

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	

DER 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 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 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			4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.32 (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) =		0.32 (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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DER WorkSheet: New dwelling design stage

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

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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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= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Windows Type 2			6.99	$\times 1/[1/(1.2) + 0.04] =$	8		(27)
Windows Type 3			2.79	$\times 1/[1/(1.2) + 0.04] =$	3.19		(27)
Windows Type 4			8.82	$\times 1/[1/(1.2) + 0.04] =$	10.1		(27)
Windows Type 5			2.04	$\times 1/[1/(1.2) + 0.04] =$	2.34		(27)
Windows Type 6			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Walls Type1	70.53	23.44	47.09	$\times 0.17 =$	8.01	60	2825.4 (29)
Walls Type2	17.32	0	17.32	$\times 0.17 =$	2.94	60	1039.2 (29)
Roof	38.87	0	38.87	$\times 0.12 =$	4.66	9	349.83 (30)
Total area of elements, m²			126.72				(31)
Party wall			9.14	$\times 0 =$	0	45	411.3 (32)
Party floor			64.88			40	2595.2 (32a)
Party ceiling			26.01			30	780.3 (32b)
Internal wall **			91.57			9	824.13 (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) = 42.45 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8825.36 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 136.03 (35)

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

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can be used instead of a detailed calculation.

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

12.84

(36)

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

Total fabric heat loss

(33) + (36) =

55.29

(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
32.43	32.25	32.07	31.25	31.1	30.38	30.38	30.25	30.66	31.1	31.41	31.73

(38)

Heat transfer coefficient, W/K

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

(39)m=

87.72	87.54	87.36	86.54	86.39	85.67	85.67	85.54	85.95	86.39	86.7	87.02
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Average = Sum(39)_{1...12} /12=

86.54

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.35	1.35	1.35	1.33	1.33	1.32	1.32	1.32	1.32	1.33	1.34	1.34
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Average = Sum(40)_{1...12} /12=

1.33

(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

170

(47)

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

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

Water storage loss:

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

0.54

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(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
0.59

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41
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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=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41
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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=	-41.42	-36.05	-38.41	-35.71	-35.4	-32.8	-33.89	-35.4	-35.71	-38.41	-38.63	-41.42
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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=	138.01	122.08	127.6	113.01	110.29	97.28	90.95	101.71	101.19	115.82	124.56	133.67
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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	9.42	8.24	8.5	7.41	7.11	6.14	5.69	6.53	6.61	7.7	8.4	9.13
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(63) (G2)

Output from water heater

(64)m=	130.43	115.38	120.62	106.84	104.28	92	86	96.16	95.65	109.46	117.72	126.31
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Output from water heater (annual)_{1...12}

1300.86

(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=	68.79	61.16	65.08	59.38	59.07	53.91	52.52	56.22	55.45	61.16	63.46	67.35
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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=	0	0	0	0	0	0	0	0	0	0	0	0
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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=	92.46	91.02	87.47	82.47	79.4	74.87	70.59	75.57	77.01	82.21	88.14	90.52
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(72)

Total internal gains =

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

(73)m=	348.76	347.39	336.27	318.07	299.72	281.92	269.93	274.83	283.85	302.24	323.46	339.11
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(73)

DER 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	2.79	x	11.28	x	0.45	x	0.7	=	6.87	(75)
Northeast 0.9x	0.77	x	2.79	x	22.97	x	0.45	x	0.7	=	13.99	(75)
Northeast 0.9x	0.77	x	2.79	x	41.38	x	0.45	x	0.7	=	25.2	(75)
Northeast 0.9x	0.77	x	2.79	x	67.96	x	0.45	x	0.7	=	41.39	(75)
Northeast 0.9x	0.77	x	2.79	x	91.35	x	0.45	x	0.7	=	55.63	(75)
Northeast 0.9x	0.77	x	2.79	x	97.38	x	0.45	x	0.7	=	59.31	(75)
Northeast 0.9x	0.77	x	2.79	x	91.1	x	0.45	x	0.7	=	55.48	(75)
Northeast 0.9x	0.77	x	2.79	x	72.63	x	0.45	x	0.7	=	44.23	(75)
Northeast 0.9x	0.77	x	2.79	x	50.42	x	0.45	x	0.7	=	30.71	(75)
Northeast 0.9x	0.77	x	2.79	x	28.07	x	0.45	x	0.7	=	17.09	(75)
Northeast 0.9x	0.77	x	2.79	x	14.2	x	0.45	x	0.7	=	8.65	(75)
Northeast 0.9x	0.77	x	2.79	x	9.21	x	0.45	x	0.7	=	5.61	(75)
Southeast 0.9x	0.77	x	2.04	x	36.79	x	0.45	x	0.7	=	16.39	(77)
Southeast 0.9x	0.77	x	2.04	x	62.67	x	0.45	x	0.7	=	27.91	(77)
Southeast 0.9x	0.77	x	2.04	x	85.75	x	0.45	x	0.7	=	38.19	(77)
Southeast 0.9x	0.77	x	2.04	x	106.25	x	0.45	x	0.7	=	47.32	(77)
Southeast 0.9x	0.77	x	2.04	x	119.01	x	0.45	x	0.7	=	53	(77)
Southeast 0.9x	0.77	x	2.04	x	118.15	x	0.45	x	0.7	=	52.61	(77)
Southeast 0.9x	0.77	x	2.04	x	113.91	x	0.45	x	0.7	=	50.73	(77)
Southeast 0.9x	0.77	x	2.04	x	104.39	x	0.45	x	0.7	=	46.49	(77)
Southeast 0.9x	0.77	x	2.04	x	92.85	x	0.45	x	0.7	=	41.35	(77)
Southeast 0.9x	0.77	x	2.04	x	69.27	x	0.45	x	0.7	=	30.85	(77)
Southeast 0.9x	0.77	x	2.04	x	44.07	x	0.45	x	0.7	=	19.63	(77)
Southeast 0.9x	0.77	x	2.04	x	31.49	x	0.45	x	0.7	=	14.02	(77)
South 0.9x	0.77	x	1.4	x	46.75	x	0.45	x	0.7	=	14.29	(78)
South 0.9x	0.77	x	1.4	x	76.57	x	0.45	x	0.7	=	23.4	(78)
South 0.9x	0.77	x	1.4	x	97.53	x	0.45	x	0.7	=	29.81	(78)
South 0.9x	0.77	x	1.4	x	110.23	x	0.45	x	0.7	=	33.69	(78)
South 0.9x	0.77	x	1.4	x	114.87	x	0.45	x	0.7	=	35.11	(78)
South 0.9x	0.77	x	1.4	x	110.55	x	0.45	x	0.7	=	33.78	(78)
South 0.9x	0.77	x	1.4	x	108.01	x	0.45	x	0.7	=	33.01	(78)
South 0.9x	0.77	x	1.4	x	104.89	x	0.45	x	0.7	=	32.06	(78)
South 0.9x	0.77	x	1.4	x	101.89	x	0.45	x	0.7	=	31.14	(78)
South 0.9x	0.77	x	1.4	x	82.59	x	0.45	x	0.7	=	25.24	(78)
South 0.9x	0.77	x	1.4	x	55.42	x	0.45	x	0.7	=	16.94	(78)
South 0.9x	0.77	x	1.4	x	40.4	x	0.45	x	0.7	=	12.35	(78)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	8.82	x	36.79		0.45	x	0.7	=	70.84	(79)
Southwest	0.9x	0.77	x	8.82	x	62.67		0.45	x	0.7	=	120.67	(79)
Southwest	0.9x	0.77	x	8.82	x	85.75		0.45	x	0.7	=	165.1	(79)
Southwest	0.9x	0.77	x	8.82	x	106.25		0.45	x	0.7	=	204.57	(79)
Southwest	0.9x	0.77	x	8.82	x	119.01		0.45	x	0.7	=	229.14	(79)
Southwest	0.9x	0.77	x	8.82	x	118.15		0.45	x	0.7	=	227.48	(79)
Southwest	0.9x	0.77	x	8.82	x	113.91		0.45	x	0.7	=	219.32	(79)
Southwest	0.9x	0.77	x	8.82	x	104.39		0.45	x	0.7	=	200.99	(79)
Southwest	0.9x	0.77	x	8.82	x	92.85		0.45	x	0.7	=	178.77	(79)
Southwest	0.9x	0.77	x	8.82	x	69.27		0.45	x	0.7	=	133.37	(79)
Southwest	0.9x	0.77	x	8.82	x	44.07		0.45	x	0.7	=	84.85	(79)
Southwest	0.9x	0.77	x	8.82	x	31.49		0.45	x	0.7	=	60.63	(79)
West	0.9x	0.77	x	1.4	x	19.64	x	0.45	x	0.7	=	6	(80)
West	0.9x	0.77	x	1.4	x	38.42	x	0.45	x	0.7	=	11.74	(80)
West	0.9x	0.77	x	1.4	x	63.27	x	0.45	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	1.4	x	92.28	x	0.45	x	0.7	=	28.2	(80)
West	0.9x	0.77	x	1.4	x	113.09	x	0.45	x	0.7	=	34.56	(80)
West	0.9x	0.77	x	1.4	x	115.77	x	0.45	x	0.7	=	35.38	(80)
West	0.9x	0.77	x	1.4	x	110.22	x	0.45	x	0.7	=	33.68	(80)
West	0.9x	0.77	x	1.4	x	94.68	x	0.45	x	0.7	=	28.93	(80)
West	0.9x	0.77	x	1.4	x	73.59	x	0.45	x	0.7	=	22.49	(80)
West	0.9x	0.77	x	1.4	x	45.59	x	0.45	x	0.7	=	13.93	(80)
West	0.9x	0.77	x	1.4	x	24.49	x	0.45	x	0.7	=	7.48	(80)
West	0.9x	0.77	x	1.4	x	16.15	x	0.45	x	0.7	=	4.94	(80)
Northwest	0.9x	0.77	x	6.99	x	11.28	x	0.45	x	0.7	=	17.22	(81)
Northwest	0.9x	0.77	x	6.99	x	22.97	x	0.45	x	0.7	=	35.04	(81)
Northwest	0.9x	0.77	x	6.99	x	41.38	x	0.45	x	0.7	=	63.14	(81)
Northwest	0.9x	0.77	x	6.99	x	67.96	x	0.45	x	0.7	=	103.69	(81)
Northwest	0.9x	0.77	x	6.99	x	91.35	x	0.45	x	0.7	=	139.38	(81)
Northwest	0.9x	0.77	x	6.99	x	97.38	x	0.45	x	0.7	=	148.6	(81)
Northwest	0.9x	0.77	x	6.99	x	91.1	x	0.45	x	0.7	=	139.01	(81)
Northwest	0.9x	0.77	x	6.99	x	72.63	x	0.45	x	0.7	=	110.82	(81)
Northwest	0.9x	0.77	x	6.99	x	50.42	x	0.45	x	0.7	=	76.94	(81)
Northwest	0.9x	0.77	x	6.99	x	28.07	x	0.45	x	0.7	=	42.83	(81)
Northwest	0.9x	0.77	x	6.99	x	14.2	x	0.45	x	0.7	=	21.66	(81)
Northwest	0.9x	0.77	x	6.99	x	9.21	x	0.45	x	0.7	=	14.06	(81)

