Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 03 November 2015 at 15:18:06

Project Information:

Assessed By:	Joe Solti (STRO003946)	**Building Type:**	Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 209m²	
Site Reference :	TJ-34	**Plot Reference:**	TJ3401
Address :	Plots 1-4, 59 Ham Street, Richmond, TW10 7HR		

Client Details:

Name: Ascot Design
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: Electricity
Fuel factor: 1.47 (electricity)

Target Carbon Dioxide Emission Rate (TER)	21.03 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.65 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.8 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Database: (rev 383, product index 100013): Heat pumps with radiators or underfloor heating - electric Brand name: Model: Model qualifier: () Minimum 88.0 %	
Secondary heating system:	Room heaters - wood Closed room heater Efficiency 65.0 % Minimum 65.0 %	OK

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.60 kWh/day	
	Permitted by DBSCG: 2.86 kWh/day	
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):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North East	12m²
Windows facing: South East	12m²
Ventilation rate:	4.00
Blinds/curtains:	None
	Closed 100% of daylight hours

10 Key features

Thermal bridging	0.037 W/m²K
Roofs U-value	0.11 W/m²K
Party Walls U-value	0 W/m²K
Secondary heating (wood logs)	
Secondary heating fuel wood logs	

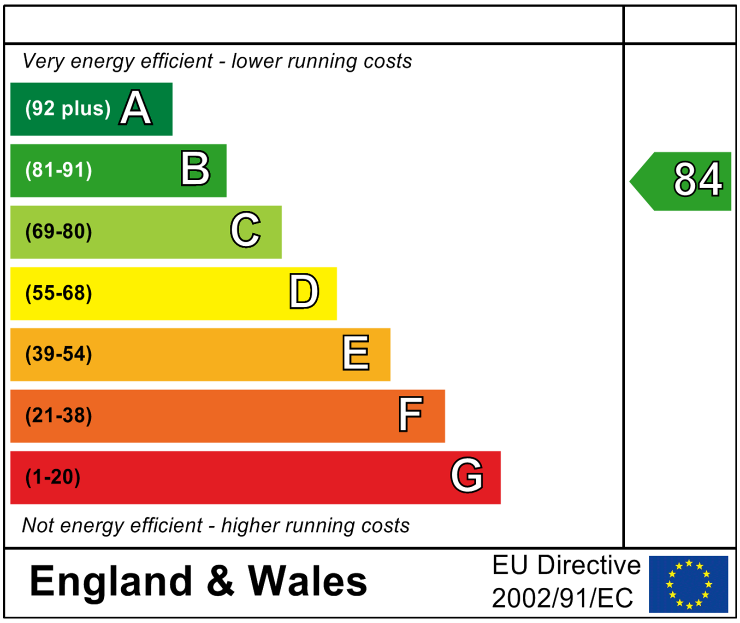
Predicted Energy Assessment

Plots 1-4		Dwelling type:	Semi-detached House
59 Ham Street		Date of assessment:	03 November 2015
Richmond		Produced by:	Joe Solti
TW10 7HR		Total floor area:	209 m²

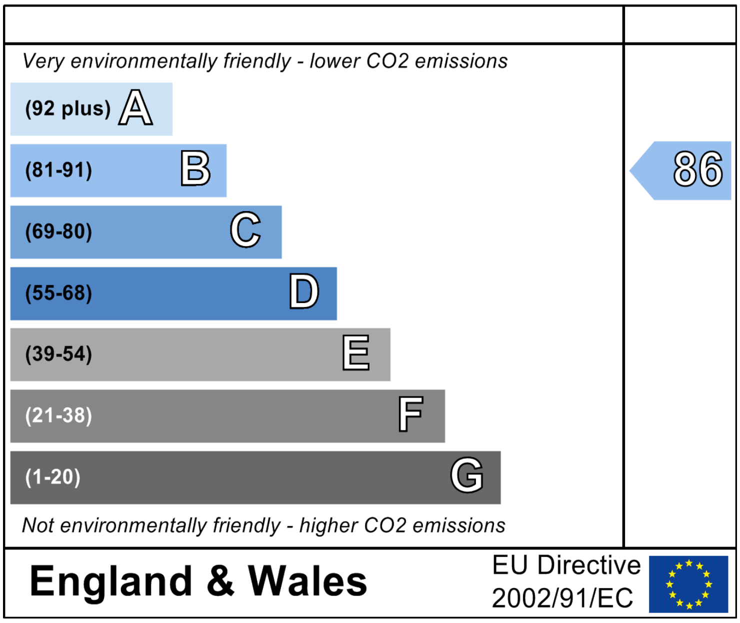
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: TJ3401

