Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
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Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 48.05m²

Site Reference : Green **Plot Reference:** Flat 1 - Base

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
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	23.62 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	38.60 kg/m²	Fail

Excess emissions = 14.98 kg/m² (63.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	66.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	109.4 kWh/m²	
		Fail

Excess energy = 43.39 kg/m² (65.7 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	15.00	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Efficiency 86.0 % SEDBUK2009
Minimum 88.0 % **Fail**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:

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	Measured cylinder loss: 1.25 kWh/day		
	Permitted by DBSCG: 1.89 kWh/day		OK
Primary pipework insulated:	Yes		OK

6 Controls

Space heating controls	Programmer, room thermostat and TRVs	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South West	4.93m²
Windows facing: North East	1.35m²
Windows facing: North West	2.05m²
Ventilation rate:	3.00

10 Key features

Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: Flat 1 - Base

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.05	(1a) x	2.95	(2a) =	141.75	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	48.05	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		141.75	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
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) =		0.89	(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

DER WorkSheet: New dwelling design stage

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

1.14	1.11	1.09	0.98	0.96	0.85	0.85	0.82	0.89	0.96	1	1.05

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	1.14	1.11	1.09	0.98	0.96	0.86	0.86	0.84	0.9	0.96	1	1.05	(24d)

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

(25)m=	1.14	1.11	1.09	0.98	0.96	0.86	0.86	0.84	0.9	0.96	1	1.05	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.6	=	3.024			(26)
Windows Type 1			4.93	x1/[1/(1.6)+ 0.04]		=	7.41			(27)
Windows Type 2			1.35	x1/[1/(1.6)+ 0.04]		=	2.03			(27)
Windows Type 3			2.05	x1/[1/(1.6)+ 0.04]		=	3.08			(27)
Floor			48.05	x	0.22	=	10.571			(28)
Walls Type1	32.49	8.33	24.16	x	0.28	=	6.76			(29)
Walls Type2	29.43	1.89	27.54	x	0.25	=	6.88			(29)
Roof	15.41	0	15.41	x	0.18	=	2.77			(30)
Total area of elements, m²			125.38							(31)
Party wall			45.18	x	0	=	0			(32)
Party ceiling			32.64							(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 42.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12667.99 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 18.81 (36)

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

Total fabric heat loss (33) + (36) = 61.35 (37)

DER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	53.15	52.1	51.06	45.86	44.85	40.15	40.15	39.28	41.96	44.85	46.89	48.98	(38)

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

(39)m=	114.49	113.45	112.41	107.21	106.2	101.5	101.5	100.63	103.31	106.2	108.24	110.33	

Average = Sum(39)$_{1…12}$ /12= 107.12 (39)

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

(40)m=	2.38	2.36	2.34	2.23	2.21	2.11	2.11	2.09	2.15	2.21	2.25	2.3	

Average = Sum(40)$_{1…12}$ /12= 2.23 (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 1.63 (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 72.98 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	80.28	77.36	74.44	71.52	68.6	65.68	65.68	68.6	71.52	74.44	77.36	80.28	

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

Total = Sum(44)$_{1…12}$ = 875.77 (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=	119.05	104.12	107.45	93.67	89.88	77.56	71.87	82.47	83.46	97.26	106.17	115.29	

Total = Sum(45)$_{1…12}$ = 1148.27 (45)

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

(46)m=	17.86	15.62	16.12	14.05	13.48	11.63	10.78	12.37	12.52	14.59	15.93	17.29	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 150 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.93 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0.67 (54)

Enter (50) or (54) in (55) 0.67 (55)

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

(56)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(56)

DER WorkSheet: New dwelling design stage

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=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(57)

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

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

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

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

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

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

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

(62)m=	163.19	143.99	151.59	136.39	134.02	120.28	116.01	126.62	126.18	141.4	148.89	159.44	(62)

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

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

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

Output from water heater

(64)m=	163.19	143.99	151.59	136.39	134.02	120.28	116.01	126.62	126.18	141.4	148.89	159.44

Output from water heater (annual)$_{1…12}$ — 1667.99 (64)

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

(65)m=	74.9	66.52	71.04	65.32	65.2	59.96	59.21	62.74	61.92	67.65	69.48	73.65	(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=	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	81.64	(66)

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

(67)m=	16.86	14.98	12.18	9.22	6.89	5.82	6.29	8.17	10.97	13.93	16.26	17.33	(67)

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

(68)m=	142.17	143.65	139.93	132.01	122.02	112.63	106.36	104.89	108.6	116.52	126.51	135.9	(68)

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

(69)m=	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	31.16	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	-65.31	(71)

Water heating gains (Table 5)

(72)m=	100.67	98.98	95.48	90.72	87.63	83.28	79.58	84.32	86.01	90.93	96.49	98.99	(72)

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

(73)m=	310.2	308.1	298.08	282.45	267.04	252.23	242.73	247.87	256.07	271.87	289.75	302.71	(73)

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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