Solar gains in watts, calculated for each month

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

(83)m= 131.61 232.75 340.78 458.86 546.82 557.17 531.23 463.52 381.39 263.3 159.21 111.6 (83)

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

(84)m= 480.37 580.15 677.05 776.93 846.54 839.09 801.16 738.35 665.25 565.55 482.66 450.71 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(86)m=	0.97	0.95	0.92	0.84	0.72	0.57	0.44	0.49	0.7	0.88	0.96	0.98	(86)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(87)m=	18.86	19.16	19.61	20.15	20.59	20.85	20.95	20.93	20.72	20.14	19.4	18.81	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(88)m=	19.8	19.8	19.8	19.81	19.82	19.82	19.82	19.83	19.82	19.82	19.81	19.81	(88)
--------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.94	0.9	0.81	0.67	0.49	0.33	0.38	0.62	0.85	0.95	0.97	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	16.99	17.43	18.07	18.82	19.39	19.71	19.8	19.79	19.58	18.83	17.78	16.92	(90)
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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=	17.81	18.18	18.74	19.4	19.91	20.21	20.3	20.29	20.08	19.4	18.49	17.74	(92)
--------	-------	-------	-------	------	-------	-------	------	-------	-------	------	-------	-------	------

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

(93)m=	17.81	18.18	18.74	19.4	19.91	20.21	20.3	20.29	20.08	19.4	18.49	17.74	(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=	0.95	0.93	0.88	0.8	0.67	0.52	0.38	0.42	0.64	0.84	0.93	0.96	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	458.16	537.66	596.43	619.91	570.87	434.63	303.69	313.63	426.73	475.52	449.29	432.77	(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=	1184.91	1162.83	1069.35	908.88	709.57	480.38	316.97	332.35	513.76	760.26	987.19	1178.23	(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=	540.71	420.11	351.85	208.05	103.19	0	0	0	0	211.85	387.29	554.62	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2777.68	(99)
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Space heating requirement in kWh/m²/year

42.81	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
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Fraction of space heat from community system 1 – (301) =	1	(302)
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The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
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Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
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Distribution loss factor (Table 12c) for community heating system	1.05	(306)
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Space heating

Annual space heating requirement	kWh/year	2777.68
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DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	2916.56	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1300.86	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1365.9	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	42.82	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		291.37	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4573.84	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		96 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.22	= 963.55 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 22.23 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 985.78 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		985.78 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 151.22 (379)
Total CO2, kg/year	sum of (376)...(382) =		1137 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.52 (384)
EI rating (section 14)			86.13 (385)

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 15:43:00

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	

DER 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) x	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 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		4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.32 (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) =	0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

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

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
-----	-----	------	------	------	-----	-----	------	------	------	------	------

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= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			1.4	$x1/[1/(1.2) + 0.04] =$	1.6		(27)
Windows Type 2			4.19	$x1/[1/(1.2) + 0.04] =$	4.8		(27)
Windows Type 3			8.82	$x1/[1/(1.2) + 0.04] =$	10.1		(27)
Windows Type 4			2.04	$x1/[1/(1.2) + 0.04] =$	2.34		(27)
Windows Type 5			1.4	$x1/[1/(1.2) + 0.04] =$	1.6		(27)
Rooflights			0.7	$x1/[1/(1.2) + 0.04] =$	0.84		(27b)
Walls Type1	69.96	17.85	52.11	x 0.17 =	8.86	60	3126.6 (29)
Walls Type2	16.03	0	16.03	x 0.17 =	2.73	60	961.8 (29)
Roof	34.97	0.7	34.27	x 0.12 =	4.11	9	308.43 (30)
Total area of elements, m²			120.96				(31)
Party wall			9.14	x 0 =	0	45	411.3 (32)
Party floor			65.81			40	2632.4 (32a)
Party ceiling			30.84			30	925.2 (32b)
Internal wall **			95.68			9	861.12 (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) = 36.94 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9226.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 140.2 (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

11.38 (36)

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

Total fabric heat loss

(33) + (36) =

48.32 (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
32.84	32.66	32.49	31.66	31.51	30.79	30.79	30.66	31.07	31.51	31.82	32.15

(38)

Heat transfer coefficient, W/K

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

(39)m=

81.16	80.98	80.8	79.98	79.83	79.11	79.11	78.98	79.39	79.83	80.14	80.46
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

79.98 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.23	1.23	1.23	1.22	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

1.22 (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

170

(47)

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

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

Water storage loss:

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

0.54

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(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
0.59

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=

18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

-41.71	-36.3	-38.67	-35.96	-35.64	-33.02	-34.12	-35.64	-35.96	-38.67	-38.89	-41.71
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(61)

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

(62)m=

138.68	122.66	128.19	113.52	110.76	97.68	91.29	102.13	101.61	116.33	125.14	134.3
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------

(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

9.49 8.3 8.56 7.47 7.16 6.18 5.73 6.57 6.65 7.75 8.46 9.19

(63) (G2)

Output from water heater

(64)m=

131.05	115.93	121.17	107.31	104.73	92.37	86.32	96.55	96.04	109.94	118.27	126.91
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

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

1306.59

(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=

69.04	61.38	65.3	59.57	59.25	54.06	52.65	56.38	55.61	61.35	63.67	67.58
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

