

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.26
 Printed on 30 June 2020 at 09:50:57

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 51.72m²
Site Reference : HO LA TW11 **Plot Reference:** Plot 3 - 1B2P
Address : Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE

Client Details:

Name: Howarth Homes
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) 20.83 kg/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 13.39 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.8 kWh/m²
 Dwelling Fabric Energy Efficiency (DFEE) 47.7 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.16 (max. 2.00)	1.20 (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 452, product index 017929):
 Boiler systems with radiators or underfloor heating - mains gas
 Brand name: Ideal
 Model: LOGIC COMBI
 Model qualifier: ESP1 35
 (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 thermostat

No cylinder
Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading: Average or unknown
Windows facing: West 3.15m²
Windows facing: West 5.08m²
Ventilation rate: 2.00
Blinds/curtains: Dark-coloured curtain or roller blind
Closed 100% of daylight hours

10 Key features

Doors U-value 1 W/m²K
Party Walls U-value 0 W/m²K
Photovoltaic array

DRAFT

SAP Input

Property Details: Plot 3 - 1B2P

Address: Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE
 Located in: England
 Region: Thames valley
 UPRN:
 Date of assessment: 03 March 2020
 Date of certificate: 30 June 2020
 Assessment type: New dwelling design stage
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 276.57
 Water use <= 125 litres/person/day: True
 PCDF Version: 452

Property description:

Dwelling type: Flat
 Detachment:
 Year Completed: 2020
 Floor Location: Floor area:
 Storey height:
 Floor 0 51.72 m² 2.8 m

Living area: 23.64 m² (fraction 0.457)
 Front of dwelling faces: North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Flat door	Manufacturer	Solid			Wood
Bedroom	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Terrace	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Flat door	mm	0.7	0	1	2.04	1
Bedroom	16mm or more	0.7	0.63	1.2	3.15	1
Terrace	16mm or more	0.7	0.63	1.2	5.08	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Flat door		Corridor	East	0.97	2.1
Bedroom		Main wall	West	1.5	2.1
Terrace		Main wall	West	2.42	2.1

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Main wall	22.764	8.23	14.53	0.18	0	False	60
Corridor	26.292	2.04	24.25	0.18	0.43	False	60
Ground floor	51.72			0.13			110
<u>Internal Elements</u>							
Internal	94.36						9
<u>Party Elements</u>							
Party	35.336						110
Party	51.72						30

Thermal bridges:

SAP Input

Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0949

	Length	Psi-value		
[Approved]	4.89	0.3	E2	Other lintels (including other steel lintels)
[Approved]	3.92	0.04	E3	Sill
[Approved]	12.6	0.05	E4	Jamb
[Approved]	17.59	0.16	E5	Ground floor (normal)
[Approved]	17.59	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.6	0.09	E16	Corner (normal)
[Approved]	2.8	-0.09	E17	Corner (inverted internal area greater than external area)
[Approved]	5.6	0.06	E18	Party wall between dwellings
	5.6	0.12	E25	Staggered party wall between dwellings
	12.52	0.16	P1	Ground floor
	12.52	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	3
Pressure test:	5

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 452, product index 017929) Efficiency: Winter 87.3 % Summer: 90.5
	Brand name: Ideal
	Model: LOGIC COMBI
	Model qualifier: ESP1 35
	(Combi boiler)
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Unknown
	Boiler interlock: Yes
	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
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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%

SAP Input

Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	<u>Photovoltaic 1</u> Installed Peak power: 0.714 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

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SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Plot 3 - 1B2P

Address : Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.72	(1a) x	2.8	(2a) =	144.82
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.72	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	144.82

2. Ventilation rate:

	main heating	+	secondary heating	+	other	=	total		m ³ per hour
Number of chimneys	0		0		0	=	0	x 40 =	0
Number of open flues	0		0		0	=	0	x 20 =	0
Number of intermittent fans					2		2	x 10 =	20
Number of passive vents					0		0	x 10 =	0
Number of flueless gas fires					0		0	x 40 =	0

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.14 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 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 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.3 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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
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SAP WorkSheet: New dwelling design stage

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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.57 0.57 0.57 0.55 0.55 0.54 0.54 0.54 0.55 0.55 0.56 0.56 (24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors			2.04	1	2.04		
Windows Type 1			3.15	1/[1/(1.2)+0.04]	3.61		
Windows Type 2			5.08	1/[1/(1.2)+0.04]	5.82		
Floor			51.72	0.13	6.7236	110	5689.2
Walls Type1	22.76	8.23	14.53	0.18	2.62	60	872.04
Walls Type2	26.29	2.04	24.25	0.17	4.05	60	1455.12
Total area of elements, m ²			100.78				
Party wall			35.34	0	0	110	3886.96
Party ceiling			51.72			30	1551.6
Internal wall **			94.36			9	849.24

* 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) = 24.86 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14304.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 276.57 (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 9.56 (36)

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

Total fabric heat loss (33) + (36) = 34.42 (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
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SAP WorkSheet: New dwelling design stage