Address:	Plots 1-4, 59 Ham Street, Richmond, TW10 7HR
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	03 November 2015
Date of certificate:	03 November 2015
Assessment type:	New dwelling design stage
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:	383

Property description:

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

Floor Location:	Floor area:	Storey height:
Basement floor	71 m²	2.8 m
Floor 1	69 m²	3 m
Floor 2	69 m²	2.5 m

Living area:	28 m² (fraction 0.134)
Front of dwelling faces:	North East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	Wood
Windows (NE/NW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood
Windows (SE/SW)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Front Door	16mm or more mm	0.7	0.63	1.4	2.5	1
Windows (NE/NW)	16mm or more	0.7	0.63	1.4	12	1
Windows (SE/SW)	16mm or more	0.7	0.63	1.4	12	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	North East	0	0
Windows (NE/NW)		Wall	North East	0	0
Windows (SE/SW)		Wall	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	198	26.5	171.5	0.22	0	False	N/A
Roof (loft)	63	0	63	0.11	0		N/A
Roof (skeilings)	10	0	10	0.16	0		N/A
Basement Floor	71			0.16			N/A
Exposed Upper Floor	4			0.22			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Walls	90						N/A

SAP Input

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0365

	Length	Psi-value		
	11	0.056	E2	Other lintels (including other steel lintels)
	15	0.038	E3	Sill
	52	0.042	E4	Jamb
	24	0.061	E5	Ground floor (normal)
	48	0	E6	Intermediate floor within a dwelling
[Approved]	0	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	0	0.04	E11	Eaves (insulation at rafter level)
[Approved]	11	0.24	E12	Gable (insulation at ceiling level)
[Approved]	12.5	0.04	E13	Gable (insulation at rafter level)
	16	0.052	E16	Corner (normal)
[Approved]	0	-0.09	E17	Corner (inverted internal area greater than external area)
[Approved]	32	0.06	E18	Party wall between dwellings
	6	0.32	E20	Exposed floor (normal)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	1 (main: 0, secondary: 1, other: 0)
Number of fans:	6
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	5

Main heating system:

Main heating system:

Heat pumps with radiators or underfloor heating
Electric heat pumps
Fuel: Electricity
Info Source: Boiler Database
Database: (rev 383, product index 100013, SEDBUK 400%):
Brand name: Daikin Altherma
Model: ERHQ006BV3 + EKHBH008B
Model qualifier: Underfloor
(provides DHW all year)
Underfloor heating and radiators, pipes in screed above insulation
Central heating pump : 2012 or earlier
Design flow temperature: Design flow temperature >45°C
Unknown
Boiler interlock: Yes

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2207

Secondary heating system:

Secondary heating system:

Room heaters
Solid fuel room heaters
Fuel :wood logs
Info Source: SAP Tables
Closed room heater
HETAS Approved

Water heating:

Water heating: From main heating system

SAP Input

	Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 300 litres Cylinder insulation: Measured loss, 1.6kWh/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 design stage

User Details:

Assessor Name:	Joe Solti	**Stroma Number:**	STRO003946
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.25

Property Address: TJ3401

Address : Plots 1-4, 59 Ham Street, Richmond, TW10 7HR

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	71	(1a)	x	2.8	(2a)	=	198.8	(3a)
Ground floor	69	(1b)	x	3	(2b)	=	207	(3b)
First floor	69	(1c)	x	2.5	(2c)	=	172.5	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	209	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	578.3	(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	+	1	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							6	x 10 =	60	(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) =	80	÷ (5) =	0.14	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(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) =	0.33	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.31	0.33	0.35	0.37	0.39

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=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(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			2.5	x	1.4	=	3.5			(26)
Windows Type 1			12	x1/[1/(1.4)+ 0.04]		=	15.91			(27)
Windows Type 2			12	x1/[1/(1.4)+ 0.04]		=	15.91			(27)
Floor Type 1			71	x	0.16	=	11.36			(28)
Floor Type 2			4	x	0.22	=	0.88			(28)
Walls	198	26.5	171.5	x	0.22	=	37.73			(29)
Roof Type1	63	0	63	x	0.11	=	6.93			(30)
Roof Type2	10	0	10	x	0.16	=	1.6			(30)
Total area of elements, m²			346							(31)
Party wall			90	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) = 93.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 36752 (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 12.65 (36) *if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 106.46 (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=	112.32	111.66	111.02	108	107.43	104.8	104.8	104.32	105.82	107.43	108.58	109.77	(38)

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

(39)m=	218.78	218.13	217.49	214.46	213.9	211.27	211.27	210.78	212.28	213.9	215.04	216.24	