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

(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=

92.79	91.33	87.77	82.73	79.64	75.08	70.77	75.78	77.23	82.46	88.44	90.83
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=

351.92	350.54	339.31	320.91	302.35	284.36	272.25	277.18	286.3	304.89	326.33	342.16
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

(73)

DER 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	4.19	x	11.28	x	0.45	x	0.7	=	10.32	(75)
Northeast 0.9x	0.77	x	4.19	x	22.97	x	0.45	x	0.7	=	21.01	(75)
Northeast 0.9x	0.77	x	4.19	x	41.38	x	0.45	x	0.7	=	37.85	(75)
Northeast 0.9x	0.77	x	4.19	x	67.96	x	0.45	x	0.7	=	62.16	(75)
Northeast 0.9x	0.77	x	4.19	x	91.35	x	0.45	x	0.7	=	83.55	(75)
Northeast 0.9x	0.77	x	4.19	x	97.38	x	0.45	x	0.7	=	89.07	(75)
Northeast 0.9x	0.77	x	4.19	x	91.1	x	0.45	x	0.7	=	83.33	(75)
Northeast 0.9x	0.77	x	4.19	x	72.63	x	0.45	x	0.7	=	66.43	(75)
Northeast 0.9x	0.77	x	4.19	x	50.42	x	0.45	x	0.7	=	46.12	(75)
Northeast 0.9x	0.77	x	4.19	x	28.07	x	0.45	x	0.7	=	25.67	(75)
Northeast 0.9x	0.77	x	4.19	x	14.2	x	0.45	x	0.7	=	12.99	(75)
Northeast 0.9x	0.77	x	4.19	x	9.21	x	0.45	x	0.7	=	8.43	(75)
Southeast 0.9x	0.77	x	2.04	x	36.79	x	0.45	x	0.7	=	16.39	(77)
Southeast 0.9x	0.77	x	2.04	x	62.67	x	0.45	x	0.7	=	27.91	(77)
Southeast 0.9x	0.77	x	2.04	x	85.75	x	0.45	x	0.7	=	38.19	(77)
Southeast 0.9x	0.77	x	2.04	x	106.25	x	0.45	x	0.7	=	47.32	(77)
Southeast 0.9x	0.77	x	2.04	x	119.01	x	0.45	x	0.7	=	53	(77)
Southeast 0.9x	0.77	x	2.04	x	118.15	x	0.45	x	0.7	=	52.61	(77)
Southeast 0.9x	0.77	x	2.04	x	113.91	x	0.45	x	0.7	=	50.73	(77)
Southeast 0.9x	0.77	x	2.04	x	104.39	x	0.45	x	0.7	=	46.49	(77)
Southeast 0.9x	0.77	x	2.04	x	92.85	x	0.45	x	0.7	=	41.35	(77)
Southeast 0.9x	0.77	x	2.04	x	69.27	x	0.45	x	0.7	=	30.85	(77)
Southeast 0.9x	0.77	x	2.04	x	44.07	x	0.45	x	0.7	=	19.63	(77)
Southeast 0.9x	0.77	x	2.04	x	31.49	x	0.45	x	0.7	=	14.02	(77)
South 0.9x	0.77	x	1.4	x	46.75	x	0.45	x	0.7	=	14.29	(78)
South 0.9x	0.77	x	1.4	x	76.57	x	0.45	x	0.7	=	23.4	(78)
South 0.9x	0.77	x	1.4	x	97.53	x	0.45	x	0.7	=	29.81	(78)
South 0.9x	0.77	x	1.4	x	110.23	x	0.45	x	0.7	=	33.69	(78)
South 0.9x	0.77	x	1.4	x	114.87	x	0.45	x	0.7	=	35.11	(78)
South 0.9x	0.77	x	1.4	x	110.55	x	0.45	x	0.7	=	33.78	(78)
South 0.9x	0.77	x	1.4	x	108.01	x	0.45	x	0.7	=	33.01	(78)
South 0.9x	0.77	x	1.4	x	104.89	x	0.45	x	0.7	=	32.06	(78)
South 0.9x	0.77	x	1.4	x	101.89	x	0.45	x	0.7	=	31.14	(78)
South 0.9x	0.77	x	1.4	x	82.59	x	0.45	x	0.7	=	25.24	(78)
South 0.9x	0.77	x	1.4	x	55.42	x	0.45	x	0.7	=	16.94	(78)
South 0.9x	0.77	x	1.4	x	40.4	x	0.45	x	0.7	=	12.35	(78)

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Southwest	0.9x	0.77	x	8.82	x	36.79		0.45	x	0.7	=	70.84	(79)
Southwest	0.9x	0.77	x	8.82	x	62.67		0.45	x	0.7	=	120.67	(79)
Southwest	0.9x	0.77	x	8.82	x	85.75		0.45	x	0.7	=	165.1	(79)
Southwest	0.9x	0.77	x	8.82	x	106.25		0.45	x	0.7	=	204.57	(79)
Southwest	0.9x	0.77	x	8.82	x	119.01		0.45	x	0.7	=	229.14	(79)
Southwest	0.9x	0.77	x	8.82	x	118.15		0.45	x	0.7	=	227.48	(79)
Southwest	0.9x	0.77	x	8.82	x	113.91		0.45	x	0.7	=	219.32	(79)
Southwest	0.9x	0.77	x	8.82	x	104.39		0.45	x	0.7	=	200.99	(79)
Southwest	0.9x	0.77	x	8.82	x	92.85		0.45	x	0.7	=	178.77	(79)
Southwest	0.9x	0.77	x	8.82	x	69.27		0.45	x	0.7	=	133.37	(79)
Southwest	0.9x	0.77	x	8.82	x	44.07		0.45	x	0.7	=	84.85	(79)
Southwest	0.9x	0.77	x	8.82	x	31.49		0.45	x	0.7	=	60.63	(79)
West	0.9x	0.77	x	1.4	x	19.64	x	0.45	x	0.7	=	6	(80)
West	0.9x	0.77	x	1.4	x	38.42	x	0.45	x	0.7	=	11.74	(80)
West	0.9x	0.77	x	1.4	x	63.27	x	0.45	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	1.4	x	92.28	x	0.45	x	0.7	=	28.2	(80)
West	0.9x	0.77	x	1.4	x	113.09	x	0.45	x	0.7	=	34.56	(80)
West	0.9x	0.77	x	1.4	x	115.77	x	0.45	x	0.7	=	35.38	(80)
West	0.9x	0.77	x	1.4	x	110.22	x	0.45	x	0.7	=	33.68	(80)
West	0.9x	0.77	x	1.4	x	94.68	x	0.45	x	0.7	=	28.93	(80)
West	0.9x	0.77	x	1.4	x	73.59	x	0.45	x	0.7	=	22.49	(80)
West	0.9x	0.77	x	1.4	x	45.59	x	0.45	x	0.7	=	13.93	(80)
West	0.9x	0.77	x	1.4	x	24.49	x	0.45	x	0.7	=	7.48	(80)
West	0.9x	0.77	x	1.4	x	16.15	x	0.45	x	0.7	=	4.94	(80)
Rooflights	0.9x	1	x	0.7	x	26	x	0.45	x	0.7	=	5.16	(82)
Rooflights	0.9x	1	x	0.7	x	54	x	0.45	x	0.7	=	10.72	(82)
Rooflights	0.9x	1	x	0.7	x	96	x	0.45	x	0.7	=	19.05	(82)
Rooflights	0.9x	1	x	0.7	x	150	x	0.45	x	0.7	=	29.77	(82)
Rooflights	0.9x	1	x	0.7	x	192	x	0.45	x	0.7	=	38.1	(82)
Rooflights	0.9x	1	x	0.7	x	200	x	0.45	x	0.7	=	39.69	(82)
Rooflights	0.9x	1	x	0.7	x	189	x	0.45	x	0.7	=	37.51	(82)
Rooflights	0.9x	1	x	0.7	x	157	x	0.45	x	0.7	=	31.16	(82)
Rooflights	0.9x	1	x	0.7	x	115	x	0.45	x	0.7	=	22.82	(82)
Rooflights	0.9x	1	x	0.7	x	66	x	0.45	x	0.7	=	13.1	(82)
Rooflights	0.9x	1	x	0.7	x	33	x	0.45	x	0.7	=	6.55	(82)
Rooflights	0.9x	1	x	0.7	x	21	x	0.45	x	0.7	=	4.17	(82)