(38)m=	27.41	27.27	27.14	26.51	26.39	25.85	25.85	25.74	26.06	26.39	26.63	26.88	(38)
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Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	61.83	61.69	61.56	60.93	60.81	60.26	60.26	60.16	60.47	60.81	61.05	61.3	
Average = Sum(39) _{1...12} / 12 =												60.93	(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.2	1.19	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19	
Average = Sum(40) _{1...12} / 12 =												1.18	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N	1.74	(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	75.54	(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)	83.1	80.08	77.06	74.03	71.01	67.99	67.99	71.01	74.03	77.06	80.08	83.1		
(44)m=	Total = Sum(44) _{1...12} =												906.53	(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=	123.23	107.78	111.22	96.96	93.04	80.29	74.4	85.37	86.39	100.68	109.9	119.34	
Total = Sum(45) _{1...12} =												1188.61	(45)

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

(46)m=	18.48	16.17	16.68	14.54	13.96	12.04	11.16	12.81	12.96	15.1	16.49	17.9	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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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)
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Temperature factor from Table 2b	0	(49)
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Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a	0	(52)
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Temperature factor from Table 2b	0	(53)
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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
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Enter (50) or (54) in (55)	0	(55)
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Water storage loss calculated for each month ((56)m = (55) x (41)m)

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
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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)
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SAP WorkSheet: New dwelling design stage

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

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

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

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m=

14	12.63	13.96	13.49	13.92	13.44	13.88	13.9	13.47	13.94	13.52	13.99
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 (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=

137.24	120.41	125.18	110.45	106.95	93.73	88.27	99.27	99.86	114.62	123.42	133.34
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 (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
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 (63)

Output from water heater

(64)m=

137.24	120.41	125.18	110.45	106.95	93.73	88.27	99.27	99.86	114.62	123.42	133.34
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Output from water heater (annual)_{1...12} 1352.75 (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=

44.48	39	40.47	35.61	34.41	30.06	28.21	31.86	32.09	36.96	39.92	43.18
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 (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
(66)m=	104.45	104.45	104.45	104.45	104.45	104.45	104.45	104.45	104.45	104.45	104.45	104.45

 (66)

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

(67)m=

35.31	31.36	25.51	19.31	14.43	12.19	13.17	17.12	22.97	29.17	34.05	36.29
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 (67)

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

(68)m=

226.42	228.77	222.85	210.24	194.33	179.38	169.39	167.04	172.96	185.56	201.47	216.43
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 (68)

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

(69)m=

47.19	47.19	47.19	47.19	47.19	47.19	47.19	47.19	47.19	47.19	47.19	47.19
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63
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 (71)

Water heating gains (Table 5)

(72)m=

59.78	58.03	54.4	49.46	46.26	41.74	37.91	42.82	44.57	49.68	55.45	58.04
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 (72)

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

(73)m=

406.51	403.16	387.75	364.01	340.02	318.31	305.47	311.98	325.5	349.41	375.97	395.76
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 (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)
West	0.9x 0.77	x 3.15	x 19.64	x 0.63	x 0.7	= 18.91 (80)
West	0.9x 0.77	x 5.08	x 19.64	x 0.63	x 0.7	= 30.49 (80)

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West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(80)

Solar gains in watts, calculated for each month

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

(83)m=	49.4	96.64	159.14	232.1	284.45	291.19	277.22	238.13	185.09	114.67	61.59	40.62	(83)
--------	------	-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	455.91	499.8	546.9	596.12	624.47	609.49	582.69	550.11	510.6	464.08	437.56	436.38	(84)
--------	--------	-------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.8	0.61	0.45	0.5	0.75	0.94	0.99	0.99	(86)

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

(87)m=	20.04	20.17	20.4	20.68	20.89	20.98	21	20.99	20.94	20.67	20.3	20.01	(87)
--------	-------	-------	------	-------	-------	-------	----	-------	-------	-------	------	-------	------

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

(88)m=	19.92	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.89	0.74	0.52	0.35	0.39	0.66	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=	18.67	18.86	19.19	19.59	19.84	19.94	19.95	19.95	19.9	19.59	19.07	18.64	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.29	19.46	19.74	20.09	20.32	20.41	20.43	20.43	20.38	20.08	19.63	19.26	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.14	19.31	19.59	19.94	20.17	20.26	20.28	20.28	20.23	19.93	19.48	19.11	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=	0.99	0.98	0.95	0.89	0.75	0.55	0.38	0.42	0.69	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	450.15	489.13	522.27	529.7	469.49	334.51	220.82	231.88	349.77	424.21	427.3	431.88	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	917.79	888.95	805.95	672.56	515.03	341.24	221.57	233.19	370.58	567.63	756.03	914.1	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	347.92	268.68	211.05	102.86	33.88	0	0	0	0	106.71	236.68	358.77	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 1666.56

Space heating requirement in $kWh/m^2/year$

(98)	1666.56
(99)	32.22

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

Space heating:

Fraction of space heat from secondary/supplementary system

(201)	0	(201)
-------	---	-------

Fraction of space heat from main system(s)

(202) = $1 - (201) =$

(202)	1	(202)
-------	---	-------

Fraction of total heating from main system 1

(204) = $(202) \times [1 - (203)] =$

(204)	1	(204)
-------	---	-------

Efficiency of main space heating system 1

(206)	90.5	(206)
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Efficiency of secondary/supplementary heating system, %