Northeast	0.9x	0.3	x	1.35	x	11.28	x	0.63	x	0.7	=	1.81	(75)
Northeast	0.9x	0.3	x	1.35	x	22.97	x	0.63	x	0.7	=	3.69	(75)
Northeast	0.9x	0.3	x	1.35	x	41.38	x	0.63	x	0.7	=	6.65	(75)
Northeast	0.9x	0.3	x	1.35	x	67.96	x	0.63	x	0.7	=	10.92	(75)
Northeast	0.9x	0.3	x	1.35	x	91.35	x	0.63	x	0.7	=	14.68	(75)
Northeast	0.9x	0.3	x	1.35	x	97.38	x	0.63	x	0.7	=	15.65	(75)
Northeast	0.9x	0.3	x	1.35	x	91.1	x	0.63	x	0.7	=	14.64	(75)
Northeast	0.9x	0.3	x	1.35	x	72.63	x	0.63	x	0.7	=	11.67	(75)
Northeast	0.9x	0.3	x	1.35	x	50.42	x	0.63	x	0.7	=	8.1	(75)
Northeast	0.9x	0.3	x	1.35	x	28.07	x	0.63	x	0.7	=	4.51	(75)
Northeast	0.9x	0.3	x	1.35	x	14.2	x	0.63	x	0.7	=	2.28	(75)
Northeast	0.9x	0.3	x	1.35	x	9.21	x	0.63	x	0.7	=	1.48	(75)
Southwest	0.9x	0.77	x	4.93	x	36.79		0.63	x	0.7	=	55.44	(79)
Southwest	0.9x	0.77	x	4.93	x	62.67		0.63	x	0.7	=	94.43	(79)
Southwest	0.9x	0.77	x	4.93	x	85.75		0.63	x	0.7	=	129.2	(79)
Southwest	0.9x	0.77	x	4.93	x	106.25		0.63	x	0.7	=	160.09	(79)
Southwest	0.9x	0.77	x	4.93	x	119.01		0.63	x	0.7	=	179.31	(79)
Southwest	0.9x	0.77	x	4.93	x	118.15		0.63	x	0.7	=	178.01	(79)
Southwest	0.9x	0.77	x	4.93	x	113.91		0.63	x	0.7	=	171.62	(79)
Southwest	0.9x	0.77	x	4.93	x	104.39		0.63	x	0.7	=	157.28	(79)
Southwest	0.9x	0.77	x	4.93	x	92.85		0.63	x	0.7	=	139.9	(79)
Southwest	0.9x	0.77	x	4.93	x	69.27		0.63	x	0.7	=	104.36	(79)
Southwest	0.9x	0.77	x	4.93	x	44.07		0.63	x	0.7	=	66.4	(79)
Southwest	0.9x	0.77	x	4.93	x	31.49		0.63	x	0.7	=	47.44	(79)
Northwest	0.9x	0.3	x	2.05	x	11.28	x	0.63	x	0.7	=	2.75	(81)
Northwest	0.9x	0.3	x	2.05	x	22.97	x	0.63	x	0.7	=	5.61	(81)
Northwest	0.9x	0.3	x	2.05	x	41.38	x	0.63	x	0.7	=	10.1	(81)
Northwest	0.9x	0.3	x	2.05	x	67.96	x	0.63	x	0.7	=	16.59	(81)
Northwest	0.9x	0.3	x	2.05	x	91.35	x	0.63	x	0.7	=	22.3	(81)
Northwest	0.9x	0.3	x	2.05	x	97.38	x	0.63	x	0.7	=	23.77	(81)
Northwest	0.9x	0.3	x	2.05	x	91.1	x	0.63	x	0.7	=	22.24	(81)
Northwest	0.9x	0.3	x	2.05	x	72.63	x	0.63	x	0.7	=	17.73	(81)
Northwest	0.9x	0.3	x	2.05	x	50.42	x	0.63	x	0.7	=	12.31	(81)
Northwest	0.9x	0.3	x	2.05	x	28.07	x	0.63	x	0.7	=	6.85	(81)
Northwest	0.9x	0.3	x	2.05	x	14.2	x	0.63	x	0.7	=	3.47	(81)
Northwest	0.9x	0.3	x	2.05	x	9.21	x	0.63	x	0.7	=	2.25	(81)

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

(83)m=	60	103.73	145.95	187.6	216.29	217.44	208.51	186.68	160.31	115.73	72.15	51.17	(83)

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

(84)m=	370.2	411.83	444.04	470.05	483.33	469.67	451.23	434.56	416.38	387.6	361.9	353.88	(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	0.99	0.98	0.97	0.94	0.87	0.76	0.79	0.91	0.97	0.99	0.99	(86)

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

(87)m=	18.54	18.73	19.08	19.63	20.13	20.6	20.83	20.8	20.45	19.81	19.13	18.57	(87)

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

(88)m=	19.09	19.1	19.12	19.18	19.2	19.26	19.26	19.27	19.24	19.2	19.17	19.14	(88)

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

(89)m=	0.99	0.99	0.98	0.96	0.9	0.76	0.55	0.59	0.84	0.96	0.99	0.99	(89)

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

(90)m=	16.97	17.17	17.54	18.12	18.61	19.07	19.22	19.22	18.94	18.31	17.62	17.05	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	17.85	18.05	18.41	18.97	19.46	19.93	20.12	20.11	19.79	19.15	18.47	17.9	(92)

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

(93)m=	17.85	18.05	18.41	18.97	19.46	19.93	20.12	20.11	19.79	19.15	18.47	17.9	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.97	0.95	0.91	0.81	0.67	0.7	0.87	0.96	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	366.03	405.19	432.81	448.73	440.18	381.45	300.9	304.81	362.59	371.17	355.79	350.48	(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=	1551.64	1491.74	1338.49	1079.31	824.41	540.93	357.64	373.03	587.76	908.38	1231.15	1511.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	882.1	730.17	673.82	454.01	285.87	0	0	0	0	399.69	630.26	864.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4920.06 (98)

Space heating requirement in kWh/m²/year 102.39 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		86.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	882.1	730.17	673.82	454.01	285.87	0	0	0	0	399.69	630.26	864.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1015.07	840.24	775.4	522.45	328.97	0	0	0	0	459.94	725.27	994.41	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 5661.75 (211)

DER WorkSheet: New dwelling design stage

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

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

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

Water heating

Output from water heater (calculated above)

163.19	143.99	151.59	136.39	134.02	120.28	116.01	126.62	126.18	141.4	148.89	159.44

Efficiency of water heater 76.8 (216)

(217)m=	85.15	85.06	84.85	84.34	83.4	76.8	76.8	76.8	76.8	84.01	84.77	85.16

(217)

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

(219)m=	191.65	169.29	178.65	161.72	160.7	156.61	151.06	164.86	164.29	168.31	175.64	187.23

