

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.2.0

Printed on 17 November 2017 at 14:34:55

Project Information:

Assessed By: Jonathan Ponting (STRO000148)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 120.81m²

Site Reference : TW.ES.RG3

Plot Reference: ab Plot 19

Address : 2, Ruhemann Street, READING, RG30 3EZ

Client Details:

Name: Paul Slingo

Address : Taylor Wimpey (West London), Stratfield House, Station Road, Hook, RG27 9PQ

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)

15.9 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

15.13 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

52.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

45.9 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.25 (max. 0.30)

0.25 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

0.15 (max. 0.25)

0.15 (max. 0.70)

OK

Roof

0.11 (max. 0.20)

0.11 (max. 0.35)

OK

Openings

1.41 (max. 2.00)

1.50 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

4.18 (measured in this dwelling)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 419, product index 016393):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Ideal

Model: Logic System

Model qualifier: 30

(Regular)

Efficiency 89.6 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day	
	Permitted by DBSCG: 2.30 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	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	100.0%	
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 East	3.15m ²	
Windows facing: South East	0.66m ²	
Windows facing: South East	0.66m ²	
Windows facing: South East	0.66m ²	
Windows facing: South East	0.66m ²	
Windows facing: South East	0.66m ²	
Windows facing: South East	3.24m ²	
Windows facing: South East	2.79m ²	
Windows facing: South West	6.09m ²	
Windows facing: South West	2.43m ²	
Windows facing: South West	2.43m ²	
Windows facing: South West	0.88m ²	
Windows facing: North East	2m ²	
Windows facing: North East	0.53m ²	
Windows facing: North East	0.88m ²	
Windows facing: North East	1.3m ²	
Windows facing: North East	1.8m ²	
Windows facing: North East	2.36m ²	
Windows facing: North East	0.63m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Light-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m ² K
Party Walls U-value	0 W/m ² K

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 19

Address : 2, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	41.13 (1a)	x	2.4 (2a)	=	98.71 (3a)
First floor	39.84 (1b)	x	2.65 (2b)	=	105.58 (3b)
Second floor	39.84 (1c)	x	2.65 (2c)	=	105.58 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.81 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	309.86 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1	(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			4.17999982833862	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.26	(21)
Infiltration rate modified for monthly wind speed				

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 as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.33	0.32	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31
--	------	------	------	------	------	------	------	------	------	------	------	------

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

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

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

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=	0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55
---------	------	------	------	------	------	------	------	------	------	------	------	------

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

(25)m=	0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55
--------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			3.15	x 1/[1/(1.4)+ 0.04]	= 4.18		(27)
Windows Type 2			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 3			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 4			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 5			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 6			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 7			3.24	x 1/[1/(1.4)+ 0.04]	= 4.3		(27)
Windows Type 8			2.79	x 1/[1/(1.4)+ 0.04]	= 3.7		(27)
Windows Type 9			6.09	x 1/[1/(1.4)+ 0.04]	= 8.07		(27)
Windows Type 10			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 11			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 12			0.88	x 1/[1/(1.4)+ 0.04]	= 1.17		(27)
Windows Type 13			2	x 1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 14			0.53	x 1/[1/(1.4)+ 0.04]	= 0.7		(27)
Windows Type 15			0.88	x 1/[1/(1.4)+ 0.04]	= 1.17		(27)
Windows Type 16			1.3	x 1/[1/(1.4)+ 0.04]	= 1.72		(27)

DER WorkSheet: New dwelling as built

Windows Type 17			1.8	$\times 1/[1/(1.4)+0.04]=$	2.39			(27)		
Windows Type 18			2.36	$\times 1/[1/(1.4)+0.04]=$	3.13			(27)		
Windows Type 19			0.63	$\times 1/[1/(1.4)+0.04]=$	0.84			(27)		
Floor			41.13	$\times$	0.15	$=$	6.1695	110	4524.3	(28)
Walls	149.07	35.91	113.16	$\times$	0.25	$=$	28.29	60	6789.6	(29)
Roof	39.84	0	39.84	$\times$	0.11	$=$	4.38	9	358.56	(30)
Total area of elements, m²			230.04	(31)						
Party wall			69.45	$\times$	0	$=$	0	45	3125.25	(32)
Internal wall **			102.89					9	925.965	(32c)
Internal wall **			86.96					9	782.613	(32c)
Internal floor			79.68					18	1434.24	(32d)
Internal ceiling			79.68					9	717.12	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 86.82 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18657.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 154.44 (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 13.78 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 100.6 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.74	56.53	56.31	55.31	55.12	54.25	54.25	54.08	54.58	55.12	55.5	55.9	(38)

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

(39)m=	157.34	157.12	156.91	155.91	155.72	154.84	154.84	154.68	155.18	155.72	156.1	156.49	
Average = Sum(39) _{1...12} /12=												155.9	(39)

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

(40)m=	1.3	1.3	1.3	1.29	1.29	1.28	1.28	1.28	1.28	1.29	1.29	1.3	
Average = Sum(40) _{1...12} /12=												1.29	(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 2.87 (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) + 36 102.28 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.5	108.41	104.32	100.23	96.14	92.05	92.05	96.14	100.23	104.32	108.41	112.5	
Total = Sum(44) _{1...12} =												1227.32	(44)

DER WorkSheet: New dwelling as built

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.84	145.92	150.58	131.28	125.96	108.7	100.72	115.58	116.96	136.31	148.79	161.58		
Total = Sum(45) _{1...12} =													1609.21	(45)

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

(46)m=	25.03	21.89	22.59	19.69	18.89	16.3	15.11	17.34	17.54	20.45	22.32	24.24	
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	--

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	210	(47)
---	-----	------

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	1.57	(48)
---	------	------

Temperature factor from Table 2b	0.54	(49)
----------------------------------	------	------

Energy lost from water storage, kWh/year	(48) x (49) =	0.85	(50)
--	---------------	------	------

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

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

If community heating see section 4.3

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

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

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

Enter (50) or (54) in (55)	0.85	(55)
----------------------------	------	------

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

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

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

(62)m=	216.39	190.67	200.12	179.22	175.51	156.64	150.27	165.13	164.91	185.85	196.74	211.12	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

Output from water heater

(64)m=	216.39	190.67	200.12	179.22	175.51	156.64	150.27	165.13	164.91	185.85	196.74	211.12		
Output from water heater (annual) _{1...12}													2192.55	(64)

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

(65)m=	95.11	84.32	89.7	82.01	81.52	74.5	73.13	78.07	77.25	84.96	87.83	93.36	
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	--

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

DER WorkSheet: New dwelling as built

(66)m=

143.32	143.32	143.32	143.32	143.32	143.32	143.32	143.32	143.32	143.32	143.32	143.32
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (66)

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

(67)m=

25.52	22.67	18.43	13.96	10.43	8.81	9.52	12.37	16.6	21.08	24.61	26.23
-------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------

 (67)

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

(68)m=

286.26	289.23	281.75	265.81	245.7	226.79	214.16	211.19	218.67	234.61	254.73	273.63
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

37.33	37.33	37.33	37.33	37.33	37.33	37.33	37.33	37.33	37.33	37.33	37.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.84	125.47	120.57	113.9	109.57	103.47	98.29	104.93	107.29	114.19	121.99	125.48
--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

508.62	506.37	489.75	462.66	434.69	408.06	390.96	397.48	411.56	438.88	470.31	494.34
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2</td></tr></table>	2	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>8.37</td></tr></table>	8.37	(75)
0.77																			
2																			
11.28																			
0.63																			
0.85																			
8.37																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.53</td></tr></table>	0.53	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>2.22</td></tr></table>	2.22	(75)
0.77																			
0.53																			
11.28																			
0.63																			
0.85																			
2.22																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.88</td></tr></table>	0.88	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>3.68</td></tr></table>	3.68	(75)
0.77																			
0.88																			
11.28																			
0.63																			
0.85																			
3.68																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.3</td></tr></table>	1.3	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>5.44</td></tr></table>	5.44	(75)
0.77																			
1.3																			
11.28																			
0.63																			
0.85																			
5.44																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.8</td></tr></table>	1.8	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>7.54</td></tr></table>	7.54	(75)
0.77																			
1.8																			
11.28																			
0.63																			
0.85																			
7.54																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>9.88</td></tr></table>	9.88	(75)
0.77																			
2.36																			
11.28																			
0.63																			
0.85																			
9.88																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>2.64</td></tr></table>	2.64	(75)
0.77																			
0.63																			
11.28																			
0.63																			
0.85																			
2.64																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2</td></tr></table>	2	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>17.05</td></tr></table>	17.05	(75)
0.77																			
2																			
22.97																			
0.63																			
0.85																			
17.05																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.53</td></tr></table>	0.53	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>4.52</td></tr></table>	4.52	(75)
0.77																			
0.53																			
22.97																			
0.63																			
0.85																			
4.52																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.88</td></tr></table>	0.88	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>7.5</td></tr></table>	7.5	(75)
0.77																			
0.88																			
22.97																			
0.63																			
0.85																			
7.5																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.3</td></tr></table>	1.3	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>11.08</td></tr></table>	11.08	(75)
0.77																			
1.3																			
22.97																			
0.63																			
0.85																			
11.08																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.8</td></tr></table>	1.8	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>15.34</td></tr></table>	15.34	(75)
0.77																			
1.8																			
22.97																			
0.63																			
0.85																			
15.34																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>20.11</td></tr></table>	20.11	(75)
0.77																			
2.36																			
22.97																			
0.63																			
0.85																			
20.11																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>5.37</td></tr></table>	5.37	(75)
0.77																			
0.63																			
22.97																			
0.63																			
0.85																			
5.37																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2</td></tr></table>	2	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>30.71</td></tr></table>	30.71	(75)
0.77																			
2																			
41.38																			
0.63																			
0.85																			
30.71																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.53</td></tr></table>	0.53	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>8.14</td></tr></table>	8.14	(75)
0.77																			
0.53																			
41.38																			
0.63																			
0.85																			
8.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.88</td></tr></table>	0.88	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>13.51</td></tr></table>	13.51	(75)
0.77																			
0.88																			
41.38																			
0.63																			
0.85																			
13.51																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.3</td></tr></table>	1.3	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>19.96</td></tr></table>	19.96	(75)
0.77																			
1.3																			
41.38																			
0.63																			
0.85																			
19.96																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.8</td></tr></table>	1.8	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>27.64</td></tr></table>	27.64	(75)
0.77																			
1.8																			
41.38																			
0.63																			
0.85																			
27.64																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>36.24</td></tr></table>	36.24	(75)
0.77																			
2.36																			
41.38																			
0.63																			
0.85																			
36.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>9.67</td></tr></table>	9.67	(75)
0.77																			
0.63																			
41.38																			
0.63																			
0.85																			
9.67																			

DER WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	2	x	67.96	x	0.63	x	0.85	=	50.44	(75)
Northeast 0.9x	0.77	x	0.53	x	67.96	x	0.63	x	0.85	=	13.37	(75)
Northeast 0.9x	0.77	x	0.88	x	67.96	x	0.63	x	0.85	=	22.19	(75)
Northeast 0.9x	0.77	x	1.3	x	67.96	x	0.63	x	0.85	=	32.78	(75)
Northeast 0.9x	0.77	x	1.8	x	67.96	x	0.63	x	0.85	=	45.39	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(75)
Northeast 0.9x	0.77	x	2	x	91.35	x	0.63	x	0.85	=	67.8	(75)
Northeast 0.9x	0.77	x	0.53	x	91.35	x	0.63	x	0.85	=	17.97	(75)
Northeast 0.9x	0.77	x	0.88	x	91.35	x	0.63	x	0.85	=	29.83	(75)
Northeast 0.9x	0.77	x	1.3	x	91.35	x	0.63	x	0.85	=	44.07	(75)
Northeast 0.9x	0.77	x	1.8	x	91.35	x	0.63	x	0.85	=	61.02	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(75)
Northeast 0.9x	0.77	x	2	x	97.38	x	0.63	x	0.85	=	72.28	(75)
Northeast 0.9x	0.77	x	0.53	x	97.38	x	0.63	x	0.85	=	19.15	(75)
Northeast 0.9x	0.77	x	0.88	x	97.38	x	0.63	x	0.85	=	31.8	(75)
Northeast 0.9x	0.77	x	1.3	x	97.38	x	0.63	x	0.85	=	46.98	(75)
Northeast 0.9x	0.77	x	1.8	x	97.38	x	0.63	x	0.85	=	65.05	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(75)
Northeast 0.9x	0.77	x	2	x	91.1	x	0.63	x	0.85	=	67.62	(75)
Northeast 0.9x	0.77	x	0.53	x	91.1	x	0.63	x	0.85	=	17.92	(75)
Northeast 0.9x	0.77	x	0.88	x	91.1	x	0.63	x	0.85	=	29.75	(75)
Northeast 0.9x	0.77	x	1.3	x	91.1	x	0.63	x	0.85	=	43.95	(75)
Northeast 0.9x	0.77	x	1.8	x	91.1	x	0.63	x	0.85	=	60.85	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(75)
Northeast 0.9x	0.77	x	2	x	72.63	x	0.63	x	0.85	=	53.9	(75)
Northeast 0.9x	0.77	x	0.53	x	72.63	x	0.63	x	0.85	=	14.28	(75)
Northeast 0.9x	0.77	x	0.88	x	72.63	x	0.63	x	0.85	=	23.72	(75)
Northeast 0.9x	0.77	x	1.3	x	72.63	x	0.63	x	0.85	=	35.04	(75)
Northeast 0.9x	0.77	x	1.8	x	72.63	x	0.63	x	0.85	=	48.51	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(75)
Northeast 0.9x	0.77	x	2	x	50.42	x	0.63	x	0.85	=	37.42	(75)
Northeast 0.9x	0.77	x	0.53	x	50.42	x	0.63	x	0.85	=	9.92	(75)
Northeast 0.9x	0.77	x	0.88	x	50.42	x	0.63	x	0.85	=	16.47	(75)
Northeast 0.9x	0.77	x	1.3	x	50.42	x	0.63	x	0.85	=	24.32	(75)
Northeast 0.9x	0.77	x	1.8	x	50.42	x	0.63	x	0.85	=	33.68	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)

DER WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(75)
Northeast 0.9x	0.77	x	2	x	28.07	x	0.63	x	0.85	=	20.83	(75)
Northeast 0.9x	0.77	x	0.53	x	28.07	x	0.63	x	0.85	=	5.52	(75)
Northeast 0.9x	0.77	x	0.88	x	28.07	x	0.63	x	0.85	=	9.17	(75)
Northeast 0.9x	0.77	x	1.3	x	28.07	x	0.63	x	0.85	=	13.54	(75)
Northeast 0.9x	0.77	x	1.8	x	28.07	x	0.63	x	0.85	=	18.75	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)
Northeast 0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(75)
Northeast 0.9x	0.77	x	2	x	14.2	x	0.63	x	0.85	=	10.54	(75)
Northeast 0.9x	0.77	x	0.53	x	14.2	x	0.63	x	0.85	=	2.79	(75)
Northeast 0.9x	0.77	x	0.88	x	14.2	x	0.63	x	0.85	=	4.64	(75)
Northeast 0.9x	0.77	x	1.3	x	14.2	x	0.63	x	0.85	=	6.85	(75)
Northeast 0.9x	0.77	x	1.8	x	14.2	x	0.63	x	0.85	=	9.48	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(75)
Northeast 0.9x	0.77	x	2	x	9.21	x	0.63	x	0.85	=	6.84	(75)
Northeast 0.9x	0.77	x	0.53	x	9.21	x	0.63	x	0.85	=	1.81	(75)
Northeast 0.9x	0.77	x	0.88	x	9.21	x	0.63	x	0.85	=	3.01	(75)
Northeast 0.9x	0.77	x	1.3	x	9.21	x	0.63	x	0.85	=	4.45	(75)
Northeast 0.9x	0.77	x	1.8	x	9.21	x	0.63	x	0.85	=	6.15	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Northeast 0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(75)
Southeast 0.9x	0.77	x	3.15	x	36.79	x	0.63	x	0.85	=	43.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	3.24	x	36.79	x	0.63	x	0.85	=	44.24	(77)
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.63	x	0.85	=	38.1	(77)
Southeast 0.9x	0.77	x	3.15	x	62.67	x	0.63	x	0.85	=	73.26	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	3.24	x	62.67	x	0.63	x	0.85	=	75.36	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.63	x	0.85	=	64.89	(77)
Southeast 0.9x	0.77	x	3.15	x	85.75	x	0.63	x	0.85	=	100.24	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)

DER WorkSheet: New dwelling as built

Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	3.24	x	85.75	x	0.63	x	0.85	=	103.11	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.63	x	0.85	=	88.79	(77)
Southeast 0.9x	0.77	x	3.15	x	106.25	x	0.63	x	0.85	=	124.2	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	3.24	x	106.25	x	0.63	x	0.85	=	127.75	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.63	x	0.85	=	110.01	(77)
Southeast 0.9x	0.77	x	3.15	x	119.01	x	0.63	x	0.85	=	139.12	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	3.24	x	119.01	x	0.63	x	0.85	=	143.09	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.63	x	0.85	=	123.22	(77)
Southeast 0.9x	0.77	x	3.15	x	118.15	x	0.63	x	0.85	=	138.11	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	3.24	x	118.15	x	0.63	x	0.85	=	142.06	(77)
Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.63	x	0.85	=	122.33	(77)
Southeast 0.9x	0.77	x	3.15	x	113.91	x	0.63	x	0.85	=	133.16	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	3.24	x	113.91	x	0.63	x	0.85	=	136.96	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.63	x	0.85	=	117.94	(77)
Southeast 0.9x	0.77	x	3.15	x	104.39	x	0.63	x	0.85	=	122.03	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)

DER WorkSheet: New dwelling as built

Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	3.24	x	104.39	x	0.63	x	0.85	=	125.52	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.63	x	0.85	=	108.08	(77)
Southeast 0.9x	0.77	x	3.15	x	92.85	x	0.63	x	0.85	=	108.54	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	3.24	x	92.85	x	0.63	x	0.85	=	111.64	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.63	x	0.85	=	96.14	(77)
Southeast 0.9x	0.77	x	3.15	x	69.27	x	0.63	x	0.85	=	80.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	3.24	x	69.27	x	0.63	x	0.85	=	83.29	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.63	x	0.85	=	71.72	(77)
Southeast 0.9x	0.77	x	3.15	x	44.07	x	0.63	x	0.85	=	51.52	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	3.24	x	44.07	x	0.63	x	0.85	=	52.99	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.63	x	0.85	=	45.63	(77)
Southeast 0.9x	0.77	x	3.15	x	31.49	x	0.63	x	0.85	=	36.81	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	3.24	x	31.49	x	0.63	x	0.85	=	37.86	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.63	x	0.85	=	32.6	(77)
Southwest 0.9x	0.77	x	6.09	x	36.79		0.63	x	0.85	=	83.15	(79)
Southwest 0.9x	0.77	x	2.43	x	36.79		0.63	x	0.85	=	33.18	(79)
Southwest 0.9x	0.77	x	2.43	x	36.79		0.63	x	0.85	=	33.18	(79)
Southwest 0.9x	0.77	x	0.88	x	36.79		0.63	x	0.85	=	12.02	(79)
Southwest 0.9x	0.77	x	6.09	x	62.67		0.63	x	0.85	=	141.64	(79)

