Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 21 June 2022 at 16:45:39

Project Information:

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

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.03m²

Site Reference : Great Russell Street LEAN **Plot Reference:** FLAT A

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)	24.73 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.17 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	73.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	59.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.08 (max. 0.25)	0.08 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.30 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 499, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	8.61m²
Ventilation rate:	6.00

10 Key features

Party Walls U-value	0 W/m²K
Floors U-value	0.08 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: 1.0.5.51

Property Address: FLAT A

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.03	(1a) x	3	(2a) =	150.09	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.03	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	150.09	(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) =	0.2	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.45	(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

0.57	0.56	0.55	0.49	0.48	0.43	0.43	0.42	0.45	0.48	0.51	0.53

Calculate effective air change rate for the applicable case

If mechanical ventilation: | 0 | (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.66	0.66	0.65	0.62	0.62	0.59	0.59	0.59	0.6	0.62	0.63	0.64	(24d)

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

(25)m=	0.66	0.66	0.65	0.62	0.62	0.59	0.59	0.59	0.6	0.62	0.63	0.64	(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			1.99	x	1.3	=	2.587			(26)
Windows			8.61	x1/[1/(1.3)+ 0.04]		=	10.64			(27)
Floor			50.03	x	0.075	=	3.75225	20	1000.6	(28)
Walls Type1	72.3	8.61	63.69	x	0.18	=	11.46	60	3821.4	(29)
Walls Type2	16.47	1.99	14.48	x	0.17	=	2.42	60	868.8	(29)
Total area of elements, m²			138.8							(31)
Party wall			16.96	x	0	=	0	45	763.2	(32)
Party ceiling			50.03					30	1500.9	(32b)
Internal wall **			94.32					75	7074	(32c)

** 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) = | 30.86 | (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = | 15028.9 | (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = | 300.4 | (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 | 8.93 | (36)

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

Total fabric heat loss (33) + (36) = | 39.79 | (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=	32.91	32.6	32.29	30.83	30.56	29.29	29.29	29.05	29.78	30.56	31.11	31.68	(38)

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

(39)m=	72.7	72.39	72.08	70.62	70.35	69.08	69.08	68.84	69.57	70.35	70.9	71.47	

Average = Sum(39)$_{1…12}$ /12= | 70.62 | (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=	1.45	1.45	1.44	1.41	1.41	1.38	1.38	1.38	1.39	1.41	1.42	1.43	

Average = Sum(40)$_{1…12}$ /12= 1.41 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.69 (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 — 74.36 (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)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.8	78.82	75.85	72.87	69.9	66.92	66.92	69.9	72.87	75.85	78.82	81.8	

Total = Sum(44)$_{1…12}$ = 892.33 (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=	121.3	106.09	109.48	95.45	91.58	79.03	73.23	84.03	85.04	99.1	108.18	117.48	

Total = Sum(45)$_{1…12}$ = 1169.99 (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=	18.2	15.91	16.42	14.32	13.74	11.85	10.98	12.61	12.76	14.87	16.23	17.62	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b — 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

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

(61)m=	18.19	16.37	18.03	17.34	17.83	17.17	17.68	17.78	17.26	17.95	17.49	18.16	(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=	139.49	122.46	127.5	112.78	109.42	96.2	90.91	101.82	102.3	117.05	125.67	135.63	(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=	139.49	122.46	127.5	112.78	109.42	96.2	90.91	101.82	102.3	117.05	125.67	135.63	

Output from water heater (annual)$_{1...12}$ 1381.23 (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=	44.88	39.37	40.91	36.07	34.91	30.57	28.77	32.39	32.59	37.44	40.34	43.6	(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=	84.55	84.55	84.55	84.55	84.55	84.55	84.55	84.55	84.55	84.55	84.55	84.55	(66)

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

(67)m=	13.52	12	9.76	7.39	5.52	4.66	5.04	6.55	8.79	11.16	13.03	13.89	(67)

