



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 100 Highwood Avenue, North Stoneham Park
EASTLEIGH, SO50 9QZ

Contact: Scott Spearing | BEAT Solutions
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Report Issue Date: 31/01/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 199	Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	FOG 1
Property	100 Highwood Avenue, North Stoneham Park, EASTLEIGH, SO50 9QZ		
SAP Rating	85 B	DER	17.03
Environmental	86 B	TER	21.56
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.02
General Requirements Compliance	Pass	DFEE	55.66
		TFEE	68.87
		% DFEE<TFEE	19.19
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk		Assessor ID
			p775-0001
Client	Highwood Construction Ltd, HIGHWOOD		

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	21.56	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.03	kgCO ₂ /m ²	Pass
	-4.53 (-21.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	68.87	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	55.66	kWh/m ² /yr	
	-13.2 (-19.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Floor	0.16 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.12 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
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Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

5.63 m², No overhang

Windows facing South

4.57 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.12 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.10

W/m²K

Photovoltaic array

0.64

kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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General Requirements Compliance		Pass	% DFEE<TFEE	19.19		
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SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	13.44 m	6.30 m ²	2.40 m
1st Storey:	36.90 m	80.15 m ²	2.40 m

7.0 Living Area 24.50 m²

8.0 Thermal Mass Parameter
Thermal Mass Precise calculation
52.59 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	120.82	108.45

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - FF	Plasterboard on timber frame	9.00	99.98

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	80.15	80.15

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.18	75.00	6.30
Suspended Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.16	20.00	73.85

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Solid Doors	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Wall	North							2.17	
Front Elevation	Window	[1] External Wall	North	None	0.00					5.63	
Rear Elevation	Window	[1] External Wall	South	None	0.00					4.57	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	10.00	0.300	Yes
Table K1 - Approved	E3 Sill	8.97	0.040	Yes
Table K1 - Approved	E4 Jamb	22.38	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	13.44	0.160	No
Table K1 - Default	E20 Exposed floor (normal)	28.45	0.320	No
Table K1 - Default	E21 Exposed floor (inverted)	4.95	0.320	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	6.40	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	24.88	0.060	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	12.02	0.240	No
Table K1 - Approved	E16 Corner (normal)	14.40	0.090	No

Y-value 0.083 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 6.00 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 4.12 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows fully open

Cross ventilation possible Yes

Night Ventilation Yes

Air change rate 8.00

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

SUMMARY FOR INPUT DATA

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22.0 Lighting

Internal

Total number of light fittings	17	
Total number of L.E.L. fittings	17	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Boiler	
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder

None

32.0 Photovoltaic Unit

One Dwelling

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

PV Cells kWp

0.64

Orientation

South

Elevation

45°

Overshading

None Or Little

Connected to Dwelling

Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

U-VALUE CALCULATOR REPORT

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CO ₂ Emissions (t/year)	1.19	DFEE	55.66	TFEE	68.87
General Requirements Compliance	Pass	% DFEE<TFEE	19.19		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	A808-0004
Client	Highwood Construction Ltd, HIGHWOOD		

Building Elements

Roof Pitched Roof - 400mm Quilt

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool				
	Main construction	300	0.0400	7.5000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	100	0.0400	2.5000	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 10.046 m ² K/W	Lower limit = 9.832 m ² K/W	Average = 9.939 m ² K/W
	Total correction = 0.0005 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

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CO ₂ Emissions (t/year)	1.19	DFEE	55.66	TREE	68.87
General Requirements Compliance	Pass	% DFEE<TFEE	19.19		

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Building Elements

Wall External Walls - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.2900	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.0000	82.81
	Main construction	100	0.9407	0.0000	17.19
Layer 2	Standard cavity				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 6	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 8	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 9	Service Void				
	Main construction	25	0.0321	0.7800	89.63
	Main construction	25	0.1300	0.1923	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 11	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.477 m² K/W Lower limit = 4.778 m² K/W Average = 5.128 m² K/W
Total correction = 0.0041 m² K/W U-value (unrounded) = 0.2 W/m² K

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

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General Requirements Compliance	Pass	% DFEE<TFEE	19.19		