(208)	0	(208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

347.92	268.68	211.05	102.86	33.88	0	0	0	0	106.71	236.68	358.77
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

384.45	296.88	233.21	113.66	37.44	0	0	0	0	117.91	261.53	396.43
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1...5,10...12} =$ 1841.51 (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	(215)
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Total ($kWh/year$) = $Sum(215)_{1...5,10...12} =$ 0 (215)

Water heating

Output from water heater (calculated above)

137.24	120.41	125.18	110.45	106.95	93.73	88.27	99.27	99.86	114.62	123.42	133.34
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

Efficiency of water heater

(216)	87.3	(216)
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(217)m=	89.57	89.48	89.28	88.81	88.05	87.3	87.3	87.3	87.3	88.81	89.38	89.61	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	153.21	134.56	140.21	124.36	121.47	107.36	101.12	113.72	114.38	129.06	138.09	148.8	(219)
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Total = $Sum(219a)_{1...12} =$ 1526.35 (219)

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Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1841.51
Water heating fuel used		1526.35
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		249.45 (232)
Electricity generated by PVs		-616.62 (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	64.08 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating cost (other fuel)	(219)	3.48	53.12 (247)
Pumps, fans and electric keep-hot	(231)	13.19	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	32.9 (250)
Additional standing charges (Table 12)			120 (251)
one of (233) to (235) x		13.19	0 (252)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		280 (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] =	1.22 (257)
SAP rating (Section 12)		83.04 (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	397.77 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	329.69 (264)
Space and water heating	(261) + (262) + (263) + (264) =		727.46 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	129.46 (268)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Plot 3 - 1B2P

Address : Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.72	(1a) x	2.8	(2a) =	144.82
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.72	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	144.82

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							2	x 10 =	20
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.14 (8)

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

Number of storeys in the dwelling (ns)	0	(9)
Additional infiltration	0	[(9)-1]x0.1 = (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	0.25 - [0.2 x (14) ÷ 100] = (15)
Infiltration rate	0	(8) + (10) + (11) + (12) + (13) + (15) = (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)
<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	3	(19)
Shelter factor	0.78	(20) = 1 - [0.075 x (19)] = (20)
Infiltration rate incorporating shelter factor	0.3	(21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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
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 (24b)

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

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

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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 (24d)

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

(25)m=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors			2.04	x 1	= 2.04		(26)
Windows Type 1			3.15	x 1/[1/(1.4)+0.04]	= 4.18		(27)
Windows Type 2			5.08	x 1/[1/(1.4)+0.04]	= 6.73		(27)
Floor			51.72	x 0.13	= 6.7236		(28)
Walls Type1	22.76	8.23	14.53	x 0.18	= 2.62		(29)
Walls Type2	26.29	2.04	24.25	x 0.18	= 4.37		(29)
Total area of elements, m ²			100.78				(31)
Party wall			35.34	x 0	= 0		(32)
Party ceiling			51.72				(32b)
Internal wall **			94.36				(32c)

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

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

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

26.66

 (33)

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

14304.16

 (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

7.04

 (36)

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

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

33.7

 (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
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(38)m=	27.41	27.27	27.14	26.51	26.39	25.85	25.85	25.74	26.06	26.39	26.63	26.88	(38)
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Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	61.11	60.97	60.84	60.21	60.09	59.54	59.54	59.44	59.75	60.09	60.33	60.58	
Average = Sum(39) _{1...12} / 12 =												60.21	(39)

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

(40)m=	1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17	
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 1.74 (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 75.54 (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=	83.1	80.08	77.06	74.03	71.01	67.99	67.99	71.01	74.03	77.06	80.08	83.1	
Total = Sum(44) _{1...12} =												906.53	(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=	123.23	107.78	111.22	96.96	93.04	80.29	74.4	85.37	86.39	100.68	109.9	119.34	
Total = Sum(45) _{1...12} =												1188.61	(45)

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

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

TFEE WorkSheet: New dwelling design stage

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

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

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

(59)m=

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=

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=

104.75	91.61	94.54	82.42	79.08	68.24	63.24	72.57	73.43	85.58	93.42	101.44
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

104.75	91.61	94.54	82.42	79.08	68.24	63.24	72.57	73.43	85.58	93.42	101.44
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Output from water heater (annual)_{1...12} 1010.31 (64)

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

(65)m=

26.19	22.9	23.63	20.6	19.77	17.06	15.81	18.14	18.36	21.39	23.35	25.36
-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (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
(66)m=	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04

 (66)

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

(67)m=

14.12	12.55	10.2	7.72	5.77	4.87	5.27	6.85	9.19	11.67	13.62	14.52
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

151.7	153.27	149.31	140.86	130.2	120.18	113.49	111.92	115.88	124.33	134.99	145.01
-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

35.2	34.08	31.77	28.62	26.57	23.7	21.25	24.38	25.5	28.76	32.44	34.09
------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------

 (72)