Total = Sum(219a)$_{1...12}$ = 2030.01 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		5661.75	
Water heating fuel used		2030.01	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		297.81	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1222.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	438.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1661.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	154.56	(268)
Total CO2, kg/year		sum of (265)…(271) =		1854.91	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		38.6	(273)
EI rating (section 14)				73	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 14 December 2020 at 08:05:28

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 45.55m²

Site Reference : Green **Plot Reference:** Flat 2 - Base

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		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	23.62 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	38.87 kg/m²	Fail
Excess emissions = 15.25 kg/m² (64.6 %)		

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	64.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	109.1 kWh/m²	
		Fail
Excess energy = 44.92 kg/m² (70.0 %)		

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	15.00	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas	
	Data from manufacturer	
	Efficiency 86.0 % SEDBUK2009	
	Minimum 88.0 %	Fail
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:

Regulations Compliance Report

	Measured cylinder loss: 1.25 kWh/day	
	Permitted by DBSCG: 1.89 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Programmer, room thermostat and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**
	Independent timer for DHW	**OK**
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	4.09m²	
Windows facing: North East	0.81m²	
Windows facing: South East	2.05m²	
Ventilation rate:	3.00	

10 Key features

Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: Flat 2 - Base

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	45.55	(1a)	x	2.95	(2a)	=	134.37	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	45.55	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	134.37	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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) =	0.15	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.9	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
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) =	0.9	(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

DER WorkSheet: New dwelling design stage

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

1.15	1.12	1.1	0.99	0.97	0.85	0.85	0.83	0.9	0.97	1.01	1.06

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	1.15	1.12	1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06	(24d)

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

(25)m=	1.15	1.12	1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.6	=	3.024			(26)
Windows Type 1			4.09	x1/[1/(1.6)+ 0.04]		=	6.15			(27)
Windows Type 2			0.81	x1/[1/(1.6)+ 0.04]		=	1.22			(27)
Windows Type 3			2.05	x1/[1/(1.6)+ 0.04]		=	3.08			(27)
Floor			45.55	x	0.22	=	10.021			(28)
Walls Type1	35.85	6.95	28.9	x	0.28	=	8.09			(29)
Walls Type2	28.18	1.89	26.29	x	0.25	=	6.57			(29)
Roof	15.42	0	15.42	x	0.18	=	2.78			(30)
Total area of elements, m²			125							(31)
Party wall			39.18	x	0	=	0			(32)
Party ceiling			30.14							(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12107.48 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 18.75 (36)

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

Total fabric heat loss (33) + (36) = 59.68 (37)

DER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	50.82	49.82	48.83	43.85	42.87	38.34	38.34	37.5	40.08	42.87	44.84	46.83	(38)

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

(39)m=	110.5	109.51	108.51	103.53	102.56	98.02	98.02	97.18	99.77	102.56	104.52	106.52	

Average = Sum(39)$_{1...12}$ /12= 103.43 (39)

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

(40)m=	2.43	2.4	2.38	2.27	2.25	2.15	2.15	2.13	2.19	2.25	2.29	2.34	

Average = Sum(40)$_{1...12}$ /12= 2.27 (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 1.56 (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 71.26 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	78.39	75.54	72.68	69.83	66.98	64.13	64.13	66.98	69.83	72.68	75.54	78.39	

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

Total = Sum(44)$_{1...12}$ = 855.11 (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=	116.24	101.67	104.91	91.46	87.76	75.73	70.18	80.53	81.49	94.97	103.67	112.58	

Total = Sum(45)$_{1...12}$ = 1121.19 (45)

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

(46)m=	17.44	15.25	15.74	13.72	13.16	11.36	10.53	12.08	12.22	14.25	15.55	16.89	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 150 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.93 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0.67 (54)

Enter (50) or (54) in (55) 0.67 (55)

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

(56)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(56)

DER WorkSheet: New dwelling design stage

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=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(57)

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

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

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

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

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

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

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

(62)m=	160.38	141.54	149.05	134.18	131.9	118.45	114.32	124.67	124.21	139.11	146.38	156.72	(62)

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

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

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

Output from water heater

(64)m=	160.38	141.54	149.05	134.18	131.9	118.45	114.32	124.67	124.21	139.11	146.38	156.72

Output from water heater (annual)$_{1...12}$ | 1640.91 | (64)

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

(65)m=	73.96	65.7	70.2	64.59	64.49	59.35	58.65	62.09	61.27	66.89	68.64	72.74	(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=	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	78.02	(66)

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

(67)m=	16.09	14.29	11.62	8.8	6.58	5.55	6	7.8	10.47	13.29	15.51	16.54	(67)

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

(68)m=	135.7	137.11	133.56	126	116.47	107.51	101.52	100.11	103.66	111.21	120.75	129.71	(68)

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

(69)m=	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	-62.42	(71)

Water heating gains (Table 5)

(72)m=	99.41	97.77	94.35	89.7	86.68	82.44	78.83	83.45	85.1	89.91	95.34	97.77	(72)

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

(73)m=	300.61	298.57	288.94	273.91	259.14	244.9	235.75	240.77	248.63	263.82	281	293.43	(73)

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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