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Client	Highwood Construction Ltd, HIGHWOOD
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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 5.45 m², Perimeter = 12.11 m, Wall thickness = 275.00 mm, Soil: Unknown

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Blockwork, dense				
	Main construction	100	1.5900	0.0629	82.95
	Main construction	100	2.2000	0.0455	17.05
Layer 2	Jablite Jabfloor (HP)				
	Main construction	150	0.0320	4.6875	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 5.153 m² K/W Lower limit = 5.152 m² K/W Average = 5.152 m² K/W

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.18 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.18 W/m² K

Kappa: n/a

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Building Elements

Floor Suspended Exposed Floors

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Layer 2	Joist Void				
	Main construction	35	0.1768	0.1980	87.50
	Main construction	35	0.1300	0.2692	12.50
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Mineral wool				
	Main construction	200	0.0400	5.0000	87.50
	Main construction	200	0.1300	1.5385	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Celotex TB4000				
	Main construction	25	0.0220	1.1364	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	airspace/timber battens				
	Main construction	22	0.1222	0.1800	89.63
	Main construction	22	0.1196	0.1840	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Masterboard				
	Main construction	12	0.2200	0.0545	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 6.191 m ² K/W	Lower limit = 5.858 m ² K/W	Average = 6.024 m ² K/W
	Total correction = 0.0046 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: GarageSingle1Outside

Total thickness: 316 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS BUILT

Top-floor flat, total floor area 86 m²

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:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 21.56 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.03 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)68.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.12 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESPl 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	5.63 m ² , No overhang
Windows facing South:	4.57 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.10 W/m ² K
Photovoltaic array	0.64 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					4.1200
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4470	0.4382	0.4295	0.3857	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4119 (22b)
	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1700	1.4000	3.0380		(26)
Windows (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3700	108.4500	0.2000	21.6900	9.0000	976.0500 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2157		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5936 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6535 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.0747	40.8090	40.5487	39.3258	39.0969	38.0318	38.0318	37.8346	38.4421	39.0969	39.5598	40.0437 (38)
Heat transfer coeff	123.7282	123.4626	123.2022	121.9793	121.7505	120.6854	120.6854	120.4881	121.0956	121.7505	122.2133	122.6973 (39)
Average = Sum(39)m / 12 =												121.9782 (39)
HLP	1.4312	1.4281	1.4251	1.4110	1.4083	1.3960	1.3960	1.3937	1.4008	1.4083	1.4137	1.4193 (40)
HLP (average)												1.4110 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1499.9312 (45)
Water storage loss:	23.3266	20.4016	21.0526	18.3542	17.6113	15.1972	14.0824	16.1598	16.3528	19.0576	20.8029	22.5906 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1298	12.7517	14.0841	13.5872	14.0091	13.5214	13.9499	13.9883	13.5572	14.0531	13.6456	14.1180 (61)
Total heat required for water heating calculated for each month	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219 (64)
Heat gains from water heating, kWh/month	55.2398	48.4115	50.1877	44.0819	42.5406	37.0675	34.7035	39.3180	39.6380	45.7577	49.5245	53.6053 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0824	20.5016	16.6730	12.6226	9.4355	7.9659	8.6074	11.1882	15.0168	19.0673	22.2543	23.7240	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.3930	234.8045	228.7276	215.7905	199.4598	184.1112	173.8574	171.4459	177.5228	190.4599	206.7906	222.1392	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	(71)
Water heating gains (Table 5)	74.2470	72.0409	67.4566	61.2249	57.1783	51.4826	46.6446	52.8467	55.0528	61.5022	68.7840	72.0501	(72)
Total internal gains	394.3317	391.9562	377.4664	354.2472	330.6827	308.1689	293.7185	300.0900	312.2016	335.6386	362.4381	382.5225	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				5.6300	10.6334	0.6300		0.7000		0.7700		18.2958 (74)	
South				4.5700	46.7521	0.6300		0.7000		0.7700		65.2963 (78)	