DER WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	2.43	x	62.67	0.63	x	0.85	=	56.52	(79)
Southwest0.9x	0.77	x	2.43	x	62.67	0.63	x	0.85	=	56.52	(79)
Southwest0.9x	0.77	x	0.88	x	62.67	0.63	x	0.85	=	20.47	(79)
Southwest0.9x	0.77	x	6.09	x	85.75	0.63	x	0.85	=	193.8	(79)
Southwest0.9x	0.77	x	2.43	x	85.75	0.63	x	0.85	=	77.33	(79)
Southwest0.9x	0.77	x	2.43	x	85.75	0.63	x	0.85	=	77.33	(79)
Southwest0.9x	0.77	x	0.88	x	85.75	0.63	x	0.85	=	28	(79)
Southwest0.9x	0.77	x	6.09	x	106.25	0.63	x	0.85	=	240.13	(79)
Southwest0.9x	0.77	x	2.43	x	106.25	0.63	x	0.85	=	95.82	(79)
Southwest0.9x	0.77	x	2.43	x	106.25	0.63	x	0.85	=	95.82	(79)
Southwest0.9x	0.77	x	0.88	x	106.25	0.63	x	0.85	=	34.7	(79)
Southwest0.9x	0.77	x	6.09	x	119.01	0.63	x	0.85	=	268.97	(79)
Southwest0.9x	0.77	x	2.43	x	119.01	0.63	x	0.85	=	107.32	(79)
Southwest0.9x	0.77	x	2.43	x	119.01	0.63	x	0.85	=	107.32	(79)
Southwest0.9x	0.77	x	0.88	x	119.01	0.63	x	0.85	=	38.87	(79)
Southwest0.9x	0.77	x	6.09	x	118.15	0.63	x	0.85	=	267.02	(79)
Southwest0.9x	0.77	x	2.43	x	118.15	0.63	x	0.85	=	106.54	(79)
Southwest0.9x	0.77	x	2.43	x	118.15	0.63	x	0.85	=	106.54	(79)
Southwest0.9x	0.77	x	0.88	x	118.15	0.63	x	0.85	=	38.58	(79)
Southwest0.9x	0.77	x	6.09	x	113.91	0.63	x	0.85	=	257.44	(79)
Southwest0.9x	0.77	x	2.43	x	113.91	0.63	x	0.85	=	102.72	(79)
Southwest0.9x	0.77	x	2.43	x	113.91	0.63	x	0.85	=	102.72	(79)
Southwest0.9x	0.77	x	0.88	x	113.91	0.63	x	0.85	=	37.2	(79)
Southwest0.9x	0.77	x	6.09	x	104.39	0.63	x	0.85	=	235.92	(79)
Southwest0.9x	0.77	x	2.43	x	104.39	0.63	x	0.85	=	94.14	(79)
Southwest0.9x	0.77	x	2.43	x	104.39	0.63	x	0.85	=	94.14	(79)
Southwest0.9x	0.77	x	0.88	x	104.39	0.63	x	0.85	=	34.09	(79)
Southwest0.9x	0.77	x	6.09	x	92.85	0.63	x	0.85	=	209.85	(79)
Southwest0.9x	0.77	x	2.43	x	92.85	0.63	x	0.85	=	83.73	(79)
Southwest0.9x	0.77	x	2.43	x	92.85	0.63	x	0.85	=	83.73	(79)
Southwest0.9x	0.77	x	0.88	x	92.85	0.63	x	0.85	=	30.32	(79)
Southwest0.9x	0.77	x	6.09	x	69.27	0.63	x	0.85	=	156.55	(79)
Southwest0.9x	0.77	x	2.43	x	69.27	0.63	x	0.85	=	62.46	(79)
Southwest0.9x	0.77	x	2.43	x	69.27	0.63	x	0.85	=	62.46	(79)
Southwest0.9x	0.77	x	0.88	x	69.27	0.63	x	0.85	=	22.62	(79)
Southwest0.9x	0.77	x	6.09	x	44.07	0.63	x	0.85	=	99.6	(79)
Southwest0.9x	0.77	x	2.43	x	44.07	0.63	x	0.85	=	39.74	(79)
Southwest0.9x	0.77	x	2.43	x	44.07	0.63	x	0.85	=	39.74	(79)
Southwest0.9x	0.77	x	0.88	x	44.07	0.63	x	0.85	=	14.39	(79)
Southwest0.9x	0.77	x	6.09	x	31.49	0.63	x	0.85	=	71.16	(79)
Southwest0.9x	0.77	x	2.43	x	31.49	0.63	x	0.85	=	28.4	(79)

DER WorkSheet: New dwelling as built

Southwest 0.9x

0.77

 x

2.43

 x

31.49

0.63

 x

0.85

 =

28.4

 (79)

Southwest 0.9x

0.77

 x

0.88

 x

31.49

0.63

 x

0.85

 =

10.28

 (79)

Solar gains in watts, calculated for each month

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

(83)m=

371.71	646.38	919.49	1198.12	1395.69	1409.21	1348.8	1197.8	1015.42	723.85	447.63	316.55
--------	--------	--------	---------	---------	---------	--------	--------	---------	--------	--------	--------

 (83)

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

(84)m=

880.33	1152.75	1409.24	1660.78	1830.38	1817.28	1739.76	1595.28	1426.98	1162.72	917.94	810.89
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.98	0.95	0.91	0.81	0.67	0.51	0.38	0.43	0.64	0.87	0.96	0.98

 (86)

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

(87)m=

19.11	19.47	19.93	20.42	20.76	20.93	20.98	20.97	20.84	20.35	19.62	19.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

19.84	19.84	19.84	19.85	19.85	19.86	19.86	19.86	19.85	19.85	19.85	19.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.98	0.94	0.89	0.77	0.61	0.43	0.29	0.33	0.57	0.84	0.95	0.98
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

(90)m=

17.35	17.87	18.52	19.18	19.61	19.8	19.84	19.84	19.72	19.11	18.09	17.25
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.16

 (91)

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

(92)m=

17.63	18.12	18.74	19.38	19.79	19.98	20.03	20.02	19.9	19.31	18.34	17.53
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (92)

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

(93)m=

17.48	17.97	18.59	19.23	19.64	19.83	19.88	19.87	19.75	19.16	18.19	17.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

0.96	0.92	0.86	0.75	0.6	0.43	0.29	0.33	0.56	0.81	0.93	0.97
------	------	------	------	-----	------	------	------	------	------	------	------

 (94)

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

(95)m=

846.64	1065.29	1213.14	1247.18	1096.42	775.82	500.52	526.13	795.99	944.46	857.59	785.78
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------

 (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=

2073.87	2053.78	1897.27	1610.49	1236.89	809.89	507.26	536.75	876.36	1333.21	1730.68	2062.85
---------	---------	---------	---------	---------	--------	--------	--------	--------	---------	---------	---------

 (97)

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

(98)m=

913.06	664.27	508.99	261.59	104.51	0	0	0	0	289.23	628.62	950.14
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

4320.4

 (98)

Space heating requirement in kWh/m²/year

35.76

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

DER WorkSheet: New dwelling as built

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.6	(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)													
913.06	664.27	508.99	261.59	104.51	0	0	0	0	289.23	628.62	950.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
975.49	709.68	543.8	279.47	111.66	0	0	0	0	309	671.6	1015.11		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												4615.81	(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
Total (kWh/year) =Sum(215) _{1...5,10...12} =											0

Water heating

Output from water heater (calculated above)													
216.39	190.67	200.12	179.22	175.51	156.64	150.27	165.13	164.91	185.85	196.74	211.12		
Efficiency of water heater												79.9	(216)
(217)m=	88.33	87.97	87.3	85.92	83.58	79.9	79.9	79.9	79.9	86.09	87.8	88.45	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	244.96	216.74	229.23	208.59	209.98	196.05	188.07	206.66	206.39	215.88	224.08	238.7	
Total = Sum(219a) _{1...12} =												2585.33	(219)

Annual totals

Space heating fuel used, main system 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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) ×	0.216	=	997.01 (261)
Space heating (secondary)	(215) ×	0.519	=	0 (263)
Water heating	(219) ×	0.216	=	558.43 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1555.45 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	=	38.93 (267)
Electricity for lighting	(232) ×	0.519	=	233.91 (268)

DER WorkSheet: New dwelling as built

Total CO2, kg/year	sum of (265)...(271) =	1828.29	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =	15.13	(273)
El rating (section 14)		85	(274)

SAP Input

Property Details: ab Plot 19

Address: 2, Ruhemann Street, READING, RG30 3EZ
Located in: England
Region: Thames valley
UPRN: 6307905578
Date of assessment: 17 November 2017
Date of certificate: 17 November 2017
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 154.44
Water use <= 125 litres/person/day: True
PCDF Version: 419

Property description:

Dwelling type: House
Detachment: End-terrace
Year Completed: 2015
Floor Location: Floor area: Storey height:
 Floor 0 41.13 m² 2.4 m
 Floor 1 39.84 m² 2.65 m
 Floor 2 39.84 m² 2.65 m
Living area: 19.31 m² (fraction 0.16)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 10	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 11	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 12	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 13	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 14	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 15	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 16	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 17	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 18	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 19	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.5	2.1	1
Window 1	16mm or more	0.85	0.63	1.4	3.15	1
Window 2	16mm or more	0.85	0.63	1.4	0.66	1
Window 3	16mm or more	0.85	0.63	1.4	0.66	1
Window 4	16mm or more	0.85	0.63	1.4	0.66	1

SAP Input

Window 5	16mm or more	0.85	0.63	1.4	0.66	1
Window 6	16mm or more	0.85	0.63	1.4	0.66	1
Window 7	16mm or more	0.85	0.63	1.4	3.24	1
Window 8	16mm or more	0.85	0.63	1.4	2.79	1
Window 9	16mm or more	0.85	0.63	1.4	6.09	1
Window 10	16mm or more	0.85	0.63	1.4	2.43	1
Window 11	16mm or more	0.85	0.63	1.4	2.43	1
Window 12	16mm or more	0.85	0.63	1.4	0.88	1
Window 13	16mm or more	0.85	0.63	1.4	2	1
Window 14	16mm or more	0.85	0.63	1.4	0.53	1
Window 15	16mm or more	0.85	0.63	1.4	0.88	1
Window 16	16mm or more	0.85	0.63	1.4	1.3	1
Window 17	16mm or more	0.85	0.63	1.4	1.8	1
Window 18	16mm or more	0.85	0.63	1.4	2.36	1
Window 19	16mm or more	0.85	0.63	1.4	0.63	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Walls	South East	1	2.1
Window 1		External Walls	South East	1.8	1.75
Window 2		External Walls	South East	0.63	1.05
Window 3		External Walls	South East	0.63	1.05
Window 4		External Walls	South East	0.63	1.05
Window 5		External Walls	South East	0.63	1.05
Window 6		External Walls	South East	0.63	1.05
Window 7		External Walls	South East	1.8	1.8
Window 8		External Walls	South East	1.8	1.55
Window 9		External Walls	South West	2.9	2.1
Window 10		External Walls	South West	1.8	1.35
Window 11		External Walls	South West	1.8	1.35
Window 12		External Walls	South West	0.5	1.75
Window 13		External Walls	North East	1.6	1.25
Window 14		External Walls	North East	0.5	1.05
Window 15		External Walls	North East	0.5	1.75
Window 16		External Walls	North East	0.65	2
Window 17		External Walls	North East	0.9	2
Window 18		External Walls	North East	1.75	1.35
Window 19		External Walls	North East	0.5	1.25

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	149.07	35.91	113.16	0.25	0	False	60
Ceiling Level	39.84	0	39.84	0.11	0		9
Ground Floor	41.13			0.15			110
<u>Internal Elements</u>							
Internal Walls	102.885						9
Internal Walls	86.957						9
Internal Ceilings	79.68						9
Internal Floors	79.68						18
<u>Party Elements</u>							
Party Walls	69.45						45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0599					
	Length	Psi-value				
	22.95	0.186	E2	Other lintels (including other steel lintels)		

SAP Input

	21.95	0.025	E3	Sill
	59.3	0.027	E4	Jamb
	19.58	0.051	E5	Ground floor (normal)
	38.36	0.011	E6	Intermediate floor within a dwelling
	11.51	0.07	E10	Eaves (insulation at ceiling level)
	9.76	0.07	E13	Gable (insulation at rafter level)
	33.2	0.052	E16	Corner (normal)
	17.8	-0.0952	E17	Corner (inverted internal area greater than external area)
[Approved]	15.4	0.06	E18	Party wall between dwellings
	6.58	0.02	E11	
	7.69	0.08	E14	
	9.7	0.098	P1	Ground floor
	17.8	0	P2	Intermediate floor within a dwelling
	8.9	0.037	P4	Roof (insulation at ceiling level)
	14.78	0.08	R4	Ridge (vaulted ceiling)
	1.15	0.08	R1	
	1.15	0.06	R2	
	1.6	0.08	R3	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.18 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 419, product index 016393) Efficiency: Winter 79.9 % Summer: 90.6
	Brand name: Ideal
	Model: Logic System
	Model qualifier: 30
	(Regular boiler)
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Unknown
	Unknown
	Boiler interlock: Yes
	Weather Compensator
	Delayed start

Main heating Control:

Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services
	Control code: 2110

Secondary heating system:

Secondary heating system:	None
---------------------------	------

Water heating:

Water heating:	From main heating system
	Water code: 901
	Fuel :mains gas

SAP Input

Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Measured loss, 1.57kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: ab Plot 19

Address: 2, Ruhemann Street, READING, RG30 3EZ
Located in: England
Region: Thames valley
UPRN: 6307905578
Date of assessment: 17 November 2017
Date of certificate: 17 November 2017
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 154.44
Water use <= 125 litres/person/day: True
PCDF Version: 419

Property description:

Dwelling type: House
Detachment: End-terrace
Year Completed: 2015
Floor Location: **Floor area:** **Storey height:**
 Floor 0 41.13 m² 2.4 m
 Floor 1 39.84 m² 2.65 m
 Floor 2 39.84 m² 2.65 m
Living area: 19.31 m² (fraction 0.16)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 10	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 11	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 12	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 13	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 14	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 15	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 16	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 17	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 18	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 19	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.5	2.1	1
Window 1	16mm or more	0.85	0.63	1.4	3.15	1
Window 2	16mm or more	0.85	0.63	1.4	0.66	1
Window 3	16mm or more	0.85	0.63	1.4	0.66	1
Window 4	16mm or more	0.85	0.63	1.4	0.66	1

SAP Input

Window 5	16mm or more	0.85	0.63	1.4	0.66	1
Window 6	16mm or more	0.85	0.63	1.4	0.66	1
Window 7	16mm or more	0.85	0.63	1.4	3.24	1
Window 8	16mm or more	0.85	0.63	1.4	2.79	1
Window 9	16mm or more	0.85	0.63	1.4	6.09	1
Window 10	16mm or more	0.85	0.63	1.4	2.43	1
Window 11	16mm or more	0.85	0.63	1.4	2.43	1
Window 12	16mm or more	0.85	0.63	1.4	0.88	1
Window 13	16mm or more	0.85	0.63	1.4	2	1
Window 14	16mm or more	0.85	0.63	1.4	0.53	1
Window 15	16mm or more	0.85	0.63	1.4	0.88	1
Window 16	16mm or more	0.85	0.63	1.4	1.3	1
Window 17	16mm or more	0.85	0.63	1.4	1.8	1
Window 18	16mm or more	0.85	0.63	1.4	2.36	1
Window 19	16mm or more	0.85	0.63	1.4	0.63	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Walls	South East	1	2.1
Window 1		External Walls	South East	1.8	1.75
Window 2		External Walls	South East	0.63	1.05
Window 3		External Walls	South East	0.63	1.05
Window 4		External Walls	South East	0.63	1.05
Window 5		External Walls	South East	0.63	1.05
Window 6		External Walls	South East	0.63	1.05
Window 7		External Walls	South East	1.8	1.8
Window 8		External Walls	South East	1.8	1.55
Window 9		External Walls	South West	2.9	2.1
Window 10		External Walls	South West	1.8	1.35
Window 11		External Walls	South West	1.8	1.35
Window 12		External Walls	South West	0.5	1.75
Window 13		External Walls	North East	1.6	1.25
Window 14		External Walls	North East	0.5	1.05
Window 15		External Walls	North East	0.5	1.75
Window 16		External Walls	North East	0.65	2
Window 17		External Walls	North East	0.9	2
Window 18		External Walls	North East	1.75	1.35
Window 19		External Walls	North East	0.5	1.25

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	149.07	35.91	113.16	0.25	0	False	60
Ceiling Level	39.84	0	39.84	0.11	0		9
Ground Floor	41.13			0.15			110
<u>Internal Elements</u>							
Internal Walls	102.885						9
Internal Walls	86.957						9
Internal Ceilings	79.68						9
Internal Floors	79.68						18
<u>Party Elements</u>							
Party Walls	69.45						45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0599		
	Length	Psi-value	
	22.95	0.186	E2 Other lintels (including other steel lintels)

SAP Input

	21.95	0.025	E3	Sill
	59.3	0.027	E4	Jamb
	19.58	0.051	E5	Ground floor (normal)
	38.36	0.011	E6	Intermediate floor within a dwelling
	11.51	0.07	E10	Eaves (insulation at ceiling level)
	9.76	0.07	E13	Gable (insulation at rafter level)
	33.2	0.052	E16	Corner (normal)
	17.8	-0.0952	E17	Corner (inverted internal area greater than external area)
[Approved]	15.4	0.06	E18	Party wall between dwellings
	6.58	0.02	E11	
	7.69	0.08	E14	
	9.7	0.098	P1	Ground floor
	17.8	0	P2	Intermediate floor within a dwelling
	8.9	0.037	P4	Roof (insulation at ceiling level)
	14.78	0.08	R4	Ridge (vaulted ceiling)
	1.15	0.08	R1	
	1.15	0.06	R2	
	1.6	0.08	R3	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.18 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 419, product index 016393) Efficiency: Winter 79.9 % Summer: 90.6
	Brand name: Ideal
	Model: Logic System
	Model qualifier: 30
	(Regular boiler)
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Unknown
	Unknown
	Boiler interlock: Yes
	Weather Compensator
	Delayed start

Main heating Control:

Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services
	Control code: 2110

Secondary heating system:

Secondary heating system:	None
---------------------------	------

Water heating:

Water heating:	From main heating system
	Water code: 901
	Fuel :mains gas

SAP Input

Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Measured loss, 1.57kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 19

Address : 2, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	41.13 (1a)	x	2.4 (2a)	=	98.71 (3a)
First floor	39.84 (1b)	x	2.65 (2b)	=	105.58 (3b)
Second floor	39.84 (1c)	x	2.65 (2c)	=	105.58 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	120.81 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	309.86 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.17999982833862	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.26	(21)
Infiltration rate modified for monthly wind speed				

SAP WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.33	0.32	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31
--	------	------	------	------	------	------	------	------	------	------	------	------

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=	0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(24d)
---------	------	------	------	------	------	------	------	------	------	------	------	------	-------

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

(25)m=	0.55	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			3.15	x 1/[1/(1.4)+ 0.04]	= 4.18		(27)
Windows Type 2			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 3			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 4			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 5			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 6			0.66	x 1/[1/(1.4)+ 0.04]	= 0.88		(27)
Windows Type 7			3.24	x 1/[1/(1.4)+ 0.04]	= 4.3		(27)
Windows Type 8			2.79	x 1/[1/(1.4)+ 0.04]	= 3.7		(27)
Windows Type 9			6.09	x 1/[1/(1.4)+ 0.04]	= 8.07		(27)
Windows Type 10			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 11			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 12			0.88	x 1/[1/(1.4)+ 0.04]	= 1.17		(27)
Windows Type 13			2	x 1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 14			0.53	x 1/[1/(1.4)+ 0.04]	= 0.7		(27)
Windows Type 15			0.88	x 1/[1/(1.4)+ 0.04]	= 1.17		(27)
Windows Type 16			1.3	x 1/[1/(1.4)+ 0.04]	= 1.72		(27)

SAP WorkSheet: New dwelling as built

Windows Type 17			1.8	$\times 1/[1/(1.4)+0.04]=$	2.39			(27)			
Windows Type 18			2.36	$\times 1/[1/(1.4)+0.04]=$	3.13			(27)			
Windows Type 19			0.63	$\times 1/[1/(1.4)+0.04]=$	0.84			(27)			
Floor			41.13	$\times$	0.15	$=$	6.1695	110	4524.3	(28)	
Walls	149.07	35.91	113.16	$\times$	0.25	$=$	28.29	60	6789.6	(29)	
Roof	39.84	0	39.84	$\times$	0.11	$=$	4.38	9	358.56	(30)	
Total area of elements, m²			230.04							(31)	
Party wall			69.45	$\times$	0	$=$	0	45	3125.25	(32)	
Internal wall **			102.89						9	925.965	(32c)
Internal wall **			86.96						9	782.613	(32c)
Internal floor			79.68						18	1434.24	(32d)
Internal ceiling			79.68						9	717.12	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 86.82 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18657.65 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 154.44 (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 13.78 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 100.6 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.74	56.53	56.31	55.31	55.12	54.25	54.25	54.08	54.58	55.12	55.5	55.9	(38)

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

(39)m=	157.34	157.12	156.91	155.91	155.72	154.84	154.84	154.68	155.18	155.72	156.1	156.49	
Average = Sum(39) _{1...12} /12=												155.9	(39)

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

(40)m=	1.3	1.3	1.3	1.29	1.29	1.28	1.28	1.28	1.28	1.29	1.29	1.3	
Average = Sum(40) _{1...12} /12=												1.29	(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 2.87 (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) + 36 102.28 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.5	108.41	104.32	100.23	96.14	92.05	92.05	96.14	100.23	104.32	108.41	112.5	
Total = Sum(44) _{1...12} =												1227.32	(44)

SAP WorkSheet: New dwelling as built

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.84	145.92	150.58	131.28	125.96	108.7	100.72	115.58	116.96	136.31	148.79	161.58		
Total = Sum(45) _{1...12} =													1609.21	(45)

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

(46)m=	25.03	21.89	22.59	19.69	18.89	16.3	15.11	17.34	17.54	20.45	22.32	24.24	
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	--