Northeast 0.9x	0.3	x	0.81	x	11.28	x	0.63	x	0.7	=	1.09	(75)
Northeast 0.9x	0.3	x	0.81	x	22.97	x	0.63	x	0.7	=	2.22	(75)
Northeast 0.9x	0.3	x	0.81	x	41.38	x	0.63	x	0.7	=	3.99	(75)
Northeast 0.9x	0.3	x	0.81	x	67.96	x	0.63	x	0.7	=	6.55	(75)
Northeast 0.9x	0.3	x	0.81	x	91.35	x	0.63	x	0.7	=	8.81	(75)
Northeast 0.9x	0.3	x	0.81	x	97.38	x	0.63	x	0.7	=	9.39	(75)
Northeast 0.9x	0.3	x	0.81	x	91.1	x	0.63	x	0.7	=	8.79	(75)
Northeast 0.9x	0.3	x	0.81	x	72.63	x	0.63	x	0.7	=	7	(75)
Northeast 0.9x	0.3	x	0.81	x	50.42	x	0.63	x	0.7	=	4.86	(75)
Northeast 0.9x	0.3	x	0.81	x	28.07	x	0.63	x	0.7	=	2.71	(75)
Northeast 0.9x	0.3	x	0.81	x	14.2	x	0.63	x	0.7	=	1.37	(75)
Northeast 0.9x	0.3	x	0.81	x	9.21	x	0.63	x	0.7	=	0.89	(75)
Southeast 0.9x	0.77	x	2.05	x	36.79	x	0.63	x	0.7	=	23.05	(77)
Southeast 0.9x	0.77	x	2.05	x	62.67	x	0.63	x	0.7	=	39.27	(77)
Southeast 0.9x	0.77	x	2.05	x	85.75	x	0.63	x	0.7	=	53.72	(77)
Southeast 0.9x	0.77	x	2.05	x	106.25	x	0.63	x	0.7	=	66.57	(77)
Southeast 0.9x	0.77	x	2.05	x	119.01	x	0.63	x	0.7	=	74.56	(77)
Southeast 0.9x	0.77	x	2.05	x	118.15	x	0.63	x	0.7	=	74.02	(77)
Southeast 0.9x	0.77	x	2.05	x	113.91	x	0.63	x	0.7	=	71.36	(77)
Southeast 0.9x	0.77	x	2.05	x	104.39	x	0.63	x	0.7	=	65.4	(77)
Southeast 0.9x	0.77	x	2.05	x	92.85	x	0.63	x	0.7	=	58.17	(77)
Southeast 0.9x	0.77	x	2.05	x	69.27	x	0.63	x	0.7	=	43.4	(77)
Southeast 0.9x	0.77	x	2.05	x	44.07	x	0.63	x	0.7	=	27.61	(77)
Southeast 0.9x	0.77	x	2.05	x	31.49	x	0.63	x	0.7	=	19.73	(77)
Southwest 0.9x	0.77	x	4.09	x	36.79		0.63	x	0.7	=	45.99	(79)
Southwest 0.9x	0.77	x	4.09	x	62.67		0.63	x	0.7	=	78.34	(79)
Southwest 0.9x	0.77	x	4.09	x	85.75		0.63	x	0.7	=	107.19	(79)
Southwest 0.9x	0.77	x	4.09	x	106.25		0.63	x	0.7	=	132.81	(79)
Southwest 0.9x	0.77	x	4.09	x	119.01		0.63	x	0.7	=	148.76	(79)
Southwest 0.9x	0.77	x	4.09	x	118.15		0.63	x	0.7	=	147.68	(79)
Southwest 0.9x	0.77	x	4.09	x	113.91		0.63	x	0.7	=	142.38	(79)
Southwest 0.9x	0.77	x	4.09	x	104.39		0.63	x	0.7	=	130.48	(79)
Southwest 0.9x	0.77	x	4.09	x	92.85		0.63	x	0.7	=	116.06	(79)
Southwest 0.9x	0.77	x	4.09	x	69.27		0.63	x	0.7	=	86.58	(79)
Southwest 0.9x	0.77	x	4.09	x	44.07		0.63	x	0.7	=	55.09	(79)
Southwest 0.9x	0.77	x	4.09	x	31.49		0.63	x	0.7	=	39.36	(79)

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

(83)m=	70.13	119.82	164.9	205.93	232.13	231.1	222.53	202.89	179.1	132.69	84.07	59.97	(83)

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

(84)m=	370.74	418.39	453.84	479.84	491.27	476	458.28	443.66	427.72	396.5	365.07	353.4	(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	0.99	0.98	0.97	0.93	0.85	0.74	0.76	0.9	0.97	0.99	0.99	(86)

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

(87)m=	18.53	18.74	19.1	19.65	20.15	20.61	20.84	20.81	20.47	19.83	19.14	18.56	(87)

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

(88)m=	19.06	19.08	19.09	19.16	19.17	19.23	19.23	19.25	19.21	19.17	19.14	19.12	(88)

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

(89)m=	0.99	0.98	0.97	0.95	0.89	0.74	0.52	0.56	0.82	0.95	0.98	0.99	(89)

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

(90)m=	16.95	17.16	17.53	18.12	18.61	19.06	19.2	19.2	18.93	18.31	17.61	17.02	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	17.81	18.02	18.39	18.95	19.45	19.91	20.09	20.08	19.77	19.14	18.44	17.86	(92)

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

(93)m=	17.81	18.02	18.39	18.95	19.45	19.91	20.09	20.08	19.77	19.14	18.44	17.86	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.97	0.95	0.9	0.79	0.64	0.67	0.85	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	365.87	410.3	440.03	454.09	440.97	376.83	293.13	298.5	363.89	376.43	357.78	349.44	(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=	1493.01	1436.85	1290.12	1040.93	794.57	520.17	342.33	357.49	566.11	875.63	1185.6	1455.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	838.59	689.84	632.47	422.53	263.08	0	0	0	0	371.4	596.03	822.62	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4636.56 (98)

Space heating requirement in kWh/m²/year 101.79 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		86.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	838.59	689.84	632.47	422.53	263.08	0	0	0	0	371.4	596.03	822.62	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	965.01	793.83	727.81	486.22	302.74	0	0	0	0	427.39	685.88	946.63	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 5335.51 (211)

DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

160.38	141.54	149.05	134.18	131.9	118.45	114.32	124.67	124.21	139.11	146.38	156.72

Efficiency of water heater 76.8 (216)

(217)m=	85.1	85	84.77	84.23	83.24	76.8	76.8	76.8	76.8	83.89	84.7	85.11	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	188.46	166.52	175.82	159.3	158.45	154.23	148.85	162.33	161.73	165.82	172.82	184.14