Solar gains	83.5922	141.9028	195.6336	249.3913	288.9908	292.0197	279.3436	248.4404	213.7322	156.9637	99.9687	71.6743	(83)
Total gains	477.9238	533.8591	573.1000	603.6384	619.6735	600.1886	573.0622	548.5305	525.9338	492.6023	462.4068	454.1968	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.2077	10.2296	10.2513	10.3540	10.3735	10.4650	10.4650	10.4822	10.4296	10.3735	10.3342	10.2934	
alpha	1.6805	1.6820	1.6834	1.6903	1.6916	1.6977	1.6977	1.6988	1.6953	1.6916	1.6889	1.6862	
util living area	0.9330	0.9174	0.8948	0.8567	0.7965	0.7057	0.6051	0.6327	0.7628	0.8657	0.9167	0.9381	(86)
MIT	16.9708	17.2694	17.8235	18.5918	19.3938	20.1173	20.5338	20.4752	19.9035	18.8881	17.8023	16.9098	(87)
Th 2	19.7395	19.7418	19.7441	19.7549	19.7569	19.7664	19.7664	19.7681	19.7628	19.7569	19.7529	19.7486	(88)
util rest of house	0.9251	0.9076	0.8814	0.8359	0.7613	0.6412	0.4989	0.5326	0.7091	0.8423	0.9051	0.9308	(89)
MIT 2	16.0887	16.3850	16.9343	17.6967	18.4765	19.1626	19.5228	19.4801	18.9731	17.9967	16.9240	16.0341	(90)
Living area fraction									fLA = Living area / (4) =			0.2834	(91)
MIT	16.3386	16.6357	17.1863	17.9504	18.7364	19.4331	19.8094	19.7621	19.2368	18.2493	17.1729	16.2823	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.3386	16.6357	17.1863	17.9504	18.7364	19.4331	19.8094	19.7621	19.2368	18.2493	17.1729	16.2823	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	427.4803	466.3415	483.7112	480.8213	449.2929	372.2933	288.3712	291.8079	357.9178	396.2336	402.8899	409.4694	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1489.5195	1448.9143	1316.5744	1103.9615	856.6899	583.2888	387.3228	405.0966	622.0437	931.3069	1231.0389	1482.4619	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	790.1571	660.2889	619.6502	448.6609	303.1034	0.0000	0.0000	0.0000	0.0000	398.0945	596.2673	798.3065	(98)
Space heating												4614.5289	(98)
Space heating per m2												53.3780	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5098.9270 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	790.1571	660.2889	619.6502	448.6609	303.1034	0.0000	0.0000	0.0000	0.0000	398.0945	596.2673	798.3065	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	873.1018	729.6010	684.6964	495.7579	334.9209	0.0000	0.0000	0.0000	0.0000	439.8835	658.8589	882.1066	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Efficiency of water heater (217)m	89.9175	89.8941	89.8430	89.7351	89.5077	87.3000	87.3000	87.3000	87.3000	89.6401	89.8300	87.3000	(216)
Fuel for water heating, kWh/month	188.6626	165.4863	171.8943	151.4998	146.8227	131.5419	123.5198	139.4276	140.4077	157.4115	169.5776	183.1543	(219)
Water heating fuel used												1869.4062	(219)
Annual totals kWh/year													
Space heating fuel - main system												5098.9270	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.6430	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1068 * 1.00) =										-546.8521		-546.8521	(233)
Total delivered energy for all uses												6904.1240	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5098.9270	0.2160	1101.3682 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1869.4062	0.2160	403.7917 (264)
Space and water heating			1505.1600 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Energy saving/generation technologies			
PV Unit	-546.8521	0.5190	-283.8162 (269)
Total CO2, kg/year			1471.8354 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0300 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.0300	ZC1
Total Floor Area	TFA	86.4500	
Assumed number of occupants	N	2.5739	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9296	ZC2
CO2 emissions from cooking, equation (L16)		2.0911	ZC3
Total CO2 emissions		35.0507	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.0507	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3946 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3946 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5031	0.4932	0.4834	0.4341	0.4242	0.3749	0.3749	0.3650	0.3946	0.4242	0.4439	0.4636 (22b)