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

(68)m=	147.31	148.84	144.99	136.79	126.44	116.71	110.21	108.68	112.53	120.73	131.08	140.81	(68)

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

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(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=	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	-67.64	(71)

Water heating gains (Table 5)

(72)m=	60.32	58.58	54.98	50.1	46.92	42.46	38.67	43.53	45.26	50.32	56.03	58.6	(72)

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

(73)m=	272.52	270.79	261.1	245.64	230.25	215.19	205.28	210.12	217.95	233.58	251.51	264.67	(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)	
East	0.9x	0.77	x	8.61	x	19.64	x	0.63	x	0.7	=	51.68	(76)
East	0.9x	0.77	x	8.61	x	38.42	x	0.63	x	0.7	=	101.1	(76)
East	0.9x	0.77	x	8.61	x	63.27	x	0.63	x	0.7	=	166.49	(76)
East	0.9x	0.77	x	8.61	x	92.28	x	0.63	x	0.7	=	242.82	(76)
East	0.9x	0.77	x	8.61	x	113.09	x	0.63	x	0.7	=	297.58	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.61	x	115.77	x	0.63	x	0.7	=	304.63	(76)
East	0.9x	0.77	x	8.61	x	110.22	x	0.63	x	0.7	=	290.02	(76)
East	0.9x	0.77	x	8.61	x	94.68	x	0.63	x	0.7	=	249.12	(76)
East	0.9x	0.77	x	8.61	x	73.59	x	0.63	x	0.7	=	193.64	(76)
East	0.9x	0.77	x	8.61	x	45.59	x	0.63	x	0.7	=	119.96	(76)
East	0.9x	0.77	x	8.61	x	24.49	x	0.63	x	0.7	=	64.44	(76)
East	0.9x	0.77	x	8.61	x	16.15	x	0.63	x	0.7	=	42.5	(76)

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

(83)m=	51.68	101.1	166.49	242.82	297.58	304.63	290.02	249.12	193.64	119.96	64.44	42.5	(83)

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

(84)m=	324.2	371.89	427.59	488.46	527.83	519.82	495.3	459.25	411.59	353.54	315.95	307.17	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.91	0.76	0.59	0.65	0.89	0.99	1	1	(86)

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

(87)m=	19.62	19.77	20.04	20.41	20.73	20.93	20.98	20.97	20.82	20.4	19.96	19.61	(87)

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

(88)m=	19.72	19.73	19.73	19.75	19.76	19.78	19.78	19.78	19.77	19.76	19.75	19.74	(88)

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

(89)m=	1	1	0.99	0.96	0.86	0.65	0.44	0.5	0.82	0.98	1	1	(89)

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

(90)m=	17.92	18.14	18.53	19.07	19.5	19.73	19.77	19.77	19.64	19.08	18.43	17.91	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	18.73	18.92	19.25	19.71	20.09	20.3	20.35	20.35	20.2	19.71	19.16	18.73	(92)

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

(93)m=	18.58	18.77	19.1	19.56	19.94	20.15	20.2	20.2	20.05	19.56	19.01	18.58	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.96	0.87	0.69	0.49	0.55	0.84	0.97	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	323.39	369.98	421.71	466.56	458.39	357.69	244.85	254.59	344.05	344.41	314.38	306.58	(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=	1038.39	1003.76	908.15	752.96	579.47	383.67	248.79	261.38	414.14	630.36	844.24	1027.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	531.96	425.9	361.91	206.21	90.09	0	0	0	0	212.75	381.5	536.39	(98)

