Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.1.25
Printed on 16 November 2016 at 13:56:26

Project Information:

Assessed By: Colleen Robinson (STRO028057) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING AS BUILT Total Floor Area: 70.58m²

Site Reference : 1a and 1b Woodside Avenue **Plot Reference:** 1b Woodside Avenue

Address : 1b, Woodside Avenue, EASTLEIGH, SO50 9ER

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	20.29 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.20 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.3 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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	1.24 (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	7.0m³/m²h (average for dwelling type)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Database: (rev 401, product index 017505):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Worcester
Model: Greenstar
Model qualifier: 25i ErP
(Combi)
Efficiency 89.6 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

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

Section to be completed

9 Summertime temperature

Overheating risk (South England):	Medium	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	1.89m²
Windows facing: West	0.51m²
Windows facing: West	2.16m²
Windows facing: West	1.44m²
Windows facing: South	0.47m²
Windows facing: South	0.95m²
Windows facing: East	1.44m²
Windows facing: East	1.44m²
Windows facing: East	5.04m²
Ventilation rate:	4.00
Blinds/curtains:	None
	Closed 100% of daylight hours

10 Key features

Roofs U-value	0.11 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

SAP Input

Property Details: 1b Woodside Avenue

Address:	1b, Woodside Avenue, EASTLEIGH, SO50 9ER
Located in:	England
Region:	South England
UPRN:	1533928478
Date of assessment:	08 October 2015
Date of certificate:	16 November 2016
Assessment type:	New dwelling as built
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	401

Property description:

Dwelling type:	House
Detachment:	Semi-detached
Year Completed:	2015

Floor Location:	Floor area:	Storey height:
Floor 0	35.29 m²	2.45 m
Floor 1	35.29 m²	2.614 m

Living area:	14.49 m² (fraction 0.205)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
DG01 - Front door	Manufacturer	Solid			Wood
WG01 - Kitchen	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WG02 - Hall	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WF01 - Bed 2	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WF02 - Study	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WG03 - WC	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WF03 - Stairs	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WF04 - Bath	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WF05 - Bed 1	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
DG05 - Double doors	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
DG01 - Front door	mm	0.7	0	1.5	2.1	1
WG01 - Kitchen	16mm or more	0	0.71	1.2	1.89	1
WG02 - Hall	16mm or more	0	0.71	1.2	0.51	1
WF01 - Bed 2	16mm or more	0	0.71	1.2	2.16	1
WF02 - Study	16mm or more	0	0.71	1.2	1.44	1
WG03 - WC	16mm or more	0	0.71	1.2	0.47	1
WF03 - Stairs	16mm or more	0	0.71	1.2	0.95	1
WF04 - Bath	16mm or more	0	0.71	1.2	1.44	1
WF05 - Bed 1	16mm or more	0	0.71	1.2	1.44	1
DG05 - Double doors	16mm or more	0	0.71	1.2	5.04	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
DG01 - Front door		Exetrnal walls	West	1	2.1
WG01 - Kitchen		Exetrnal walls	West	1.8	1.05
WG02 - Hall		Exetrnal walls	West	0.485	1.05
WF01 - Bed 2		Exetrnal walls	West	1.8	1.2
WF02 - Study		Exetrnal walls	West	1.2	1.2

SAP Input

WG03 - WC	Exetrnal walls	South	0.45	1.05
WF03 - Stairs	Exetrnal walls	South	0.9	1.05
WF04 - Bath	Exetrnal walls	East	1.2	1.2
WF05 - Bed 1	Exetrnal walls	East	1.2	1.2
DG05 - Double doors	Exetrnal walls	East	2.4	2.1

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External walls	86.29	0	86.29	0.24	0	False	N/A
Plain ceiling	35.29	0	35.29	0.11	0		N/A
Ground floor	35.29			0.15			N/A
Internal Elements							
Party Elements							
Party wall	35.95						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0533