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

(73)m=

250.13	249.01	240.39	226.32	211.66	197.86	189.12	192.26	199.68	213.86	230.15	242.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)						
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>3.15</td></tr></table>	3.15	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>18.91</td></tr></table> (80)	18.91
0.77												
3.15												
19.64												
0.63												
0.7												
18.91												
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>5.08</td></tr></table>	5.08	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>30.49</td></tr></table> (80)	30.49
0.77												
5.08												
19.64												
0.63												
0.7												
30.49												

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West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(80)

Solar gains in watts, calculated for each month

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

(83)m=	49.4	96.64	159.14	232.1	284.45	291.19	277.22	238.13	185.09	114.67	61.59	40.62	(83)
--------	------	-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	299.53	345.65	399.53	458.42	496.11	489.05	466.34	430.39	384.77	328.53	291.75	283.35	(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	0.96	0.88	0.72	0.55	0.61	0.86	0.98	1	1	(86)

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

(87)m=	19.7	19.85	20.12	20.48	20.78	20.94	20.99	20.98	20.85	20.45	20.01	19.67	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.95	0.83	0.62	0.43	0.48	0.79	0.97	1	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.75	18.9	19.17	19.53	19.8	19.93	19.96	19.96	19.87	19.51	19.07	18.73	(90)
--------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

TFEE WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = $f_{LA} \times T1 + (1 - f_{LA}) \times T2$

(92)m=	19.18	19.33	19.61	19.96	20.25	20.4	20.43	20.42	20.32	19.94	19.5	19.16	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	------

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

(93)m=	19.18	19.33	19.61	19.96	20.25	20.4	20.43	20.42	20.32	19.94	19.5	19.16	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	1	0.99	0.98	0.95	0.85	0.66	0.48	0.54	0.82	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	298.68	343.54	392.84	433.48	420.2	324.98	224.68	233.47	315.07	318.69	290.09	282.73	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	909.43	880.09	797.3	666.07	513.59	345.08	227.92	239.18	371.75	561.26	747.98	906.23	(97)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	454.4	360.56	300.92	167.46	69.48	0	0	0	0	180.47	329.68	463.88	
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 2326.86 (98)

Space heating requirement in $kWh/m^2/year$

44.99 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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

Heat loss rate L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	559.71	440.62	451.76	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.88	0.94	0.91	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	494.33	412.78	412.89	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	637.61	609.83	568.87	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

set (104)m to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	103.16	146.61	116.05	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = $Sum(104) =$ 365.81 (104)

Cooled fraction

$f_C = \text{cooled area} \div (4) =$ 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = $Sum(104) =$ 0 (106)

Space cooling requirement for month = $(104)m \times (105) \times (106)m$

(107)m=	0	0	0	0	0	25.79	36.65	29.01	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = $Sum(107) =$ 91.45 (107)

Space cooling requirement in $kWh/m^2/year$

$(107) \div (4) =$ 1.77 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 46.76 (109)

TFEE WorkSheet: New dwelling design stage

Target Fabric Energy Efficiency (TFEE)

53.77

(109)

DRAFT

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Plot 3 - 1B2P

Address : Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.72	(1a) x	2.8	(2a) =	144.82
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.72	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	144.82

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							2	x 10 =	20
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.14 (8)

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

Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <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			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(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			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3	(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
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DFEE WorkSheet: New dwelling design stage

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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors			2.04	1	2.04		(26)
Windows Type 1			3.15	x1/[1/(1.2)+0.04]	3.61		(27)
Windows Type 2			5.08	x1/[1/(1.2)+0.04]	5.82		(27)
Floor			51.72	0.13	6.7236	110	5689.2 (28)
Walls Type1	22.76	8.23	14.53	0.18	2.62	60	872.04 (29)
Walls Type2	26.29	2.04	24.25	0.17	4.05	60	1455.12 (29)
Total area of elements, m ²			100.78				(31)
Party wall			35.34	0	0	110	3886.96 (32)
Party ceiling			51.72			30	1551.6 (32b)
Internal wall **			94.36			9	849.24 (32c)

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

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

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

24.86

 (33)

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

14304.16

 (34)

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

276.57

 (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

9.56

 (36)

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

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

34.42

 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DFEE WorkSheet: New dwelling design stage

(38)m=	27.41	27.27	27.14	26.51	26.39	25.85	25.85	25.74	26.06	26.39	26.63	26.88	(38)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(39)m=	61.83	61.69	61.56	60.93	60.81	60.26	60.26	60.16	60.47	60.81	61.05	61.3	
Average = Sum(39) _{1...12} / 12 =												60.93	(39)

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

(40)m=	1.2	1.19	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19	
Average = Sum(40) _{1...12} / 12 =												1.18	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.74 (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 75.54 (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=	83.1	80.08	77.06	74.03	71.01	67.99	67.99	71.01	74.03	77.06	80.08	83.1	
Total = Sum(44) _{1...12} =												906.53	(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=	123.23	107.78	111.22	96.96	93.04	80.29	74.4	85.37	86.39	100.68	109.9	119.34	
Total = Sum(45) _{1...12} =												1188.61	(45)

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

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

DFEE WorkSheet: New dwelling design stage

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

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

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

(59)m=

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=

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=

104.75	91.61	94.54	82.42	79.08	68.24	63.24	72.57	73.43	85.58	93.42	101.44
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