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	210	(47)
---	-----	------

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):	1.57	(48)
---	------	------

Temperature factor from Table 2b	0.54	(49)
----------------------------------	------	------

Energy lost from water storage, kWh/year	(48) x (49) =	0.85	(50)
--	---------------	------	------

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

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

If community heating see section 4.3

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

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

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

Enter (50) or (54) in (55)	0.85	(55)
----------------------------	------	------

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

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

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

(62)m=	216.39	190.67	200.12	179.22	175.51	156.64	150.27	165.13	164.91	185.85	196.74	211.12	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

Output from water heater

(64)m=	216.39	190.67	200.12	179.22	175.51	156.64	150.27	165.13	164.91	185.85	196.74	211.12		
Output from water heater (annual) _{1...12}													2192.55	(64)

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

(65)m=	95.11	84.32	89.7	82.01	81.52	74.5	73.13	78.07	77.25	84.96	87.83	93.36	
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	--

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

SAP WorkSheet: New dwelling as built

(66)m=

171.98	171.98	171.98	171.98	171.98	171.98	171.98	171.98	171.98	171.98	171.98	171.98
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (66)

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

(67)m=

63.8	56.67	46.09	34.89	26.08	22.02	23.79	30.93	41.51	52.7	61.51	65.57
------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (67)

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

(68)m=

427.26	431.69	420.52	396.74	366.71	338.49	319.64	315.21	326.38	350.16	380.19	408.41
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

55.06	55.06	55.06	55.06	55.06	55.06	55.06	55.06	55.06	55.06	55.06	55.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66	-114.66
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.84	125.47	120.57	113.9	109.57	103.47	98.29	104.93	107.29	114.19	121.99	125.48
--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

734.29	729.23	702.57	660.92	617.75	579.37	557.11	566.45	590.57	632.45	679.08	714.86
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2</td></tr></table>	2	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>8.37</td></tr></table>	8.37	(75)
0.77																			
2																			
11.28																			
0.63																			
0.85																			
8.37																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.53</td></tr></table>	0.53	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>2.22</td></tr></table>	2.22	(75)
0.77																			
0.53																			
11.28																			
0.63																			
0.85																			
2.22																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.88</td></tr></table>	0.88	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>3.68</td></tr></table>	3.68	(75)
0.77																			
0.88																			
11.28																			
0.63																			
0.85																			
3.68																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.3</td></tr></table>	1.3	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>5.44</td></tr></table>	5.44	(75)
0.77																			
1.3																			
11.28																			
0.63																			
0.85																			
5.44																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.8</td></tr></table>	1.8	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>7.54</td></tr></table>	7.54	(75)
0.77																			
1.8																			
11.28																			
0.63																			
0.85																			
7.54																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>9.88</td></tr></table>	9.88	(75)
0.77																			
2.36																			
11.28																			
0.63																			
0.85																			
9.88																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>2.64</td></tr></table>	2.64	(75)
0.77																			
0.63																			
11.28																			
0.63																			
0.85																			
2.64																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2</td></tr></table>	2	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>17.05</td></tr></table>	17.05	(75)
0.77																			
2																			
22.97																			
0.63																			
0.85																			
17.05																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.53</td></tr></table>	0.53	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>4.52</td></tr></table>	4.52	(75)
0.77																			
0.53																			
22.97																			
0.63																			
0.85																			
4.52																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.88</td></tr></table>	0.88	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>7.5</td></tr></table>	7.5	(75)
0.77																			
0.88																			
22.97																			
0.63																			
0.85																			
7.5																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.3</td></tr></table>	1.3	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>11.08</td></tr></table>	11.08	(75)
0.77																			
1.3																			
22.97																			
0.63																			
0.85																			
11.08																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.8</td></tr></table>	1.8	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>15.34</td></tr></table>	15.34	(75)
0.77																			
1.8																			
22.97																			
0.63																			
0.85																			
15.34																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>20.11</td></tr></table>	20.11	(75)
0.77																			
2.36																			
22.97																			
0.63																			
0.85																			
20.11																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>5.37</td></tr></table>	5.37	(75)
0.77																			
0.63																			
22.97																			
0.63																			
0.85																			
5.37																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2</td></tr></table>	2	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>30.71</td></tr></table>	30.71	(75)
0.77																			
2																			
41.38																			
0.63																			
0.85																			
30.71																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.53</td></tr></table>	0.53	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>8.14</td></tr></table>	8.14	(75)
0.77																			
0.53																			
41.38																			
0.63																			
0.85																			
8.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.88</td></tr></table>	0.88	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>13.51</td></tr></table>	13.51	(75)
0.77																			
0.88																			
41.38																			
0.63																			
0.85																			
13.51																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.3</td></tr></table>	1.3	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>19.96</td></tr></table>	19.96	(75)
0.77																			
1.3																			
41.38																			
0.63																			
0.85																			
19.96																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.8</td></tr></table>	1.8	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>27.64</td></tr></table>	27.64	(75)
0.77																			
1.8																			
41.38																			
0.63																			
0.85																			
27.64																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>36.24</td></tr></table>	36.24	(75)
0.77																			
2.36																			
41.38																			
0.63																			
0.85																			
36.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>9.67</td></tr></table>	9.67	(75)
0.77																			
0.63																			
41.38																			
0.63																			
0.85																			
9.67																			

SAP WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	2	x	67.96	x	0.63	x	0.85	=	50.44	(75)
Northeast 0.9x	0.77	x	0.53	x	67.96	x	0.63	x	0.85	=	13.37	(75)
Northeast 0.9x	0.77	x	0.88	x	67.96	x	0.63	x	0.85	=	22.19	(75)
Northeast 0.9x	0.77	x	1.3	x	67.96	x	0.63	x	0.85	=	32.78	(75)
Northeast 0.9x	0.77	x	1.8	x	67.96	x	0.63	x	0.85	=	45.39	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(75)
Northeast 0.9x	0.77	x	2	x	91.35	x	0.63	x	0.85	=	67.8	(75)
Northeast 0.9x	0.77	x	0.53	x	91.35	x	0.63	x	0.85	=	17.97	(75)
Northeast 0.9x	0.77	x	0.88	x	91.35	x	0.63	x	0.85	=	29.83	(75)
Northeast 0.9x	0.77	x	1.3	x	91.35	x	0.63	x	0.85	=	44.07	(75)
Northeast 0.9x	0.77	x	1.8	x	91.35	x	0.63	x	0.85	=	61.02	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(75)
Northeast 0.9x	0.77	x	2	x	97.38	x	0.63	x	0.85	=	72.28	(75)
Northeast 0.9x	0.77	x	0.53	x	97.38	x	0.63	x	0.85	=	19.15	(75)
Northeast 0.9x	0.77	x	0.88	x	97.38	x	0.63	x	0.85	=	31.8	(75)
Northeast 0.9x	0.77	x	1.3	x	97.38	x	0.63	x	0.85	=	46.98	(75)
Northeast 0.9x	0.77	x	1.8	x	97.38	x	0.63	x	0.85	=	65.05	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(75)
Northeast 0.9x	0.77	x	2	x	91.1	x	0.63	x	0.85	=	67.62	(75)
Northeast 0.9x	0.77	x	0.53	x	91.1	x	0.63	x	0.85	=	17.92	(75)
Northeast 0.9x	0.77	x	0.88	x	91.1	x	0.63	x	0.85	=	29.75	(75)
Northeast 0.9x	0.77	x	1.3	x	91.1	x	0.63	x	0.85	=	43.95	(75)
Northeast 0.9x	0.77	x	1.8	x	91.1	x	0.63	x	0.85	=	60.85	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(75)
Northeast 0.9x	0.77	x	2	x	72.63	x	0.63	x	0.85	=	53.9	(75)
Northeast 0.9x	0.77	x	0.53	x	72.63	x	0.63	x	0.85	=	14.28	(75)
Northeast 0.9x	0.77	x	0.88	x	72.63	x	0.63	x	0.85	=	23.72	(75)
Northeast 0.9x	0.77	x	1.3	x	72.63	x	0.63	x	0.85	=	35.04	(75)
Northeast 0.9x	0.77	x	1.8	x	72.63	x	0.63	x	0.85	=	48.51	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(75)
Northeast 0.9x	0.77	x	2	x	50.42	x	0.63	x	0.85	=	37.42	(75)
Northeast 0.9x	0.77	x	0.53	x	50.42	x	0.63	x	0.85	=	9.92	(75)
Northeast 0.9x	0.77	x	0.88	x	50.42	x	0.63	x	0.85	=	16.47	(75)
Northeast 0.9x	0.77	x	1.3	x	50.42	x	0.63	x	0.85	=	24.32	(75)
Northeast 0.9x	0.77	x	1.8	x	50.42	x	0.63	x	0.85	=	33.68	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)

SAP WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(75)
Northeast 0.9x	0.77	x	2	x	28.07	x	0.63	x	0.85	=	20.83	(75)
Northeast 0.9x	0.77	x	0.53	x	28.07	x	0.63	x	0.85	=	5.52	(75)
Northeast 0.9x	0.77	x	0.88	x	28.07	x	0.63	x	0.85	=	9.17	(75)
Northeast 0.9x	0.77	x	1.3	x	28.07	x	0.63	x	0.85	=	13.54	(75)
Northeast 0.9x	0.77	x	1.8	x	28.07	x	0.63	x	0.85	=	18.75	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)
Northeast 0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(75)
Northeast 0.9x	0.77	x	2	x	14.2	x	0.63	x	0.85	=	10.54	(75)
Northeast 0.9x	0.77	x	0.53	x	14.2	x	0.63	x	0.85	=	2.79	(75)
Northeast 0.9x	0.77	x	0.88	x	14.2	x	0.63	x	0.85	=	4.64	(75)
Northeast 0.9x	0.77	x	1.3	x	14.2	x	0.63	x	0.85	=	6.85	(75)
Northeast 0.9x	0.77	x	1.8	x	14.2	x	0.63	x	0.85	=	9.48	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(75)
Northeast 0.9x	0.77	x	2	x	9.21	x	0.63	x	0.85	=	6.84	(75)
Northeast 0.9x	0.77	x	0.53	x	9.21	x	0.63	x	0.85	=	1.81	(75)
Northeast 0.9x	0.77	x	0.88	x	9.21	x	0.63	x	0.85	=	3.01	(75)
Northeast 0.9x	0.77	x	1.3	x	9.21	x	0.63	x	0.85	=	4.45	(75)
Northeast 0.9x	0.77	x	1.8	x	9.21	x	0.63	x	0.85	=	6.15	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Northeast 0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(75)
Southeast 0.9x	0.77	x	3.15	x	36.79	x	0.63	x	0.85	=	43.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	0.66	x	36.79	x	0.63	x	0.85	=	9.01	(77)
Southeast 0.9x	0.77	x	3.24	x	36.79	x	0.63	x	0.85	=	44.24	(77)
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.63	x	0.85	=	38.1	(77)
Southeast 0.9x	0.77	x	3.15	x	62.67	x	0.63	x	0.85	=	73.26	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	0.66	x	62.67	x	0.63	x	0.85	=	15.35	(77)
Southeast 0.9x	0.77	x	3.24	x	62.67	x	0.63	x	0.85	=	75.36	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.63	x	0.85	=	64.89	(77)
Southeast 0.9x	0.77	x	3.15	x	85.75	x	0.63	x	0.85	=	100.24	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)

SAP WorkSheet: New dwelling as built

Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	0.66	x	85.75	x	0.63	x	0.85	=	21	(77)
Southeast 0.9x	0.77	x	3.24	x	85.75	x	0.63	x	0.85	=	103.11	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.63	x	0.85	=	88.79	(77)
Southeast 0.9x	0.77	x	3.15	x	106.25	x	0.63	x	0.85	=	124.2	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	0.66	x	106.25	x	0.63	x	0.85	=	26.02	(77)
Southeast 0.9x	0.77	x	3.24	x	106.25	x	0.63	x	0.85	=	127.75	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.63	x	0.85	=	110.01	(77)
Southeast 0.9x	0.77	x	3.15	x	119.01	x	0.63	x	0.85	=	139.12	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	0.66	x	119.01	x	0.63	x	0.85	=	29.15	(77)
Southeast 0.9x	0.77	x	3.24	x	119.01	x	0.63	x	0.85	=	143.09	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.63	x	0.85	=	123.22	(77)
Southeast 0.9x	0.77	x	3.15	x	118.15	x	0.63	x	0.85	=	138.11	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	0.66	x	118.15	x	0.63	x	0.85	=	28.94	(77)
Southeast 0.9x	0.77	x	3.24	x	118.15	x	0.63	x	0.85	=	142.06	(77)
Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.63	x	0.85	=	122.33	(77)
Southeast 0.9x	0.77	x	3.15	x	113.91	x	0.63	x	0.85	=	133.16	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	0.66	x	113.91	x	0.63	x	0.85	=	27.9	(77)
Southeast 0.9x	0.77	x	3.24	x	113.91	x	0.63	x	0.85	=	136.96	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.63	x	0.85	=	117.94	(77)
Southeast 0.9x	0.77	x	3.15	x	104.39	x	0.63	x	0.85	=	122.03	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)

SAP WorkSheet: New dwelling as built

Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	0.66	x	104.39	x	0.63	x	0.85	=	25.57	(77)
Southeast 0.9x	0.77	x	3.24	x	104.39	x	0.63	x	0.85	=	125.52	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.63	x	0.85	=	108.08	(77)
Southeast 0.9x	0.77	x	3.15	x	92.85	x	0.63	x	0.85	=	108.54	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	0.66	x	92.85	x	0.63	x	0.85	=	22.74	(77)
Southeast 0.9x	0.77	x	3.24	x	92.85	x	0.63	x	0.85	=	111.64	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.63	x	0.85	=	96.14	(77)
Southeast 0.9x	0.77	x	3.15	x	69.27	x	0.63	x	0.85	=	80.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	0.66	x	69.27	x	0.63	x	0.85	=	16.97	(77)
Southeast 0.9x	0.77	x	3.24	x	69.27	x	0.63	x	0.85	=	83.29	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.63	x	0.85	=	71.72	(77)
Southeast 0.9x	0.77	x	3.15	x	44.07	x	0.63	x	0.85	=	51.52	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	0.66	x	44.07	x	0.63	x	0.85	=	10.79	(77)
Southeast 0.9x	0.77	x	3.24	x	44.07	x	0.63	x	0.85	=	52.99	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.63	x	0.85	=	45.63	(77)
Southeast 0.9x	0.77	x	3.15	x	31.49	x	0.63	x	0.85	=	36.81	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	0.66	x	31.49	x	0.63	x	0.85	=	7.71	(77)
Southeast 0.9x	0.77	x	3.24	x	31.49	x	0.63	x	0.85	=	37.86	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.63	x	0.85	=	32.6	(77)
Southwest 0.9x	0.77	x	6.09	x	36.79		0.63	x	0.85	=	83.15	(79)
Southwest 0.9x	0.77	x	2.43	x	36.79		0.63	x	0.85	=	33.18	(79)
Southwest 0.9x	0.77	x	2.43	x	36.79		0.63	x	0.85	=	33.18	(79)
Southwest 0.9x	0.77	x	0.88	x	36.79		0.63	x	0.85	=	12.02	(79)
Southwest 0.9x	0.77	x	6.09	x	62.67		0.63	x	0.85	=	141.64	(79)

SAP WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	2.43	x	62.67	0.63	x	0.85	=	56.52	(79)
Southwest0.9x	0.77	x	2.43	x	62.67	0.63	x	0.85	=	56.52	(79)
Southwest0.9x	0.77	x	0.88	x	62.67	0.63	x	0.85	=	20.47	(79)
Southwest0.9x	0.77	x	6.09	x	85.75	0.63	x	0.85	=	193.8	(79)
Southwest0.9x	0.77	x	2.43	x	85.75	0.63	x	0.85	=	77.33	(79)
Southwest0.9x	0.77	x	2.43	x	85.75	0.63	x	0.85	=	77.33	(79)
Southwest0.9x	0.77	x	0.88	x	85.75	0.63	x	0.85	=	28	(79)
Southwest0.9x	0.77	x	6.09	x	106.25	0.63	x	0.85	=	240.13	(79)
Southwest0.9x	0.77	x	2.43	x	106.25	0.63	x	0.85	=	95.82	(79)
Southwest0.9x	0.77	x	2.43	x	106.25	0.63	x	0.85	=	95.82	(79)
Southwest0.9x	0.77	x	0.88	x	106.25	0.63	x	0.85	=	34.7	(79)
Southwest0.9x	0.77	x	6.09	x	119.01	0.63	x	0.85	=	268.97	(79)
Southwest0.9x	0.77	x	2.43	x	119.01	0.63	x	0.85	=	107.32	(79)
Southwest0.9x	0.77	x	2.43	x	119.01	0.63	x	0.85	=	107.32	(79)
Southwest0.9x	0.77	x	0.88	x	119.01	0.63	x	0.85	=	38.87	(79)
Southwest0.9x	0.77	x	6.09	x	118.15	0.63	x	0.85	=	267.02	(79)
Southwest0.9x	0.77	x	2.43	x	118.15	0.63	x	0.85	=	106.54	(79)
Southwest0.9x	0.77	x	2.43	x	118.15	0.63	x	0.85	=	106.54	(79)
Southwest0.9x	0.77	x	0.88	x	118.15	0.63	x	0.85	=	38.58	(79)
Southwest0.9x	0.77	x	6.09	x	113.91	0.63	x	0.85	=	257.44	(79)
Southwest0.9x	0.77	x	2.43	x	113.91	0.63	x	0.85	=	102.72	(79)
Southwest0.9x	0.77	x	2.43	x	113.91	0.63	x	0.85	=	102.72	(79)
Southwest0.9x	0.77	x	0.88	x	113.91	0.63	x	0.85	=	37.2	(79)
Southwest0.9x	0.77	x	6.09	x	104.39	0.63	x	0.85	=	235.92	(79)
Southwest0.9x	0.77	x	2.43	x	104.39	0.63	x	0.85	=	94.14	(79)
Southwest0.9x	0.77	x	2.43	x	104.39	0.63	x	0.85	=	94.14	(79)
Southwest0.9x	0.77	x	0.88	x	104.39	0.63	x	0.85	=	34.09	(79)
Southwest0.9x	0.77	x	6.09	x	92.85	0.63	x	0.85	=	209.85	(79)
Southwest0.9x	0.77	x	2.43	x	92.85	0.63	x	0.85	=	83.73	(79)
Southwest0.9x	0.77	x	2.43	x	92.85	0.63	x	0.85	=	83.73	(79)
Southwest0.9x	0.77	x	0.88	x	92.85	0.63	x	0.85	=	30.32	(79)
Southwest0.9x	0.77	x	6.09	x	69.27	0.63	x	0.85	=	156.55	(79)
Southwest0.9x	0.77	x	2.43	x	69.27	0.63	x	0.85	=	62.46	(79)
Southwest0.9x	0.77	x	2.43	x	69.27	0.63	x	0.85	=	62.46	(79)
Southwest0.9x	0.77	x	0.88	x	69.27	0.63	x	0.85	=	22.62	(79)
Southwest0.9x	0.77	x	6.09	x	44.07	0.63	x	0.85	=	99.6	(79)
Southwest0.9x	0.77	x	2.43	x	44.07	0.63	x	0.85	=	39.74	(79)
Southwest0.9x	0.77	x	2.43	x	44.07	0.63	x	0.85	=	39.74	(79)
Southwest0.9x	0.77	x	0.88	x	44.07	0.63	x	0.85	=	14.39	(79)
Southwest0.9x	0.77	x	6.09	x	31.49	0.63	x	0.85	=	71.16	(79)
Southwest0.9x	0.77	x	2.43	x	31.49	0.63	x	0.85	=	28.4	(79)

SAP WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	2.43	x	31.49		0.63	x	0.85	=	28.4	(79)
Southwest0.9x	0.77	x	0.88	x	31.49		0.63	x	0.85	=	10.28	(79)

Solar gains in watts, calculated for each month

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

(83)m=	371.71	646.38	919.49	1198.12	1395.69	1409.21	1348.8	1197.8	1015.42	723.85	447.63	316.55	(83)
--------	--------	--------	--------	---------	---------	---------	--------	--------	---------	--------	--------	--------	------

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

(84)m=	1106	1375.6	1622.06	1859.04	2013.44	1988.59	1905.92	1764.25	1605.98	1356.3	1126.71	1031.41	(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=	0.96	0.93	0.87	0.77	0.63	0.47	0.35	0.39	0.59	0.83	0.94	0.97	(86)

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

(87)m=	19.33	19.66	20.08	20.51	20.8	20.94	20.98	20.98	20.87	20.46	19.8	19.25	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	------