Average = Sum(39)1…12 /12= 214.46 (39)

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

(40)m=	1.05	1.04	1.04	1.03	1.02	1.01	1.01	1.01	1.02	1.02	1.03	1.03	

Average = Sum(40)1…12 /12= 1.03 (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 3.01 (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) + 36 105.77 (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=	116.35	112.12	107.89	103.66	99.43	95.2	95.2	99.43	103.66	107.89	112.12	116.35	

Total = Sum(44)1…12 = 1269.28 (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=	172.55	150.91	155.72	135.76	130.27	112.41	104.17	119.53	120.96	140.97	153.88	167.1	

Total = Sum(45)1…12 = 1664.23 (45)

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

(46)m=	25.88	22.64	23.36	20.36	19.54	16.86	15.63	17.93	18.14	21.15	23.08	25.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (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): 1.6 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.86 (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) 0.86 (55)

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

(56)m=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(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=	26.78	24.19	26.78	25.92	26.78	25.92	26.78	26.78	25.92	26.78	25.92	26.78	(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

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

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

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

(62)m=	222.59	196.11	205.77	184.2	180.32	138.33	130.95	146.32	146.88	191.01	202.31	217.15	(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=	222.59	196.11	205.77	184.2	180.32	0	0	0	0	191.01	202.31	217.15

Output from water heater (annual)1…12 | 1599.46 | (64)

Output immersion

(64)m=	0	0	0	0	0	138.33	130.95	146.32	146.88	0	0	0

Output from immersion (annual)1…12 | 562.480541922569 | (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=	97.41	86.34	91.82	83.89	83.35	58.11	56.06	61.17	60.96	86.91	89.91	95.6	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	180.82	180.82	180.82	180.82	180.82	180.82	180.82	180.82	180.82	180.82	180.82	180.82	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	92.75	82.38	66.99	50.72	37.91	32.01	34.59	44.96	60.34	76.61	89.42	95.33	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	566.45	572.33	557.51	525.98	486.18	448.76	423.77	417.89	432.7	464.24	504.04	541.46	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	-120.55	(71)
Water heating gains (Table 5)													
(72)m=	130.93	128.48	123.41	116.51	112.03	80.71	75.35	82.22	84.66	116.81	124.87	128.49	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	906.49	899.55	864.28	809.58	752.49	677.85	650.08	661.44	694.07	774.03	834.71	881.64	(73)

SAP WorkSheet: New dwelling design stage

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	12	x	11.28	x	0.63	x	0.7	=	41.38	(75)
Northeast	0.9x	0.77	x	12	x	22.97	x	0.63	x	0.7	=	84.23	(75)
Northeast	0.9x	0.77	x	12	x	41.38	x	0.63	x	0.7	=	151.75	(75)
Northeast	0.9x	0.77	x	12	x	67.96	x	0.63	x	0.7	=	249.22	(75)
Northeast	0.9x	0.77	x	12	x	91.35	x	0.63	x	0.7	=	335	(75)
Northeast	0.9x	0.77	x	12	x	97.38	x	0.63	x	0.7	=	357.14	(75)
Northeast	0.9x	0.77	x	12	x	91.1	x	0.63	x	0.7	=	334.1	(75)
Northeast	0.9x	0.77	x	12	x	72.63	x	0.63	x	0.7	=	266.35	(75)
Northeast	0.9x	0.77	x	12	x	50.42	x	0.63	x	0.7	=	184.91	(75)
Northeast	0.9x	0.77	x	12	x	28.07	x	0.63	x	0.7	=	102.93	(75)
Northeast	0.9x	0.77	x	12	x	14.2	x	0.63	x	0.7	=	52.06	(75)
Northeast	0.9x	0.77	x	12	x	9.21	x	0.63	x	0.7	=	33.79	(75)
Southeast	0.9x	0.77	x	12	x	36.79	x	0.63	x	0.7	=	134.94	(77)
Southeast	0.9x	0.77	x	12	x	62.67	x	0.63	x	0.7	=	229.85	(77)
Southeast	0.9x	0.77	x	12	x	85.75	x	0.63	x	0.7	=	314.49	(77)
Southeast	0.9x	0.77	x	12	x	106.25	x	0.63	x	0.7	=	389.66	(77)
Southeast	0.9x	0.77	x	12	x	119.01	x	0.63	x	0.7	=	436.45	(77)
Southeast	0.9x	0.77	x	12	x	118.15	x	0.63	x	0.7	=	433.3	(77)
Southeast	0.9x	0.77	x	12	x	113.91	x	0.63	x	0.7	=	417.75	(77)
Southeast	0.9x	0.77	x	12	x	104.39	x	0.63	x	0.7	=	382.84	(77)
Southeast	0.9x	0.77	x	12	x	92.85	x	0.63	x	0.7	=	340.52	(77)
Southeast	0.9x	0.77	x	12	x	69.27	x	0.63	x	0.7	=	254.03	(77)
Southeast	0.9x	0.77	x	12	x	44.07	x	0.63	x	0.7	=	161.62	(77)
Southeast	0.9x	0.77	x	12	x	31.49	x	0.63	x	0.7	=	115.48	(77)