Solar gains in watts, calculated for each month

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

(83)m=

123	215.44	309.34	405.7	473.46	478.03	457.57	406.05	342.69	242.15	148.43	104.53
-----	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

474.92	565.99	648.64	726.62	775.81	762.38	729.82	683.23	628.99	547.04	474.76	446.69
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=	0.97	0.96	0.92	0.85	0.74	0.59	0.45	0.5	0.7	0.89	0.96	0.98	(86)
--------	------	------	------	------	------	------	------	-----	-----	------	------	------	------

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

(87)m=	19.09	19.37	19.77	20.25	20.64	20.88	20.96	20.95	20.77	20.26	19.59	19.04	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.91	19.91	19.91	19.9	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(89)m=	0.97	0.95	0.91	0.83	0.69	0.51	0.35	0.39	0.63	0.86	0.95	0.97	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.37	17.77	18.35	19.03	19.53	19.82	19.9	19.89	19.71	19.05	18.1	17.3	(90)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------	------	------

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

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

(92)m=	18.14	18.48	18.98	19.57	20.03	20.29	20.37	20.36	20.18	19.59	18.76	18.07	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.14	18.48	18.98	19.57	20.03	20.29	20.37	20.36	20.18	19.59	18.76	18.07	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.89	0.82	0.7	0.54	0.39	0.44	0.65	0.85	0.94	0.96	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(95)m=	455.42	528.76	578.73	592.46	540.71	410.78	287.47	297.73	409.78	464.86	444.93	431	(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=	1123	1099.84	1008.55	853.45	664.6	450.01	298.15	312.6	482.99	717.45	934.31	1116.35	(97)
--------	------	---------	---------	--------	-------	--------	--------	-------	--------	--------	--------	---------	------

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

(98)m=	496.68	383.77	319.79	187.91	92.17	0	0	0	0	187.93	352.36	509.9	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2530.5	(99)
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Space heating requirement in kWh/m²/year

38.45	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
--	---	-------

Fraction of space heat from community system 1 – (301) =	1	(302)
--	---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
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Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
---	------------------	---	--------

Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
---	---	-------

Distribution loss factor (Table 12c) for community heating system	1.05	(306)
---	------	-------

Space heating

Annual space heating requirement	kWh/year	2530.5
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DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	2657.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1306.59	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1371.92	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	40.29	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		294.93	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4323.88	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		96 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 906.51 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 20.91 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 927.42 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		927.42 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 153.07 (379)
Total CO2, kg/year	sum of (376)...(382) =		1080.49 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		16.42 (384)
EI rating (section 14)			86.93 (385)

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 15:42:59

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	

DER 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 3

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 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			4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.32 (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) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

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

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
------	-----	------	------	------	-----	-----	------	------	------	------	------

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= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Windows Type 2			6.99	$\times 1/[1/(1.2) + 0.04] =$	8		(27)
Windows Type 3			2.79	$\times 1/[1/(1.2) + 0.04] =$	3.19		(27)
Windows Type 4			8.82	$\times 1/[1/(1.2) + 0.04] =$	10.1		(27)
Windows Type 5			2.04	$\times 1/[1/(1.2) + 0.04] =$	2.34		(27)
Windows Type 6			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Floor			64.88	$\times$ 0.14 =	9.0832	110	7136.8 (28)
Walls Type1	70.53	23.44	47.09	$\times$ 0.17 =	8.01	60	2825.4 (29)
Walls Type2	17.32	0	17.32	$\times$ 0.17 =	2.94	60	1039.2 (29)
Roof	38.87	0	38.87	$\times$ 0.12 =	4.66	9	349.83 (30)
Total area of elements, m²			191.6				(31)
Party wall			9.14	$\times$ 0 =	0	45	411.3 (32)
Party ceiling			26.01			30	780.3 (32b)
Internal wall **			91.57			9	824.13 (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) = 51.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13366.96 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 206.03 (35)

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

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

16.15 (36)

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

Total fabric heat loss

(33) + (36) =

67.69 (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
32.43	32.25	32.07	31.25	31.1	30.38	30.38	30.25	30.66	31.1	31.41	31.73

(38)

Heat transfer coefficient, W/K

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

(39)m=

100.11	99.93	99.76	98.94	98.79	98.07	98.07	97.94	98.35	98.79	99.1	99.42
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

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

98.94 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.54	1.54	1.54	1.52	1.52	1.51	1.51	1.51	1.52	1.52	1.53	1.53
------	------	------	------	------	------	------	------	------	------	------	------

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

1.52 (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

170

(47)

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

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

Water storage loss:

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

0.54

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85

(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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

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

0
0.59

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41
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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=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41
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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=	-41.42	-36.05	-38.41	-35.71	-35.4	-32.8	-33.89	-35.4	-35.71	-38.41	-38.63	-41.42
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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=	138.01	122.08	127.6	113.01	110.29	97.28	90.95	101.71	101.19	115.82	124.56	133.67
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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	9.42	8.24	8.5	7.41	7.11	6.14	5.69	6.53	6.61	7.7	8.4	9.13
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(63) (G2)

Output from water heater

(64)m=	130.43	115.38	120.62	106.84	104.28	92	86	96.16	95.65	109.46	117.72	126.31
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Output from water heater (annual)_{1...12}

1300.86

(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=	68.79	61.16	65.08	59.38	59.07	53.91	52.52	56.22	55.45	61.16	63.46	67.35
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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
--------	------	-------	-------	------	------	------	------	---	-------	-------	-------	-------

(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=	0	0	0	0	0	0	0	0	0	0	0	0
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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
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	92.46	91.02	87.47	82.47	79.4	74.87	70.59	75.57	77.01	82.21	88.14	90.52
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(72)

Total internal gains =

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

(73)m=	348.76	347.39	336.27	318.07	299.72	281.92	269.93	274.83	283.85	302.24	323.46	339.11
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(73)