Length	Psi-value		
12.435	0.05	E2	Other lintels (including other steel lintels)
11.435	0.034	E3	Sill
26.4	0.04	E4	Jamb
17.04	0.06	E5	Ground floor (normal)
17.04	0	E6	Intermediate floor within a dwelling
17.04	0.123	E10	Eaves (insulation at ceiling level)
10.128	0.058	E16	Corner (normal)
10.128	0.067	E18	Party wall between dwellings
7.1	0.16	P1	Ground floor
7.1	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As built)
Ventilation: Positive input from loft
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: 4.97 (Average permeability of dwellings of that type was used)

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 401, product index 017505) Efficiency: Winter 86.6 % Summer: 90.5
Brand name: Worcester
Model: Greenstar
Model qualifier: 25i ErP
(Combi boiler)
Systems with radiators
Central heating pump : Unknown
Design flow temperature: Unknown
Boiler interlock: Yes

SAP Input

	Weather Compensator
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 No hot water cylinder 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:	Photovoltaic 1 Installed Peak power: 0.5 Tilt of collector: 45° Overshading: None or very little Collector Orientation: East
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name:	Colleen Robinson	**Stroma Number:**	STRO028057
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.1.25

Property Address: 1b Woodside Avenue

Address : 1b, Woodside Avenue, EASTLEIGH, SO50 9ER

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	35.29 (1a)	x	2.45 (2a)	=	86.46	(3a)
First floor	35.29 (1b)	x	2.61 (2b)	=	92.25	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.71	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			6.96999979019165 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.52 (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) =	0.44 (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

0.56	0.55	0.54	0.48	0.47	0.42	0.42	0.41	0.44	0.47	0.49	0.52

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.66	0.65	0.64	0.62	0.61	0.59	0.59	0.58	0.6	0.61	0.62	0.63

(24d)

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

(25)m=	0.66	0.65	0.64	0.62	0.61	0.59	0.59	0.58	0.6	0.61	0.62	0.63

(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			1.89	x1/[1/(1.2)+ 0.04]		=	2.16			(27)
Windows Type 2			0.51	x1/[1/(1.2)+ 0.04]		=	0.58			(27)
Windows Type 3			2.16	x1/[1/(1.2)+ 0.04]		=	2.47			(27)
Windows Type 4			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 5			0.47	x1/[1/(1.2)+ 0.04]		=	0.54			(27)
Windows Type 6			0.95	x1/[1/(1.2)+ 0.04]		=	1.09			(27)
Windows Type 7			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 8			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Windows Type 9			5.04	x1/[1/(1.2)+ 0.04]		=	5.77			(27)
Floor			35.29	x	0.15	=	5.2935			(28)
Walls	86.29	0	86.29	x	0.24	=	20.71			(29)
Roof	35.29	0	35.29	x	0.11	=	3.88			(30)
Total area of elements, m²			174.31							(31)
Party wall			35.95	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.6 (33)

SAP WorkSheet: New dwelling as built

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10658.26 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.29 (36)

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.72	38.36	38.01	36.36	36.05	34.61	34.61	34.35	35.17	36.05	36.68	37.33	(38)

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

(39)m=	98.61	98.25	97.9	96.25	95.94	94.5	94.5	94.24	95.06	95.94	96.57	97.22	

Average = Sum(39)$_{1...12}$ /12= 96.25 (39)

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

(40)m=	1.4	1.39	1.39	1.36	1.36	1.34	1.34	1.34	1.35	1.36	1.37	1.38	

Average = Sum(40)$_{1...12}$ /12= 1.36 (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 2.26 (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 87.88 (43)

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

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

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

(44)m=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (45)

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

(46)m=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

SAP WorkSheet: New dwelling as built

Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

(61)m=	32.98	29.77	32.94	31.85	32.9	31.82	32.86	32.89	31.84	32.92	31.89	32.97	(61)