Total = Sum(219a)$_{1...12}$ = 1998.47 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		5335.51	
Water heating fuel used		1998.47	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		284.13	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1152.47	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	431.67	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1584.14	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	147.46	(268)
Total CO2, kg/year		sum of (265)…(271) =		1770.53	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		38.87	(273)
EI rating (section 14)				74	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 14 December 2020 at 08:05:27

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 76.27m²

Site Reference : Green **Plot Reference:** Flat 3 - Base

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
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.5 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	31.49 kg/m²	Fail

Excess emissions = 14.99 kg/m² (90.8 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	92.1 kWh/m²	
		Fail

Excess energy = 48.43 kg/m² (111.0 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	2.98 (max. 2.00)	3.10 (max. 3.30)	Fail

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	15.00	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Efficiency 86.0 % SEDBUK2009
Minimum 88.0 % **Fail**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:

Regulations Compliance Report

	Measured cylinder loss: 1.25 kWh/day		
	Permitted by DBSCG: 1.89 kWh/day		OK
Primary pipework insulated:	Yes		OK

6 Controls

Space heating controls	Programmer, room thermostat and TRVs	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South West	8.14m²
Windows facing: North East	12.82m²
Ventilation rate:	6.00

10 Key features

Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: Flat 3 - Base

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	76.27	(1a)	x	2.35	(2a)	=	179.23	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.27	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	179.23	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.92	(18)

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

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) =	0.92	(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

DER WorkSheet: New dwelling design stage

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

1.17	1.15	1.12	1.01	0.99	0.87	0.87	0.85	0.92	0.99	1.03	1.08

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08	(24d)

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

(25)m=	1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.6	=	3.024			(26)
Windows Type 1			8.14	x1/[1/(3.1)+ 0.04]		=	22.45			(27)
Windows Type 2			12.82	x1/[1/(3.1)+ 0.04]		=	35.36			(27)
Floor			5.62	x	0.22	=	1.2364			(28)
Walls Type1	49.96	20.96	29	x	0.3	=	8.7			(29)
Walls Type2	24.47	1.89	22.58	x	0.25	=	5.64			(29)
Roof	13.31	0	13.31	x	0.18	=	2.4			(30)
Total area of elements, m²			93.36							(31)
Party wall			51.46	x	0	=	0			(32)
Party ceiling			62.97							(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 78.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7648.39 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14 (36)

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

Total fabric heat loss (33) + (36) = 92.81 (37)

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

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

(38)m=	69.18	67.83	66.47	59.69	58.34	52.04	52.04	50.87	54.46	58.34	61.04	63.76	(38)

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

(39)m=	161.99	160.64	159.28	152.5	151.15	144.85	144.85	143.68	147.27	151.15	153.85	156.57	

Average = $Sum(39)_{1...12}$ /12= 152.31 (39)

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

(40)m=	2.12	2.11	2.09	2	1.98	1.9	1.9	1.88	1.93	1.98	2.02	2.05	

Average = $Sum(40)_{1...12}$ /12= 2 (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 2.39 (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 90.92 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.01	96.38	92.74	89.1	85.47	81.83	81.83	85.47	89.1	92.74	96.38	100.01	

Total = $Sum(44)_{1...12}$ = 1091.06 (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=	148.32	129.72	133.86	116.7	111.98	96.63	89.54	102.75	103.98	121.17	132.27	143.64	

Total = $Sum(45)_{1...12}$ = 1430.55 (45)

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

(46)m=	22.25	19.46	20.08	17.51	16.8	14.49	13.43	15.41	15.6	18.18	19.84	21.55	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 150 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.93 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0.67 (54)

Enter (50) or (54) in (55) 0.67 (55)

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

(56)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(56)

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

(57)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(57)

DER WorkSheet: New dwelling design stage

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

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

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

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

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

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

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

(62)m=	192.46	169.59	178	159.42	156.12	139.35	133.68	146.89	146.69	165.31	174.99	187.78	(62)

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

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

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

Output from water heater

(64)m=	192.46	169.59	178	159.42	156.12	139.35	133.68	146.89	146.69	165.31	174.99	187.78

Output from water heater (annual)$_{1\ldots12}$ | 1950.27 | (64)

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

(65)m=	84.63	75.03	79.82	72.98	72.55	66.3	65.08	69.48	68.75	75.6	78.15	83.07	(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=	119.41	119.41	119.41	119.41	119.41	119.41	119.41	119.41	119.41	119.41	119.41	119.41	(66)

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

(67)m=	23.57	20.93	17.02	12.89	9.63	8.13	8.79	11.42	15.33	19.47	22.72	24.22	(67)

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

(68)m=	211.47	213.66	208.13	196.36	181.5	167.53	158.2	156.01	161.54	173.31	188.17	202.14	(68)

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

(69)m=	34.94	34.94	34.94	34.94	34.94	34.94	34.94	34.94	34.94	34.94	34.94	34.94	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	-95.53	(71)

Water heating gains (Table 5)

(72)m=	113.75	111.65	107.29	101.36	97.51	92.09	87.48	93.38	95.48	101.62	108.55	111.66	(72)

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

(73)m=	410.61	408.07	394.27	372.43	350.47	329.58	316.3	322.64	334.17	356.22	381.26	399.84	(73)

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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	12.82	x	11.28	x	0.63	x	0.7	=	44.21	(75)
Northeast	0.9x	0.77	x	12.82	x	22.97	x	0.63	x	0.7	=	89.98	(75)