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

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

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

(89)m=	0.95	0.92	0.85	0.73	0.57	0.4	0.26	0.3	0.52	0.79	0.92	0.96	(89)
--------	------	------	------	------	------	-----	------	-----	------	------	------	------	------

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

(90)m=	17.66	18.13	18.72	19.3	19.65	19.81	19.85	19.84	19.75	19.26	18.35	17.56	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.16 (91)

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

(92)m=	17.93	18.38	18.93	19.49	19.84	19.99	20.03	20.02	19.93	19.45	18.59	17.83	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.78	18.23	18.78	19.34	19.69	19.84	19.88	19.87	19.78	19.3	18.44	17.68	(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=	0.94	0.89	0.82	0.71	0.56	0.39	0.26	0.3	0.51	0.76	0.9	0.95	(94)
--------	------	------	------	------	------	------	------	-----	------	------	-----	------	------

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

(95)m=	1035.29	1227.11	1335.14	1319.67	1127.7	784.57	502.48	529.4	819.09	1034.3	1013.9	975.54	(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=	2120.33	2094.05	1927.4	1627.56	1243.77	811.74	507.69	537.46	881.41	1354.95	1769.37	2109.2	(97)
--------	---------	---------	--------	---------	---------	--------	--------	--------	--------	---------	---------	--------	------

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

(98)m=	807.27	582.58	440.64	221.68	86.36	0	0	0	0	238.56	543.94	843.44	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)1..5,9..12 = 3764.48 (99)

Space heating requirement in kWh/m²/year	31.16	(99)
--	-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
--	---	-------

SAP WorkSheet: New dwelling as built

Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.6	(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)												
807.27	582.58	440.64	221.68	86.36	0	0	0	0	238.56	543.94	843.44	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												
862.47	622.42	470.77	236.84	92.26	0	0	0	0	254.88	581.13	901.11	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												4021.88

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

Water heating

Output from water heater (calculated above)	216.39	190.67	200.12	179.22	175.51	156.64	150.27	165.13	164.91	185.85	196.74	211.12
Efficiency of water heater												79.9
(217)m=	88.11	87.7	86.96	85.48	83.14	79.9	79.9	79.9	79.9	85.58	87.49	88.23
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	245.6	217.4	230.12	209.66	211.1	196.05	188.07	206.66	206.39	217.16	224.87	239.27
Total = Sum(219a) _{1...12} =												2592.37

Annual totals

Space heating fuel used, main system 1												4021.88
Water heating fuel used												2592.37
Electricity for pumps, fans and electric keep-hot												
central heating pump:												30
boiler with a fan-assisted flue												45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =											75
Electricity for lighting												450.7

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 x 0.01 =	139.96 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	90.21 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	59.45 (250)

SAP WorkSheet: New dwelling as built

Additional standing charges (Table 12)		120	(251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	$(245) \dots (247) + (250) \dots (254) =$	419.52	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.06	(257)
SAP rating (Section 12)		85.18	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	868.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	559.95	(264)
Space and water heating	$(261) + (262) + (263) + (264) =$			1428.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	233.91	(268)
Total CO2, kg/year		$\text{sum of } (265) \dots (271) =$		1701.52	(272)
CO2 emissions per m²		$(272) \div (4) =$		14.08	(273)
El rating (section 14)				86	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	4906.7	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3162.69	(264)
Space and water heating	$(261) + (262) + (263) + (264) =$			8069.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1383.66	(268)
'Total Primary Energy		$\text{sum of } (265) \dots (271) =$		9683.29	(272)
Primary energy kWh/m²/year		$(272) \div (4) =$		80.15	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.2.0

Printed on 17 November 2017 at 14:34:49

Project Information:

Assessed By: Jonathan Ponting (STRO000148)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 116.87m²

Site Reference : TW.ES.RG3

Plot Reference: ab Plot 20

Address : 4, Ruhemann Street, READING, RG30 3EZ

Client Details:

Name: Paul Slingo

Address : Taylor Wimpey (West London), Stratfield House, Station Road, Hook, RG27 9PQ

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) 14.97 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.18 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 45.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 38.7 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.76 (measured in this dwelling)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 419, product index 016393):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: Logic System
Model qualifier: 30
(Regular)
Efficiency 89.6 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day	
	Permitted by DBSCG: 2.30 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	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	100.0%	
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	2m ²	
Windows facing: South West	1.3m ²	
Windows facing: South West	1.8m ²	
Windows facing: South West	2.36m ²	
Windows facing: North East	5.95m ²	
Windows facing: North East	2.43m ²	
Windows facing: North East	2.36m ²	
Windows facing: North West	0.63m ²	
Windows facing: South East	0.63m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Light-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m ² K
Party Walls U-value	0 W/m ² K

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 20

Address : 4, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.76000022888184 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.34 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.29 (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 as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34
--	------	------	------	------	------	------	------	------	------	------	------	------

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			5.95	x1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 6			2.43	x1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 7			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 8			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	67.42	21.56	45.86	x 0.25	= 11.46	60	2751.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			145.94				(31)
Party wall			138.93	x 0	= 0	45	6251.76 (32)
Internal wall **			95.88			9	862.9561 (32c)
Internal wall **			74.6			9	671.436 (32c)

DER WorkSheet: New dwelling as built

Internal floor	76.7	18	1380.6 (32d)
Internal ceiling	76.7	9	690.3 (32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$ (26)...(30) + (32) = 50.66 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 17372.5 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) ÷ (4) = 148.65 (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 : $S(L \times Y)$ calculated using Appendix K 11.71 (36)

if details of thermal bridging are not known (36) = $0.15 \times (31)$

Total fabric heat loss (33) + (36) = 62.37 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.08	55.83	55.57	54.39	54.16	53.13	53.13	52.94	53.53	54.16	54.61	55.08	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	118.46	118.2	117.95	116.76	116.54	115.5	115.5	115.31	115.9	116.54	116.99	117.46	
Average = $\text{Sum}(39)_{1...12} / 12 =$												116.76	(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=	1.01	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1.01	
Average = $\text{Sum}(40)_{1...12} / 12 =$												1	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.85 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 101.9 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = $\text{Sum}(44)_{1...12} =$												1222.75	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = $\text{Sum}(45)_{1...12} =$												1603.22	(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=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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:

DER WorkSheet: New dwelling as built

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52

(66)

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

(67)m=

25.21	22.39	18.21	13.78	10.3	8.7	9.4	12.22	16.4	20.82	24.3	25.91
-------	-------	-------	-------	------	-----	-----	-------	------	-------	------	-------

(67)

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

(68)m=

281.08	284	276.65	261	241.25	222.68	210.28	207.36	214.71	230.36	250.11	268.68
--------	-----	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

DER WorkSheet: New dwelling as built

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

(71)m=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

502.6	500.35	483.93	457.21	429.66	403.42	386.56	393.07	406.96	433.9	464.9	488.56
-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.63	x	0.85	=	24.91	(75)
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.63	x	0.85	=	10.17	(75)
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.85	=	9.88	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.63	x	0.85	=	50.71	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.63	x	0.85	=	20.71	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.85	=	20.11	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.63	x	0.85	=	91.37	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.63	x	0.85	=	37.31	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.85	=	36.24	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.63	x	0.85	=	150.05	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.63	x	0.85	=	61.28	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.63	x	0.85	=	201.7	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.63	x	0.85	=	82.37	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.63	x	0.85	=	215.03	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.63	x	0.85	=	87.82	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.63	x	0.85	=	201.16	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.63	x	0.85	=	82.15	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.63	x	0.85	=	160.36	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.63	x	0.85	=	65.49	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.63	x	0.85	=	111.33	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.63	x	0.85	=	45.47	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.63	x	0.85	=	61.97	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)

DER WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)
Southwest 0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest 0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)

DER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest	0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest	0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest	0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest	0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest	0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest	0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest	0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest	0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 158.07 285.07 432.04 605.72 742.72 765.62 726.37 619.85 491.51 326.38 192.21 133.41 (83)

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

(84)m= 660.67 785.41 915.97 1062.94 1172.39 1169.04 1112.93 1012.92 898.46 760.29 657.11 621.97 (84)

DER WorkSheet: New dwelling as built

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.76	0.59	0.44	0.5	0.74	0.93	0.98	0.99	(86)

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

(87)m=	19.37	19.61	19.97	20.42	20.76	20.93	20.98	20.97	20.84	20.38	19.79	19.33	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.09	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.94	0.86	0.71	0.52	0.36	0.41	0.68	0.91	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.88	18.22	18.75	19.38	19.83	20.04	20.08	20.08	19.94	19.34	18.5	17.83	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) = 0.19 (91)

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

(92)m=	18.17	18.48	18.98	19.58	20.01	20.21	20.25	20.25	20.11	19.53	18.74	18.11	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.02	18.33	18.83	19.43	19.86	20.06	20.1	20.1	19.96	19.38	18.59	17.96	(93)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.93	0.84	0.7	0.51	0.36	0.41	0.67	0.89	0.96	0.98	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(95)m=	646.63	755.44	847.77	895.99	821.1	600.78	398.98	416.83	600.85	675.86	633.4	611.09	(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=	1624.78	1587.93	1454.12	1229.21	950.46	630.36	404.62	426.26	678.93	1023.51	1344.48	1616.3	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	--------	------

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

(98)m=	727.74	559.44	451.13	239.92	96.24	0	0	0	0	258.65	511.98	747.88	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3592.98 (98)

Space heating requirement in kWh/m²/year 30.74 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (206)

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

DER WorkSheet: New dwelling as built

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	727.74	559.44	451.13	239.92	96.24	0	0	0	0	258.65	511.98	747.88	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$	777.5	597.69	481.98	256.32	102.82	0	0	0	0	276.33	546.99	799.02	(211)
Total (kWh/year) = Sum(211) _{1..5,10...12} =													3838.65 (211)
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$	0	0	0	0	0	0	0	0	0	0	0	0	
(215)m =													0 (215)
Total (kWh/year) = Sum(215) _{1..5,10...12} =													
Water heating													
Output from water heater (calculated above)	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater													79.9 (216)
(217)m =	87.91	87.62	87.03	85.7	83.39	79.9	79.9	79.9	79.9	85.8	87.36	88.01	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m	245.44	216.98	229.31	208.56	209.89	195.54	187.6	206.13	205.85	216.01	224.57	239.2	
(219)m =													2585.08 (219)
Total = Sum(219a) _{1..12} =													
Annual totals													
Space heating fuel used, main system 1													3838.65
Water heating fuel used													2585.08
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													75 (231)
Electricity for lighting													445.17 (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	=	829.15 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	558.38 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1387.53 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	231.04 (268)
Total CO2, kg/year	sum of (265)...(271) =			1657.49 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			14.18 (273)
El rating (section 14)				86 (274)

SAP Input

Property Details: ab Plot 20

Address: 4, Ruhemann Street, READING, RG30 3EZ
Located in: England
Region: Thames valley
UPRN: 8707905578
Date of assessment: 17 November 2017
Date of certificate: 17 November 2017
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 148.65
Water use <= 125 litres/person/day: True
PCDF Version: 419

Property description:

Dwelling type: House
Detachment: Mid-terrace
Year Completed: 2015
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.17 m² 2.4 m
 Floor 1 38.35 m² 2.65 m
 Floor 2 38.35 m² 2.65 m
Living area: 22.11 m² (fraction 0.209)
Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.5	2.1	1
Window 1	16mm or more	0.85	0.63	1.4	2	1
Window 2	16mm or more	0.85	0.63	1.4	1.3	1
Window 3	16mm or more	0.85	0.63	1.4	1.8	1
Window 4	16mm or more	0.85	0.63	1.4	2.36	1
Window 5	16mm or more	0.85	0.63	1.4	5.95	1
Window 6	16mm or more	0.85	0.63	1.4	2.43	1
Window 7	16mm or more	0.85	0.63	1.4	2.36	1
Window 8	16mm or more	0.85	0.63	1.4	0.63	1
Window 9	16mm or more	0.85	0.63	1.4	0.63	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Walls	South West	1	2.1
Window 1		External Walls	South West	1.6	1.25
Window 2		External Walls	South West	0.65	2
Window 3		External Walls	South West	0.9	2

SAP Input

Window 4	External Walls	South West	1.75	1.35
Window 5	External Walls	North East	2.9	2.05
Window 6	External Walls	North East	1.8	1.35
Window 7	External Walls	North East	1.75	1.35
Window 8	External Walls	North West	0.5	1.25
Window 9	External Walls	South East	0.5	1.25

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	67.42	21.56	45.86	0.25	0	False	60
Ceiling Level	38.35	0	38.35	0.11	0		9
Ground Floor	40.17			0.15			110
<u>Internal Elements</u>							
Internal Walls	95.884						9
Internal Walls	74.604						9
Internal Ceilings	76.7						9
Internal Floors	76.7						18
<u>Party Elements</u>							
Party Walls	138.928						45

Thermal bridges:

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.0803					
		Length	Psi-value				
		13.35	0.186	E2	Other lintels (including other steel lintels)		
		12.35	0.025	E3	Sill		
		31.9	0.027	E4	Jamb		
		9.4	0.051	E5	Ground floor (normal)		
		17.24	0.011	E6	Intermediate floor within a dwelling		
		8.62	0.07	E10	Eaves (insulation at ceiling level)		
		2.4	0.052	E16	Corner (normal)		
		2.4	-0.0952	E17	Corner (inverted internal area greater than external area)		
	[Approved]	30.8	0.06	E18	Party wall between dwellings		
		6.58	0.02	E11			
		5.06	0.07	E13			
		7.69	0.08	E14			
		18.6	0.098	P1	Ground floor		
		35.44	0	P2	Intermediate floor within a dwelling		
		17.78	0.037	P4	Roof (insulation at ceiling level)		
		14.67	0.08	R4	Ridge (vaulted ceiling)		
		1.15	0.08	R1			
		1.15	0.06	R2			
		1.6	0.08	R3			

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.76 (Assessed dwelling is tested)

Main heating system:

SAP Input

Main heating system: Boiler systems with radiators or underfloor heating
 Gas boilers and oil boilers
 Fuel: mains gas
 Info Source: Boiler Database
 Database: (rev 419, product index 016393) Efficiency: Winter 79.9 % Summer: 90.6
 Brand name: Ideal
 Model: Logic System
 Model qualifier: 30
 (Regular boiler)
 Systems with radiators
 Central heating pump : 2013 or later
 Design flow temperature: Unknown
 Unknown
 Boiler interlock: Yes
 Weather Compensator
 Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
 Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
 Water code: 901
 Fuel :mains gas
 Hot water cylinder
 Cylinder volume: 210 litres
 Cylinder insulation: Measured loss, 1.57kWh/day
 Primary pipework insulation: True
 Cylinderstat: True
 Cylinder in heated space: True
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 100%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 20

Address : 4, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.76000022888184	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.34	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.29	(21)
Infiltration rate modified for monthly wind speed				

SAP WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34
--	------	------	------	------	------	------	------	------	------	------	------	------

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			5.95	x1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 6			2.43	x1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 7			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 8			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	67.42	21.56	45.86	x 0.25	= 11.46	60	2751.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			145.94				(31)
Party wall			138.93	x 0	= 0	45	6251.76 (32)
Internal wall **			95.88			9	862.9561 (32c)
Internal wall **			74.6			9	671.436 (32c)

SAP WorkSheet: New dwelling as built

Internal floor	76.7	18	1380.6 (32d)
Internal ceiling	76.7	9	690.3 (32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 50.66 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 17372.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 148.65 (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 11.71 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 62.37 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.08	55.83	55.57	54.39	54.16	53.13	53.13	52.94	53.53	54.16	54.61	55.08	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	118.46	118.2	117.95	116.76	116.54	115.5	115.5	115.31	115.9	116.54	116.99	117.46	
Average = Sum(39) _{1...12} /12=												116.76	(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=	1.01	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1.01	
Average = Sum(40) _{1...12} /12=												1	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.85 (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) + 36 101.9 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = Sum(44) _{1...12} =												1222.75	(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=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = Sum(45) _{1...12} =												1603.22	(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=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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:

SAP WorkSheet: New dwelling as built

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02

(66)

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

(67)m=

63.02	55.97	45.52	34.46	25.76	21.75	23.5	30.55	41	52.06	60.76	64.77
-------	-------	-------	-------	-------	-------	------	-------	----	-------	-------	-------

(67)

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

(68)m=

419.52	423.88	412.91	389.55	360.07	332.36	313.85	309.5	320.47	343.82	373.3	401.01
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------

(68)

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

(69)m=

54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

SAP WorkSheet: New dwelling as built

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

(71)m=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

725.06	720.01	693.7	652.64	610.15	572.35	550.43	559.74	583.51	624.8	670.75	705.96
--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.63	x	0.85	=	24.91	(75)
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.63	x	0.85	=	10.17	(75)
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.85	=	9.88	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.63	x	0.85	=	50.71	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.63	x	0.85	=	20.71	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.85	=	20.11	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.63	x	0.85	=	91.37	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.63	x	0.85	=	37.31	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.85	=	36.24	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.63	x	0.85	=	150.05	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.63	x	0.85	=	61.28	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.63	x	0.85	=	201.7	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.63	x	0.85	=	82.37	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.63	x	0.85	=	215.03	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.63	x	0.85	=	87.82	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.63	x	0.85	=	201.16	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.63	x	0.85	=	82.15	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.63	x	0.85	=	160.36	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.63	x	0.85	=	65.49	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.63	x	0.85	=	111.33	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.63	x	0.85	=	45.47	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.63	x	0.85	=	61.97	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)

SAP WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)
Southwest 0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest 0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)

SAP WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest	0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest	0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest	0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest	0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest	0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest	0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest	0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest	0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 158.07 285.07 432.04 605.72 742.72 765.62 726.37 619.85 491.51 326.38 192.21 133.41 (83)

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

(84)m= 883.13 1005.08 1125.74 1258.37 1352.87 1337.97 1276.81 1179.59 1075.02 951.19 862.96 839.37 (84)

SAP WorkSheet: New dwelling as built

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.92	0.83	0.69	0.52	0.39	0.44	0.66	0.87	0.95	0.98	(86)

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

(87)m=	19.63	19.84	20.17	20.55	20.82	20.95	20.99	20.98	20.89	20.53	20.01	19.58	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.09	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.95	0.9	0.8	0.65	0.46	0.31	0.36	0.6	0.84	0.94	0.97	(89)
--------	------	------	-----	-----	------	------	------	------	-----	------	------	------	------

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

(90)m=	18.25	18.56	19.02	19.55	19.9	20.06	20.09	20.08	19.99	19.54	18.81	18.19	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.19 (91)

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

(92)m=	18.51	18.8	19.24	19.74	20.08	20.23	20.26	20.25	20.16	19.73	19.04	18.45	(92)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.36	18.65	19.09	19.59	19.93	20.08	20.11	20.1	20.01	19.58	18.89	18.3	(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=	0.95	0.93	0.88	0.79	0.64	0.46	0.31	0.36	0.59	0.83	0.93	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	841.77	933.56	992.8	989.77	863.79	612.38	401.5	421.26	633.92	785.51	800.57	805.4	(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=	1665.28	1625.2	1484.59	1248.38	958.71	632.5	405.1	427.1	685.28	1046.24	1379.19	1656.25	(97)
--------	---------	--------	---------	---------	--------	-------	-------	-------	--------	---------	---------	---------	------

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

(98)m=	612.69	464.78	365.89	186.2	70.62	0	0	0	0	193.98	416.61	633.03	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2943.79 (98)

Space heating requirement in kWh/m²/year 25.19 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (206)

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

SAP WorkSheet: New dwelling as built

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	612.69	464.78	365.89	186.2	70.62	0	0	0	0	193.98	416.61	633.03	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)													
	654.58	496.56	390.91	198.93	75.44	0	0	0	0	207.25	445.1	676.31	
Total (kWh/year) = Sum(211) _{1..5,10...12} =													3145.08 (211)
Space heating fuel (secondary), kWh/month													
= $\{[(98)m \times (201)]\} \times 100 \div (208)$													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =													0 (215)
Water heating													
Output from water heater (calculated above)													
	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater													79.9 (216)
(217)m=	87.55	87.21	86.51	85.02	82.71	79.9	79.9	79.9	79.9	85.04	86.88	87.67	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	246.46	218.01	230.68	210.22	211.63	195.54	187.6	206.13	205.85	217.96	225.82	240.13	
Total = Sum(219a) _{1..12} =													2596.02 (219)
Annual totals													
kWh/year													kWh/year
Space heating fuel used, main system 1													3145.08
Water heating fuel used													2596.02
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													75 (231)
Electricity for lighting													445.17 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 x 0.01 =	109.45 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	90.34 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	58.72 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		388.4 (255)