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

(62)m=	176.33	155.15	162.32	144.65	141.13	125.21	119.41	132.19	132.33	150.04	159.73	171.8	(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=	176.33	155.15	162.32	144.65	141.13	125.21	119.41	132.19	132.33	150.04	159.73	171.8	

Output from water heater (annual)$_{1...12}$ 1770.28 (64)

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

(65)m=	55.91	49.13	51.25	45.47	44.21	39.01	36.99	41.24	41.37	47.17	50.48	54.4	(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=	135.61	135.61	135.61	135.61	135.61	135.61	135.61	135.61	135.61	135.61	135.61	135.61	(66)

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

(67)m=	44.31	39.35	32.01	24.23	18.11	15.29	16.52	21.48	28.83	36.6	42.72	45.54	(67)

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

(68)m=	296.49	299.56	291.81	275.31	254.47	234.89	221.81	218.73	226.48	242.99	263.82	283.41	(68)

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

(69)m=	50.82	50.82	50.82	50.82	50.82	50.82	50.82	50.82	50.82	50.82	50.82	50.82	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	75.15	73.11	68.89	63.15	59.42	54.18	49.72	55.43	57.46	63.4	70.11	73.12	(72)

SAP WorkSheet: New dwelling as built

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

(73)m=	521.97	518.05	498.73	468.71	438.03	410.38	394.07	401.66	418.8	449.02	482.68	508.09	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	1.44	x	19.64	x	0.71	x	1.11	=	15.46 (76)
East	0.9x	1	x	1.44	x	19.64	x	0.71	x	1.11	=	15.46 (76)
East	0.9x	1	x	5.04	x	19.64	x	0.71	x	1.11	=	54.12 (76)
East	0.9x	1	x	1.44	x	38.42	x	0.71	x	1.11	=	30.25 (76)
East	0.9x	1	x	1.44	x	38.42	x	0.71	x	1.11	=	30.25 (76)
East	0.9x	1	x	5.04	x	38.42	x	0.71	x	1.11	=	105.86 (76)
East	0.9x	1	x	1.44	x	63.27	x	0.71	x	1.11	=	49.81 (76)
East	0.9x	1	x	1.44	x	63.27	x	0.71	x	1.11	=	49.81 (76)
East	0.9x	1	x	5.04	x	63.27	x	0.71	x	1.11	=	174.34 (76)
East	0.9x	1	x	1.44	x	92.28	x	0.71	x	1.11	=	72.65 (76)
East	0.9x	1	x	1.44	x	92.28	x	0.71	x	1.11	=	72.65 (76)
East	0.9x	1	x	5.04	x	92.28	x	0.71	x	1.11	=	254.27 (76)
East	0.9x	1	x	1.44	x	113.09	x	0.71	x	1.11	=	89.03 (76)
East	0.9x	1	x	1.44	x	113.09	x	0.71	x	1.11	=	89.03 (76)
East	0.9x	1	x	5.04	x	113.09	x	0.71	x	1.11	=	311.61 (76)
East	0.9x	1	x	1.44	x	115.77	x	0.71	x	1.11	=	91.14 (76)
East	0.9x	1	x	1.44	x	115.77	x	0.71	x	1.11	=	91.14 (76)
East	0.9x	1	x	5.04	x	115.77	x	0.71	x	1.11	=	318.99 (76)
East	0.9x	1	x	1.44	x	110.22	x	0.71	x	1.11	=	86.77 (76)
East	0.9x	1	x	1.44	x	110.22	x	0.71	x	1.11	=	86.77 (76)
East	0.9x	1	x	5.04	x	110.22	x	0.71	x	1.11	=	303.69 (76)
East	0.9x	1	x	1.44	x	94.68	x	0.71	x	1.11	=	74.53 (76)
East	0.9x	1	x	1.44	x	94.68	x	0.71	x	1.11	=	74.53 (76)
East	0.9x	1	x	5.04	x	94.68	x	0.71	x	1.11	=	260.87 (76)
East	0.9x	1	x	1.44	x	73.59	x	0.71	x	1.11	=	57.93 (76)
East	0.9x	1	x	1.44	x	73.59	x	0.71	x	1.11	=	57.93 (76)
East	0.9x	1	x	5.04	x	73.59	x	0.71	x	1.11	=	202.77 (76)
East	0.9x	1	x	1.44	x	45.59	x	0.71	x	1.11	=	35.89 (76)
East	0.9x	1	x	1.44	x	45.59	x	0.71	x	1.11	=	35.89 (76)
East	0.9x	1	x	5.04	x	45.59	x	0.71	x	1.11	=	125.61 (76)
East	0.9x	1	x	1.44	x	24.49	x	0.71	x	1.11	=	19.28 (76)
East	0.9x	1	x	1.44	x	24.49	x	0.71	x	1.11	=	19.28 (76)
East	0.9x	1	x	5.04	x	24.49	x	0.71	x	1.11	=	67.48 (76)
East	0.9x	1	x	1.44	x	16.15	x	0.71	x	1.11	=	12.71 (76)