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2746.71	(98)
Space heating requirement in kWh/m²/year	54.9	(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		90	(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)	531.96	425.9	361.91	206.21	90.09	0	0	0	0	212.75	381.5	536.39		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	591.07	473.22	402.13	229.12	100.09	0	0	0	0	236.39	423.89	595.99		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3051.9	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	139.49	122.46	127.5	112.78	109.42	96.2	90.91	101.82	102.3	117.05	125.67	135.63		
Efficiency of water heater													87	(216)
(217)m=	89.36	89.31	89.2	88.92	88.33	87	87	87	87	88.91	89.24	89.38		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	156.1	137.12	142.94	126.84	123.87	110.57	104.5	117.03	117.58	131.65	140.83	151.75		
Total = Sum(219a)$_{1...12}$ =													1560.79	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3051.9	
Water heating fuel used			1560.79	
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			238.68	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4926.37	(338)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	659.21	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	337.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =			996.34	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.88	(268)
Total CO2, kg/year		sum of (265)…(271) =		1159.14	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		23.17	(273)
EI rating (section 14)				84	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 21 June 2022 at 16:45:38

Project Information:

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

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 49.42m²

Site Reference : Great Russell Street LEAN **Plot Reference:** FLAT B

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)	24 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.74 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	68.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	61.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (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	1.30 (max. 2.00)	1.30 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Database: (rev 499, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: East	7.44m²
Ventilation rate:	6.00

10 Key features

Roofs U-value	0.12 W/m²K
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: 1.0.5.51

Property Address: FLAT B

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.42	(1a) x	2.9	(2a) =	143.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.42	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	143.32	(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) =	0.21	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.46	(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) =	0.46	(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

0.59	0.57	0.56	0.51	0.49	0.44	0.44	0.42	0.46	0.49	0.52	0.54

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.67	0.66	0.66	0.63	0.62	0.6	0.6	0.59	0.61	0.62	0.63	0.65	(24d)

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

(25)m=	0.67	0.66	0.66	0.63	0.62	0.6	0.6	0.59	0.61	0.62	0.63	0.65	(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			1.99	x	1.3	=	2.587			(26)
Windows			7.44	x1/[1/(1.3)+ 0.04]		=	9.19			(27)
Walls Type1	69.89	7.44	62.45	x	0.18	=	11.24	60	3747	(29)
Walls Type2	18.59	1.99	16.6	x	0.17	=	2.77	60	996	(29)
Roof	49.42	0	49.42	x	0.12	=	5.93	9	444.78	(30)
Total area of elements, m²			137.9							(31)
Party wall			16.39	x	0	=	0	45	737.55	(32)
Party floor			49.42					40	1976.8	(32a)
Internal wall **			85.26					75	6394.5	(32c)

** 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) = 31.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14296.63 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 289.29 (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 8.95 (36)

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

Total fabric heat loss (33) + (36) = 40.68 (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=	31.76	31.44	31.13	29.68	29.41	28.15	28.15	27.92	28.64	29.41	29.96	30.54	(38)

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

(39)m=	72.43	72.12	71.81	70.36	70.09	68.83	68.83	68.59	69.31	70.09	70.64	71.21

Average = Sum(39)$_{1…12}$ /12= 70.36 (39)

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

(40)m=	1.47	1.46	1.45	1.42	1.42	1.39	1.39	1.39	1.4	1.42	1.43	1.44

Average = Sum(40)$_{1…12}$ /12= 1.42 (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 1.67 (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 73.93 (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=	81.33	78.37	75.41	72.46	69.5	66.54	66.54	69.5	72.46	75.41	78.37	81.33	
									Total = Sum(44)$_{1…12}$ =			887.22	(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=	120.61	105.48	108.85	94.9	91.06	78.58	72.81	83.55	84.55	98.53	107.56	116.8	
									Total = Sum(45)$_{1…12}$ =			1163.28	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.09	15.82	16.33	14.23	13.66	11.79	10.92	12.53	12.68	14.78	16.13	17.52	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0 (55)

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

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

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

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

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

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

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

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

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

(61)m=	18.18	16.36	18.02	17.33	17.83	17.16	17.68	17.77	17.25	17.94	17.48	18.15	(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=	138.79	121.84	126.87	112.23	108.88	95.74	90.49	101.33	101.8	116.47	125.04	134.95	(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=	138.79	121.84	126.87	112.23	108.88	95.74	90.49	101.33	101.8	116.47	125.04	134.95	