SAP WorkSheet: New dwelling as built

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.01	(257)
SAP rating (Section 12)		85.94	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	679.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	560.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1240.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	231.04	(268)
Total CO2, kg/year		sum of (265)...(271) =		1510.04	(272)
CO2 emissions per m²		(272) ÷ (4) =		12.92	(273)
El rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3836.99	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3167.14	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7004.14	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1366.67	(268)
'Total Primary Energy		sum of (265)...(271) =		8601.06	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		73.6	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.2.0

Printed on 17 November 2017 at 14:34:44

Project Information:

Assessed By: Jonathan Ponting (STRO000148)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 116.87m²

Site Reference : TW.ES.RG3

Plot Reference: ab Plot 21

Address : 6, Ruhemann Street, READING, RG30 3EZ

Client Details:

Name: Paul Slingo

Address : Taylor Wimpey (West London), Stratfield House, Station Road, Hook, RG27 9PQ

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) 14.97 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.16 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 45.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 38.6 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.62 (measured in this dwelling)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 419, product index 016393):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: Logic System
Model qualifier: 30
(Regular)
Efficiency 89.6 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day	
	Permitted by DBSCG: 2.30 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	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	100.0%	
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	2m ²	
Windows facing: South West	1.3m ²	
Windows facing: South West	1.8m ²	
Windows facing: South West	2.36m ²	
Windows facing: North East	5.95m ²	
Windows facing: North East	2.43m ²	
Windows facing: North East	2.36m ²	
Windows facing: North West	0.63m ²	
Windows facing: South East	0.63m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Light-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m ² K
Party Walls U-value	0 W/m ² K

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 21

Address : 6, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17	(1a) x	2.4	(2a) =	96.41 (3a)
First floor	38.35	(1b) x	2.65	(2b) =	101.63 (3b)
Second floor	38.35	(1c) x	2.65	(2c) =	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.61999988555908 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28 (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 as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.36	0.35	0.34	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33
--	------	------	------	------	-----	------	------	------	------	-----	------	------

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 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 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 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= 0.56 0.56 0.56 0.55 0.55 0.54 0.54 0.53 0.54 0.55 0.55 0.55 (24d)

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

(25)m= 0.56 0.56 0.56 0.55 0.55 0.54 0.54 0.53 0.54 0.55 0.55 0.55 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			5.95	x1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 6			2.43	x1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 7			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 8			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	67.42	21.56	45.86	x 0.25	= 11.46	60	2751.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			145.94				(31)
Party wall			138.93	x 0	= 0	45	6251.76 (32)
Internal wall **			95.88			9	862.9561 (32c)
Internal wall **			74.6			9	671.436 (32c)

DER WorkSheet: New dwelling as built

Internal floor	76.7	18	1380.6 (32d)
Internal ceiling	76.7	9	690.3 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) $\div$ (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 : $S (L \times Y)$ calculated using Appendix K (36)

if details of thermal bridging are not known (36) = $0.15 \times (31)$

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

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	55.81	55.56	55.32	54.18	53.97	52.98	52.98	52.8	53.36	53.97	54.4	54.85	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	118.18	117.94	117.69	116.56	116.34	115.35	115.35	115.17	115.73	116.34	116.77	117.22	
Average = Sum(39) _{1...12} /12=												116.55	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m $\div$ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.01	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1	
Average = Sum(40) _{1...12} /12=												1	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = Sum(44) _{1...12} =												1222.75	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = Sum(45) _{1...12} =												1603.22	(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=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)

Water storage loss:

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

DER WorkSheet: New dwelling as built

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52

(66)

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

(67)m=

25.21	22.39	18.21	13.78	10.3	8.7	9.4	12.22	16.4	20.82	24.3	25.91
-------	-------	-------	-------	------	-----	-----	-------	------	-------	------	-------

(67)

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

(68)m=

281.08	284	276.65	261	241.25	222.68	210.28	207.36	214.71	230.36	250.11	268.68
--------	-----	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

DER WorkSheet: New dwelling as built

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

(71)m=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

502.6	500.35	483.93	457.21	429.66	403.42	386.56	393.07	406.96	433.9	464.9	488.56
-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.63	x	0.85	=	24.91	(75)
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.63	x	0.85	=	10.17	(75)
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.85	=	9.88	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.63	x	0.85	=	50.71	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.63	x	0.85	=	20.71	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.85	=	20.11	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.63	x	0.85	=	91.37	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.63	x	0.85	=	37.31	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.85	=	36.24	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.63	x	0.85	=	150.05	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.63	x	0.85	=	61.28	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.63	x	0.85	=	201.7	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.63	x	0.85	=	82.37	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.63	x	0.85	=	215.03	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.63	x	0.85	=	87.82	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.63	x	0.85	=	201.16	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.63	x	0.85	=	82.15	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.63	x	0.85	=	160.36	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.63	x	0.85	=	65.49	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.63	x	0.85	=	111.33	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.63	x	0.85	=	45.47	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.63	x	0.85	=	61.97	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)

DER WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)
Southwest 0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest 0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)

DER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest	0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest	0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest	0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest	0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest	0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest	0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest	0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest	0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 158.07 285.07 432.04 605.72 742.72 765.62 726.37 619.85 491.51 326.38 192.21 133.41 (83)

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

(84)m= 660.67 785.41 915.97 1062.94 1172.39 1169.04 1112.93 1012.92 898.46 760.29 657.11 621.97 (84)

DER WorkSheet: New dwelling as built

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.76	0.59	0.44	0.5	0.74	0.93	0.98	0.99	(86)

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

(87)m=	19.38	19.61	19.97	20.42	20.76	20.93	20.98	20.97	20.84	20.38	19.79	19.33	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.1	20.09	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.94	0.86	0.71	0.52	0.36	0.41	0.68	0.91	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.89	18.23	18.75	19.39	19.83	20.04	20.08	20.08	19.94	19.34	18.5	17.83	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) = 0.19 (91)

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

(92)m=	18.17	18.49	18.98	19.58	20.01	20.21	20.25	20.25	20.11	19.54	18.75	18.12	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.02	18.34	18.83	19.43	19.86	20.06	20.1	20.1	19.96	19.39	18.6	17.97	(93)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.93	0.84	0.7	0.51	0.36	0.41	0.67	0.89	0.96	0.98	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(95)m=	646.63	755.42	847.68	895.74	820.59	600.3	398.61	416.47	600.49	675.76	633.39	611.09	(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=	1621.9	1585.22	1451.74	1227.54	949.18	629.68	404.2	425.84	678.16	1022.22	1342.62	1613.84	(97)
--------	--------	---------	---------	---------	--------	--------	-------	--------	--------	---------	---------	---------	------

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

(98)m=	725.6	557.63	449.42	238.9	95.67	0	0	0	0	257.77	510.65	746.05	(98)
--------	-------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3581.67 (98)

Space heating requirement in kWh/m²/year 30.65 (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 93.6 (206)

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

DER WorkSheet: New dwelling as built

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	725.6	557.63	449.42	238.9	95.67	0	0	0	0	257.77	510.65	746.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)													
	775.21	595.75	480.15	255.24	102.22	0	0	0	0	275.39	545.56	797.06	
Total (kWh/year) = Sum(211) _{1..5,10...12} =													3826.58 (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)													
	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater													79.9 (216)
(217)m=	87.9	87.62	87.02	85.69	83.38	79.9	79.9	79.9	79.9	85.79	87.35	88.01	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	245.46	217	229.34	208.58	209.93	195.54	187.6	206.13	205.85	216.03	224.59	239.21	
Total = Sum(219a) _{1..12} =													2585.25 (219)
Annual totals													
	kWh/year												kWh/year
Space heating fuel used, main system 1													3826.58
Water heating fuel used													2585.25
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													75 (231)
Electricity for lighting													445.17 (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	=	826.54 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	558.41 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1384.95 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	231.04 (268)
Total CO2, kg/year	sum of (265)...(271) =			1654.92 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			14.16 (273)
El rating (section 14)				86 (274)

SAP Input

Property Details: ab Plot 21

Address: 6, Ruhemann Street, READING, RG30 3EZ
Located in: England
Region: Thames valley
UPRN: 3117905578
Date of assessment: 17 November 2017
Date of certificate: 17 November 2017
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 148.65
Water use <= 125 litres/person/day: True
PCDF Version: 419

Property description:

Dwelling type: House
Detachment: Mid-terrace
Year Completed: 2015
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.17 m² 2.4 m
 Floor 1 38.35 m² 2.65 m
 Floor 2 38.35 m² 2.65 m
Living area: 22.11 m² (fraction 0.209)
Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.5	2.1	1
Window 1	16mm or more	0.85	0.63	1.4	2	1
Window 2	16mm or more	0.85	0.63	1.4	1.3	1
Window 3	16mm or more	0.85	0.63	1.4	1.8	1
Window 4	16mm or more	0.85	0.63	1.4	2.36	1
Window 5	16mm or more	0.85	0.63	1.4	5.95	1
Window 6	16mm or more	0.85	0.63	1.4	2.43	1
Window 7	16mm or more	0.85	0.63	1.4	2.36	1
Window 8	16mm or more	0.85	0.63	1.4	0.63	1
Window 9	16mm or more	0.85	0.63	1.4	0.63	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Walls	South West	1	2.1
Window 1		External Walls	South West	1.6	1.25
Window 2		External Walls	South West	0.65	2
Window 3		External Walls	South West	0.9	2

SAP Input

Window 4	External Walls	South West	1.75	1.35
Window 5	External Walls	North East	2.9	2.05
Window 6	External Walls	North East	1.8	1.35
Window 7	External Walls	North East	1.75	1.35
Window 8	External Walls	North West	0.5	1.25
Window 9	External Walls	South East	0.5	1.25

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	67.42	21.56	45.86	0.25	0	False	60
Ceiling Level	38.35	0	38.35	0.11	0		9
Ground Floor	40.17			0.15			110
<u>Internal Elements</u>							
Internal Walls	95.884						9
Internal Walls	74.604						9
Internal Ceilings	76.7						9
Internal Floors	76.7						18
<u>Party Elements</u>							
Party Walls	138.928						45

Thermal bridges:

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.0803					
		Length	Psi-value				
		13.35	0.186	E2	Other lintels (including other steel lintels)		
		12.35	0.025	E3	Sill		
		31.9	0.027	E4	Jamb		
		9.4	0.051	E5	Ground floor (normal)		
		17.24	0.011	E6	Intermediate floor within a dwelling		
		8.62	0.07	E10	Eaves (insulation at ceiling level)		
		2.4	0.052	E16	Corner (normal)		
		2.4	-0.0952	E17	Corner (inverted internal area greater than external area)		
	[Approved]	30.8	0.06	E18	Party wall between dwellings		
		6.58	0.02	E11			
		5.06	0.07	E13			
		7.69	0.08	E14			
		18.6	0.098	P1	Ground floor		
		35.44	0	P2	Intermediate floor within a dwelling		
		17.78	0.037	P4	Roof (insulation at ceiling level)		
		14.67	0.08	R4	Ridge (vaulted ceiling)		
		1.15	0.08	R1			
		1.15	0.06	R2			
		1.6	0.08	R3			

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.62 (Assessed dwelling is tested)

Main heating system:

SAP Input

Main heating system: Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 419, product index 016393) Efficiency: Winter 79.9 % Summer: 90.6
Brand name: Ideal
Model: Logic System
Model qualifier: 30
(Regular boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Unknown
Unknown
Boiler interlock: Yes
Weather Compensator
Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Measured loss, 1.57kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 21

Address : 6, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.61999988555908	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.33	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28	(21)
Infiltration rate modified for monthly wind speed				

SAP WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.36	0.35	0.34	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33
--	------	------	------	------	-----	------	------	------	------	-----	------	------

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=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24d)

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

(25)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55
--------	------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			5.95	x1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 6			2.43	x1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 7			2.36	x1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 8			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x1/[1/(1.4)+ 0.04]	= 0.84		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	67.42	21.56	45.86	x 0.25	= 11.46	60	2751.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			145.94				(31)
Party wall			138.93	x 0	= 0	45	6251.76 (32)
Internal wall **			95.88			9	862.9561 (32c)
Internal wall **			74.6			9	671.436 (32c)

SAP WorkSheet: New dwelling as built

Internal floor	76.7	18	1380.6 (32d)
Internal ceiling	76.7	9	690.3 (32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$ (26)...(30) + (32) = 50.66 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 17372.5 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) ÷ (4) = 148.65 (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 : $S(L \times Y)$ calculated using Appendix K 11.71 (36)

if details of thermal bridging are not known (36) = $0.15 \times (31)$

Total fabric heat loss (33) + (36) = 62.37 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	55.81	55.56	55.32	54.18	53.97	52.98	52.98	52.8	53.36	53.97	54.4	54.85	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	118.18	117.94	117.69	116.56	116.34	115.35	115.35	115.17	115.73	116.34	116.77	117.22	
Average = $\text{Sum}(39)_{1...12} / 12 =$												116.55	(39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.01	1.01	1.01	1	1	0.99	0.99	0.99	0.99	1	1	1	
Average = $\text{Sum}(40)_{1...12} / 12 =$												1	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.85 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 101.9 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = $\text{Sum}(44)_{1...12} =$												1222.75	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = $\text{Sum}(45)_{1...12} =$												1603.22	(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=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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:

SAP WorkSheet: New dwelling as built

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02

(66)

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

(67)m=

63.02	55.97	45.52	34.46	25.76	21.75	23.5	30.55	41	52.06	60.76	64.77
-------	-------	-------	-------	-------	-------	------	-------	----	-------	-------	-------

(67)

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

(68)m=

419.52	423.88	412.91	389.55	360.07	332.36	313.85	309.5	320.47	343.82	373.3	401.01
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------

(68)

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

(69)m=

54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

SAP WorkSheet: New dwelling as built

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

(71)m=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

725.06	720.01	693.7	652.64	610.15	572.35	550.43	559.74	583.51	624.8	670.75	705.96
--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.63	x	0.85	=	24.91	(75)
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.63	x	0.85	=	10.17	(75)
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.85	=	9.88	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.63	x	0.85	=	50.71	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.63	x	0.85	=	20.71	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.85	=	20.11	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.63	x	0.85	=	91.37	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.63	x	0.85	=	37.31	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.85	=	36.24	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.63	x	0.85	=	150.05	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.63	x	0.85	=	61.28	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.63	x	0.85	=	201.7	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.63	x	0.85	=	82.37	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.63	x	0.85	=	215.03	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.63	x	0.85	=	87.82	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.63	x	0.85	=	201.16	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.63	x	0.85	=	82.15	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.63	x	0.85	=	160.36	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.63	x	0.85	=	65.49	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.63	x	0.85	=	111.33	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.63	x	0.85	=	45.47	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.63	x	0.85	=	61.97	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)

SAP WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)
Southwest 0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest 0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)

SAP WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest	0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest	0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest	0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest	0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest	0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest	0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest	0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest	0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 158.07 285.07 432.04 605.72 742.72 765.62 726.37 619.85 491.51 326.38 192.21 133.41 (83)

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

(84)m= 883.13 1005.08 1125.74 1258.37 1352.87 1337.97 1276.81 1179.59 1075.02 951.19 862.96 839.37 (84)

SAP WorkSheet: New dwelling as built

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.92	0.83	0.69	0.52	0.39	0.44	0.66	0.87	0.95	0.98	(86)

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

(87)m=	19.63	19.84	20.17	20.55	20.82	20.95	20.99	20.98	20.89	20.53	20.01	19.58	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.1	20.09	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.95	0.9	0.8	0.65	0.46	0.31	0.36	0.6	0.84	0.94	0.97	(89)
--------	------	------	-----	-----	------	------	------	------	-----	------	------	------	------

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

(90)m=	18.26	18.56	19.03	19.56	19.91	20.06	20.09	20.09	19.99	19.54	18.82	18.19	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.19 (91)

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

(92)m=	18.52	18.81	19.24	19.75	20.08	20.23	20.26	20.25	20.16	19.73	19.04	18.46	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.37	18.66	19.09	19.6	19.93	20.08	20.11	20.1	20.01	19.58	18.89	18.31	(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=	0.95	0.93	0.88	0.79	0.64	0.46	0.31	0.36	0.59	0.83	0.93	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	841.73	933.47	992.57	989.34	863.11	611.83	401.11	420.88	633.44	785.26	800.5	805.38	(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=	1662.32	1622.41	1482.12	1246.65	957.38	631.8	404.68	426.68	684.48	1044.89	1377.27	1653.72	(97)
--------	---------	---------	---------	---------	--------	-------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	610.52	462.97	364.23	185.26	70.14	0	0	0	0	193.16	415.27	631.16	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2932.71	(98)

Space heating requirement in kWh/m²/year

25.09 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (206)

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

SAP WorkSheet: New dwelling as built

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
610.52	462.97	364.23	185.26	70.14	0	0	0	0	193.16	415.27	631.16	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$												(211)
652.26	494.62	389.13	197.93	74.94	0	0	0	0	206.37	443.67	674.32	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												3133.24 (211)
Space heating fuel (secondary), kWh/month												
= $\{[(98)m \times (201)]\} \times 100 \div (208)$												
(215)m =												
0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0 (215)
Water heating												
Output from water heater (calculated above)												
215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater												79.9 (216)
(217)m =												(217)
87.54	87.2	86.5	85.01	82.69	79.9	79.9	79.9	79.9	85.02	86.87	87.66	
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m =												
246.48	218.03	230.71	210.25	211.67	195.54	187.6	206.13	205.85	217.99	225.84	240.14	
Total = Sum(219a) _{1..12} =												2596.23 (219)
Annual totals												
Space heating fuel used, main system 1												3133.24
Water heating fuel used												2596.23
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												75 (231)
Electricity for lighting												445.17 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 x 0.01 =	109.04 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	90.35 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)			
Energy for lighting	(232)	13.19 x 0.01 =	58.72 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		388 (255)

SAP WorkSheet: New dwelling as built

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.01	(257)
SAP rating (Section 12)		85.96	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	676.78	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	560.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1237.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	231.04	(268)
Total CO2, kg/year		sum of (265)...(271) =		1507.53	(272)
CO2 emissions per m²		(272) ÷ (4) =		12.9	(273)
El rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3822.55	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3167.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6989.95	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1366.67	(268)
'Total Primary Energy		sum of (265)...(271) =		8586.87	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		73.47	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.2.0

Printed on 17 November 2017 at 14:34:40

Project Information:

Assessed By: Jonathan Ponting (STRO000148)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 116.87m²

Site Reference : TW.ES.RG3

Plot Reference: ab Plot 22

Address : 8, Ruhemann Street, READING, RG30 3EZ

Client Details:

Name: Paul Slingo

Address : Taylor Wimpey (West London), Stratfield House, Station Road, Hook, RG27 9PQ

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) 14.97 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.11 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 45.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 38.3 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.26 (measured in this dwelling)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 419, product index 016393):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: Logic System
Model qualifier: 30
(Regular)
Efficiency 89.6 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day	
	Permitted by DBSCG: 2.30 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	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	100.0%	
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	2m ²	
Windows facing: South West	1.3m ²	
Windows facing: South West	1.8m ²	
Windows facing: South West	2.36m ²	
Windows facing: North East	5.95m ²	
Windows facing: North East	2.43m ²	
Windows facing: North East	2.36m ²	
Windows facing: North West	0.63m ²	
Windows facing: South East	0.63m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Light-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m ² K
Party Walls U-value	0 W/m ² K

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 22

Address : 8, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.26000022888184 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.31 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (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 as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
--	------	------	------	------	------	------	------	------	------	------	-----	------

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

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

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

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=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55
---------	------	------	------	------	------	------	------	------	------	------	------	------

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

(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55
--------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x 1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x 1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x 1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x 1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			5.95	x 1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 6			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 7			2.36	x 1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 8			0.63	x 1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x 1/[1/(1.4)+ 0.04]	= 0.84		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	67.42	21.56	45.86	x 0.25	= 11.46	60	2751.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			145.94				(31)
Party wall			138.93	x 0	= 0	45	6251.76 (32)
Internal wall **			95.88			9	862.9561 (32c)
Internal wall **			74.6			9	671.436 (32c)

DER WorkSheet: New dwelling as built

Internal floor	76.7	18	1380.6 (32d)
Internal ceiling	76.7	9	690.3 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) $\div$ (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 : $S (L \times Y)$ calculated using Appendix K (36)

if details of thermal bridging are not known (36) = $0.15 \times (31)$

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

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	55.14	54.92	54.7	53.68	53.49	52.61	52.61	52.44	52.95	53.49	53.88	54.28	(38)

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

(39)m=	117.51	117.29	117.07	116.05	115.86	114.98	114.98	114.81	115.32	115.86	116.25	116.65	
	Average = $\text{Sum}(39)_{1...12} / 12 =$											116.05	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m $\div$ (4)