SAP WorkSheet: New dwelling as built

East	0.9x	1	x	1.44	x	16.15	x	0.71	x	1.11	=	12.71	(76)
East	0.9x	1	x	5.04	x	16.15	x	0.71	x	1.11	=	44.5	(76)
South	0.9x	0.77	x	0.47	x	46.75	x	0.71	x	1.11	=	12.01	(78)
South	0.9x	0.77	x	0.95	x	46.75	x	0.71	x	1.11	=	24.28	(78)
South	0.9x	0.77	x	0.47	x	76.57	x	0.71	x	1.11	=	19.67	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.71	x	1.11	=	39.77	(78)
South	0.9x	0.77	x	0.47	x	97.53	x	0.71	x	1.11	=	25.06	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.71	x	1.11	=	50.66	(78)
South	0.9x	0.77	x	0.47	x	110.23	x	0.71	x	1.11	=	28.32	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.71	x	1.11	=	57.25	(78)
South	0.9x	0.77	x	0.47	x	114.87	x	0.71	x	1.11	=	29.52	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.71	x	1.11	=	59.66	(78)
South	0.9x	0.77	x	0.47	x	110.55	x	0.71	x	1.11	=	28.41	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.71	x	1.11	=	57.41	(78)
South	0.9x	0.77	x	0.47	x	108.01	x	0.71	x	1.11	=	27.75	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.71	x	1.11	=	56.1	(78)
South	0.9x	0.77	x	0.47	x	104.89	x	0.71	x	1.11	=	26.95	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.71	x	1.11	=	54.48	(78)
South	0.9x	0.77	x	0.47	x	101.89	x	0.71	x	1.11	=	26.18	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.71	x	1.11	=	52.92	(78)
South	0.9x	0.77	x	0.47	x	82.59	x	0.71	x	1.11	=	21.22	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.71	x	1.11	=	42.89	(78)
South	0.9x	0.77	x	0.47	x	55.42	x	0.71	x	1.11	=	14.24	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.71	x	1.11	=	28.78	(78)
South	0.9x	0.77	x	0.47	x	40.4	x	0.71	x	1.11	=	10.38	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.71	x	1.11	=	20.98	(78)
West	0.9x	0.77	x	1.89	x	19.64	x	0.71	x	1.11	=	20.29	(80)
West	0.9x	0.77	x	0.51	x	19.64	x	0.71	x	1.11	=	5.48	(80)
West	0.9x	0.77	x	2.16	x	19.64	x	0.71	x	1.11	=	23.19	(80)
West	0.9x	0.77	x	1.44	x	19.64	x	0.71	x	1.11	=	15.46	(80)
West	0.9x	0.77	x	1.89	x	38.42	x	0.71	x	1.11	=	39.7	(80)
West	0.9x	0.77	x	0.51	x	38.42	x	0.71	x	1.11	=	10.71	(80)
West	0.9x	0.77	x	2.16	x	38.42	x	0.71	x	1.11	=	45.37	(80)
West	0.9x	0.77	x	1.44	x	38.42	x	0.71	x	1.11	=	30.25	(80)
West	0.9x	0.77	x	1.89	x	63.27	x	0.71	x	1.11	=	65.38	(80)
West	0.9x	0.77	x	0.51	x	63.27	x	0.71	x	1.11	=	17.64	(80)
West	0.9x	0.77	x	2.16	x	63.27	x	0.71	x	1.11	=	74.72	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.71	x	1.11	=	49.81	(80)
West	0.9x	0.77	x	1.89	x	92.28	x	0.71	x	1.11	=	95.35	(80)
West	0.9x	0.77	x	0.51	x	92.28	x	0.71	x	1.11	=	25.73	(80)
West	0.9x	0.77	x	2.16	x	92.28	x	0.71	x	1.11	=	108.97	(80)