Effective ac	0.6266	0.6216	0.6168	0.5942	0.5900	0.5703	0.5703	0.5666	0.5779	0.5900	0.5985	0.6075 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1700	1.0000	2.1700		(26)
TER Opening Type (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1300	0.8190		(28a)
Suspended Floor			73.8500	0.1300	9.6005		(28b)
External Wall	120.8200	12.3700	108.4500	0.1800	19.5210		(29a)
External Roof	80.1500		80.1500	0.1300	10.4195		(30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.0527		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4159 (36)
Total fabric heat loss						(33) + (36) =	74.4686 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.8994	42.5629	42.2331	40.6839	40.3941	39.0449	39.0449	38.7950	39.5646	40.3941	40.9804	41.5934 (38)
Heat transfer coeff	117.3680	117.0315	116.7017	115.1526	114.8627	113.5135	113.5135	113.2636	114.0332	114.8627	115.4491	116.0621 (39)
Average = Sum(39)m / 12 =												115.1512 (39)
HLP	1.3576	1.3537	1.3499	1.3320	1.3287	1.3131	1.3131	1.3102	1.3191	1.3287	1.3354	1.3425 (40)
HLP (average)												1.3320 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3266	20.4016	21.0526	18.3542	17.6113	15.1972	14.0824	16.1598	16.3528	19.0576	20.8029	22.5906 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	49.5513	46.0274	45.6650	42.3114	43.7218	45.6650	46.0724	49.5513	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	206.4697	182.0381	189.9022	168.4337	163.0735	143.6261	137.6047	153.3970	155.0911	176.6021	188.0010	201.5628	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	206.4697	182.0381	189.9022	168.4337	163.0735	143.6261	137.6047	153.3970	155.0911	176.6021	188.0010	201.5628	(64)
Heat gains from water heating, kWh/month	64.4471	56.7304	59.0545	52.2032	50.4546	44.2650	42.1465	47.2371	47.7668	54.6322	58.4418	62.8155	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0824	20.5016	16.6730	12.6226	9.4355	7.9659	8.6074	11.1882	15.0168	19.0673	22.2543	23.7240	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.3930	234.8045	228.7276	215.7905	199.4598	184.1112	173.8574	171.4459	177.5228	190.4599	206.7906	222.1392	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	(71)
Water heating gains (Table 5)	86.6224	84.4203	79.3743	72.5045	67.8153	61.4791	56.6486	63.4908	66.3428	73.4304	81.1692	84.4295	(72)
Total internal gains	406.7070	404.3356	389.3841	365.5268	341.3198	318.1654	303.7225	310.7341	323.4916	347.5668	374.8233	394.9018	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					5.6300	10.6334	0.6300	0.7000	0.7700	18.2958		
South					4.5700	46.7521	0.6300	0.7000	0.7700	65.2963 (74)		
Solar gains	83.5922	141.9028	195.6336	249.3913	288.9908	292.0197	279.3436	248.4404	213.7322	156.9637	99.9687	71.6743 (83)
Total gains	490.2992	546.2384	585.0177	614.9180	630.3106	610.1851	583.0661	559.1745	537.2238	504.5304	474.7920	466.5762 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.1508	51.2979	51.4429	52.1349	52.2665	52.8877	52.8877	53.0044	52.6467	52.2665	52.0010	51.7264	
alpha	4.4101	4.4199	4.4295	4.4757	4.4844	4.5258	4.5258	4.5336	4.5098	4.4844	4.4667	4.4484	
util living area	0.9983	0.9970	0.9941	0.9855	0.9593	0.8825	0.7505	0.7892	0.9353	0.9878	0.9969	0.9987	(86)
MIT	19.4607	19.5968	19.8358	20.1721	20.5122	20.8017	20.9348	20.9158	20.7003	20.2675	19.8110	19.4426	(87)
Th 2	19.7960	19.7990	19.8019	19.8158	19.8185	19.8306	19.8306	19.8329	19.8259	19.8185	19.8132	19.8077	(88)
util rest of house	0.9977	0.9959	0.9917	0.9788	0.9367	0.8077	0.5979	0.6482	0.8884	0.9808	0.9956	0.9982	(89)
MIT 2	17.7576	17.9585	18.3094	18.8069	19.2912	19.6747	19.8027	19.7922	19.5547	18.9493	18.2817	17.7390	(90)
Living area fraction	18.2402	18.4228	18.7420	19.1938	19.6373	19.9941	20.1235	20.1106	19.8794	19.3229	18.7151	18.2218	(91)