DER 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	2.79	x	11.28	x	0.45	x	0.7	=	6.87	(75)
Northeast 0.9x	0.77	x	2.79	x	22.97	x	0.45	x	0.7	=	13.99	(75)
Northeast 0.9x	0.77	x	2.79	x	41.38	x	0.45	x	0.7	=	25.2	(75)
Northeast 0.9x	0.77	x	2.79	x	67.96	x	0.45	x	0.7	=	41.39	(75)
Northeast 0.9x	0.77	x	2.79	x	91.35	x	0.45	x	0.7	=	55.63	(75)
Northeast 0.9x	0.77	x	2.79	x	97.38	x	0.45	x	0.7	=	59.31	(75)
Northeast 0.9x	0.77	x	2.79	x	91.1	x	0.45	x	0.7	=	55.48	(75)
Northeast 0.9x	0.77	x	2.79	x	72.63	x	0.45	x	0.7	=	44.23	(75)
Northeast 0.9x	0.77	x	2.79	x	50.42	x	0.45	x	0.7	=	30.71	(75)
Northeast 0.9x	0.77	x	2.79	x	28.07	x	0.45	x	0.7	=	17.09	(75)
Northeast 0.9x	0.77	x	2.79	x	14.2	x	0.45	x	0.7	=	8.65	(75)
Northeast 0.9x	0.77	x	2.79	x	9.21	x	0.45	x	0.7	=	5.61	(75)
Southeast 0.9x	0.77	x	2.04	x	36.79	x	0.45	x	0.7	=	16.39	(77)
Southeast 0.9x	0.77	x	2.04	x	62.67	x	0.45	x	0.7	=	27.91	(77)
Southeast 0.9x	0.77	x	2.04	x	85.75	x	0.45	x	0.7	=	38.19	(77)
Southeast 0.9x	0.77	x	2.04	x	106.25	x	0.45	x	0.7	=	47.32	(77)
Southeast 0.9x	0.77	x	2.04	x	119.01	x	0.45	x	0.7	=	53	(77)
Southeast 0.9x	0.77	x	2.04	x	118.15	x	0.45	x	0.7	=	52.61	(77)
Southeast 0.9x	0.77	x	2.04	x	113.91	x	0.45	x	0.7	=	50.73	(77)
Southeast 0.9x	0.77	x	2.04	x	104.39	x	0.45	x	0.7	=	46.49	(77)
Southeast 0.9x	0.77	x	2.04	x	92.85	x	0.45	x	0.7	=	41.35	(77)
Southeast 0.9x	0.77	x	2.04	x	69.27	x	0.45	x	0.7	=	30.85	(77)
Southeast 0.9x	0.77	x	2.04	x	44.07	x	0.45	x	0.7	=	19.63	(77)
Southeast 0.9x	0.77	x	2.04	x	31.49	x	0.45	x	0.7	=	14.02	(77)
South 0.9x	0.77	x	1.4	x	46.75	x	0.45	x	0.7	=	14.29	(78)
South 0.9x	0.77	x	1.4	x	76.57	x	0.45	x	0.7	=	23.4	(78)
South 0.9x	0.77	x	1.4	x	97.53	x	0.45	x	0.7	=	29.81	(78)
South 0.9x	0.77	x	1.4	x	110.23	x	0.45	x	0.7	=	33.69	(78)
South 0.9x	0.77	x	1.4	x	114.87	x	0.45	x	0.7	=	35.11	(78)
South 0.9x	0.77	x	1.4	x	110.55	x	0.45	x	0.7	=	33.78	(78)
South 0.9x	0.77	x	1.4	x	108.01	x	0.45	x	0.7	=	33.01	(78)
South 0.9x	0.77	x	1.4	x	104.89	x	0.45	x	0.7	=	32.06	(78)
South 0.9x	0.77	x	1.4	x	101.89	x	0.45	x	0.7	=	31.14	(78)
South 0.9x	0.77	x	1.4	x	82.59	x	0.45	x	0.7	=	25.24	(78)
South 0.9x	0.77	x	1.4	x	55.42	x	0.45	x	0.7	=	16.94	(78)
South 0.9x	0.77	x	1.4	x	40.4	x	0.45	x	0.7	=	12.35	(78)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	8.82	x	36.79		0.45	x	0.7	=	70.84	(79)
Southwest	0.9x	0.77	x	8.82	x	62.67		0.45	x	0.7	=	120.67	(79)
Southwest	0.9x	0.77	x	8.82	x	85.75		0.45	x	0.7	=	165.1	(79)
Southwest	0.9x	0.77	x	8.82	x	106.25		0.45	x	0.7	=	204.57	(79)
Southwest	0.9x	0.77	x	8.82	x	119.01		0.45	x	0.7	=	229.14	(79)
Southwest	0.9x	0.77	x	8.82	x	118.15		0.45	x	0.7	=	227.48	(79)
Southwest	0.9x	0.77	x	8.82	x	113.91		0.45	x	0.7	=	219.32	(79)
Southwest	0.9x	0.77	x	8.82	x	104.39		0.45	x	0.7	=	200.99	(79)
Southwest	0.9x	0.77	x	8.82	x	92.85		0.45	x	0.7	=	178.77	(79)
Southwest	0.9x	0.77	x	8.82	x	69.27		0.45	x	0.7	=	133.37	(79)
Southwest	0.9x	0.77	x	8.82	x	44.07		0.45	x	0.7	=	84.85	(79)
Southwest	0.9x	0.77	x	8.82	x	31.49		0.45	x	0.7	=	60.63	(79)
West	0.9x	0.77	x	1.4	x	19.64	x	0.45	x	0.7	=	6	(80)
West	0.9x	0.77	x	1.4	x	38.42	x	0.45	x	0.7	=	11.74	(80)
West	0.9x	0.77	x	1.4	x	63.27	x	0.45	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	1.4	x	92.28	x	0.45	x	0.7	=	28.2	(80)
West	0.9x	0.77	x	1.4	x	113.09	x	0.45	x	0.7	=	34.56	(80)
West	0.9x	0.77	x	1.4	x	115.77	x	0.45	x	0.7	=	35.38	(80)
West	0.9x	0.77	x	1.4	x	110.22	x	0.45	x	0.7	=	33.68	(80)
West	0.9x	0.77	x	1.4	x	94.68	x	0.45	x	0.7	=	28.93	(80)
West	0.9x	0.77	x	1.4	x	73.59	x	0.45	x	0.7	=	22.49	(80)
West	0.9x	0.77	x	1.4	x	45.59	x	0.45	x	0.7	=	13.93	(80)
West	0.9x	0.77	x	1.4	x	24.49	x	0.45	x	0.7	=	7.48	(80)
West	0.9x	0.77	x	1.4	x	16.15	x	0.45	x	0.7	=	4.94	(80)
Northwest	0.9x	0.77	x	6.99	x	11.28	x	0.45	x	0.7	=	17.22	(81)
Northwest	0.9x	0.77	x	6.99	x	22.97	x	0.45	x	0.7	=	35.04	(81)
Northwest	0.9x	0.77	x	6.99	x	41.38	x	0.45	x	0.7	=	63.14	(81)
Northwest	0.9x	0.77	x	6.99	x	67.96	x	0.45	x	0.7	=	103.69	(81)
Northwest	0.9x	0.77	x	6.99	x	91.35	x	0.45	x	0.7	=	139.38	(81)
Northwest	0.9x	0.77	x	6.99	x	97.38	x	0.45	x	0.7	=	148.6	(81)
Northwest	0.9x	0.77	x	6.99	x	91.1	x	0.45	x	0.7	=	139.01	(81)
Northwest	0.9x	0.77	x	6.99	x	72.63	x	0.45	x	0.7	=	110.82	(81)
Northwest	0.9x	0.77	x	6.99	x	50.42	x	0.45	x	0.7	=	76.94	(81)
Northwest	0.9x	0.77	x	6.99	x	28.07	x	0.45	x	0.7	=	42.83	(81)
Northwest	0.9x	0.77	x	6.99	x	14.2	x	0.45	x	0.7	=	21.66	(81)
Northwest	0.9x	0.77	x	6.99	x	9.21	x	0.45	x	0.7	=	14.06	(81)

Solar gains in watts, calculated for each month

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

(83)m= 131.61 232.75 340.78 458.86 546.82 557.17 531.23 463.52 381.39 263.3 159.21 111.6 (83)

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

(84)m= 480.37 580.15 677.05 776.93 846.54 839.09 801.16 738.35 665.25 565.55 482.66 450.71 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.96	0.91	0.81	0.66	0.51	0.56	0.79	0.94	0.98	0.99	(86)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(87)m=	19.14	19.39	19.76	20.24	20.64	20.88	20.96	20.95	20.76	20.23	19.59	19.1	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.66	19.66	19.66	19.67	19.67	19.68	19.68	19.68	19.67	19.67	19.66	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.88	0.75	0.55	0.37	0.42	0.7	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=	17.24	17.59	18.13	18.8	19.32	19.6	19.66	19.66	19.48	18.81	17.9	17.18	(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=	18.07	18.37	18.84	19.43	19.89	20.16	20.23	20.22	20.04	19.43	18.64	18.01	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.07	18.37	18.84	19.43	19.89	20.16	20.23	20.22	20.04	19.43	18.64	18.01	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.88	0.76	0.59	0.43	0.48	0.73	0.91	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	472.24	562.05	636.27	680.4	643.61	496.23	344.36	356.46	482.59	514.76	468.72	444.47	(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=	1378.42	1346.36	1231.4	1041.46	809.38	544.83	356.01	374.03	584.04	871.91	1143.53	1373.39	(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=	674.2	527.06	442.78	259.96	123.33	0	0	0	0	265.72	485.86	691.12	(98)
--------	-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3470.03	(99)
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Space heating requirement in kWh/m²/year

53.48	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
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Fraction of space heat from community system 1 – (301) =	1	(302)
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The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers	1	(303a)
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Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
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Distribution loss factor (Table 12c) for community heating system	1.05	(306)
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Space heating

Annual space heating requirement	kWh/year	3470.03
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DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	3643.53	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1300.86	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1365.9	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	50.09	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		291.37	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5300.81	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		96 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.22	= 1127.12 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 26 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1153.12 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1153.12 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 151.22 (379)
Total CO2, kg/year	sum of (376)...(382) =		1304.35 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		20.1 (384)
EI rating (section 14)			84.09 (385)

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 15:42:59

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	

DER 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 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 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			4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.32 (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) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