SAP WorkSheet: New dwelling as built

West	0.9x	0.77	x	1.44	x	92.28	x	0.71	x	1.11	=	72.65	(80)
West	0.9x	0.77	x	1.89	x	113.09	x	0.71	x	1.11	=	116.85	(80)
West	0.9x	0.77	x	0.51	x	113.09	x	0.71	x	1.11	=	31.53	(80)
West	0.9x	0.77	x	2.16	x	113.09	x	0.71	x	1.11	=	133.55	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.71	x	1.11	=	89.03	(80)
West	0.9x	0.77	x	1.89	x	115.77	x	0.71	x	1.11	=	119.62	(80)
West	0.9x	0.77	x	0.51	x	115.77	x	0.71	x	1.11	=	32.28	(80)
West	0.9x	0.77	x	2.16	x	115.77	x	0.71	x	1.11	=	136.71	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.71	x	1.11	=	91.14	(80)
West	0.9x	0.77	x	1.89	x	110.22	x	0.71	x	1.11	=	113.88	(80)
West	0.9x	0.77	x	0.51	x	110.22	x	0.71	x	1.11	=	30.73	(80)
West	0.9x	0.77	x	2.16	x	110.22	x	0.71	x	1.11	=	130.15	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.71	x	1.11	=	86.77	(80)
West	0.9x	0.77	x	1.89	x	94.68	x	0.71	x	1.11	=	97.83	(80)
West	0.9x	0.77	x	0.51	x	94.68	x	0.71	x	1.11	=	26.4	(80)
West	0.9x	0.77	x	2.16	x	94.68	x	0.71	x	1.11	=	111.8	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.71	x	1.11	=	74.53	(80)
West	0.9x	0.77	x	1.89	x	73.59	x	0.71	x	1.11	=	76.04	(80)
West	0.9x	0.77	x	0.51	x	73.59	x	0.71	x	1.11	=	20.52	(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.71	x	1.11	=	86.9	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.71	x	1.11	=	57.93	(80)
West	0.9x	0.77	x	1.89	x	45.59	x	0.71	x	1.11	=	47.11	(80)
West	0.9x	0.77	x	0.51	x	45.59	x	0.71	x	1.11	=	12.71	(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.71	x	1.11	=	53.83	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.71	x	1.11	=	35.89	(80)
West	0.9x	0.77	x	1.89	x	24.49	x	0.71	x	1.11	=	25.3	(80)
West	0.9x	0.77	x	0.51	x	24.49	x	0.71	x	1.11	=	6.83	(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.71	x	1.11	=	28.92	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.71	x	1.11	=	19.28	(80)
West	0.9x	0.77	x	1.89	x	16.15	x	0.71	x	1.11	=	16.69	(80)
West	0.9x	0.77	x	0.51	x	16.15	x	0.71	x	1.11	=	4.5	(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.71	x	1.11	=	19.07	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.71	x	1.11	=	12.71	(80)