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

(83)m=	176.31	314.07	466.24	638.88	771.45	790.44	751.85	649.19	525.43	356.96	213.69	149.27	(83)

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

(84)m=	1082.8	1213.63	1330.52	1448.46	1523.94	1468.29	1401.92	1310.62	1219.5	1131	1048.39	1030.91	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.93	0.81	0.64	0.7	0.91	0.99	1	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	20.04	20.05	20.05	20.06	20.06	20.07	20.07	20.08	20.07	20.06	20.06	20.05	(88)

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

(89)m=	1	1	0.99	0.97	0.91	0.73	0.52	0.58	0.86	0.98	1	1	(89)

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

(90)m=	20.04	20.05	20.05	20.06	20.06	20.07	20.07	20.08	20.07	20.06	20.06	20.05	(90)

fLA = Living area ÷ (4) = 0.13 (91)

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

(92)m=	20.17	20.17	20.18	20.19	20.19	20.2	20.2	20.2	20.19	20.19	20.19	20.18	(92)

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

(93)m=	20.17	20.17	20.18	20.19	20.19	20.2	20.2	20.2	20.19	20.19	20.19	20.18	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.91	0.74	0.53	0.6	0.87	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1081.46	1210.44	1321.29	1412.89	1387.34	1092.08	748.56	780.31	1062.7	1111.66	1045.51	1029.95	(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=	3472.66	3331.86	2974.53	2420.72	1815.84	1182.74	760.21	800.96	1293.81	2051.13	2813.9	3455.74	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1779.05	1425.59	1230.01	725.64	318.8	0	0	0	0	698.96	1273.24	1804.79	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9256.09 (98)

Space heating requirement in kWh/m²/year 44.29 (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		399.94	(206)
Efficiency of secondary/supplementary heating system, %		65	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1779.05	1425.59	1230.01	725.64	318.8	0	0	0	0	698.96	1273.24	1804.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	444.83	356.45	307.55	181.44	79.71	0	0	0	0	174.77	318.36	451.27	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2314.37 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	222.59	196.11	205.77	184.2	180.32	0	0	0	0	191.01	202.31	217.15	
Efficiency of water heater													100 (216)
(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.59	196.11	205.77	184.2	180.32	0	0	0	0	191.01	202.31	217.15	

Total = $Sum(219a)_{1...12}$ = 1599.46 (219)

Water heating requirement (immersion)

	0	0	0	0	0	138.33	130.95	146.32	146.88	0	0	0	
Efficiency of water heater (Immersion)													100 (216)
(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

Fuel for water heating (Immersion), kWh/month

(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	138.33	130.95	146.32	146.88	0	0	0	

Total = $Sum(219a)_{1...12}$ = 562.48 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2314.37	
Water heating fuel used			1599.46	
Water heating fuel used (Immersion)			562.48	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			655.18	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	305.27	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	4.23	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	13.19	x 0.01 =	210.97	(247)
Water heating cost (Immersion)	(219)	0	x 0.01 =	74.19	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	0	(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 =	86.42	(250)
Additional standing charges (Table 12)				0	(251)

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

Total energy cost (245)...(247) + (250)…(254) = 676.84 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

SAP WorkSheet: New dwelling design stage

Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =		1.12	(257)
SAP rating (Section 12)			84.39	(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	0.519	=	1201.16	(261)
Space heating (secondary)	(215) x	0.019	=	0	(263)
Water heating	(219) x	0.519	=	830.12	(264)
Water heating (Immersion)	(219) x	0.519	=	291.93	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2323.21	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	340.04	(268)
Total CO2, kg/year		sum of (265)…(271) =		2663.25	(272)
CO2 emissions per m²		(272) ÷ (4) =		12.74	(273)
EI rating (section 14)				86	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	7105.13	(261)
Space heating (secondary)	(215) x	1.04	=	0	(263)
Energy for water heating	(219) x	3.07	=	4910.34	(264)
Energy for water heating (Immersion)	(219) x	3.07	=	1726.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			13742.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	0	(267)
Electricity for lighting	(232) x	0	=	2011.42	(268)
'Total Primary Energy		sum of (265)…(271) =		15753.69	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		75.38	(273)