104.75	91.61	94.54	82.42	79.08	68.24	63.24	72.57	73.43	85.58	93.42	101.44
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Output from water heater (annual)_{1...12} 1010.31 (64)

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

(65)m=

26.19	22.9	23.63	20.6	19.77	17.06	15.81	18.14	18.36	21.39	23.35	25.36
-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (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
(66)m=	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04

 (66)

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

(67)m=

14.12	12.55	10.2	7.72	5.77	4.87	5.27	6.85	9.19	11.67	13.62	14.52
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

151.7	153.27	149.31	140.86	130.2	120.18	113.49	111.92	115.88	124.33	134.99	145.01
-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

35.2	34.08	31.77	28.62	26.57	23.7	21.25	24.38	25.5	28.76	32.44	34.09
------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------

 (72)

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

(73)m=

250.13	249.01	240.39	226.32	211.66	197.86	189.12	192.26	199.68	213.86	230.15	242.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 _o Table 6b	FF Table 6c	Gains (W)						
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>3.15</td></tr></table>	3.15	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>18.91</td></tr></table> (80)	18.91
0.77												
3.15												
19.64												
0.63												
0.7												
18.91												
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>5.08</td></tr></table>	5.08	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>30.49</td></tr></table> (80)	30.49
0.77												
5.08												
19.64												
0.63												
0.7												
30.49												

DFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(80)

Solar gains in watts, calculated for each month

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

(83)m=	49.4	96.64	159.14	232.1	284.45	291.19	277.22	238.13	185.09	114.67	61.59	40.62	(83)
--------	------	-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	299.53	345.65	399.53	458.42	496.11	489.05	466.34	430.39	384.77	328.53	291.75	283.35	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.73	0.56	0.62	0.88	0.99	1	1	(86)

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

(87)m=	19.78	19.92	20.17	20.51	20.8	20.95	20.99	20.98	20.87	20.49	20.07	19.76	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.92	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.96	0.85	0.63	0.43	0.49	0.81	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.82	18.96	19.21	19.55	19.8	19.93	19.95	19.95	19.87	19.53	19.11	18.8	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.46 (91)

DFEE WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = $f_{LA} \times T_1 + (1 - f_{LA}) \times T_2$

(92)m=	19.26	19.4	19.65	19.99	20.26	20.4	20.42	20.42	20.33	19.97	19.55	19.24	(92)
--------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.26	19.4	19.65	19.99	20.26	20.4	20.42	20.42	20.33	19.97	19.55	19.24	(93)
--------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	1	1	0.99	0.96	0.86	0.68	0.49	0.55	0.83	0.98	1	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	299.01	344.26	394.69	438.16	427.68	330.89	227.79	237.03	320.89	321	290.66	282.98	(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, L_m , $W = [(93)m - (96)m]$

(97)m=	924.71	894.38	809.52	675.53	520.37	349.25	230.41	241.86	376.52	569.5	760.15	921.65	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	465.53	369.68	308.63	170.91	68.96	0	0	0	0	184.89	338.03	475.17	
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 2381.79 (98)

Space heating requirement in $kWh/m^2/year$

46.05 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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

Heat loss rate L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	566.48	445.95	457.23	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.89	0.94	0.92	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	503.58	420.35	420.63	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	637.61	609.83	568.87	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$

set (104)m to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	96.5	140.97	110.29	0	0	0	0	
---------	---	---	---	---	---	------	--------	--------	---	---	---	---	--

Total = $Sum(104) =$ 347.77 (104)

Cooled fraction

$f_C = \text{cooled area} \div (4) =$ 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = $Sum(104) =$ 0 (106)

Space cooling requirement for month = $(104)m \times (105) \times (106)m$

(107)m=	0	0	0	0	0	24.13	35.24	27.57	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = $Sum(107) =$ 86.94 (107)

Space cooling requirement in $kWh/m^2/year$

$(107) \div (4) =$ 1.68 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency $(99) + (108) =$ 47.73 (109)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Plot 3 - 1B2P

Address : Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.72	(1a) x	2.8	(2a) =	144.82
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.72	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	144.82

2. Ventilation rate:

	main heating	+	secondary heating	+	other	=	total		m ³ per hour
Number of chimneys	0		0		0	=	0	x 40 =	0
Number of open flues	0		0		0	=	0	x 20 =	0
Number of intermittent fans							2	x 10 =	20
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.14 (8)

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

Number of storeys in the dwelling (ns)	0	(9)
Additional infiltration	0	[(9)-1]x0.1 = (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	0.25 - [0.2 x (14) ÷ 100] = (15)
Infiltration rate	0	(8) + (10) + (11) + (12) + (13) + (15) = (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)
<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	3	(19)
Shelter factor	0.78	(20) = 1 - [0.075 x (19)] = (20)
Infiltration rate incorporating shelter factor	0.3	(21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors			2.04	1	2.04		(26)
Windows Type 1			3.15	x1/[1/(1.2)+0.04]	3.61		(27)
Windows Type 2			5.08	x1/[1/(1.2)+0.04]	5.82		(27)
Floor			51.72	0.13	6.7236	110	5689.2 (28)
Walls Type1	22.76	8.23	14.53	0.18	2.62	60	872.04 (29)
Walls Type2	26.29	2.04	24.25	0.17	4.05	60	1455.12 (29)
Total area of elements, m ²			100.78				(31)
Party wall			35.34	0	0	110	3886.96 (32)
Party ceiling			51.72			30	1551.6 (32b)
Internal wall **			94.36			9	849.24 (32c)