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Northeast 0.9x	0.77	x	12.82	x	41.38	x	0.63	x	0.7	=	162.12	(75)
Northeast 0.9x	0.77	x	12.82	x	67.96	x	0.63	x	0.7	=	266.25	(75)
Northeast 0.9x	0.77	x	12.82	x	91.35	x	0.63	x	0.7	=	357.89	(75)
Northeast 0.9x	0.77	x	12.82	x	97.38	x	0.63	x	0.7	=	381.55	(75)
Northeast 0.9x	0.77	x	12.82	x	91.1	x	0.63	x	0.7	=	356.93	(75)
Northeast 0.9x	0.77	x	12.82	x	72.63	x	0.63	x	0.7	=	284.55	(75)
Northeast 0.9x	0.77	x	12.82	x	50.42	x	0.63	x	0.7	=	197.55	(75)
Northeast 0.9x	0.77	x	12.82	x	28.07	x	0.63	x	0.7	=	109.97	(75)
Northeast 0.9x	0.77	x	12.82	x	14.2	x	0.63	x	0.7	=	55.62	(75)
Northeast 0.9x	0.77	x	12.82	x	9.21	x	0.63	x	0.7	=	36.1	(75)
Southwest0.9x	0.77	x	8.14	x	36.79		0.63	x	0.7	=	91.53	(79)
Southwest0.9x	0.77	x	8.14	x	62.67		0.63	x	0.7	=	155.91	(79)
Southwest0.9x	0.77	x	8.14	x	85.75		0.63	x	0.7	=	213.33	(79)
Southwest0.9x	0.77	x	8.14	x	106.25		0.63	x	0.7	=	264.32	(79)
Southwest0.9x	0.77	x	8.14	x	119.01		0.63	x	0.7	=	296.06	(79)
Southwest0.9x	0.77	x	8.14	x	118.15		0.63	x	0.7	=	293.92	(79)
Southwest0.9x	0.77	x	8.14	x	113.91		0.63	x	0.7	=	283.37	(79)
Southwest0.9x	0.77	x	8.14	x	104.39		0.63	x	0.7	=	259.69	(79)
Southwest0.9x	0.77	x	8.14	x	92.85		0.63	x	0.7	=	230.99	(79)
Southwest0.9x	0.77	x	8.14	x	69.27		0.63	x	0.7	=	172.32	(79)
Southwest0.9x	0.77	x	8.14	x	44.07		0.63	x	0.7	=	109.63	(79)
Southwest0.9x	0.77	x	8.14	x	31.49		0.63	x	0.7	=	78.33	(79)

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

(83)m=	135.74	245.89	375.45	530.57	653.95	675.47	640.3	544.24	428.53	282.28	165.26	114.43	(83)

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

(84)m=	546.34	653.96	769.71	903	1004.42	1005.05	956.6	866.88	762.71	638.5	546.52	514.27	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.88	0.74	0.6	0.66	0.87	0.97	0.99	1	(86)

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

(87)m=	18.74	18.97	19.36	19.95	20.44	20.8	20.93	20.9	20.62	19.98	19.3	18.76	(87)

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

(88)m=	19.25	19.26	19.28	19.33	19.35	19.4	19.4	19.41	19.38	19.35	19.32	19.3	(88)

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

(89)m=	0.99	0.99	0.97	0.93	0.82	0.62	0.41	0.48	0.78	0.95	0.99	0.99	(89)

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

(90)m=	17.29	17.52	17.92	18.53	18.99	19.32	19.39	19.39	19.18	18.58	17.9	17.34	(90)

fLA = Living area ÷ (4) = 0.48 (91)

DER WorkSheet: New dwelling design stage

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

(92)m=	17.99	18.22	18.62	19.22	19.69	20.04	20.13	20.12	19.88	19.26	18.58	18.03	(92)

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

(93)m=	17.99	18.22	18.62	19.22	19.69	20.04	20.13	20.12	19.88	19.26	18.58	18.03	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.97	0.93	0.83	0.67	0.5	0.57	0.81	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	541.54	643.64	745.17	835.81	838.38	676.15	482.4	491.22	619.99	607.28	538.55	510.62	(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=	2217.57	2139.78	1930.5	1573.12	1207.99	787.68	512	534.87	850.88	1308.8	1765.71	2164.82	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1246.96	1005.41	881.88	530.86	274.99	0	0	0	0	521.93	883.55	1230.73	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6576.31 (98)

Space heating requirement in kWh/m²/year 86.22 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		86.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1246.96	1005.41	881.88	530.86	274.99	0	0	0	0	521.93	883.55	1230.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1434.94	1156.97	1014.82	610.89	316.45	0	0	0	0	600.61	1016.75	1416.25	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 7567.68 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	192.46	169.59	178	159.42	156.12	139.35	133.68	146.89	146.69	165.31	174.99	187.78	
Efficiency of water heater												76.8	(216)
(217)m=	85.4	85.28	85.02	84.34	82.95	76.8	76.8	76.8	76.8	84.24	85.05	85.41	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	225.37	198.86	209.36	189.02	188.21	181.44	174.06	191.26	191.01	196.25	205.74	219.85

Total = Sum(219a)$_{1...12}$ = 2370.43 (219)

DER WorkSheet: New dwelling design stage

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7567.68	
Water heating fuel used			2370.43	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			416.18	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1634.62	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	512.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2146.63	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	216	(268)
Total CO2, kg/year		sum of (265)…(271) =		2401.55	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		31.49	(273)
EI rating (section 14)				73	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 14 December 2020 at 08:05:26

Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 81.65m²

Site Reference : Green **Plot Reference:** Flat 4 - Base

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
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	27.49 kg/m²	Fail

Excess emissions = 10.77 kg/m² (64.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	47.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	77.5 kWh/m²	
		Fail

Excess energy = 30.53 kg/m² (65.0 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	15.00	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Efficiency 86.0 % SEDBUK2009
Minimum 88.0 % **Fail**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:

Regulations Compliance Report

	Measured cylinder loss: 1.25 kWh/day	
	Permitted by DBSCG: 1.89 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Programmer, room thermostat and TRVs	**OK**
Hot water controls:	Cylinderstat	**OK**
	Independent timer for DHW	**OK**
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	5.92m²
Windows facing: North East	5.92m²
Roof windows facing: Horizontal	4.3m²
Ventilation rate:	8.00