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

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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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= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Windows Type 2			4.19	$\times 1/[1/(1.2) + 0.04] =$	4.8		(27)
Windows Type 3			8.82	$\times 1/[1/(1.2) + 0.04] =$	10.1		(27)
Windows Type 4			2.04	$\times 1/[1/(1.2) + 0.04] =$	2.34		(27)
Windows Type 5			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Floor			65.81	$\times$ 0.14 =	9.2134	110	7239.1 (28)
Walls Type1	69.96	17.85	52.11	$\times$ 0.17 =	8.86	60	3126.6 (29)
Walls Type2	16.03	0	16.03	$\times$ 0.17 =	2.73	60	961.8 (29)
Roof	34.97	0	34.97	$\times$ 0.12 =	4.2	9	314.73 (30)
Total area of elements, m²			186.77				(31)
Party wall			9.14	$\times$ 0 =	0	45	411.3 (32)
Party ceiling			30.84			30	925.2 (32b)
Internal wall **			95.68			9	861.12 (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) = 45.43 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13839.85 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 210.3 (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 14.46 (36)

DER WorkSheet: New dwelling design stage

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=	32.84	32.66	32.49	31.66	31.51	30.79	30.79	30.66	31.07	31.51	31.82	32.15	(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=	92.73	92.55	92.38	91.55	91.4	90.68	90.68	90.55	90.96	91.4	91.71	92.04	
Average = Sum(39) _{1...12} /12=												91.55	(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=	1.41	1.41	1.4	1.39	1.39	1.38	1.38	1.38	1.38	1.39	1.39	1.4	
Average = Sum(40) _{1...12} /12=												1.39	(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 170 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (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) 0.59 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

(56)m=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41	(56)
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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=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41	(57)
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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)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	-41.71	-36.3	-38.67	-35.96	-35.64	-33.02	-34.12	-35.64	-35.96	-38.67	-38.89	-41.71	(61)
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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=	138.68	122.66	128.19	113.52	110.76	97.68	91.29	102.13	101.61	116.33	125.14	134.3	(62)
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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)
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FHRS	9.49	8.3	8.56	7.47	7.16	6.18	5.73	6.57	6.65	7.75	8.46	9.19	(63) (G2)
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Output from water heater

(64)m=	131.05	115.93	121.17	107.31	104.73	92.37	86.32	96.55	96.04	109.94	118.27	126.91	
Output from water heater (annual) _{1...12}												1306.59	(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=	69.04	61.38	65.3	59.57	59.25	54.06	52.65	56.38	55.61	61.35	63.67	67.58	(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=	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)
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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)
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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)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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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)
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Water heating gains (Table 5)

(72)m=	92.79	91.33	87.77	82.73	79.64	75.08	70.77	75.78	77.23	82.46	88.44	90.83	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	351.92	350.54	339.31	320.91	302.35	284.36	272.25	277.18	286.3	304.89	326.33	342.16	(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.

DER WorkSheet: New dwelling design stage

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	4.19	x	11.28	x	0.45	x	0.7	=	10.32	(75)
Northeast 0.9x	0.77	x	4.19	x	22.97	x	0.45	x	0.7	=	21.01	(75)
Northeast 0.9x	0.77	x	4.19	x	41.38	x	0.45	x	0.7	=	37.85	(75)
Northeast 0.9x	0.77	x	4.19	x	67.96	x	0.45	x	0.7	=	62.16	(75)
Northeast 0.9x	0.77	x	4.19	x	91.35	x	0.45	x	0.7	=	83.55	(75)
Northeast 0.9x	0.77	x	4.19	x	97.38	x	0.45	x	0.7	=	89.07	(75)
Northeast 0.9x	0.77	x	4.19	x	91.1	x	0.45	x	0.7	=	83.33	(75)
Northeast 0.9x	0.77	x	4.19	x	72.63	x	0.45	x	0.7	=	66.43	(75)
Northeast 0.9x	0.77	x	4.19	x	50.42	x	0.45	x	0.7	=	46.12	(75)
Northeast 0.9x	0.77	x	4.19	x	28.07	x	0.45	x	0.7	=	25.67	(75)
Northeast 0.9x	0.77	x	4.19	x	14.2	x	0.45	x	0.7	=	12.99	(75)
Northeast 0.9x	0.77	x	4.19	x	9.21	x	0.45	x	0.7	=	8.43	(75)
Southeast 0.9x	0.77	x	2.04	x	36.79	x	0.45	x	0.7	=	16.39	(77)
Southeast 0.9x	0.77	x	2.04	x	62.67	x	0.45	x	0.7	=	27.91	(77)
Southeast 0.9x	0.77	x	2.04	x	85.75	x	0.45	x	0.7	=	38.19	(77)
Southeast 0.9x	0.77	x	2.04	x	106.25	x	0.45	x	0.7	=	47.32	(77)
Southeast 0.9x	0.77	x	2.04	x	119.01	x	0.45	x	0.7	=	53	(77)
Southeast 0.9x	0.77	x	2.04	x	118.15	x	0.45	x	0.7	=	52.61	(77)
Southeast 0.9x	0.77	x	2.04	x	113.91	x	0.45	x	0.7	=	50.73	(77)
Southeast 0.9x	0.77	x	2.04	x	104.39	x	0.45	x	0.7	=	46.49	(77)
Southeast 0.9x	0.77	x	2.04	x	92.85	x	0.45	x	0.7	=	41.35	(77)
Southeast 0.9x	0.77	x	2.04	x	69.27	x	0.45	x	0.7	=	30.85	(77)
Southeast 0.9x	0.77	x	2.04	x	44.07	x	0.45	x	0.7	=	19.63	(77)
Southeast 0.9x	0.77	x	2.04	x	31.49	x	0.45	x	0.7	=	14.02	(77)
South 0.9x	0.77	x	1.4	x	46.75	x	0.45	x	0.7	=	14.29	(78)
South 0.9x	0.77	x	1.4	x	76.57	x	0.45	x	0.7	=	23.4	(78)
South 0.9x	0.77	x	1.4	x	97.53	x	0.45	x	0.7	=	29.81	(78)
South 0.9x	0.77	x	1.4	x	110.23	x	0.45	x	0.7	=	33.69	(78)
South 0.9x	0.77	x	1.4	x	114.87	x	0.45	x	0.7	=	35.11	(78)
South 0.9x	0.77	x	1.4	x	110.55	x	0.45	x	0.7	=	33.78	(78)
South 0.9x	0.77	x	1.4	x	108.01	x	0.45	x	0.7	=	33.01	(78)
South 0.9x	0.77	x	1.4	x	104.89	x	0.45	x	0.7	=	32.06	(78)
South 0.9x	0.77	x	1.4	x	101.89	x	0.45	x	0.7	=	31.14	(78)
South 0.9x	0.77	x	1.4	x	82.59	x	0.45	x	0.7	=	25.24	(78)
South 0.9x	0.77	x	1.4	x	55.42	x	0.45	x	0.7	=	16.94	(78)
South 0.9x	0.77	x	1.4	x	40.4	x	0.45	x	0.7	=	12.35	(78)
Southwest 0.9x	0.77	x	8.82	x	36.79		0.45	x	0.7	=	70.84	(79)
Southwest 0.9x	0.77	x	8.82	x	62.67		0.45	x	0.7	=	120.67	(79)
Southwest 0.9x	0.77	x	8.82	x	85.75		0.45	x	0.7	=	165.1	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	8.82	x	106.25		0.45	x	0.7	=	204.57	(79)
Southwest	0.9x	0.77	x	8.82	x	119.01		0.45	x	0.7	=	229.14	(79)
Southwest	0.9x	0.77	x	8.82	x	118.15		0.45	x	0.7	=	227.48	(79)
Southwest	0.9x	0.77	x	8.82	x	113.91		0.45	x	0.7	=	219.32	(79)
Southwest	0.9x	0.77	x	8.82	x	104.39		0.45	x	0.7	=	200.99	(79)
Southwest	0.9x	0.77	x	8.82	x	92.85		0.45	x	0.7	=	178.77	(79)
Southwest	0.9x	0.77	x	8.82	x	69.27		0.45	x	0.7	=	133.37	(79)
Southwest	0.9x	0.77	x	8.82	x	44.07		0.45	x	0.7	=	84.85	(79)
Southwest	0.9x	0.77	x	8.82	x	31.49		0.45	x	0.7	=	60.63	(79)
West	0.9x	0.77	x	1.4	x	19.64	x	0.45	x	0.7	=	6	(80)
West	0.9x	0.77	x	1.4	x	38.42	x	0.45	x	0.7	=	11.74	(80)
West	0.9x	0.77	x	1.4	x	63.27	x	0.45	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	1.4	x	92.28	x	0.45	x	0.7	=	28.2	(80)
West	0.9x	0.77	x	1.4	x	113.09	x	0.45	x	0.7	=	34.56	(80)
West	0.9x	0.77	x	1.4	x	115.77	x	0.45	x	0.7	=	35.38	(80)
West	0.9x	0.77	x	1.4	x	110.22	x	0.45	x	0.7	=	33.68	(80)
West	0.9x	0.77	x	1.4	x	94.68	x	0.45	x	0.7	=	28.93	(80)
West	0.9x	0.77	x	1.4	x	73.59	x	0.45	x	0.7	=	22.49	(80)
West	0.9x	0.77	x	1.4	x	45.59	x	0.45	x	0.7	=	13.93	(80)
West	0.9x	0.77	x	1.4	x	24.49	x	0.45	x	0.7	=	7.48	(80)
West	0.9x	0.77	x	1.4	x	16.15	x	0.45	x	0.7	=	4.94	(80)