Output from water heater (annual)$_{1...12}$ 1374.43 (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=	44.65	39.16	40.7	35.89	34.73	30.42	28.63	32.22	32.43	37.25	40.13	43.37	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	83.65	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.72	12.19	9.91	7.5	5.61	4.74	5.12	6.65	8.93	11.34	13.23	14.1	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	145.73	147.24	143.43	135.32	125.08	115.45	109.02	107.51	111.32	119.43	129.67	139.3	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.37	31.37	31.37	31.37	31.37	31.37	31.37	31.37	31.37	31.37	31.37	31.37	(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=	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	-66.92	(71)
Water heating gains (Table 5)													
(72)m=	60.01	58.28	54.7	49.84	46.68	42.25	38.48	43.31	45.04	50.06	55.74	58.3	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	270.56	268.8	259.14	243.76	228.47	213.53	203.71	208.57	216.38	231.93	249.74	262.8	(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)	
East	0.9x	0.77	x	7.44	x	19.64	x	0.63	x	0.7	=	44.66	(76)
East	0.9x	0.77	x	7.44	x	38.42	x	0.63	x	0.7	=	87.36	(76)
East	0.9x	0.77	x	7.44	x	63.27	x	0.63	x	0.7	=	143.87	(76)
East	0.9x	0.77	x	7.44	x	92.28	x	0.63	x	0.7	=	209.82	(76)
East	0.9x	0.77	x	7.44	x	113.09	x	0.63	x	0.7	=	257.15	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	7.44	x	115.77	x	0.63	x	0.7	=	263.23	(76)
East	0.9x	0.77	x	7.44	x	110.22	x	0.63	x	0.7	=	250.61	(76)
East	0.9x	0.77	x	7.44	x	94.68	x	0.63	x	0.7	=	215.27	(76)
East	0.9x	0.77	x	7.44	x	73.59	x	0.63	x	0.7	=	167.32	(76)
East	0.9x	0.77	x	7.44	x	45.59	x	0.63	x	0.7	=	103.66	(76)
East	0.9x	0.77	x	7.44	x	24.49	x	0.63	x	0.7	=	55.68	(76)
East	0.9x	0.77	x	7.44	x	16.15	x	0.63	x	0.7	=	36.72	(76)

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

(83)m=	44.66	87.36	143.87	209.82	257.15	263.23	250.61	215.27	167.32	103.66	55.68	36.72	(83)

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

(84)m=	315.21	356.16	403.01	453.58	485.61	476.76	454.32	423.84	383.7	335.59	305.42	299.52	(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=	1	1	0.99	0.98	0.92	0.79	0.63	0.69	0.91	0.99	1	1	(86)

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

(87)m=	19.56	19.7	19.97	20.34	20.67	20.9	20.97	20.96	20.79	20.36	19.9	19.55	(87)

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

(88)m=	19.71	19.72	19.72	19.75	19.75	19.77	19.77	19.77	19.76	19.75	19.74	19.73	(88)

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

(89)m=	1	1	0.99	0.96	0.88	0.69	0.47	0.53	0.84	0.98	1	1	(89)

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

(90)m=	17.82	18.04	18.42	18.97	19.43	19.71	19.76	19.76	19.59	19.01	18.35	17.82	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	18.66	18.84	19.17	19.63	20.03	20.28	20.35	20.34	20.17	19.66	19.1	18.66	(92)

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

(93)m=	18.51	18.69	19.02	19.48	19.88	20.13	20.2	20.19	20.02	19.51	18.95	18.51	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.96	0.89	0.72	0.53	0.59	0.85	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	314.33	354.27	397.78	435.84	431.11	345.55	241.53	250.11	327.97	327.37	303.8	298.86	(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=	1029.62	994.65	899.07	744.67	573.26	380.83	247.65	260.03	410.36	624.43	837.08	1019.03	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	532.18	430.34	372.96	222.35	105.76	0	0	0	0	221.02	383.96	535.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2804.37 (98)