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

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

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

24.86

 (33)

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

14304.16

 (34)

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

276.57

 (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

9.56

 (36)

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

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

34.42

 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(38)m=	27.41	27.27	27.14	26.51	26.39	25.85	25.85	25.74	26.06	26.39	26.63	26.88	(38)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	61.83	61.69	61.56	60.93	60.81	60.26	60.26	60.16	60.47	60.81	61.05	61.3	
Average = Sum(39) _{1...12} / 12 =												60.93	(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.2	1.19	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19	
Average = Sum(40) _{1...12} / 12 =												1.18	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	1.74	(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	75.54	(43)
<i>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)</i>		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<i>Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)</i>													
(44)m=	83.1	80.08	77.06	74.03	71.01	67.99	67.99	71.01	74.03	77.06	80.08	83.1	
Total = Sum(44) _{1...12} =												906.53	(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=	123.23	107.78	111.22	96.96	93.04	80.29	74.4	85.37	86.39	100.68	109.9	119.34	
Total = Sum(45) _{1...12} =												1188.61	(45)

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

(46)m=	18.48	16.17	16.68	14.54	13.96	12.04	11.16	12.81	12.96	15.1	16.49	17.9	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	------

Water storage loss:

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

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

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

Water storage loss:

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

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

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

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

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

If community heating see section 4.3

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

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

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

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

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

DER WorkSheet: New dwelling design stage

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

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

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

(59)m=

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=

14	12.63	13.96	13.49	13.92	13.44	13.88	13.9	13.47	13.94	13.52	13.99
----	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

 (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=

137.24	120.41	125.18	110.45	106.95	93.73	88.27	99.27	99.86	114.62	123.42	133.34
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

 (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=

137.24	120.41	125.18	110.45	106.95	93.73	88.27	99.27	99.86	114.62	123.42	133.34
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

Output from water heater (annual)_{1...12} 1352.75 (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=

44.48	39	40.47	35.61	34.41	30.06	28.21	31.86	32.09	36.96	39.92	43.18
-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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
(66)m=	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04

 (66)

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

(67)m=

14.12	12.55	10.2	7.72	5.77	4.87	5.27	6.85	9.19	11.67	13.62	14.52
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

151.7	153.27	149.31	140.86	130.2	120.18	113.49	111.92	115.88	124.33	134.99	145.01
-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

59.78	58.03	54.4	49.46	46.26	41.74	37.91	42.82	44.57	49.68	55.45	58.04
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

277.72	275.96	266.02	250.16	234.34	218.91	208.78	213.7	221.75	237.79	256.17	269.67
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g _o Table 6b	FF Table 6c	Gains (W)						
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>3.15</td></tr></table>	3.15	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>18.91</td></tr></table> (80)	18.91
0.77												
3.15												
19.64												
0.63												
0.7												
18.91												
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>5.08</td></tr></table>	5.08	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>30.49</td></tr></table> (80)	30.49
0.77												
5.08												
19.64												
0.63												
0.7												
30.49												

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(80)

Solar gains in watts, calculated for each month

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

(83)m=	49.4	96.64	159.14	232.1	284.45	291.19	277.22	238.13	185.09	114.67	61.59	40.62	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	327.11	372.59	425.16	482.26	518.79	510.1	486	451.83	406.85	352.45	317.76	310.3	(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	0.96	0.88	0.71	0.54	0.59	0.85	0.98	1	1	(86)

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

(87)m=	19.83	19.97	20.21	20.54	20.82	20.96	20.99	20.99	20.88	20.52	20.11	19.8	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.92	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.83	0.61	0.41	0.47	0.78	0.97	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.57	18.93	19.41	19.76	19.92	19.95	19.94	19.85	19.39	18.79	18.34	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

DER WorkSheet: New dwelling design stage

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

(92)m=	19.03	19.21	19.52	19.93	20.24	20.4	20.42	20.42	20.32	19.91	19.4	19.01	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	------

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

(93)m=	18.88	19.06	19.37	19.78	20.09	20.25	20.27	20.27	20.17	19.76	19.25	18.86	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.84	0.64	0.45	0.51	0.8	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

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

(95)m=	326.13	370.23	417.75	454.59	433.6	326.46	219.66	229.7	324.36	340.63	315.78	309.59	(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=	901.67	873.44	792.22	662.77	510.49	340.23	221.4	232.89	367.37	556.73	741.59	898.33	(97)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(98)m=	428.2	338.15	278.6	149.88	57.2	0	0	0	0	160.78	306.58	438.03	
--------	-------	--------	-------	--------	------	---	---	---	---	--------	--------	--------	--

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2157.43 (98)

Space heating requirement in kWh/m²/year

	41.71	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

	0	(201)
--	---	-------

Fraction of space heat from main system(s)