MIT	18.2402	18.4228	18.7420	19.1938	19.6373	19.9941	20.1235	20.1106	19.8794	19.3229	18.7151	18.2218	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2402	18.4228	18.7420	19.1938	19.6373	19.9941	20.1235	20.1106	19.8794	19.3229	18.7151	18.2218	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	488.6073	542.9803	578.3462	598.7900	587.4857	500.6239	373.9096	384.2517	478.7543	492.7051	471.8129	465.2906	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1636.1369	1582.5921	1428.6599	1185.3558	911.6966	612.2995	399.9665	420.2776	659.0424	1001.9367	1340.9546	1627.3987	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	853.7620	698.6191	632.6334	422.3273	241.2129	0.0000	0.0000	0.0000	0.0000	378.8683	625.7820	864.6084	(98)
Space heating												4717.8134	(98)
Space heating per m2												54.5727	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5051.1921 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	853.7620	698.6191	632.6334	422.3273	241.2129	0.0000	0.0000	0.0000	0.0000	378.8683	625.7820	864.6084 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	914.0921	747.9862	677.3377	452.1706	258.2579	0.0000	0.0000	0.0000	0.0000	405.6405	670.0021	925.7049 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	206.4697	182.0381	189.9022	168.4337	163.0735	143.6261	137.6047	153.3970	155.0911	176.6021	188.0010	201.5628 (64)
Efficiency of water heater (217)m	88.2387	88.1092	87.8490	87.2704	86.0351	80.3000	80.3000	80.3000	80.3000	86.9240	87.8474	80.3000 (216)
Fuel for water heating, kWh/month	233.9900	206.6051	216.1690	193.0021	189.5431	178.8619	171.3633	191.0299	193.1396	203.1685	214.0086	228.2696 (219)
Water heating fuel used												2419.1506 (219)
Annual totals kWh/year												
Space heating fuel - main system												5051.1921 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												407.6430 (232)
Total delivered energy for all uses												7952.9857 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5051.1921	0.2160	1091.0575 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2419.1506	0.2160	522.5365 (264)
Space and water heating			1613.5940 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Total CO2, kg/m2/year			1864.0857 (272)
Emissions per m2 for space and water heating			18.6651 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4473 (272b)
Emissions per m2 for pumps and fans			0.4503 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.6651 * 1.00) + 2.4473 + 0.4503, rounded to 2 d.p.			21.5600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.4800 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					4.1200
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4470	0.4382	0.4295	0.3857	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4119 (22b)
	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1700	1.4000	3.0380		(26)
Windows (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3700	108.4500	0.2000	21.6900	9.0000	976.0500 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2157		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5936 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6535 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.0747	40.8090	40.5487	39.3258	39.0969	38.0318	38.0318	37.8346	38.4421	39.0969	39.5598	40.0437 (38)
Heat transfer coeff	123.7282	123.4626	123.2022	121.9793	121.7505	120.6854	120.6854	120.4881	121.0956	121.7505	122.2133	122.6973 (39)
Average = Sum(39)m / 12 =												121.9782 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4312	1.4281	1.4251	1.4110	1.4083	1.3960	1.3960	1.3937	1.4008	1.4083	1.4137	1.4193 (40)
HLP (average)												1.4110 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1499.9312 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.0460	28.9023	29.8246	26.0018	24.9493	21.5294	19.9501	22.8931	23.1665	26.9983	29.4708	32.0033 (65)