Space heating requirement in kWh/m²/year 56.75 (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 90 (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)	532.18	430.34	372.96	222.35	105.76	0	0	0	0	221.02	383.96	535.8		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	591.31	478.15	414.4	247.06	117.51	0	0	0	0	245.57	426.62	595.34		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3115.97	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	138.79	121.84	126.87	112.23	108.88	95.74	90.49	101.33	101.8	116.47	125.04	134.95		
Efficiency of water heater													87	(216)
(217)m=	89.36	89.32	89.22	88.97	88.45	87	87	87	87	88.94	89.24	89.38		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	155.31	136.41	142.2	126.14	123.1	110.04	104.01	116.47	117.01	130.96	140.11	150.98		
Total = Sum(219a)$_{1...12}$ =													1552.74	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3115.97	
Water heating fuel used		1552.74	
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		242.35	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4986.06	(338)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	673.05	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	335.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1008.44	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.78	(268)
Total CO2, kg/year		sum of (265)…(271) =		1173.15	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		23.74	(273)
EI rating (section 14)				83	(274)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 21 June 2022 at 16:45:38

Project Information:

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

Dwelling Details:

NEW DWELLING CREATED BY CHANGE OF USE Total Floor Area: 85.3m²
Site Reference : Great Russell Street LEAN **Plot Reference:** FLAT C
Address : Third Floor Flat, Russell House, 37 Great Russell Street, LONDON, WC1B 3PP

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)	20.05 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	26.36 kg/m²	**Fail**

Excess emissions = 6.31 kg/m² (31.5 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	85.4 kWh/m²	
		Fail

Excess energy = 24.19 kg/m² (39.5 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.30 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.08 (max. 0.25)	0.08 (max. 0.70)	**OK**
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	**OK**
Openings	1.30 (max. 2.00)	1.30 (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: Database: (rev 499, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Regulations Compliance Report

Secondary heating system:	None		

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: South	6.81m²	
Windows facing: North	7.41m²	
Ventilation rate:	6.00	

10 Key features

Roofs U-value	0.12 W/m²K
Party Walls U-value	0 W/m²K
Floors U-value	0.08 W/m²K

DER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.51

Property Address: FLAT C

Address : Third Floor Flat, Russell House, 37 Great Russell Street, LONDON, WC1B 3PP

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	85.3	(1a)	x	2.75	(2a)	=	234.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.3	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			234.58	(5)

2. Ventilation rate:

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

Air changes per hour

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

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)

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

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.81	(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 created by change of use

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

1.04	1.02	0.99	0.89	0.87	0.77	0.77	0.75	0.81	0.87	0.91	0.95

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=	1.04	1.02	0.99	0.9	0.88	0.8	0.8	0.78	0.83	0.88	0.92	0.96	(24d)

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

(25)m=	1.04	1.02	0.99	0.9	0.88	0.8	0.8	0.78	0.83	0.88	0.92	0.96	(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			1.99	x	1.3	=	2.587			(26)
Windows Type 1			6.81	x1/[1/(1.3)+ 0.04]		=	8.42			(27)
Windows Type 2			7.41	x1/[1/(1.3)+ 0.04]		=	9.16			(27)
Floor			85.3	x	0.075	=	6.397501			(28)
Walls Type1	51.52	14.22	37.3	x	0.3	=	11.19			(29)
Walls Type2	37.41	1.99	35.42	x	0.15	=	5.49			(29)
Roof	49.42	0	49.42	x	0.12	=	5.93			(30)
Total area of elements, m²			223.65							(31)
Party wall			43.2	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) = 49.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6555.68 (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 33.55 (36)

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

Total fabric heat loss (33) + (36) = 82.71 (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=	80.15	78.58	77.01	69.59	68.2	61.74	61.74	60.54	64.23	68.2	71.01	73.94	(38)