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

(83)m=	185.76	351.82	557.23	787.83	949.82	966.84	922.62	801.92	639.11	411.05	229.38	154.27	(83)

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

(84)m=	707.72	869.88	1055.96	1256.54	1387.85	1377.22	1316.69	1203.58	1057.91	860.07	712.06	662.37	(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	0.91	0.78	0.61	0.43	0.31	0.36	0.59	0.87	0.97	0.99	(86)

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

(87)m=	19.79	20.05	20.42	20.77	20.94	20.99	21	21	20.96	20.68	20.17	19.75	(87)

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

(88)m=	19.77	19.77	19.77	19.79	19.79	19.81	19.81	19.81	19.8	19.79	19.79	19.78	(88)

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

(89)m=	0.98	0.95	0.89	0.73	0.54	0.36	0.23	0.27	0.5	0.83	0.96	0.98	(89)

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

(90)m=	18.21	18.59	19.09	19.56	19.74	19.8	19.81	19.81	19.78	19.47	18.77	18.17	(90)

fLA = Living area ÷ (4) = 0.21 (91)

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

(92)m=	18.54	18.89	19.37	19.8	19.99	20.05	20.05	20.06	20.02	19.72	19.06	18.49	(92)

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

(93)m=	18.54	18.89	19.37	19.8	19.99	20.05	20.05	20.06	20.02	19.72	19.06	18.49	(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=	0.97	0.94	0.88	0.73	0.55	0.37	0.25	0.29	0.52	0.82	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	688.96	821.53	925.67	923.41	764.43	510.78	325.9	343.54	546.24	706.91	676.65	648.4	(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=	1404.08	1374.74	1259.53	1049.57	795.13	514.81	326.39	344.46	562.78	874.92	1154.71	1389.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	532.05	371.75	248.39	90.83	22.84	0	0	0	0	125	344.2	551.31	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2286.39 (98)

Space heating requirement in kWh/m²/year 32.39 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	532.05	371.75	248.39	90.83	22.84	0	0	0	0	125	344.2	551.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	569.04	397.6	265.66	97.15	24.43	0	0	0	0	133.69	368.13	589.64	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2445.33 (211)

SAP 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)

	176.33	155.15	162.32	144.65	141.13	125.21	119.41	132.19	132.33	150.04	159.73	171.8

Efficiency of water heater 86.6 (216)

(217)m=	89.5	89.32	88.92	88.06	87.12	86.6	86.6	86.6	86.6	88.33	89.23	89.54

(217)

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

(219)m=	197.02	173.71	182.55	164.25	161.99	144.58	137.88	152.65	152.81	169.86	179.02	191.86

Total = Sum(219a)$_{1...12}$ = 2008.19 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2445.33	
Water heating fuel used		2008.19	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	120		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		165	(231)
Electricity for lighting		313	(232)
Electricity generated by PVs		-341.21	(233)

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 =	85.1	(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 =	69.88	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	21.76	(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 =	41.29	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-45.01	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 293.03 (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] =	1.06	(257)

SAP WorkSheet: New dwelling as built

SAP rating (Section 12) 85.15 (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	=	528.19	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	433.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				961.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	85.64	(267)
Electricity for lighting	(232) x		0.519	=	162.45	(268)
Energy saving/generation technologies Item 1			0.519	=	-177.09	(269)
Total CO2, kg/year		sum of (265)…(271) =			1032.96	(272)
CO2 emissions per m²		(272) ÷ (4) =			14.64	(273)
EI 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	=	2983.31	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		1.22	=	2449.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5433.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	506.55	(267)
Electricity for lighting	(232) x		0	=	960.92	(268)
Energy saving/generation technologies Item 1			3.07	=	-1047.52	(269)
'Total Primary Energy		sum of (265)…(271) =			5853.25	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			82.93	(273)