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	23.0824	20.5016	16.6730	12.6226	9.4355	7.9659	8.6074	11.1882	15.0168	19.0673	22.2543	23.7240 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	232.3930	234.8045	228.7276	215.7905	199.4598	184.1112	173.8574	171.4459	177.5228	190.4599	206.7906	222.1392 (68)
Pumps, fans	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578 (71)
Total internal gains	44.4167	43.0093	40.0868	36.1136	33.5340	29.9019	26.8147	30.7702	32.1757	36.2880	40.9316	43.0152 (72)
	361.5014	359.9247	347.0966	326.1358	304.0385	283.5882	270.8887	275.0135	286.3245	307.4244	331.5857	350.4876 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
North	5.6300											18.2958 (74)
South	4.5700											65.2963 (78)

Solar gains	83.5922	141.9028	195.6336	249.3913	288.9908	292.0197	279.3436	248.4404	213.7322	156.9637	99.9687	71.6743 (83)
Total gains	445.0935	501.8275	542.7302	575.5271	593.0293	575.6078	550.2323	523.4540	500.0566	464.3881	431.5544	422.1619 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	10.2077	10.2296	10.2513	10.3540	10.3735	10.4650	10.4650	10.4822	10.4296	10.3735	10.3342	10.2934
util living area	1.6805	1.6820	1.6834	1.6903	1.6916	1.6977	1.6977	1.6988	1.6953	1.6916	1.6889	1.6862
	0.9396	0.9243	0.9023	0.8651	0.8066	0.7176	0.6181	0.6473	0.7756	0.8756	0.9244	0.9444 (86)
MIT	16.9018	17.2048	17.7658	18.5435	19.3554	20.0908	20.5169	20.4544	19.8698	18.8382	17.7397	16.8412 (87)
Th 2	19.7395	19.7418	19.7441	19.7549	19.7569	19.7664	19.7664	19.7681	19.7628	19.7569	19.7529	19.7486 (88)
util rest of house	0.9323	0.9152	0.8896	0.8453	0.7725	0.6542	0.5120	0.5477	0.7234	0.8535	0.9137	0.9377 (89)
MIT 2	16.0211	16.3221	16.8787	17.6513	18.4421	19.1416	19.5123	19.4664	18.9448	17.9500	16.8633	15.9668 (90)
Living area fraction									fLA = Living area / (4) =			0.2834 (91)
MIT	16.2707	16.5723	17.1301	17.9041	18.7009	19.4106	19.7970	19.7464	19.2070	18.2017	17.1116	16.2146 (92)
Temperature adjustment												0.0000
adjusted MIT	16.2707	16.5723	17.1301	17.9041	18.7009	19.4106	19.7970	19.7464	19.2070	18.2017	17.1116	16.2146 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9034	0.8825	0.8533	0.8063	0.7358	0.6320	0.5151	0.5456	0.6937	0.8161	0.8815	0.9102 (94)
Ext temp.	402.0970	442.8733	463.1049	464.0405	436.3256	363.7872	283.4125	285.6163	346.9143	378.9823	380.3952	384.2668 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1481.1137	1441.0862	1309.6524	1098.3165	852.3662	580.5653	385.8283	403.2021	618.4303	925.5111	1223.5568	1474.1633 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	802.7884	670.7990	629.8313	456.6787	309.5342	0.0000	0.0000	0.0000	0.0000	406.6175	607.0764	810.8830 (98)
Space heating per m2												4694.2085 (98)
										(98) / (4) =		54.2997 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1134.4423	893.0716	915.7096	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.5048	0.5686	0.5475	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	572.6123	507.8405	501.3952	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	770.4276	738.8239	709.5116	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	142.4271	171.8517	154.8386	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												469.1174 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	35.6068	42.9629	38.7097	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												117.2793 (107)
Energy for space heating												1.3566 (108)
Energy for space cooling												54.2997 (99)
Total												1.3566 (108)
Dwelling Fabric Energy Efficiency (DFEE)												55.6563 (109)
												55.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3946 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3946 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5031	0.4932	0.4834	0.4341	0.4242	0.3749	0.3749	0.3650	0.3946	0.4242	0.4439	0.4636 (22b)
Effective ac	0.6266	0.6216	0.6168	0.5942	0.5900	0.5703	0.5703	0.5666	0.5779	0.5900	0.5985	0.6075 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1700	1.0000	2.1700		(26)
TER Opening Type (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1300	0.8190		(28a)
Suspended Floor			73.8500	0.1300	9.6005		(28b)
External Wall	120.8200	12.3700	108.4500	0.1800	19.5210		(29a)
External Roof	80.1500		80.1500	0.1300	10.4195		(30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.0527	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4159 (36)
Total fabric heat loss						(33) + (36) =	74.4686 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.8994	42.5629	42.2331	40.6839	40.3941	39.0449	39.0449	38.7950	39.5646	40.3941	40.9804	41.5934 (38)
Heat transfer coeff	117.3680	117.0315	116.7017	115.1526	114.8627	113.5135	113.5135	113.2636	114.0332	114.8627	115.4491	116.0621 (39)
Average = Sum(39)m / 12 =												115.1512 (39)
HLP	1.3576	1.3537	1.3499	1.3320	1.3287	1.3131	1.3131	1.3102	1.3191	1.3287	1.3354	1.3425 (40)
HLP (average)												1.3320 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m												1499.9312 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.0460	28.9023	29.8246	26.0018	24.9493	21.5294	19.9501	22.8931	23.1665	26.9983	29.4708	32.0033 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	128.6973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.0824	20.5016	16.6730	12.6226	9.4355	7.9659	8.6074	11.1882	15.0168	19.0673	22.2543	23.7240	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.3930	234.8045	228.7276	215.7905	199.4598	184.1112	173.8574	171.4459	177.5228	190.4599	206.7906	222.1392	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	35.8697	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	(71)