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

(39)m=	162.86	161.29	159.72	152.3	150.91	144.45	144.45	143.25	146.94	150.91	153.72	156.65	

Average = Sum(39)$_{1…12}$ /12= 152.29 (39)

DER WorkSheet: New dwelling created by change of use

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

(40)m=	1.91	1.89	1.87	1.79	1.77	1.69	1.69	1.68	1.72	1.77	1.8	1.84	

Average = Sum(40)$_{1…12}$ /12= 1.79 (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 2.56 (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 94.9 (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=	104.39	100.59	96.8	93	89.21	85.41	85.41	89.21	93	96.8	100.59	104.39	

Total = Sum(44)$_{1…12}$ = 1138.8 (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=	154.81	135.4	139.72	121.81	116.88	100.86	93.46	107.24	108.53	126.48	138.06	149.92	

Total = Sum(45)$_{1…12}$ = 1493.14 (45)

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

(46)m=	23.22	20.31	20.96	18.27	17.53	15.13	14.02	16.09	16.28	18.97	20.71	22.49	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0 (55)

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

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

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

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

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

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

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

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

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

(61)m=	18.75	16.89	18.55	17.78	18.24	17.5	17.99	18.15	17.65	18.42	18.03	18.7	(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=	173.56	152.29	158.27	139.59	135.12	118.36	111.45	125.4	126.18	144.9	156.09	168.62	(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=	173.56	152.29	158.27	139.59	135.12	118.36	111.45	125.4	126.18	144.9	156.09	168.62	

Output from water heater (annual)$_{1...12}$ 1709.82 (64)

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

(65)m=	56.16	49.24	51.09	44.95	43.42	37.91	35.57	40.2	40.5	46.66	50.41	54.52	(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):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	127.79	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	21.24	18.86	15.34	11.61	8.68	7.33	7.92	10.29	13.82	17.54	20.48	21.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	230.16	232.55	226.53	213.72	197.54	182.34	172.19	169.8	175.82	188.63	204.8	220.01	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	35.78	(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=	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	-102.23	(71)
Water heating gains (Table 5)													
(72)m=	75.49	73.28	68.67	62.42	58.36	52.65	47.81	54.03	56.25	62.71	70.02	73.29	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	391.22	389.03	374.88	352.09	328.93	306.66	292.26	298.46	310.22	333.23	359.63	379.46	(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)	
North	0.9x	0.77	x	7.41	x	10.63	x	0.63	x	0.7	=	24.08	(74)
North	0.9x	0.77	x	7.41	x	20.32	x	0.63	x	0.7	=	46.02	(74)
North	0.9x	0.77	x	7.41	x	34.53	x	0.63	x	0.7	=	78.2	(74)
North	0.9x	0.77	x	7.41	x	55.46	x	0.63	x	0.7	=	125.6	(74)
North	0.9x	0.77	x	7.41	x	74.72	x	0.63	x	0.7	=	169.2	(74)