Solar gains in watts, calculated for each month

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

(83)m=	117.84	204.73	290.28	375.94	435.36	438.34	420.06	374.9	319.87	229.06	141.88	100.36	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	469.76	555.27	629.59	696.85	737.71	722.69	692.31	652.08	606.17	533.94	468.21	442.52	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.93	0.84	0.7	0.54	0.59	0.81	0.95	0.99	0.99	(86)

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

(87)m=	19.32	19.54	19.87	20.28	20.65	20.88	20.97	20.95	20.78	20.31	19.74	19.28	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.76	19.77	19.77	19.78	19.78	19.78	19.78	19.77	19.77	19.76	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.91	0.79	0.6	0.41	0.46	0.72	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=	17.56	17.87	18.35	18.94	19.42	19.7	19.77	19.76	19.6	18.99	18.17	17.51	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.44

(91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.34	18.61	19.02	19.54	19.97	20.22	20.3	20.29	20.13	19.57	18.87	18.29	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.34	18.61	19.02	19.54	19.97	20.22	20.3	20.29	20.13	19.57	18.87	18.29	(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, h_m :

(94)m=	0.99	0.97	0.95	0.9	0.8	0.64	0.47	0.52	0.75	0.92	0.98	0.99	(94)
--------	------	------	------	-----	-----	------	------	------	------	------	------	------	------

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

(95)m=	463.24	541.14	599.05	627.33	591.01	461.37	324.26	336.07	455.1	492.25	456.85	437.52	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1302.22	1269.09	1156.94	973.86	755.45	509.93	335.4	352.19	548.1	820.3	1079.01	1297.25	(97)
--------	---------	---------	---------	--------	--------	--------	-------	--------	-------	-------	---------	---------	------

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

(98)m=	624.21	489.18	415.07	249.51	122.34	0	0	0	0	244.07	447.95	639.64	
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 3231.97 (98)

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

49.11 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

3231.97

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

3393.57 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

1306.59

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

1371.92 (310a)

Electricity used for heat distribution

$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$

47.65 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

0 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

0 (331)

Energy for lighting (calculated in Appendix L)

294.93 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =

5060.43 (338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		96 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.22	= 1072.24 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 24.73 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1096.97 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1096.97 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332)) \times$	0.52	= 153.07 (379)
Total CO2, kg/year	sum of (376)...(382) =		1250.04 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		18.99 (384)
EI rating (section 14)			84.88 (385)

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 15:42:58

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	

DER 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 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	74.38 (1a) x	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				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) =	0.11 (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		4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.31 (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) =	0.31 (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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DER WorkSheet: New dwelling design stage

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

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37
-----	------	------	------	------	-----	-----	------	------	------	------	------

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= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (24d)

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

(25)m= 0.58 0.58 0.57 0.56 0.56 0.54 0.54 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			5.59	$\times 1/[1/(1.2) + 0.04] =$	6.4		(27)
Windows Type 2			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Windows Type 3			2.79	$\times 1/[1/(1.2) + 0.04] =$	3.19		(27)
Windows Type 4			1.4	$\times 1/[1/(1.2) + 0.04] =$	1.6		(27)
Windows Type 5			8.39	$\times 1/[1/(1.2) + 0.04] =$	9.61		(27)
Rooflights			1.12	$\times 1/[1/(1.2) + 0.04] =$	1.344		(27b)
Floor			16.91	$\times$ 0.14 =	2.3674	75	1268.25 (28)
Walls Type1	90.22	19.57	70.65	$\times$ 0.17 =	12.01	60	4239 (29)
Walls Type2	40.8	0	40.8	$\times$ 0.15 =	6.02	60	2448 (29)
Roof	74.38	1.12	73.26	$\times$ 0.12 =	8.79	9	659.34 (30)
Total area of elements, m²			222.31				(31)
Party floor			57.47			40	2298.8 (32a)
Internal wall **			89.42			9	804.78 (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) = 52.88 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11718.17 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 157.54 (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 15.83 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 68.71 (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=	34.12	33.94	33.76	32.92	32.77	32.04	32.04	31.91	32.32	32.77	33.08	33.41	(38)

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

	102.82	102.64	102.46	101.63	101.48	100.75	100.75	100.62	101.03	101.48	101.79	102.12	
(39)m=													
Average = Sum(39) _{1...12} / 12 =												101.63	(39)

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

	1.38	1.38	1.38	1.37	1.36	1.35	1.35	1.35	1.36	1.36	1.37	1.37	
(40)m=													
Average = Sum(40) _{1...12} / 12 =												1.37	(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)

	146.74	128.34	132.44	115.46	110.79	95.6	88.59	101.66	102.87	119.89	130.87	142.11	
(45)m=													
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)

	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)m=													(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (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) 0.59 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

(56)m=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41	(56)
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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=	18.41	16.63	18.41	17.82	18.41	17.82	18.41	18.41	17.82	18.41	17.82	18.41	(57)
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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)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	-44.12	-38.4	-40.91	-38.04	-37.7	-34.93	-36.1	-37.7	-38.04	-40.91	-41.15	-44.12	(61)
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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=	144.3	127.58	133.2	117.75	114.76	101	94.17	105.63	105.16	120.65	130.05	139.67	(62)
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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)
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FHRS	10.04	8.78	9.06	7.9	7.58	6.54	6.06	6.95	7.04	8.2	8.95	9.72	(63) (G2)
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Output from water heater

(64)m=	136.32	120.55	125.88	111.29	108.48	95.48	89	99.83	99.36	113.99	122.87	131.94	
Output from water heater (annual) _{1...12}												1355	(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=	71.1	63.19	67.15	61.15	60.75	55.32	53.77	57.72	56.96	62.98	65.49	69.56	(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)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(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=	95.57	94.03	90.25	84.93	81.66	76.83	72.27	77.58	79.11	84.64	90.96	93.5	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(73)m=	379.56	378.11	365.84	345.73	325.34	305.65	292.46	297.68	307.7	328.02	351.45	368.86	(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.