(202) = 1 – (201) =

	1	(202)
--	---	-------

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

	1	(204)
--	---	-------

Efficiency of main space heating system 1

	90.5	(206)
--	------	-------

Efficiency of secondary/supplementary heating system, %

	0	(208)
--	---	-------

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

Space heating requirement (calculated above)

428.2	338.15	278.6	149.88	57.2	0	0	0	0	160.78	306.58	438.03
-------	--------	-------	--------	------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

473.15	373.65	307.85	165.62	63.21	0	0	0	0	177.66	338.77	484.01
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 2383.9 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

137.24	120.41	125.18	110.45	106.95	93.73	88.27	99.27	99.86	114.62	123.42	133.34
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

Efficiency of water heater

	87.3	(216)
--	------	-------

(217)m=	89.7	89.64	89.48	89.11	88.39	87.3	87.3	87.3	87.3	89.14	89.56	89.73	(217)
---------	------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	152.99	134.33	139.89	123.94	121	107.36	101.12	113.72	114.38	128.59	137.82	148.6	
---------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	-------	--

Total = Sum(219a)_{1...12} = 1523.74 (219)

DER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2383.9
Water heating fuel used		1523.74
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
Electricity for lighting		249.45 (232)
Electricity generated by PVs		-616.62 (233)

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	=	514.92 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	329.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =				844.05 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	129.46 (268)
Energy saving/generation technologies Item 1			0.519	=	-320.03 (269)
Total CO2, kg/year		sum of (265)...(271) =			692.41 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			13.39 (273)
El rating (section 14)					90 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Plot 3 - 1B2P

Address : Plot 3, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	51.72	(1a) x	2.8	(2a) =	144.82
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.72	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	144.82

2. Ventilation rate:

	main heating	+	secondary heating	+	other	=	total		m ³ per hour
Number of chimneys	0		0		0	=	0	x 40 =	0
Number of open flues	0		0		0	=	0	x 20 =	0
Number of intermittent fans					2	=	2	x 10 =	20
Number of passive vents					0	=	0	x 10 =	0
Number of flueless gas fires					0	=	0	x 40 =	0

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.14 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 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 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.3 (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
------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m=

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors			2.04	x 1	= 2.04		(26)
Windows Type 1			3.15	x 1/[1/(1.4)+0.04]	= 4.18		(27)
Windows Type 2			5.08	x 1/[1/(1.4)+0.04]	= 6.73		(27)
Floor			51.72	x 0.13	= 6.7236		(28)
Walls Type1	22.76	8.23	14.53	x 0.18	= 2.62		(29)
Walls Type2	26.29	2.04	24.25	x 0.18	= 4.37		(29)
Total area of elements, m ²			100.78				(31)
Party wall			35.34	x 0	= 0		(32)
Party ceiling			51.72				(32b)
Internal wall **			94.36				(32c)

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

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

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

26.66

 (33)

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

14304.16

 (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

7.04

 (36)

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

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

33.7

 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(38)m=	27.41	27.27	27.14	26.51	26.39	25.85	25.85	25.74	26.06	26.39	26.63	26.88	(38)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(39)m=	61.11	60.97	60.84	60.21	60.09	59.54	59.54	59.44	59.75	60.09	60.33	60.58	
Average = Sum(39) _{1...12} / 12 =												60.21	(39)

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

(40)m=	1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17	
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 1.74 (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 V_{d,average} = (25 x N) + 36 75.54 (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=	83.1	80.08	77.06	74.03	71.01	67.99	67.99	71.01	74.03	77.06	80.08	83.1	
Total = Sum(44) _{1...12} =												906.53	(44)

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

(45)m=	123.23	107.78	111.22	96.96	93.04	80.29	74.4	85.37	86.39	100.68	109.9	119.34	
Total = Sum(45) _{1...12} =												1188.61	(45)

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

(46)m=	18.48	16.17	16.68	14.54	13.96	12.04	11.16	12.81	12.96	15.1	16.49	17.9	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	------

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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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=

42.35	36.86	39.27	36.51	36.19	33.53	34.65	36.19	36.51	39.27	39.49	42.35
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 (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=

165.58	144.64	150.49	133.47	129.23	113.82	109.04	121.56	122.9	139.95	149.39	161.69
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 (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=

165.58	144.64	150.49	133.47	129.23	113.82	109.04	121.56	122.9	139.95	149.39	161.69
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

Output from water heater (annual)_{1...12} 1641.75 (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=

51.56	45.05	46.8	41.37	39.98	35.08	33.4	37.43	37.85	43.29	46.41	50.27
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 (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
(66)m=	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04	87.04

 (66)

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

(67)m=

14.12	12.55	10.2	7.72	5.77	4.87	5.27	6.85	9.19	11.67	13.62	14.52
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 (67)

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

(68)m=

151.7	153.27	149.31	140.86	130.2	120.18	113.49	111.92	115.88	124.33	134.99	145.01
-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63	-69.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

69.3	67.04	62.9	57.46	53.74	48.72	44.89	50.31	52.57	58.19	64.46	67.57
------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