North	0.9x	0.77	x	7.41	x	79.99	x	0.63	x	0.7	=	181.13	(74)
North	0.9x	0.77	x	7.41	x	74.68	x	0.63	x	0.7	=	169.11	(74)
North	0.9x	0.77	x	7.41	x	59.25	x	0.63	x	0.7	=	134.17	(74)
North	0.9x	0.77	x	7.41	x	41.52	x	0.63	x	0.7	=	94.02	(74)
North	0.9x	0.77	x	7.41	x	24.19	x	0.63	x	0.7	=	54.78	(74)
North	0.9x	0.77	x	7.41	x	13.12	x	0.63	x	0.7	=	29.71	(74)
North	0.9x	0.77	x	7.41	x	8.86	x	0.63	x	0.7	=	20.07	(74)
South	0.9x	0.77	x	6.81	x	46.75	x	0.63	x	0.7	=	97.3	(78)
South	0.9x	0.77	x	6.81	x	76.57	x	0.63	x	0.7	=	159.35	(78)
South	0.9x	0.77	x	6.81	x	97.53	x	0.63	x	0.7	=	202.99	(78)
South	0.9x	0.77	x	6.81	x	110.23	x	0.63	x	0.7	=	229.42	(78)
South	0.9x	0.77	x	6.81	x	114.87	x	0.63	x	0.7	=	239.07	(78)
South	0.9x	0.77	x	6.81	x	110.55	x	0.63	x	0.7	=	230.07	(78)
South	0.9x	0.77	x	6.81	x	108.01	x	0.63	x	0.7	=	224.8	(78)
South	0.9x	0.77	x	6.81	x	104.89	x	0.63	x	0.7	=	218.31	(78)
South	0.9x	0.77	x	6.81	x	101.89	x	0.63	x	0.7	=	212.05	(78)
South	0.9x	0.77	x	6.81	x	82.59	x	0.63	x	0.7	=	171.88	(78)
South	0.9x	0.77	x	6.81	x	55.42	x	0.63	x	0.7	=	115.34	(78)
South	0.9x	0.77	x	6.81	x	40.4	x	0.63	x	0.7	=	84.08	(78)

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

(83)m=	121.38	205.37	281.19	355.03	408.27	411.21	393.91	352.48	306.06	226.66	145.04	104.15	(83)

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

(84)m=	512.6	594.4	656.07	707.12	737.2	717.87	686.17	650.94	616.28	559.88	504.68	483.61	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.95	0.88	0.76	0.79	0.93	0.98	1	1	(86)

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

(87)m=	18.86	19.05	19.38	19.87	20.31	20.7	20.88	20.86	20.56	19.99	19.39	18.9	(87)

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

(88)m=	19.39	19.41	19.42	19.48	19.49	19.55	19.55	19.56	19.52	19.49	19.47	19.44	(88)

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

(89)m=	1	0.99	0.99	0.97	0.92	0.79	0.58	0.63	0.87	0.97	0.99	1	(89)

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

(90)m=	16.64	16.92	17.4	18.14	18.77	19.33	19.5	19.49	19.15	18.34	17.45	16.71	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

(92)m=	17.65	17.89	18.3	18.92	19.47	19.95	20.13	20.11	19.79	19.09	18.33	17.7	(92)

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

(93)m=	17.5	17.74	18.15	18.77	19.32	19.8	19.98	19.96	19.64	18.94	18.18	17.55	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.98	0.96	0.92	0.81	0.64	0.68	0.88	0.97	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	509.72	588.65	644.58	681.42	676.36	578.83	438.72	445.87	542.63	542.87	500.03	481.46		(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=	2149.16	2070.82	1860.56	1503.85	1149.64	751.29	488.03	510.29	813.89	1258.4	1703.41	2091.89		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1219.74	996.02	904.68	592.15	352.12	0	0	0	0	532.35	866.43	1198.16		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													6661.66	(98)
Space heating requirement in kWh/m²/year													78.1	(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		90	(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)														
	1219.74	996.02	904.68	592.15	352.12	0	0	0	0	532.35	866.43	1198.16		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1355.27	1106.69	1005.2	657.95	391.24	0	0	0	0	591.5	962.7	1331.29		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													7401.84	(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)														
	173.56	152.29	158.27	139.59	135.12	118.36	111.45	125.4	126.18	144.9	156.09	168.62		
Efficiency of water heater													87	(216)
(217)m=	89.62	89.59	89.54	89.41	89.15	87	87	87	87	89.34	89.53	89.62		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.67	169.98	176.76	156.11	151.57	136.05	128.11	144.14	145.03	162.19	174.34	188.16		
Total = Sum(219a)$_{1...12}$ =													1926.1	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		7401.84

DER WorkSheet: New dwelling created by change of use

Water heating fuel used		1926.1	
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		375.08	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9778.02	(338)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1598.8	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	416.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2014.83	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	194.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		2248.43	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		26.36	(273)
EI rating (section 14)				77	(274)