DER WorkSheet: New dwelling design stage

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	1.4	x	19.64	x	0.45	x	0.7	=	6 (76)
East	0.9x	0.77	x	1.4	x	38.42	x	0.45	x	0.7	=	11.74 (76)
East	0.9x	0.77	x	1.4	x	63.27	x	0.45	x	0.7	=	19.34 (76)
East	0.9x	0.77	x	1.4	x	92.28	x	0.45	x	0.7	=	28.2 (76)
East	0.9x	0.77	x	1.4	x	113.09	x	0.45	x	0.7	=	34.56 (76)
East	0.9x	0.77	x	1.4	x	115.77	x	0.45	x	0.7	=	35.38 (76)
East	0.9x	0.77	x	1.4	x	110.22	x	0.45	x	0.7	=	33.68 (76)
East	0.9x	0.77	x	1.4	x	94.68	x	0.45	x	0.7	=	28.93 (76)
East	0.9x	0.77	x	1.4	x	73.59	x	0.45	x	0.7	=	22.49 (76)
East	0.9x	0.77	x	1.4	x	45.59	x	0.45	x	0.7	=	13.93 (76)
East	0.9x	0.77	x	1.4	x	24.49	x	0.45	x	0.7	=	7.48 (76)
East	0.9x	0.77	x	1.4	x	16.15	x	0.45	x	0.7	=	4.94 (76)
South	0.9x	0.77	x	8.39	x	46.75	x	0.45	x	0.7	=	85.63 (78)
South	0.9x	0.77	x	8.39	x	76.57	x	0.45	x	0.7	=	140.23 (78)
South	0.9x	0.77	x	8.39	x	97.53	x	0.45	x	0.7	=	178.63 (78)
South	0.9x	0.77	x	8.39	x	110.23	x	0.45	x	0.7	=	201.89 (78)
South	0.9x	0.77	x	8.39	x	114.87	x	0.45	x	0.7	=	210.39 (78)
South	0.9x	0.77	x	8.39	x	110.55	x	0.45	x	0.7	=	202.47 (78)
South	0.9x	0.77	x	8.39	x	108.01	x	0.45	x	0.7	=	197.82 (78)
South	0.9x	0.77	x	8.39	x	104.89	x	0.45	x	0.7	=	192.11 (78)
South	0.9x	0.77	x	8.39	x	101.89	x	0.45	x	0.7	=	186.6 (78)
South	0.9x	0.77	x	8.39	x	82.59	x	0.45	x	0.7	=	151.26 (78)
South	0.9x	0.77	x	8.39	x	55.42	x	0.45	x	0.7	=	101.5 (78)
South	0.9x	0.77	x	8.39	x	40.4	x	0.45	x	0.7	=	73.99 (78)
Southwest	0.9x	0.77	x	2.79	x	36.79		0.45	x	0.7	=	22.41 (79)
Southwest	0.9x	0.77	x	2.79	x	62.67		0.45	x	0.7	=	38.17 (79)
Southwest	0.9x	0.77	x	2.79	x	85.75		0.45	x	0.7	=	52.23 (79)
Southwest	0.9x	0.77	x	2.79	x	106.25		0.45	x	0.7	=	64.71 (79)
Southwest	0.9x	0.77	x	2.79	x	119.01		0.45	x	0.7	=	72.48 (79)
Southwest	0.9x	0.77	x	2.79	x	118.15		0.45	x	0.7	=	71.96 (79)
Southwest	0.9x	0.77	x	2.79	x	113.91		0.45	x	0.7	=	69.38 (79)
Southwest	0.9x	0.77	x	2.79	x	104.39		0.45	x	0.7	=	63.58 (79)
Southwest	0.9x	0.77	x	2.79	x	92.85		0.45	x	0.7	=	56.55 (79)
Southwest	0.9x	0.77	x	2.79	x	69.27		0.45	x	0.7	=	42.19 (79)
Southwest	0.9x	0.77	x	2.79	x	44.07		0.45	x	0.7	=	26.84 (79)
Southwest	0.9x	0.77	x	2.79	x	31.49		0.45	x	0.7	=	19.18 (79)
West	0.9x	0.77	x	5.59	x	19.64	x	0.45	x	0.7	=	23.97 (80)
West	0.9x	0.77	x	5.59	x	38.42	x	0.45	x	0.7	=	46.88 (80)
West	0.9x	0.77	x	5.59	x	63.27	x	0.45	x	0.7	=	77.21 (80)

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West	0.9x	0.77	x	5.59	x	92.28	x	0.45	x	0.7	=	112.61	(80)
West	0.9x	0.77	x	5.59	x	113.09	x	0.45	x	0.7	=	138	(80)
West	0.9x	0.77	x	5.59	x	115.77	x	0.45	x	0.7	=	141.27	(80)
West	0.9x	0.77	x	5.59	x	110.22	x	0.45	x	0.7	=	134.5	(80)
West	0.9x	0.77	x	5.59	x	94.68	x	0.45	x	0.7	=	115.53	(80)
West	0.9x	0.77	x	5.59	x	73.59	x	0.45	x	0.7	=	89.8	(80)
West	0.9x	0.77	x	5.59	x	45.59	x	0.45	x	0.7	=	55.63	(80)
West	0.9x	0.77	x	5.59	x	24.49	x	0.45	x	0.7	=	29.88	(80)
West	0.9x	0.77	x	5.59	x	16.15	x	0.45	x	0.7	=	19.71	(80)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.45	x	0.7	=	3.45	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.45	x	0.7	=	7.02	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.45	x	0.7	=	12.65	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.45	x	0.7	=	20.77	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.45	x	0.7	=	27.92	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.45	x	0.7	=	29.76	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.45	x	0.7	=	27.84	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.45	x	0.7	=	22.2	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.45	x	0.7	=	15.41	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.45	x	0.7	=	8.58	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.45	x	0.7	=	4.34	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.45	x	0.7	=	2.82	(81)
Rooflights	0.9x	1	x	1.12	x	26	x	0.45	x	0.7	=	8.26	(82)
Rooflights	0.9x	1	x	1.12	x	54	x	0.45	x	0.7	=	17.15	(82)
Rooflights	0.9x	1	x	1.12	x	96	x	0.45	x	0.7	=	30.48	(82)
Rooflights	0.9x	1	x	1.12	x	150	x	0.45	x	0.7	=	47.63	(82)
Rooflights	0.9x	1	x	1.12	x	192	x	0.45	x	0.7	=	60.96	(82)
Rooflights	0.9x	1	x	1.12	x	200	x	0.45	x	0.7	=	63.5	(82)
Rooflights	0.9x	1	x	1.12	x	189	x	0.45	x	0.7	=	60.01	(82)
Rooflights	0.9x	1	x	1.12	x	157	x	0.45	x	0.7	=	49.85	(82)
Rooflights	0.9x	1	x	1.12	x	115	x	0.45	x	0.7	=	36.51	(82)
Rooflights	0.9x	1	x	1.12	x	66	x	0.45	x	0.7	=	20.96	(82)
Rooflights	0.9x	1	x	1.12	x	33	x	0.45	x	0.7	=	10.48	(82)
Rooflights	0.9x	1	x	1.12	x	21	x	0.45	x	0.7	=	6.67	(82)

Solar gains in watts, calculated for each month

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

(83)m= 149.71 261.19 370.53 475.81 544.31 544.34 523.23 472.2 407.37 292.54 180.52 127.3 (83)

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

(84)m= 529.27 639.3 736.38 821.54 869.66 850 815.69 769.88 715.07 620.56 531.97 496.15 (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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DER WorkSheet: New dwelling design stage

(86)m=	0.98	0.97	0.94	0.88	0.79	0.65	0.5	0.55	0.75	0.91	0.97	0.99	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.98	19.26	19.66	20.15	20.56	20.84	20.95	20.93	20.73	20.17	19.48	18.93	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.78	19.78	19.79	19.79	19.8	19.8	19.8	19.79	19.79	19.78	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.86	0.74	0.56	0.38	0.42	0.67	0.89	0.96	0.98	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.13	17.53	18.11	18.79	19.34	19.67	19.77	19.76	19.56	18.84	17.86	17.05	(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=	17.8	18.15	18.67	19.28	19.78	20.09	20.2	20.18	19.98	19.32	18.45	17.73	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.8	18.15	18.67	19.28	19.78	20.09	20.2	20.18	19.98	19.32	18.45	17.73	(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=	0.97	0.95	0.91	0.84	0.74	0.58	0.42	0.47	0.68	0.87	0.95	0.97	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	512.63	605.51	670.48	692.84	639.89	493.55	346.2	358.7	489.58	541.54	505.58	483.01	(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=	1388.12	1360.22	1246.85	1055.28	820.36	553.58	362.33	380.72	594.16	885.21	1154.91	1381.99	(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=	651.36	507.16	428.82	260.96	134.27	0	0	0	0	255.69	467.51	668.84	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3374.61	(99)
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Space heating requirement in kWh/m²/year

45.37	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
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The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
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Fraction of total space heat from Community boilers

(302) x (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.05	(306)
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Space heating

Annual space heating requirement

kWh/year
3374.61

DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	3543.34	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1355	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	1422.75	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	49.66	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	0	(331)
Energy for lighting (calculated in Appendix L)		326.37	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5292.46	(338)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		96 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	= 1117.37 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 25.77 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1143.14 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1143.14 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 0 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 169.39 (379)
Total CO2, kg/year	sum of (376)...(382) =		1312.53 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		17.65 (384)
EI rating (section 14)			85.27 (385)