287.24	284.97	274.52	258.15	241.83	225.89	215.76	221.19	229.76	246.3	265.18	279.2
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 (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 _o Table 6b	FF Table 6c	Gains (W)						
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>3.15</td></tr></table>	3.15	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>18.91</td></tr></table> (80)	18.91
0.77												
3.15												
19.64												
0.63												
0.7												
18.91												
West	0.9x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.77</td></tr></table>	0.77	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>5.08</td></tr></table>	5.08	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>19.64</td></tr></table>	19.64	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.63</td></tr></table>	0.63	x <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>0.7</td></tr></table>	0.7	= <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td>30.49</td></tr></table> (80)	30.49
0.77												
5.08												
19.64												
0.63												
0.7												
30.49												

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West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(80)

Solar gains in watts, calculated for each month

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

(83)m=	49.4	96.64	159.14	232.1	284.45	291.19	277.22	238.13	185.09	114.67	61.59	40.62	(83)
--------	------	-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	336.64	381.61	433.67	490.26	526.28	517.07	492.98	459.31	414.85	360.96	326.78	319.82	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.58	0.83	0.97	0.99	1	(86)

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

(87)m=	19.76	19.91	20.18	20.52	20.8	20.95	20.99	20.98	20.88	20.5	20.07	19.74	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.93	0.81	0.59	0.4	0.46	0.76	0.96	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.3	18.51	18.9	19.4	19.76	19.93	19.96	19.95	19.86	19.38	18.75	18.26	(90)
--------	------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

TER WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.97	19.15	19.48	19.91	20.24	20.4	20.43	20.43	20.32	19.89	19.35	18.94	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.97	19.15	19.48	19.91	20.24	20.4	20.43	20.43	20.32	19.89	19.35	18.94	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=	0.99	0.99	0.98	0.93	0.82	0.64	0.46	0.51	0.78	0.96	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=	334.93	377.87	423.23	456.21	432.69	328.64	225.4	234.87	325.64	345.3	323.6	318.55	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	896.21	868.98	789.85	662.96	513.09	345.17	227.97	239.27	371.94	558.34	739.27	892.63	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	417.59	330.03	272.77	148.86	59.82	0	0	0	0	158.5	299.29	427.12	
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Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$ 2113.98 (98)

Space heating requirement in $kWh/m^2/year$

													(99)
													40.87

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

Space heating:

Fraction of space heat from secondary/supplementary system

													(201)
													0

Fraction of space heat from main system(s)

(202) = $1 - (201) =$

													(202)
													1

Fraction of total heating from main system 1

(204) = $(202) \times [1 - (203)] =$

													(204)
													1

Efficiency of main space heating system 1

													(206)
													93.4

Efficiency of secondary/supplementary heating system, %

													(208)
													0

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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$kWh/year$

Space heating requirement (calculated above)

417.59	330.03	272.77	148.86	59.82	0	0	0	0	158.5	299.29	427.12
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

447.1	353.35	292.04	159.38	64.05	0	0	0	0	169.7	320.44	457.3
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Total ($kWh/year$) = $Sum(211)_{1...5,10...12} =$ 2263.36 (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	
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Total ($kWh/year$) = $Sum(215)_{1...5,10...12} =$ 0 (215)

Water heating

Output from water heater (calculated above)

165.58	144.64	150.49	133.47	129.23	113.82	109.04	121.56	122.9	139.95	149.39	161.69
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Efficiency of water heater

													(216)
													80.3

(217)m= 87.28 87.06 86.53 85.33 83.24 80.3 80.3 80.3 80.3 85.37 86.77 87.38 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	189.7	166.13	173.91	156.43	155.24	141.74	135.8	151.38	153.05	163.94	172.18	185.04	
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Total = $Sum(219a)_{1...12} =$ 1944.53 (219)

TER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2263.36
Water heating fuel used		1944.53
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		249.45 (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	=	488.89 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	420.02 (264)
Space and water heating	(261) + (262) + (263) + (264) =				908.9 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	129.46 (268)
Total CO2, kg/year	sum of (265)...(271) =				1077.29 (272)
TER =					20.83 (273)

DRAFT

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 30 June 2020

Property Details: Plot 3 - 1B2P

Dwelling type:	Flat
Located in:	England
Region:	Thames valley
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Calculated 276.57
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	2 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	95.58	(P1)
Transmission heat loss coefficient:	34.4	
Summer heat loss coefficient:	130	(P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
West (Bedroom)	0	1
West (Terrace)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
West (Bedroom)	0.85	0.9	1	0.76	(P8)
West (Terrace)	0.85	0.9	1	0.76	(P8)

Solar gains:

Orientation		Area	Flux	g ₋	FF	Shading	Gains
West (Bedroom)	0.9 x	3.15	117.51	0.63	0.7	0.76	112.39
West (Terrace)	0.9 x	5.08	117.51	0.63	0.7	0.76	181.25
						Total	293.63 (P3/P4)

Internal gains:

	June	July	August
Internal gains	315.31	302.47	308.98
Total summer gains	627.01	596.1	567.31 (P5)
Summer gain/loss ratio	4.82	4.59	4.36 (P6)
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	0.06	0.06	0.06
Threshold temperature	20.89	22.55	22.23 (P7)
Likelihood of high internal temperature	Slight	Medium	Medium

Assessment of likelihood of high internal temperature: Medium