10 Key features

Party Walls U-value	0 W/m²K

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: Flat 4 - Base

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	5.28	(1a)	x	2.55	(2a)	=	13.46	(3a)
First floor	76.37	(1b)	x	2.1	(2b)	=	160.38	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.65	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	173.84	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.92	(18)

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

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) =	0.92	(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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

1.18	1.15	1.13	1.01	0.99	0.88	0.88	0.85	0.92	0.99	1.04	1.08

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	1.18	1.15	1.13	1.01	0.99	0.88	0.88	0.86	0.93	0.99	1.04	1.08	(24d)

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

(25)m=	1.18	1.15	1.13	1.01	0.99	0.88	0.88	0.86	0.93	0.99	1.04	1.08	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.6	=	3.024			(26)
Windows Type 1			5.92	x1/[1/(1.6)+ 0.04]		=	8.9			(27)
Windows Type 2			5.92	x1/[1/(1.6)+ 0.04]		=	8.9			(27)
Rooflights			4.3	x1/[1/(1.6) + 0.04]		=	6.880001			(27b)
Floor			9.73	x	0.22	=	2.1406			(28)
Walls Type1	36.78	0	36.78	x	0.28	=	10.3			(29)
Walls Type2	8.55	1.89	6.66	x	0.25	=	1.66			(29)
Walls Type3	56.27	11.84	44.43	x	0.28	=	12.44			(29)
Roof	46.19	4.3	41.89	x	0.18	=	7.54			(30)
Total area of elements, m²			157.52							(31)
Party wall			38.99	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 61.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4966.55 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K | 23.63 | (36)

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

Total fabric heat loss | (33) + (36) = | 85.01 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	67.48	66.16	64.83	58.22	56.9	50.72	50.72	49.57	53.1	56.9	59.54	62.19	(38)

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

(39)m=	152.49	151.16	149.84	143.22	141.9	135.72	135.72	134.58	138.1	141.9	144.55	147.19	

Average = $Sum(39)_{1...12}$ /12= | 143.03 | (39)

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

(40)m=	1.87	1.85	1.84	1.75	1.74	1.66	1.66	1.65	1.69	1.74	1.77	1.8	

Average = $Sum(40)_{1...12}$ /12= | 1.75 | (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 | 2.49 | (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 | 93.42 | (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.76	99.02	95.29	91.55	87.81	84.08	84.08	87.81	91.55	95.29	99.02	102.76	

Total = $Sum(44)_{1...12}$ = | 1121.03 | (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=	152.39	133.28	137.54	119.91	115.05	99.28	92	105.57	106.83	124.5	135.9	147.58	

Total = $Sum(45)_{1...12}$ = | 1469.84 | (45)

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

(46)m=	22.86	19.99	20.63	17.99	17.26	14.89	13.8	15.84	16.02	18.68	20.39	22.14	(46)

Water storage loss:

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

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

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

Water storage loss:

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

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

Energy lost from water storage, kWh/year | (48) x (49) = | 150 | (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0.01 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0.93 | (52)

Temperature factor from Table 2b | 0.54 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0.67 (54)

Enter (50) or (54) in (55) 0.67 (55)

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

(56)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(56)

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

(57)m=	20.88	18.86	20.88	20.2	20.88	20.2	20.88	20.88	20.2	20.88	20.2	20.88	(57)

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

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

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

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

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

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

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

(62)m=	196.53	173.15	181.68	162.62	159.19	142	136.14	149.71	149.55	168.64	178.62	191.72	(62)

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

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

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

Output from water heater

(64)m=	196.53	173.15	181.68	162.62	159.19	142	136.14	149.71	149.55	168.64	178.62	191.72

Output from water heater (annual)$_{1…12}$ 1989.56 (64)

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

(65)m=	85.98	76.21	81.04	74.04	73.57	67.18	65.9	70.41	69.7	76.71	79.36	84.38	(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=	124.67	124.67	124.67	124.67	124.67	124.67	124.67	124.67	124.67	124.67	124.67	124.67	(66)

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

(67)m=	24.85	22.07	17.95	13.59	10.16	8.58	9.27	12.05	16.17	20.53	23.96	25.54	(67)

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

(68)m=	222.85	225.17	219.34	206.93	191.27	176.55	166.72	164.41	170.24	182.64	198.3	213.02	(68)

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

(69)m=	35.47	35.47	35.47	35.47	35.47	35.47	35.47	35.47	35.47	35.47	35.47	35.47	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	-99.74	(71)

Water heating gains (Table 5)

(72)m=	115.57	113.41	108.93	102.84	98.88	93.31	88.58	94.64	96.8	103.1	110.22	113.42	(72)

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

(73)m=	426.68	424.05	409.62	386.76	363.72	341.85	327.97	334.5	346.61	369.68	395.89	415.39	(73)