(40)m=	1.01	1	1	0.99	0.99	0.98	0.98	0.98	0.99	0.99	0.99	1	
	Average = $\text{Sum}(40)_{1...12} / 12 =$											0.99	(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 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
	Total = $\text{Sum}(44)_{1...12} =$											1222.75	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
	Total = $\text{Sum}(45)_{1...12} =$											1603.22	(45)

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

(46)m=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

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

DER WorkSheet: New dwelling as built

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52

(66)

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

(67)m=

25.21	22.39	18.21	13.78	10.3	8.7	9.4	12.22	16.4	20.82	24.3	25.91
-------	-------	-------	-------	------	-----	-----	-------	------	-------	------	-------

(67)

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

(68)m=

281.08	284	276.65	261	241.25	222.68	210.28	207.36	214.71	230.36	250.11	268.68
--------	-----	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

DER WorkSheet: New dwelling as built

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

(71)m=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

502.6	500.35	483.93	457.21	429.66	403.42	386.56	393.07	406.96	433.9	464.9	488.56
-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.63	x	0.85	=	24.91	(75)
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.63	x	0.85	=	10.17	(75)
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.85	=	9.88	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.63	x	0.85	=	50.71	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.63	x	0.85	=	20.71	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.85	=	20.11	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.63	x	0.85	=	91.37	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.63	x	0.85	=	37.31	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.85	=	36.24	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.63	x	0.85	=	150.05	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.63	x	0.85	=	61.28	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.63	x	0.85	=	201.7	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.63	x	0.85	=	82.37	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.63	x	0.85	=	215.03	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.63	x	0.85	=	87.82	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.63	x	0.85	=	201.16	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.63	x	0.85	=	82.15	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.63	x	0.85	=	160.36	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.63	x	0.85	=	65.49	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.63	x	0.85	=	111.33	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.63	x	0.85	=	45.47	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.63	x	0.85	=	61.97	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)

DER WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)
Southwest 0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest 0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)

DER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest	0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest	0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest	0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest	0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest	0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest	0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest	0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest	0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 158.07 285.07 432.04 605.72 742.72 765.62 726.37 619.85 491.51 326.38 192.21 133.41 (83)

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

(84)m= 660.67 785.41 915.97 1062.94 1172.39 1169.04 1112.93 1012.92 898.46 760.29 657.11 621.97 (84)

DER WorkSheet: New dwelling as built

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.76	0.58	0.44	0.5	0.74	0.93	0.98	0.99	(86)

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

(87)m=	19.39	19.62	19.98	20.43	20.76	20.93	20.98	20.97	20.84	20.38	19.8	19.34	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(88)m=	20.08	20.08	20.08	20.09	20.09	20.1	20.1	20.1	20.09	20.09	20.09	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.94	0.86	0.71	0.52	0.36	0.41	0.68	0.91	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.91	18.25	18.77	19.4	19.84	20.04	20.09	20.08	19.94	19.35	18.52	17.85	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.19 (91)

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

(92)m=	18.19	18.51	19	19.59	20.01	20.21	20.26	20.25	20.11	19.54	18.76	18.13	(92)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.04	18.36	18.85	19.44	19.86	20.06	20.11	20.1	19.96	19.39	18.61	17.98	(93)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.93	0.84	0.7	0.51	0.36	0.41	0.67	0.89	0.96	0.98	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(95)m=	646.64	755.37	847.46	895.11	819.3	599.08	397.69	415.6	599.61	675.5	633.36	611.1	(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=	1614.75	1578.5	1445.82	1223.41	946.01	627.99	403.16	424.8	676.24	1019.01	1338	1607.74	(97)
--------	---------	--------	---------	---------	--------	--------	--------	-------	--------	---------	------	---------	------

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

(98)m=	720.28	553.14	445.18	236.38	94.28	0	0	0	0	255.58	507.34	741.5	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												3553.67	(98)

Space heating requirement in kWh/m²/year

30.41 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (206)

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

DER WorkSheet: New dwelling as built

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	720.28	553.14	445.18	236.38	94.28	0	0	0	0	255.58	507.34	741.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)													
	769.53	590.96	475.62	252.54	100.72	0	0	0	0	273.05	542.03	792.2	
Total (kWh/year) = Sum(211) _{1..5,10...12} =													3796.66 (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)													
	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater													79.9 (216)
(217)m=	87.89	87.6	86.99	85.66	83.35	79.9	79.9	79.9	79.9	85.77	87.34	87.99	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	245.5	217.04	229.4	208.65	210.01	195.54	187.6	206.13	205.85	216.09	224.62	239.24	
Total = Sum(219a) _{1..12} =													2585.68 (219)
Annual totals													
	kWh/year												kWh/year
Space heating fuel used, main system 1													3796.66
Water heating fuel used													2585.68
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													75 (231)
Electricity for lighting													445.17 (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	=	820.08 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	558.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1378.58 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	231.04 (268)
Total CO2, kg/year	sum of (265)...(271) =			1648.55 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			14.11 (273)
El rating (section 14)				86 (274)

SAP Input

Property Details: ab Plot 22

Address: 8, Ruhemann Street, READING, RG30 3EZ
Located in: England
Region: Thames valley
UPRN: 5517905578
Date of assessment: 17 November 2017
Date of certificate: 17 November 2017
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 148.65
Water use <= 125 litres/person/day: True
PCDF Version: 419

Property description:

Dwelling type: House
Detachment: Mid-terrace
Year Completed: 2015
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.17 m² 2.4 m
 Floor 1 38.35 m² 2.65 m
 Floor 2 38.35 m² 2.65 m
Living area: 22.11 m² (fraction 0.209)
Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.5	2.1	1
Window 1	16mm or more	0.85	0.63	1.4	2	1
Window 2	16mm or more	0.85	0.63	1.4	1.3	1
Window 3	16mm or more	0.85	0.63	1.4	1.8	1
Window 4	16mm or more	0.85	0.63	1.4	2.36	1
Window 5	16mm or more	0.85	0.63	1.4	5.95	1
Window 6	16mm or more	0.85	0.63	1.4	2.43	1
Window 7	16mm or more	0.85	0.63	1.4	2.36	1
Window 8	16mm or more	0.85	0.63	1.4	0.63	1
Window 9	16mm or more	0.85	0.63	1.4	0.63	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Walls	South West	1	2.1
Window 1		External Walls	South West	1.6	1.25
Window 2		External Walls	South West	0.65	2
Window 3		External Walls	South West	0.9	2

SAP Input

Window 4	External Walls	South West	1.75	1.35
Window 5	External Walls	North East	2.9	2.05
Window 6	External Walls	North East	1.8	1.35
Window 7	External Walls	North East	1.75	1.35
Window 8	External Walls	North West	0.5	1.25
Window 9	External Walls	South East	0.5	1.25

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	67.42	21.56	45.86	0.25	0	False	60
Ceiling Level	38.35	0	38.35	0.11	0		9
Ground Floor	40.17			0.15			110
<u>Internal Elements</u>							
Internal Walls	95.884						9
Internal Walls	74.604						9
Internal Ceilings	76.7						9
Internal Floors	76.7						18
<u>Party Elements</u>							
Party Walls	138.928						45

Thermal bridges:

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.0803					
		Length	Psi-value				
		13.35	0.186	E2	Other lintels (including other steel lintels)		
		12.35	0.025	E3	Sill		
		31.9	0.027	E4	Jamb		
		9.4	0.051	E5	Ground floor (normal)		
		17.24	0.011	E6	Intermediate floor within a dwelling		
		8.62	0.07	E10	Eaves (insulation at ceiling level)		
		2.4	0.052	E16	Corner (normal)		
		2.4	-0.0952	E17	Corner (inverted internal area greater than external area)		
	[Approved]	30.8	0.06	E18	Party wall between dwellings		
		6.58	0.02	E11			
		5.06	0.07	E13			
		7.69	0.08	E14			
		18.6	0.098	P1	Ground floor		
		35.44	0	P2	Intermediate floor within a dwelling		
		17.78	0.037	P4	Roof (insulation at ceiling level)		
		14.67	0.08	R4	Ridge (vaulted ceiling)		
		1.15	0.08	R1			
		1.15	0.06	R2			
		1.6	0.08	R3			

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.26 (Assessed dwelling is tested)

Main heating system:

SAP Input

Main heating system: Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 419, product index 016393) Efficiency: Winter 79.9 % Summer: 90.6
Brand name: Ideal
Model: Logic System
Model qualifier: 30
(Regular boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Unknown
Unknown
Boiler interlock: Yes
Weather Compensator
Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Measured loss, 1.57kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 22

Address : 8, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.26000022888184 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.31 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

SAP WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
--	------	------	------	------	------	------	------	------	------	------	-----	------

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

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

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

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=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55
---------	------	------	------	------	------	------	------	------	------	------	------	------

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

(25)m=	0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55
--------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x 1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x 1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x 1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x 1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			5.95	x 1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 6			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 7			2.36	x 1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 8			0.63	x 1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x 1/[1/(1.4)+ 0.04]	= 0.84		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	67.42	21.56	45.86	x 0.25	= 11.46	60	2751.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			145.94				(31)
Party wall			138.93	x 0	= 0	45	6251.76 (32)
Internal wall **			95.88			9	862.9561 (32c)
Internal wall **			74.6			9	671.436 (32c)

SAP WorkSheet: New dwelling as built

Internal floor	76.7	18	1380.6 (32d)
Internal ceiling	76.7	9	690.3 (32e)

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

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

Fabric heat loss, W/K = $S (A \times U)$ (26)...(30) + (32) = 50.66 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 17372.5 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) ÷ (4) = 148.65 (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 : $S (L \times Y)$ calculated using Appendix K 11.71 (36)

if details of thermal bridging are not known (36) = $0.15 \times (31)$

Total fabric heat loss (33) + (36) = 62.37 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	55.14	54.92	54.7	53.68	53.49	52.61	52.61	52.44	52.95	53.49	53.88	54.28	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	117.51	117.29	117.07	116.05	115.86	114.98	114.98	114.81	115.32	115.86	116.25	116.65	
Average = $\text{Sum}(39)_{1...12} / 12 =$												116.05	(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=	1.01	1	1	0.99	0.99	0.98	0.98	0.98	0.99	0.99	0.99	1	
Average = $\text{Sum}(40)_{1...12} / 12 =$												0.99	(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 2.85 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$ 101.9 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = $\text{Sum}(44)_{1...12} =$												1222.75	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = $\text{Sum}(45)_{1...12} =$												1603.22	(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=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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:

SAP WorkSheet: New dwelling as built

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)_{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02

(66)

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

(67)m=

63.02	55.97	45.52	34.46	25.76	21.75	23.5	30.55	41	52.06	60.76	64.77
-------	-------	-------	-------	-------	-------	------	-------	----	-------	-------	-------

(67)

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

(68)m=

419.52	423.88	412.91	389.55	360.07	332.36	313.85	309.5	320.47	343.82	373.3	401.01
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------

(68)

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

(69)m=

54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

SAP WorkSheet: New dwelling as built

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

(71)m=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

725.06	720.01	693.7	652.64	610.15	572.35	550.43	559.74	583.51	624.8	670.75	705.96
--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.63	x	0.85	=	24.91	(75)
Northeast 0.9x	0.77	x	2.43	x	11.28	x	0.63	x	0.85	=	10.17	(75)
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.85	=	9.88	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.63	x	0.85	=	50.71	(75)
Northeast 0.9x	0.77	x	2.43	x	22.97	x	0.63	x	0.85	=	20.71	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.85	=	20.11	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.63	x	0.85	=	91.37	(75)
Northeast 0.9x	0.77	x	2.43	x	41.38	x	0.63	x	0.85	=	37.31	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.85	=	36.24	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.63	x	0.85	=	150.05	(75)
Northeast 0.9x	0.77	x	2.43	x	67.96	x	0.63	x	0.85	=	61.28	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.85	=	59.52	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.63	x	0.85	=	201.7	(75)
Northeast 0.9x	0.77	x	2.43	x	91.35	x	0.63	x	0.85	=	82.37	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.85	=	80	(75)
Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.63	x	0.85	=	215.03	(75)
Northeast 0.9x	0.77	x	2.43	x	97.38	x	0.63	x	0.85	=	87.82	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.85	=	85.29	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.63	x	0.85	=	201.16	(75)
Northeast 0.9x	0.77	x	2.43	x	91.1	x	0.63	x	0.85	=	82.15	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.85	=	79.79	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.63	x	0.85	=	160.36	(75)
Northeast 0.9x	0.77	x	2.43	x	72.63	x	0.63	x	0.85	=	65.49	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.85	=	63.61	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.63	x	0.85	=	111.33	(75)
Northeast 0.9x	0.77	x	2.43	x	50.42	x	0.63	x	0.85	=	45.47	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.85	=	44.16	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.63	x	0.85	=	61.97	(75)
Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)

SAP WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)
Southwest 0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest 0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)

SAP WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest	0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest	0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest	0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest	0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest	0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest	0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest	0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest	0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 158.07 285.07 432.04 605.72 742.72 765.62 726.37 619.85 491.51 326.38 192.21 133.41 (83)

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

(84)m= 883.13 1005.08 1125.74 1258.37 1352.87 1337.97 1276.81 1179.59 1075.02 951.19 862.96 839.37 (84)

SAP WorkSheet: New dwelling as built

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.92	0.83	0.69	0.52	0.39	0.44	0.66	0.87	0.95	0.98	(86)

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

(87)m=	19.64	19.86	20.18	20.56	20.83	20.96	20.99	20.98	20.89	20.54	20.02	19.59	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.08	20.08	20.08	20.09	20.09	20.1	20.1	20.1	20.09	20.09	20.09	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.95	0.9	0.8	0.65	0.46	0.31	0.36	0.59	0.84	0.94	0.97	(89)
--------	------	------	-----	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	18.28	18.58	19.04	19.57	19.91	20.06	20.09	20.09	20	19.55	18.83	18.21	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.19 (91)

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

(92)m=	18.53	18.82	19.26	19.75	20.08	20.23	20.26	20.26	20.17	19.74	19.06	18.47	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.38	18.67	19.11	19.6	19.93	20.08	20.11	20.11	20.02	19.59	18.91	18.32	(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=	0.95	0.93	0.88	0.79	0.64	0.46	0.31	0.36	0.59	0.82	0.93	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	841.64	933.23	992.01	988.27	861.41	610.46	400.14	419.94	632.24	784.66	800.33	805.33	(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=	1654.99	1615.5	1476.01	1242.36	954.11	630.08	403.63	425.63	682.48	1041.54	1372.51	1647.47	(97)
--------	---------	--------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	605.13	458.49	360.1	182.94	68.97	0	0	0	0	191.12	411.97	626.55	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2905.26 (98)

Space heating requirement in kWh/m²/year

24.86 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (206)

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

SAP WorkSheet: New dwelling as built

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	605.13	458.49	360.1	182.94	68.97	0	0	0	0	191.12	411.97	626.55	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)													
	646.51	489.83	384.72	195.45	73.68	0	0	0	0	204.18	440.13	669.39	
Total (kWh/year) = Sum(211) _{1..5,10...12} =													3103.91 (211)
Space heating fuel (secondary), kWh/month													
= $\{[(98)m \times (201)]\} \times 100 \div (208)$													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =													0 (215)
Water heating													
Output from water heater (calculated above)													
	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater													79.9 (216)
(217)m=	87.52	87.18	86.47	84.98	82.66	79.9	79.9	79.9	79.9	85	86.85	87.65	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	246.53	218.09	230.78	210.33	211.76	195.54	187.6	206.13	205.85	218.06	225.89	240.19	
Total = Sum(219a) _{1..12} =													2596.76 (219)
Annual totals													
													kWh/year
Space heating fuel used, main system 1													3103.91
Water heating fuel used													2596.76
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													75 (231)
Electricity for lighting													445.17 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48 x 0.01 =	108.02 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	90.37 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19 x 0.01 =	58.72 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		386.99 (255)

SAP WorkSheet: New dwelling as built

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1	(257)
SAP rating (Section 12)		85.99	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	670.44	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	560.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1231.34	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	231.04	(268)
Total CO2, kg/year		sum of (265)...(271) =		1501.31	(272)
CO2 emissions per m²		(272) ÷ (4) =		12.85	(273)
El rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3786.77	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3168.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6954.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1366.67	(268)
'Total Primary Energy		sum of (265)...(271) =		8551.73	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		73.17	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.2.0

Printed on 17 November 2017 at 14:34:35

Project Information:

Assessed By: Jonathan Ponting (STRO000148)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 116.87m²

Site Reference : TW.ES.RG3

Plot Reference: ab Plot 23

Address : 10, Ruhemann Street, READING, RG30 3EZ

Client Details:

Name: Paul Slingo

Address : Taylor Wimpey (West London), Stratfield House, Station Road, Hook, RG27 9PQ

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) 16.37 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.75 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.4 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.44 (measured in this dwelling)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 419, product index 016393):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: Logic System
Model qualifier: 30
(Regular)
Efficiency 89.6 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.57 kWh/day	
	Permitted by DBSCG: 2.30 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls	TTZC by plumbing and electrical services	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	100.0%	
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	2m ²	
Windows facing: South West	1.3m ²	
Windows facing: South West	1.8m ²	
Windows facing: South West	2.36m ²	
Windows facing: North West	0.68m ²	
Windows facing: North West	0.68m ²	
Windows facing: North West	0.68m ²	
Windows facing: North West	0.63m ²	
Windows facing: South East	0.63m ²	
Windows facing: North East	5.95m ²	
Windows facing: North East	2.43m ²	
Windows facing: North East	2.36m ²	
Ventilation rate:	4.00	
Blinds/curtains:	Light-coloured curtain or roller blind	
	Closed 100% of daylight hours	

10 Key features

Roofs U-value	0.11 W/m ² K
Party Walls U-value	0 W/m ² K

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 23

Address : 10, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.44000005722046	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.32	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27	(21)
Infiltration rate modified for monthly wind speed				

DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.35	0.34	0.34	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32
--	------	------	------	-----	------	------	------	------	------	------	------	------

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 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 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 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= 0.56 0.56 0.56 0.55 0.54 0.53 0.53 0.53 0.54 0.54 0.55 0.55 (24d)

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

(25)m= 0.56 0.56 0.56 0.55 0.54 0.53 0.53 0.53 0.54 0.54 0.55 0.55 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x 1/[1/(1.4)+ 0.04]	= 2.65		(27)
Windows Type 2			1.3	x 1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 3			1.8	x 1/[1/(1.4)+ 0.04]	= 2.39		(27)
Windows Type 4			2.36	x 1/[1/(1.4)+ 0.04]	= 3.13		(27)
Windows Type 5			0.68	x 1/[1/(1.4)+ 0.04]	= 0.9		(27)
Windows Type 6			0.68	x 1/[1/(1.4)+ 0.04]	= 0.9		(27)
Windows Type 7			0.68	x 1/[1/(1.4)+ 0.04]	= 0.9		(27)
Windows Type 8			0.63	x 1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 9			0.63	x 1/[1/(1.4)+ 0.04]	= 0.84		(27)
Windows Type 10			5.95	x 1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 11			2.43	x 1/[1/(1.4)+ 0.04]	= 3.22		(27)
Windows Type 12			2.36	x 1/[1/(1.4)+ 0.04]	= 3.13		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	136.66	23.6	113.06	x 0.25	= 28.27	60	6783.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			215.18				(31)

DER WorkSheet: New dwelling as built

Party wall	70.12	x	0	=	0	45	3155.535	(32)
Internal wall **	95.88					9	862.9561	(32c)
Internal wall **	74.6					9	671.436	(32c)
Internal floor	76.7					18	1380.6	(32d)
Internal ceiling	76.7					9	690.3	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 70.16 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18308.28 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.66 (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 10.97 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 81.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	55.47	55.24	55.01	53.93	53.73	52.79	52.79	52.62	53.15	53.73	54.14	54.56	(38)

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

(39)m=	136.6	136.37	136.14	135.06	134.86	133.92	133.92	133.75	134.28	134.86	135.27	135.69	
Average = Sum(39) _{1...12} /12=												135.06	(39)

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

(40)m=	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.14	1.15	1.15	1.16	1.16	
Average = Sum(40) _{1...12} /12=												1.16	(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 2.85 (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) + 36 101.9 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = Sum(44) _{1...12} =												1222.75	(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=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = Sum(45) _{1...12} =												1603.22	(45)

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

(46)m=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

DER WorkSheet: New dwelling as built

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

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

Water storage loss:

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

1.57 (48)

Temperature factor from Table 2b

0.54 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0.85 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

Primary circuit loss (annual) from Table 3

0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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=

215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual)^{1...12} 2186.57 (64)

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

(65)m=

94.9	84.14	89.52	81.84	81.36	74.36	73	77.92	77.1	84.79	87.65	93.16
------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52	142.52

 (66)

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

(67)m=

25.06	22.26	18.1	13.7	10.24	8.65	9.34	12.15	16.3	20.7	24.16	25.75
-------	-------	------	------	-------	------	------	-------	------	------	-------	-------