Water heating gains (Table 5)	44.4167	43.0093	40.0868	36.1136	33.5340	29.9019	26.8147	30.7702	32.1757	36.2880	40.9316	43.0152	(72)
Total internal gains	361.5014	359.9247	347.0966	326.1358	304.0385	283.5882	270.8887	275.0135	286.3245	307.4244	331.5857	350.4876	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					5.6300	10.6334	0.6300	0.7000	0.7700		18.2958 (74)	
South					4.5700	46.7521	0.6300	0.7000	0.7700		65.2963 (78)	
Solar gains	83.5922	141.9028	195.6336	249.3913	288.9908	292.0197	279.3436	248.4404	213.7322	156.9637	99.9687	71.6743 (83)
Total gains	445.0935	501.8275	542.7302	575.5271	593.0293	575.6078	550.2323	523.4540	500.0566	464.3881	431.5544	422.1619 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.1508	51.2979	51.4429	52.1349	52.2665	52.8877	52.8877	53.0044	52.6467	52.2665	52.0010	51.7264	
alpha	4.4101	4.4199	4.4295	4.4757	4.4844	4.5258	4.5258	4.5336	4.5098	4.4844	4.4667	4.4484	
util living area	0.9989	0.9979	0.9956	0.9887	0.9669	0.8999	0.7773	0.8174	0.9486	0.9911	0.9979	0.9991	(86)
MIT	19.4137	19.5509	19.7926	20.1332	20.4794	20.7801	20.9243	20.9017	20.6707	20.2274	19.7662	19.3962	(87)
Th 2	19.7960	19.7990	19.8019	19.8158	19.8185	19.8306	19.8306	19.8329	19.8259	19.8185	19.8132	19.8077	(88)
util rest of house	0.9985	0.9971	0.9938	0.9833	0.9478	0.8315	0.6268	0.6813	0.9087	0.9859	0.9970	0.9988	(89)
MIT 2	18.3574	18.4967	18.7401	19.0892	19.4287	19.7092	19.8076	19.7989	19.6167	19.1861	18.7229	18.3490	(90)
Living area fraction									fLA = Living area / (4) =			0.2834	(91)
MIT	18.6567	18.7954	19.0384	19.3851	19.7265	20.0127	20.1241	20.1114	19.9154	19.4812	19.0186	18.6458	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6567	18.7954	19.0384	19.3851	19.7265	20.0127	20.1241	20.1114	19.9154	19.4812	19.0186	18.6458	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	444.1691	499.9037	538.4904	564.4036	560.9255	486.2063	368.8806	376.7932	456.4073	456.8669	429.8833	421.4775	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1685.0197	1626.2016	1463.2530	1207.3835	921.9436	614.4090	400.0299	420.3697	663.1464	1020.1211	1375.9916	1676.6077	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	923.1929	756.8722	688.0233	462.9455	268.5975	0.0000	0.0000	0.0000	0.0000	419.0611	681.1980	933.8169	(98)
Space heating												5133.7074	(98)
Space heating per m2												59.3835	(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	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1067.0268	839.9998	860.8035	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6670	0.7629	0.7324	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	711.6692	640.8197	630.4746	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	770.4276	738.8239	709.5116	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.3061	72.9152	58.8036	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												174.0248	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	10.5765	18.2288	14.7009	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												43.5062 (107)
Space cooling per m2												0.5033 (108)
Energy for space heating												59.3835 (99)
Energy for space cooling												0.5033 (108)
Total												59.8868 (109)
Target Fabric Energy Efficiency (TFEE)												68.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					4.1200
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.3857	0.3594	0.3594	0.3418	0.3418	0.3243	0.3243	0.3068	0.3068	0.3331	0.3243	0.3418 (22b)
Effective ac	0.5744	0.5646	0.5646	0.5584	0.5584	0.5526	0.5526	0.5471	0.5471	0.5555	0.5526	0.5584 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1700	1.4000	3.0380		(26)
Windows (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3700	108.4500	0.2000	21.6900	9.0000	976.0500 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2157		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5936 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6535 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.3258	38.6551	38.6551	38.2343	38.2343	37.8346	37.8346	37.4559	37.4559	38.0318	37.8346	38.2343 (38)
Heat transfer coeff	121.9793	121.3086	121.3086	120.8879	120.8879	120.4881	120.4881	120.1094	120.1094	120.6854	120.4881	120.8879 (39)
Average = Sum(39)m / 12 =												120.8024 (39)
HLP	1.4110	1.4032	1.4032	1.3984	1.3984	1.3937	1.3937	1.3894	1.3894	1.3960	1.3937	1.3984 (40)
HLP (average)												1.3974 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1499.9312 (45)
Water storage loss:	23.3266	20.4016	21.0526	18.3542	17.6113	15.1972	14.0824	16.1598	16.3528	19.0576	20.8029	22.5906 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1298	12.7517	14.0841	13.5872	14.0091	13.5214	13.9499	13.9883	13.5572	14.0531	13.6456	14.1180 (61)
Total heat required for water heating calculated for each month	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219 (64)
RHI water heating demand	55.2398	48.4115	50.1877	44.0819	42.5406	37.0675	34.7035	39.3180	39.6380	45.7577	49.5245	53.6053 (65)
Heat gains from water heating, kWh/month												1665.3266 (64)
												1665 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7061	51.2540	41.6826	31.5564	23.5888	19.9146	21.5185	27.9705	37.5420	47.6682	55.6358	59.3099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.8552	350.4545	341.3845	322.0754	297.7012	274.7928	259.4887	255.8894	264.9595	284.2685	308.6427	331.5511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	(71)
Water heating gains (Table 5)	74.2470	72.0409	67.4566	61.2249	57.1783	51.4826	46.6446	52.8467	55.0528	61.5022	68.7840	72.0501	(72)
Total internal gains	586.3049	581.2460	558.0202	522.3532	485.9647	453.6866	435.1482	444.2032	465.0508	500.9354	540.5590	570.4076	(73)