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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	5.92	x	11.28	x	0.63	x	0.7	=	20.41	(75)
Northeast	0.9x	0.77	x	5.92	x	22.97	x	0.63	x	0.7	=	41.55	(75)
Northeast	0.9x	0.77	x	5.92	x	41.38	x	0.63	x	0.7	=	74.86	(75)
Northeast	0.9x	0.77	x	5.92	x	67.96	x	0.63	x	0.7	=	122.95	(75)
Northeast	0.9x	0.77	x	5.92	x	91.35	x	0.63	x	0.7	=	165.27	(75)
Northeast	0.9x	0.77	x	5.92	x	97.38	x	0.63	x	0.7	=	176.19	(75)
Northeast	0.9x	0.77	x	5.92	x	91.1	x	0.63	x	0.7	=	164.82	(75)
Northeast	0.9x	0.77	x	5.92	x	72.63	x	0.63	x	0.7	=	131.4	(75)
Northeast	0.9x	0.77	x	5.92	x	50.42	x	0.63	x	0.7	=	91.22	(75)
Northeast	0.9x	0.77	x	5.92	x	28.07	x	0.63	x	0.7	=	50.78	(75)
Northeast	0.9x	0.77	x	5.92	x	14.2	x	0.63	x	0.7	=	25.69	(75)
Northeast	0.9x	0.77	x	5.92	x	9.21	x	0.63	x	0.7	=	16.67	(75)
Southwest	0.9x	0.77	x	5.92	x	36.79		0.63	x	0.7	=	66.57	(79)
Southwest	0.9x	0.77	x	5.92	x	62.67		0.63	x	0.7	=	113.39	(79)
Southwest	0.9x	0.77	x	5.92	x	85.75		0.63	x	0.7	=	155.15	(79)
Southwest	0.9x	0.77	x	5.92	x	106.25		0.63	x	0.7	=	192.23	(79)
Southwest	0.9x	0.77	x	5.92	x	119.01		0.63	x	0.7	=	215.32	(79)
Southwest	0.9x	0.77	x	5.92	x	118.15		0.63	x	0.7	=	213.76	(79)
Southwest	0.9x	0.77	x	5.92	x	113.91		0.63	x	0.7	=	206.09	(79)
Southwest	0.9x	0.77	x	5.92	x	104.39		0.63	x	0.7	=	188.87	(79)
Southwest	0.9x	0.77	x	5.92	x	92.85		0.63	x	0.7	=	167.99	(79)
Southwest	0.9x	0.77	x	5.92	x	69.27		0.63	x	0.7	=	125.32	(79)
Southwest	0.9x	0.77	x	5.92	x	44.07		0.63	x	0.7	=	79.73	(79)
Southwest	0.9x	0.77	x	5.92	x	31.49		0.63	x	0.7	=	56.97	(79)
Rooflights	0.9x	1	x	4.3	x	26	x	0.63	x	0.8	=	50.71	(82)
Rooflights	0.9x	1	x	4.3	x	54	x	0.63	x	0.8	=	105.33	(82)
Rooflights	0.9x	1	x	4.3	x	96	x	0.63	x	0.8	=	187.25	(82)
Rooflights	0.9x	1	x	4.3	x	150	x	0.63	x	0.8	=	292.57	(82)
Rooflights	0.9x	1	x	4.3	x	192	x	0.63	x	0.8	=	374.49	(82)
Rooflights	0.9x	1	x	4.3	x	200	x	0.63	x	0.8	=	390.1	(82)
Rooflights	0.9x	1	x	4.3	x	189	x	0.63	x	0.8	=	368.64	(82)
Rooflights	0.9x	1	x	4.3	x	157	x	0.63	x	0.8	=	306.23	(82)
Rooflights	0.9x	1	x	4.3	x	115	x	0.63	x	0.8	=	224.31	(82)
Rooflights	0.9x	1	x	4.3	x	66	x	0.63	x	0.8	=	128.73	(82)
Rooflights	0.9x	1	x	4.3	x	33	x	0.63	x	0.8	=	64.37	(82)
Rooflights	0.9x	1	x	4.3	x	21	x	0.63	x	0.8	=	40.96	(82)

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

(83)m=	137.69	260.27	417.26	607.75	755.08	780.05	739.55	626.49	483.52	304.83	169.78	114.6	(83)

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

(84)m=	564.37	684.32	826.88	994.52	1118.79	1121.89	1067.52	960.99	830.12	674.51	565.68	529.99	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.68	0.53	0.6	0.84	0.97	0.99	1	(86)

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

(87)m=	18.98	19.21	19.61	20.17	20.61	20.89	20.97	20.95	20.73	20.15	19.5	19	(87)

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

(88)m=	19.42	19.43	19.45	19.5	19.51	19.57	19.57	19.58	19.55	19.51	19.49	19.47	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.78	0.56	0.37	0.43	0.75	0.95	0.99	1	(89)

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

(90)m=	17.65	17.88	18.28	18.87	19.27	19.52	19.56	19.57	19.41	18.87	18.22	17.7	(90)

fLA = Living area ÷ (4) = | 0.37 | (91)

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

(92)m=	18.14	18.38	18.77	19.35	19.77	20.03	20.08	20.08	19.9	19.34	18.69	18.18	(92)

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

(93)m=	18.14	18.38	18.77	19.35	19.77	20.03	20.08	20.08	19.9	19.34	18.69	18.18	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.79	0.6	0.43	0.49	0.77	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	560.16	674.27	798.89	905.88	888.93	677.43	460.38	475.18	643.02	639.43	558.24	526.87	(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=	2110.79	2036.96	1839.08	1497.16	1144.87	736.91	472.69	495.22	801.03	1240.29	1676.03	2058.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1153.67	915.73	773.9	425.72	190.42	0	0	0	0	447.04	804.81	1139.28	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 5850.57 | (98)

Space heating requirement in kWh/m²/year | 71.65 | (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		86.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1153.67	915.73	773.9	425.72	190.42	0	0	0	0	447.04	804.81	1139.28		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1327.59	1053.77	890.57	489.89	219.13	0	0	0	0	514.42	926.14	1311.02		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													6732.53	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating														
Output from water heater (calculated above)														
	196.53	173.15	181.68	162.62	159.19	142	136.14	149.71	149.55	168.64	178.62	191.72		
Efficiency of water heater													76.8	(216)
(217)m=	85.27	85.12	84.78	83.85	81.99	76.8	76.8	76.8	76.8	83.88	84.87	85.28		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.49	203.42	214.29	193.94	194.16	184.89	177.27	194.94	194.72	201.06	210.46	224.8		
Total = Sum(219a)$_{1...12}$ =													2424.44	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6732.53	
Water heating fuel used			2424.44	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			438.92	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1454.23	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	523.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1977.91	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	227.8	(268)
Total CO2, kg/year		sum of (265)…(271) =		2244.63	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		27.49	(273)
EI rating (section 14)				76	(274)