 (67)

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

(68)m=

281.08	284	276.65	261	241.25	222.68	210.28	207.36	214.71	230.36	250.11	268.68
--------	-----	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

DER WorkSheet: New dwelling as built

(69)m=

37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25	37.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

502.45	500.21	483.82	457.13	429.6	403.37	386.5	393	406.86	433.78	464.76	488.4
--------	--------	--------	--------	-------	--------	-------	-----	--------	--------	--------	-------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>24.91</td></tr></table>	24.91	(75)
0.77																		
5.95																		
11.28																		
0.63																		
0.85																		
24.91																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>10.17</td></tr></table>	10.17	(75)
0.77																		
2.43																		
11.28																		
0.63																		
0.85																		
10.17																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>9.88</td></tr></table>	9.88	(75)
0.77																		
2.36																		
11.28																		
0.63																		
0.85																		
9.88																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>50.71</td></tr></table>	50.71	(75)
0.77																		
5.95																		
22.97																		
0.63																		
0.85																		
50.71																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>20.71</td></tr></table>	20.71	(75)
0.77																		
2.43																		
22.97																		
0.63																		
0.85																		
20.71																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>20.11</td></tr></table>	20.11	(75)
0.77																		
2.36																		
22.97																		
0.63																		
0.85																		
20.11																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>91.37</td></tr></table>	91.37	(75)
0.77																		
5.95																		
41.38																		
0.63																		
0.85																		
91.37																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>37.31</td></tr></table>	37.31	(75)
0.77																		
2.43																		
41.38																		
0.63																		
0.85																		
37.31																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>36.24</td></tr></table>	36.24	(75)
0.77																		
2.36																		
41.38																		
0.63																		
0.85																		
36.24																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>150.05</td></tr></table>	150.05	(75)
0.77																		
5.95																		
67.96																		
0.63																		
0.85																		
150.05																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>61.28</td></tr></table>	61.28	(75)
0.77																		
2.43																		
67.96																		
0.63																		
0.85																		
61.28																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>59.52</td></tr></table>	59.52	(75)
0.77																		
2.36																		
67.96																		
0.63																		
0.85																		
59.52																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>201.7</td></tr></table>	201.7	(75)
0.77																		
5.95																		
91.35																		
0.63																		
0.85																		
201.7																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>82.37</td></tr></table>	82.37	(75)
0.77																		
2.43																		
91.35																		
0.63																		
0.85																		
82.37																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>80</td></tr></table>	80	(75)
0.77																		
2.36																		
91.35																		
0.63																		
0.85																		
80																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>215.03</td></tr></table>	215.03	(75)
0.77																		
5.95																		
97.38																		
0.63																		
0.85																		
215.03																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>87.82</td></tr></table>	87.82	(75)
0.77																		
2.43																		
97.38																		
0.63																		
0.85																		
87.82																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>85.29</td></tr></table>	85.29	(75)
0.77																		
2.36																		
97.38																		
0.63																		
0.85																		
85.29																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>201.16</td></tr></table>	201.16	(75)
0.77																		
5.95																		
91.1																		
0.63																		
0.85																		
201.16																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>82.15</td></tr></table>	82.15	(75)
0.77																		
2.43																		
91.1																		
0.63																		
0.85																		
82.15																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>79.79</td></tr></table>	79.79	(75)
0.77																		
2.36																		
91.1																		
0.63																		
0.85																		
79.79																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>160.36</td></tr></table>	160.36	(75)
0.77																		
5.95																		
72.63																		
0.63																		
0.85																		
160.36																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>65.49</td></tr></table>	65.49	(75)
0.77																		
2.43																		
72.63																		
0.63																		
0.85																		
65.49																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>63.61</td></tr></table>	63.61	(75)
0.77																		
2.36																		
72.63																		
0.63																		
0.85																		
63.61																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>111.33</td></tr></table>	111.33	(75)
0.77																		
5.95																		
50.42																		
0.63																		
0.85																		
111.33																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>45.47</td></tr></table>	45.47	(75)
0.77																		
2.43																		
50.42																		
0.63																		
0.85																		
45.47																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>44.16</td></tr></table>	44.16	(75)
0.77																		
2.36																		
50.42																		
0.63																		
0.85																		
44.16																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>61.97</td></tr></table>	61.97	(75)
0.77																		
5.95																		
28.07																		
0.63																		
0.85																		
61.97																		

DER WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)
Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)

DER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest	0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)
Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.68	x	11.28	x	0.63	x	0.85	=	2.85	(81)
Northwest	0.9x	0.77	x	0.68	x	11.28	x	0.63	x	0.85	=	2.85	(81)
Northwest	0.9x	0.77	x	0.68	x	11.28	x	0.63	x	0.85	=	2.85	(81)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.68	x	22.97	x	0.63	x	0.85	=	5.8	(81)
Northwest	0.9x	0.77	x	0.68	x	22.97	x	0.63	x	0.85	=	5.8	(81)
Northwest	0.9x	0.77	x	0.68	x	22.97	x	0.63	x	0.85	=	5.8	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.68	x	41.38	x	0.63	x	0.85	=	10.44	(81)
Northwest	0.9x	0.77	x	0.68	x	41.38	x	0.63	x	0.85	=	10.44	(81)
Northwest	0.9x	0.77	x	0.68	x	41.38	x	0.63	x	0.85	=	10.44	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.68	x	67.96	x	0.63	x	0.85	=	17.15	(81)
Northwest	0.9x	0.77	x	0.68	x	67.96	x	0.63	x	0.85	=	17.15	(81)

DER WorkSheet: New dwelling as built

Northwest 0.9x	0.77	x	0.68	x	67.96	x	0.63	x	0.85	=	17.15	(81)
Northwest 0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest 0.9x	0.77	x	0.68	x	91.35	x	0.63	x	0.85	=	23.05	(81)
Northwest 0.9x	0.77	x	0.68	x	91.35	x	0.63	x	0.85	=	23.05	(81)
Northwest 0.9x	0.77	x	0.68	x	91.35	x	0.63	x	0.85	=	23.05	(81)
Northwest 0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest 0.9x	0.77	x	0.68	x	97.38	x	0.63	x	0.85	=	24.57	(81)
Northwest 0.9x	0.77	x	0.68	x	97.38	x	0.63	x	0.85	=	24.57	(81)
Northwest 0.9x	0.77	x	0.68	x	97.38	x	0.63	x	0.85	=	24.57	(81)
Northwest 0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest 0.9x	0.77	x	0.68	x	91.1	x	0.63	x	0.85	=	22.99	(81)
Northwest 0.9x	0.77	x	0.68	x	91.1	x	0.63	x	0.85	=	22.99	(81)
Northwest 0.9x	0.77	x	0.68	x	91.1	x	0.63	x	0.85	=	22.99	(81)
Northwest 0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest 0.9x	0.77	x	0.68	x	72.63	x	0.63	x	0.85	=	18.33	(81)
Northwest 0.9x	0.77	x	0.68	x	72.63	x	0.63	x	0.85	=	18.33	(81)
Northwest 0.9x	0.77	x	0.68	x	72.63	x	0.63	x	0.85	=	18.33	(81)
Northwest 0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest 0.9x	0.77	x	0.68	x	50.42	x	0.63	x	0.85	=	12.72	(81)
Northwest 0.9x	0.77	x	0.68	x	50.42	x	0.63	x	0.85	=	12.72	(81)
Northwest 0.9x	0.77	x	0.68	x	50.42	x	0.63	x	0.85	=	12.72	(81)
Northwest 0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest 0.9x	0.77	x	0.68	x	28.07	x	0.63	x	0.85	=	7.08	(81)
Northwest 0.9x	0.77	x	0.68	x	28.07	x	0.63	x	0.85	=	7.08	(81)
Northwest 0.9x	0.77	x	0.68	x	28.07	x	0.63	x	0.85	=	7.08	(81)
Northwest 0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest 0.9x	0.77	x	0.68	x	14.2	x	0.63	x	0.85	=	3.58	(81)
Northwest 0.9x	0.77	x	0.68	x	14.2	x	0.63	x	0.85	=	3.58	(81)
Northwest 0.9x	0.77	x	0.68	x	14.2	x	0.63	x	0.85	=	3.58	(81)
Northwest 0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest 0.9x	0.77	x	0.68	x	9.21	x	0.63	x	0.85	=	2.33	(81)
Northwest 0.9x	0.77	x	0.68	x	9.21	x	0.63	x	0.85	=	2.33	(81)
Northwest 0.9x	0.77	x	0.68	x	9.21	x	0.63	x	0.85	=	2.33	(81)
Northwest 0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 166.61 302.45 463.37 657.17 811.88 839.34 795.34 674.83 529.68 347.63 202.96 140.39 (83)

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

(84)m= 669.06 802.67 947.19 1114.3 1241.48 1242.71 1181.84 1067.83 936.54 781.41 667.72 628.79 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

DER WorkSheet: New dwelling as built

(86)m=	0.99	0.98	0.96	0.9	0.78	0.62	0.48	0.54	0.77	0.94	0.98	0.99	(86)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(87)m=	19.16	19.4	19.79	20.28	20.68	20.9	20.97	20.95	20.77	20.24	19.61	19.12	(87)
--------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.95	19.95	19.95	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.95	19.95	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.88	0.73	0.54	0.37	0.43	0.71	0.92	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.49	17.84	18.4	19.09	19.62	19.88	19.95	19.94	19.75	19.05	18.14	17.43	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.19	(91)
---------------------------	------	------

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

(92)m=	17.81	18.13	18.66	19.32	19.82	20.08	20.14	20.13	19.95	19.28	18.42	17.75	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.66	17.98	18.51	19.17	19.67	19.93	19.99	19.98	19.8	19.13	18.27	17.6	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.93	0.85	0.72	0.54	0.38	0.43	0.69	0.9	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

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

(95)m=	656.04	774.62	882.34	952.34	893.08	666.73	444.49	462.96	650.34	703.32	645.91	618.68	(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=	1824.74	1784.24	1635.17	1386.82	1074.88	713.26	454.16	478.9	764.75	1149.81	1511.14	1818.09	(97)
--------	---------	---------	---------	---------	---------	--------	--------	-------	--------	---------	---------	---------	------

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

(98)m=	869.51	678.46	560.11	312.83	135.26	0	0	0	0	332.19	622.97	892.36	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	4403.68	(98)
---	---------	------

Space heating requirement in kWh/m²/year

37.68	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (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)

869.51	678.46	560.11	312.83	135.26	0	0	0	0	332.19	622.97	892.36
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

928.97	724.85	598.4	334.22	144.51	0	0	0	0	354.9	665.57	953.37
--------	--------	-------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211) _{1...5,10...12} =	4704.79	(211)
---	---------	-------

DER WorkSheet: New dwelling as built

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)

	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater													79.9 (216)
(217)m=	88.25	88.02	87.52	86.39	84.24	79.9	79.9	79.9	79.9	86.45	87.78	88.34	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.49	216	228.01	206.88	207.79	195.54	187.6	206.13	205.85	214.39	223.48	238.3	
Total = Sum(219a) _{1...12} =													2574.47 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		4704.79
Water heating fuel used		2574.47
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		442.53 (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	1016.23 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	556.09 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1572.32 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	229.67 (268)
Total CO2, kg/year	sum of (265)...(271) =		1840.92 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		15.75 (273)
EI rating (section 14)			85 (274)

SAP Input

Property Details: ab Plot 23

Address: 10, Ruhemann Street, READING, RG30 3EZ
Located in: England
Region: Thames valley
UPRN: 9617905578
Date of assessment: 17 November 2017
Date of certificate: 17 November 2017
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 156.66
Water use <= 125 litres/person/day: True
PCDF Version: 419

Property description:

Dwelling type: House
Detachment: End-terrace
Year Completed: 2015
Floor Location: **Floor area:** **Storey height:**
 Floor 0 40.17 m² 2.4 m
 Floor 1 38.35 m² 2.65 m
 Floor 2 38.35 m² 2.65 m
Living area: 22.11 m² (fraction 0.209)
Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 10	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 11	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Window 12	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0	1.5	2.1	1
Window 1	16mm or more	0.85	0.63	1.4	2	1
Window 2	16mm or more	0.85	0.63	1.4	1.3	1
Window 3	16mm or more	0.85	0.63	1.4	1.8	1
Window 4	16mm or more	0.85	0.63	1.4	2.36	1
Window 5	16mm or more	0.85	0.63	1.4	0.68	1
Window 6	16mm or more	0.85	0.63	1.4	0.68	1
Window 7	16mm or more	0.85	0.63	1.4	0.68	1
Window 8	16mm or more	0.85	0.63	1.4	0.63	1
Window 9	16mm or more	0.85	0.63	1.4	0.63	1
Window 10	16mm or more	0.85	0.63	1.4	5.95	1
Window 11	16mm or more	0.85	0.63	1.4	2.43	1

SAP Input

Window 12 16mm or more 0.85 0.63 1.4 2.36 1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Walls	South West	1	2.1
Window 1		External Walls	South West	1.6	1.25
Window 2		External Walls	South West	0.65	2
Window 3		External Walls	South West	0.9	2
Window 4		External Walls	South West	1.75	1.35
Window 5		External Walls	North West	0.65	1.05
Window 6		External Walls	North West	0.65	1.05
Window 7		External Walls	North West	0.65	1.05
Window 8		External Walls	North West	0.5	1.25
Window 9		External Walls	South East	0.5	1.25
Window 10		External Walls	North East	2.9	2.05
Window 11		External Walls	North East	1.8	1.35
Window 12		External Walls	North East	1.75	1.35

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	136.66	23.6	113.06	0.25	0	False	60
Ceiling Level	38.35	0	38.35	0.11	0		9
Ground Floor	40.17			0.15			110
<u>Internal Elements</u>							
Internal Walls	95.884						9
Internal Walls	74.604						9
Internal Ceilings	76.7						9
Internal Floors	76.7						18
<u>Party Elements</u>							
Party Walls	70.123						45

Thermal bridges:

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.051					
Length	Psi-value						
15.3	0.186	E2	Other lintels (including other steel lintels)				
14.3	0.025	E3	Sill				
38.2	0.027	E4	Jamb				
18.42	0.051	E5	Ground floor (normal)				
34.84	0.011	E6	Intermediate floor within a dwelling				
8.62	0.07	E10	Eaves (insulation at ceiling level)				
8.89	0.07	E13	Gable (insulation at rafter level)				
17.8	0.052	E16	Corner (normal)				
2.4	-0.0952	E17	Corner (inverted internal area greater than external area)				
6.58	0.02	E11					
7.69	0.08	E14					
9.7	0.098	P1	Ground floor				
17.78	0	P2	Intermediate floor within a dwelling				
8.89	0.037	P4	Roof (insulation at ceiling level)				
14.67	0.08	R4	Ridge (vaulted ceiling)				
1.15	0.08	R1					
1.15	0.06	R2					
1.6	0.08	R3					

Ventilation:

Pressure test: Yes (As built)

SAP Input

Ventilation: Natural ventilation (extract fans)
 Number of chimneys: 0
 Number of open flues: 0
 Number of fans: 3
 Number of passive stacks: 0
 Number of sides sheltered: 2
 Pressure test: 4.44 (Assessed dwelling is tested)

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
 Gas boilers and oil boilers
 Fuel: mains gas
 Info Source: Boiler Database
 Database: (rev 419, product index 016393) Efficiency: Winter 79.9 % Summer: 90.6
 Brand name: Ideal
 Model: Logic System
 Model qualifier: 30
 (Regular boiler)
 Systems with radiators
 Central heating pump : 2013 or later
 Design flow temperature: Unknown
 Unknown
 Boiler interlock: Yes
 Weather Compensator
 Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
 Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
 Water code: 901
 Fuel :mains gas
 Hot water cylinder
 Cylinder volume: 210 litres
 Cylinder insulation: Measured loss, 1.57kWh/day
 Primary pipework insulation: True
 Cylinderstat: True
 Cylinder in heated space: True
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 100%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: None
 Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name: Jonathan Ponting **Stroma Number:** STRO000148
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: ab Plot 23

Address : 10, Ruhemann Street, READING, RG30 3EZ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.17 (1a)	x	2.4 (2a)	=	96.41 (3a)
First floor	38.35 (1b)	x	2.65 (2b)	=	101.63 (3b)
Second floor	38.35 (1c)	x	2.65 (2c)	=	101.63 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	116.87 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	299.66 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	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) =	0.1	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.44000005722046	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.32	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27	(21)
Infiltration rate modified for monthly wind speed				

SAP WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.35	0.34	0.34	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32
--	------	------	------	-----	------	------	------	------	------	------	------	------

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=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)
---------	------	------	------	------	------	------	------	------	------	------	------	------	-------

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

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.5	= 3.15		(26)
Windows Type 1			2	x 1/[1/(1.4)+ 0.04] =	2.65		(27)
Windows Type 2			1.3	x 1/[1/(1.4)+ 0.04] =	1.72		(27)
Windows Type 3			1.8	x 1/[1/(1.4)+ 0.04] =	2.39		(27)
Windows Type 4			2.36	x 1/[1/(1.4)+ 0.04] =	3.13		(27)
Windows Type 5			0.68	x 1/[1/(1.4)+ 0.04] =	0.9		(27)
Windows Type 6			0.68	x 1/[1/(1.4)+ 0.04] =	0.9		(27)
Windows Type 7			0.68	x 1/[1/(1.4)+ 0.04] =	0.9		(27)
Windows Type 8			0.63	x 1/[1/(1.4)+ 0.04] =	0.84		(27)
Windows Type 9			0.63	x 1/[1/(1.4)+ 0.04] =	0.84		(27)
Windows Type 10			5.95	x 1/[1/(1.4)+ 0.04] =	7.89		(27)
Windows Type 11			2.43	x 1/[1/(1.4)+ 0.04] =	3.22		(27)
Windows Type 12			2.36	x 1/[1/(1.4)+ 0.04] =	3.13		(27)
Floor			40.17	x 0.15	= 6.0255	110	4418.7 (28)
Walls	136.66	23.6	113.06	x 0.25	= 28.27	60	6783.6 (29)
Roof	38.35	0	38.35	x 0.11	= 4.22	9	345.15 (30)
Total area of elements, m²			215.18				(31)

SAP WorkSheet: New dwelling as built

Party wall	70.12	x	0	=	0	45	3155.535	(32)
Internal wall **	95.88					9	862.9561	(32c)
Internal wall **	74.6					9	671.436	(32c)
Internal floor	76.7					18	1380.6	(32d)
Internal ceiling	76.7					9	690.3	(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 70.16 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18308.28 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.66 (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 10.97 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 81.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	55.47	55.24	55.01	53.93	53.73	52.79	52.79	52.62	53.15	53.73	54.14	54.56	(38)

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

(39)m=	136.6	136.37	136.14	135.06	134.86	133.92	133.92	133.75	134.28	134.86	135.27	135.69	
Average = Sum(39) _{1...12} /12=												135.06	(39)

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

(40)m=	1.17	1.17	1.16	1.16	1.15	1.15	1.15	1.14	1.15	1.15	1.16	1.16	
Average = Sum(40) _{1...12} /12=												1.16	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.85 (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) + 36 101.9 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	112.09	108.01	103.93	99.86	95.78	91.71	91.71	95.78	99.86	103.93	108.01	112.09	
Total = Sum(44) _{1...12} =												1222.75	(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=	166.22	145.38	150.02	130.79	125.49	108.29	100.35	115.15	116.53	135.8	148.24	160.98	
Total = Sum(45) _{1...12} =												1603.22	(45)

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

(46)m=	24.93	21.81	22.5	19.62	18.82	16.24	15.05	17.27	17.48	20.37	22.24	24.15	(46)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

SAP WorkSheet: New dwelling as built

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

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

Water storage loss:

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

1.57 (48)

Temperature factor from Table 2b

0.54 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.85 (50)

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

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

0 (51)

If community heating see section 4.3

Volume factor from Table 2a

0 (52)

Temperature factor from Table 2b

0 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0 (54)

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

0.85 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m= 26.28 23.74 26.28 25.43 26.28 25.43 26.28 26.28 25.43 26.28 25.43 26.28 (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= 26.28 23.74 26.28 25.43 26.28 25.43 26.28 26.28 25.43 26.28 25.43 26.28 (57)

Primary circuit loss (annual) from Table 3

0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m= 215.76 190.13 199.56 178.73 175.04 156.24 149.89 164.7 164.47 185.34 196.18 210.52 (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= 215.76 190.13 199.56 178.73 175.04 156.24 149.89 164.7 164.47 185.34 196.18 210.52

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

2186.57 (64)

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

(65)m= 94.9 84.14 89.52 81.84 81.36 74.36 73 77.92 77.1 84.79 87.65 93.16 (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=	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02	171.02

