.03	149.69	168.26	177.68	190.49		
Efficiency of water heater													79.8	(216)
(217)m=	88	87.69	87.08	85.77	83.49	79.8	79.8	79.8	79.8	85.79	87.45	88.1		(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	221.72	196.19	207.65	189.2	190.64	178.47	171.64	188.01	187.58	196.14	203.19	216.22		
Total = Sum(219a) _{1...12} =													2346.66	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3777.21
Water heating fuel used		2346.66
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
Electricity for lighting		326.37
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6525.24

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	=	815.88
Space heating (secondary)	(215) x	0.519	=	0
Water heating	(219) x	0.216	=	506.88
Space and water heating	(261) + (262) + (263) + (264) =			1322.76
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93
Electricity for lighting	(232) x	0.519	=	169.39
Total CO2, kg/year		sum of (265)...(271) =		1531.07

TER = 20.58 (273)