(66)

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

(67)m=	62.64	55.64	45.25	34.26	25.61	21.62	23.36	30.36	40.75	51.75	60.4	64.39
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(67)

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

(68)m=	419.52	423.88	412.91	389.55	360.07	332.36	313.85	309.5	320.47	343.82	373.3	401.01
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------

(68)

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

SAP WorkSheet: New dwelling as built

(69)m=

54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95	54.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01	-114.01
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

127.56	125.2	120.32	113.67	109.36	103.28	98.12	104.74	107.09	113.96	121.73	125.21
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (72)

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

(73)m=

724.69	719.68	693.43	652.44	610	572.22	550.29	559.56	583.27	624.49	670.39	705.57
--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>24.91</td></tr></table>	24.91	(75)
0.77																		
5.95																		
11.28																		
0.63																		
0.85																		
24.91																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>10.17</td></tr></table>	10.17	(75)
0.77																		
2.43																		
11.28																		
0.63																		
0.85																		
10.17																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>9.88</td></tr></table>	9.88	(75)
0.77																		
2.36																		
11.28																		
0.63																		
0.85																		
9.88																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>50.71</td></tr></table>	50.71	(75)
0.77																		
5.95																		
22.97																		
0.63																		
0.85																		
50.71																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>20.71</td></tr></table>	20.71	(75)
0.77																		
2.43																		
22.97																		
0.63																		
0.85																		
20.71																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>20.11</td></tr></table>	20.11	(75)
0.77																		
2.36																		
22.97																		
0.63																		
0.85																		
20.11																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>91.37</td></tr></table>	91.37	(75)
0.77																		
5.95																		
41.38																		
0.63																		
0.85																		
91.37																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>37.31</td></tr></table>	37.31	(75)
0.77																		
2.43																		
41.38																		
0.63																		
0.85																		
37.31																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>36.24</td></tr></table>	36.24	(75)
0.77																		
2.36																		
41.38																		
0.63																		
0.85																		
36.24																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>150.05</td></tr></table>	150.05	(75)
0.77																		
5.95																		
67.96																		
0.63																		
0.85																		
150.05																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>61.28</td></tr></table>	61.28	(75)
0.77																		
2.43																		
67.96																		
0.63																		
0.85																		
61.28																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>59.52</td></tr></table>	59.52	(75)
0.77																		
2.36																		
67.96																		
0.63																		
0.85																		
59.52																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>201.7</td></tr></table>	201.7	(75)
0.77																		
5.95																		
91.35																		
0.63																		
0.85																		
201.7																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>82.37</td></tr></table>	82.37	(75)
0.77																		
2.43																		
91.35																		
0.63																		
0.85																		
82.37																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>80</td></tr></table>	80	(75)
0.77																		
2.36																		
91.35																		
0.63																		
0.85																		
80																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>215.03</td></tr></table>	215.03	(75)
0.77																		
5.95																		
97.38																		
0.63																		
0.85																		
215.03																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>87.82</td></tr></table>	87.82	(75)
0.77																		
2.43																		
97.38																		
0.63																		
0.85																		
87.82																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>85.29</td></tr></table>	85.29	(75)
0.77																		
2.36																		
97.38																		
0.63																		
0.85																		
85.29																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>201.16</td></tr></table>	201.16	(75)
0.77																		
5.95																		
91.1																		
0.63																		
0.85																		
201.16																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>82.15</td></tr></table>	82.15	(75)
0.77																		
2.43																		
91.1																		
0.63																		
0.85																		
82.15																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>79.79</td></tr></table>	79.79	(75)
0.77																		
2.36																		
91.1																		
0.63																		
0.85																		
79.79																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>160.36</td></tr></table>	160.36	(75)
0.77																		
5.95																		
72.63																		
0.63																		
0.85																		
160.36																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>65.49</td></tr></table>	65.49	(75)
0.77																		
2.43																		
72.63																		
0.63																		
0.85																		
65.49																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>63.61</td></tr></table>	63.61	(75)
0.77																		
2.36																		
72.63																		
0.63																		
0.85																		
63.61																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>111.33</td></tr></table>	111.33	(75)
0.77																		
5.95																		
50.42																		
0.63																		
0.85																		
111.33																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.43</td></tr></table>	2.43	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>45.47</td></tr></table>	45.47	(75)
0.77																		
2.43																		
50.42																		
0.63																		
0.85																		
45.47																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>44.16</td></tr></table>	44.16	(75)
0.77																		
2.36																		
50.42																		
0.63																		
0.85																		
44.16																		
Northeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>5.95</td></tr></table>	5.95	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.85</td></tr></table>	0.85	=	<table><tr><td>61.97</td></tr></table>	61.97	(75)
0.77																		
5.95																		
28.07																		
0.63																		
0.85																		
61.97																		

SAP WorkSheet: New dwelling as built

Northeast 0.9x	0.77	x	2.43	x	28.07	x	0.63	x	0.85	=	25.31	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.85	=	24.58	(75)
Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.63	x	0.85	=	31.35	(75)
Northeast 0.9x	0.77	x	2.43	x	14.2	x	0.63	x	0.85	=	12.8	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.85	=	12.43	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.63	x	0.85	=	20.35	(75)
Northeast 0.9x	0.77	x	2.43	x	9.21	x	0.63	x	0.85	=	8.31	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.85	=	8.07	(75)
Southeast 0.9x	0.77	x	0.63	x	36.79	x	0.63	x	0.85	=	8.6	(77)
Southeast 0.9x	0.77	x	0.63	x	62.67	x	0.63	x	0.85	=	14.65	(77)
Southeast 0.9x	0.77	x	0.63	x	85.75	x	0.63	x	0.85	=	20.05	(77)
Southeast 0.9x	0.77	x	0.63	x	106.25	x	0.63	x	0.85	=	24.84	(77)
Southeast 0.9x	0.77	x	0.63	x	119.01	x	0.63	x	0.85	=	27.82	(77)
Southeast 0.9x	0.77	x	0.63	x	118.15	x	0.63	x	0.85	=	27.62	(77)
Southeast 0.9x	0.77	x	0.63	x	113.91	x	0.63	x	0.85	=	26.63	(77)
Southeast 0.9x	0.77	x	0.63	x	104.39	x	0.63	x	0.85	=	24.41	(77)
Southeast 0.9x	0.77	x	0.63	x	92.85	x	0.63	x	0.85	=	21.71	(77)
Southeast 0.9x	0.77	x	0.63	x	69.27	x	0.63	x	0.85	=	16.19	(77)
Southeast 0.9x	0.77	x	0.63	x	44.07	x	0.63	x	0.85	=	10.3	(77)
Southeast 0.9x	0.77	x	0.63	x	31.49	x	0.63	x	0.85	=	7.36	(77)
Southwest 0.9x	0.77	x	2	x	36.79		0.63	x	0.85	=	27.31	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.85	=	17.75	(79)
Southwest 0.9x	0.77	x	1.8	x	36.79		0.63	x	0.85	=	24.58	(79)
Southwest 0.9x	0.77	x	2.36	x	36.79		0.63	x	0.85	=	32.22	(79)
Southwest 0.9x	0.77	x	2	x	62.67		0.63	x	0.85	=	46.52	(79)
Southwest 0.9x	0.77	x	1.3	x	62.67		0.63	x	0.85	=	30.24	(79)
Southwest 0.9x	0.77	x	1.8	x	62.67		0.63	x	0.85	=	41.86	(79)
Southwest 0.9x	0.77	x	2.36	x	62.67		0.63	x	0.85	=	54.89	(79)
Southwest 0.9x	0.77	x	2	x	85.75		0.63	x	0.85	=	63.65	(79)
Southwest 0.9x	0.77	x	1.3	x	85.75		0.63	x	0.85	=	41.37	(79)
Southwest 0.9x	0.77	x	1.8	x	85.75		0.63	x	0.85	=	57.28	(79)
Southwest 0.9x	0.77	x	2.36	x	85.75		0.63	x	0.85	=	75.1	(79)
Southwest 0.9x	0.77	x	2	x	106.25		0.63	x	0.85	=	78.86	(79)
Southwest 0.9x	0.77	x	1.3	x	106.25		0.63	x	0.85	=	51.26	(79)
Southwest 0.9x	0.77	x	1.8	x	106.25		0.63	x	0.85	=	70.97	(79)
Southwest 0.9x	0.77	x	2.36	x	106.25		0.63	x	0.85	=	93.06	(79)
Southwest 0.9x	0.77	x	2	x	119.01		0.63	x	0.85	=	88.33	(79)
Southwest 0.9x	0.77	x	1.3	x	119.01		0.63	x	0.85	=	57.41	(79)
Southwest 0.9x	0.77	x	1.8	x	119.01		0.63	x	0.85	=	79.5	(79)
Southwest 0.9x	0.77	x	2.36	x	119.01		0.63	x	0.85	=	104.23	(79)
Southwest 0.9x	0.77	x	2	x	118.15		0.63	x	0.85	=	87.69	(79)

SAP WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	1.3	x	118.15		0.63	x	0.85	=	57	(79)
Southwest	0.9x	0.77	x	1.8	x	118.15		0.63	x	0.85	=	78.92	(79)
Southwest	0.9x	0.77	x	2.36	x	118.15		0.63	x	0.85	=	103.48	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.85	=	84.54	(79)
Southwest	0.9x	0.77	x	1.3	x	113.91		0.63	x	0.85	=	54.95	(79)
Southwest	0.9x	0.77	x	1.8	x	113.91		0.63	x	0.85	=	76.09	(79)
Southwest	0.9x	0.77	x	2.36	x	113.91		0.63	x	0.85	=	99.76	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.85	=	77.48	(79)
Southwest	0.9x	0.77	x	1.3	x	104.39		0.63	x	0.85	=	50.36	(79)
Southwest	0.9x	0.77	x	1.8	x	104.39		0.63	x	0.85	=	69.73	(79)
Southwest	0.9x	0.77	x	2.36	x	104.39		0.63	x	0.85	=	91.43	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.85	=	68.91	(79)
Southwest	0.9x	0.77	x	1.3	x	92.85		0.63	x	0.85	=	44.79	(79)
Southwest	0.9x	0.77	x	1.8	x	92.85		0.63	x	0.85	=	62.02	(79)
Southwest	0.9x	0.77	x	2.36	x	92.85		0.63	x	0.85	=	81.32	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.85	=	51.41	(79)
Southwest	0.9x	0.77	x	1.3	x	69.27		0.63	x	0.85	=	33.42	(79)
Southwest	0.9x	0.77	x	1.8	x	69.27		0.63	x	0.85	=	46.27	(79)
Southwest	0.9x	0.77	x	2.36	x	69.27		0.63	x	0.85	=	60.66	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.85	=	32.71	(79)
Southwest	0.9x	0.77	x	1.3	x	44.07		0.63	x	0.85	=	21.26	(79)
Southwest	0.9x	0.77	x	1.8	x	44.07		0.63	x	0.85	=	29.44	(79)
Southwest	0.9x	0.77	x	2.36	x	44.07		0.63	x	0.85	=	38.6	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.85	=	23.37	(79)
Southwest	0.9x	0.77	x	1.3	x	31.49		0.63	x	0.85	=	15.19	(79)
Southwest	0.9x	0.77	x	1.8	x	31.49		0.63	x	0.85	=	21.03	(79)
Southwest	0.9x	0.77	x	2.36	x	31.49		0.63	x	0.85	=	27.58	(79)
Northwest	0.9x	0.77	x	0.68	x	11.28	x	0.63	x	0.85	=	2.85	(81)
Northwest	0.9x	0.77	x	0.68	x	11.28	x	0.63	x	0.85	=	2.85	(81)
Northwest	0.9x	0.77	x	0.68	x	11.28	x	0.63	x	0.85	=	2.85	(81)
Northwest	0.9x	0.77	x	0.63	x	11.28	x	0.63	x	0.85	=	2.64	(81)
Northwest	0.9x	0.77	x	0.68	x	22.97	x	0.63	x	0.85	=	5.8	(81)
Northwest	0.9x	0.77	x	0.68	x	22.97	x	0.63	x	0.85	=	5.8	(81)
Northwest	0.9x	0.77	x	0.68	x	22.97	x	0.63	x	0.85	=	5.8	(81)
Northwest	0.9x	0.77	x	0.63	x	22.97	x	0.63	x	0.85	=	5.37	(81)
Northwest	0.9x	0.77	x	0.68	x	41.38	x	0.63	x	0.85	=	10.44	(81)
Northwest	0.9x	0.77	x	0.68	x	41.38	x	0.63	x	0.85	=	10.44	(81)
Northwest	0.9x	0.77	x	0.68	x	41.38	x	0.63	x	0.85	=	10.44	(81)
Northwest	0.9x	0.77	x	0.63	x	41.38	x	0.63	x	0.85	=	9.67	(81)
Northwest	0.9x	0.77	x	0.68	x	67.96	x	0.63	x	0.85	=	17.15	(81)
Northwest	0.9x	0.77	x	0.68	x	67.96	x	0.63	x	0.85	=	17.15	(81)

SAP WorkSheet: New dwelling as built

Northwest 0.9x	0.77	x	0.68	x	67.96	x	0.63	x	0.85	=	17.15	(81)
Northwest 0.9x	0.77	x	0.63	x	67.96	x	0.63	x	0.85	=	15.89	(81)
Northwest 0.9x	0.77	x	0.68	x	91.35	x	0.63	x	0.85	=	23.05	(81)
Northwest 0.9x	0.77	x	0.68	x	91.35	x	0.63	x	0.85	=	23.05	(81)
Northwest 0.9x	0.77	x	0.68	x	91.35	x	0.63	x	0.85	=	23.05	(81)
Northwest 0.9x	0.77	x	0.63	x	91.35	x	0.63	x	0.85	=	21.36	(81)
Northwest 0.9x	0.77	x	0.68	x	97.38	x	0.63	x	0.85	=	24.57	(81)
Northwest 0.9x	0.77	x	0.68	x	97.38	x	0.63	x	0.85	=	24.57	(81)
Northwest 0.9x	0.77	x	0.68	x	97.38	x	0.63	x	0.85	=	24.57	(81)
Northwest 0.9x	0.77	x	0.63	x	97.38	x	0.63	x	0.85	=	22.77	(81)
Northwest 0.9x	0.77	x	0.68	x	91.1	x	0.63	x	0.85	=	22.99	(81)
Northwest 0.9x	0.77	x	0.68	x	91.1	x	0.63	x	0.85	=	22.99	(81)
Northwest 0.9x	0.77	x	0.68	x	91.1	x	0.63	x	0.85	=	22.99	(81)
Northwest 0.9x	0.77	x	0.63	x	91.1	x	0.63	x	0.85	=	21.3	(81)
Northwest 0.9x	0.77	x	0.68	x	72.63	x	0.63	x	0.85	=	18.33	(81)
Northwest 0.9x	0.77	x	0.68	x	72.63	x	0.63	x	0.85	=	18.33	(81)
Northwest 0.9x	0.77	x	0.68	x	72.63	x	0.63	x	0.85	=	18.33	(81)
Northwest 0.9x	0.77	x	0.63	x	72.63	x	0.63	x	0.85	=	16.98	(81)
Northwest 0.9x	0.77	x	0.68	x	50.42	x	0.63	x	0.85	=	12.72	(81)
Northwest 0.9x	0.77	x	0.68	x	50.42	x	0.63	x	0.85	=	12.72	(81)
Northwest 0.9x	0.77	x	0.68	x	50.42	x	0.63	x	0.85	=	12.72	(81)
Northwest 0.9x	0.77	x	0.63	x	50.42	x	0.63	x	0.85	=	11.79	(81)
Northwest 0.9x	0.77	x	0.68	x	28.07	x	0.63	x	0.85	=	7.08	(81)
Northwest 0.9x	0.77	x	0.68	x	28.07	x	0.63	x	0.85	=	7.08	(81)
Northwest 0.9x	0.77	x	0.68	x	28.07	x	0.63	x	0.85	=	7.08	(81)
Northwest 0.9x	0.77	x	0.63	x	28.07	x	0.63	x	0.85	=	6.56	(81)
Northwest 0.9x	0.77	x	0.68	x	14.2	x	0.63	x	0.85	=	3.58	(81)
Northwest 0.9x	0.77	x	0.68	x	14.2	x	0.63	x	0.85	=	3.58	(81)
Northwest 0.9x	0.77	x	0.68	x	14.2	x	0.63	x	0.85	=	3.58	(81)
Northwest 0.9x	0.77	x	0.63	x	14.2	x	0.63	x	0.85	=	3.32	(81)
Northwest 0.9x	0.77	x	0.68	x	9.21	x	0.63	x	0.85	=	2.33	(81)
Northwest 0.9x	0.77	x	0.68	x	9.21	x	0.63	x	0.85	=	2.33	(81)
Northwest 0.9x	0.77	x	0.68	x	9.21	x	0.63	x	0.85	=	2.33	(81)
Northwest 0.9x	0.77	x	0.63	x	9.21	x	0.63	x	0.85	=	2.15	(81)

Solar gains in watts, calculated for each month

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

(83)m= 166.61 302.45 463.37 657.17 811.88 839.34 795.34 674.83 529.68 347.63 202.96 140.39 (83)

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

(84)m= 891.3 1022.13 1156.8 1309.61 1421.87 1411.57 1345.63 1234.39 1112.95 972.13 873.35 845.96 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

SAP WorkSheet: New dwelling as built

(86)m=	0.98	0.96	0.93	0.86	0.73	0.56	0.42	0.48	0.7	0.9	0.96	0.98	(86)
--------	------	------	------	------	------	------	------	------	-----	-----	------	------	------

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

(87)m=	19.4	19.62	19.98	20.41	20.75	20.93	20.98	20.97	20.84	20.39	19.82	19.35	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.95	19.95	19.95	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.95	19.95	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.97	0.95	0.92	0.83	0.68	0.48	0.33	0.38	0.63	0.87	0.95	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.83	18.16	18.66	19.27	19.7	19.91	19.95	19.95	19.82	19.26	18.44	17.77	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.19	(91)
---------------------------	------	------

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

(92)m=	18.13	18.43	18.91	19.49	19.9	20.1	20.15	20.14	20.01	19.47	18.7	18.07	(92)
--------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------	-------	------

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

(93)m=	17.98	18.28	18.76	19.34	19.75	19.95	20	19.99	19.86	19.32	18.55	17.92	(93)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.96	0.94	0.89	0.81	0.66	0.48	0.33	0.38	0.62	0.85	0.94	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	854.56	957.77	1034.52	1055.54	944.35	682.69	448.35	469.68	692.44	822.53	818.12	815.85	(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=	1868.59	1825.09	1669.39	1409.61	1085.6	716.42	454.94	480.25	773.49	1176.42	1549.32	1861.29	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	754.44	582.84	472.34	254.93	105.09	0	0	0	0	263.3	526.46	777.8	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	--------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3737.21	(98)
---	---------	------

Space heating requirement in kWh/m²/year

31.98	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.6 (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)

754.44	582.84	472.34	254.93	105.09	0	0	0	0	263.3	526.46	777.8
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	-------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

806.03	622.69	504.64	272.36	112.28	0	0	0	0	281.3	562.46	830.99
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211) _{1...5,10...12} =	3992.74	(211)
---	---------	-------

SAP WorkSheet: New dwelling as built

Space heating fuel (secondary), kWh/month

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

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

Water heating

Output from water heater (calculated above)

	215.76	190.13	199.56	178.73	175.04	156.24	149.89	164.7	164.47	185.34	196.18	210.52	
Efficiency of water heater												79.9	(216)
(217)m=	87.98	87.71	87.13	85.86	83.6	79.9	79.9	79.9	79.9	85.85	87.42	88.09	(217)

Fuel for water heating, kWh/month

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

(219)m=	245.24	216.77	229.03	208.17	209.37	195.54	187.6	206.13	205.85	215.89	224.41	238.99	
Total = Sum(219a) _{1..12} =												2582.97	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3992.74
Water heating fuel used		2582.97
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75
Electricity for lighting		442.53

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	x 0.01 = 138.95 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 = 89.89 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19	x 0.01 = 58.37 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		417.1 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.08	(257)
SAP rating (Section 12)		84.9	(258)

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

SAP WorkSheet: New dwelling as built

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	862.43 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	557.92 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1420.35 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	229.67 (268)
Total CO2, kg/year		sum of (265)...(271) =		1688.95 (272)
CO2 emissions per m²		(272) ÷ (4) =		14.45 (273)
El rating (section 14)				86 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	=	4871.14 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	3151.23 (264)
Space and water heating	(261) + (262) + (263) + (264) =			8022.37 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25 (267)
Electricity for lighting	(232) x	0	=	1358.55 (268)
'Total Primary Energy		sum of (265)...(271) =		9611.17 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =		82.24 (273)