6. Solar gains

[Jan]												
				Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North				5.6300				13.4839	0.6300	0.7000	0.7700	23.2004
South				4.5700				56.7559	0.6300	0.7000	0.7700	79.2682 (74)
Solar gains	102.4686	148.2771	207.3119	268.6903	296.8751	329.9430	304.1045	280.4565	238.3689	175.0101	122.1756	83.1596 (83)
Total gains	688.7734	729.5231	765.3320	791.0435	782.8398	783.6297	739.2527	724.6597	703.4197	675.9455	662.7346	653.5673 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.3540	10.4113	10.4113	10.4475	10.4475	10.4822	10.4822	10.5152	10.5152	10.4650	10.4822	10.4475	
alpha	1.6903	1.6941	1.6941	1.6965	1.6965	1.6988	1.6988	1.7010	1.7010	1.6977	1.6988	1.6965	
util living area	0.8775	0.8620	0.8299	0.7773	0.6899	0.5514	0.4312	0.4365	0.6212	0.7661	0.8457	0.8842	(86)
MIT	17.7388	17.9670	18.5031	19.1931	19.9513	20.5380	20.8002	20.7968	20.3713	19.5620	18.5740	17.7248	(87)
Th 2	19.7549	19.7609	19.7609	19.7646	19.7646	19.7681	19.7681	19.7715	19.7715	19.7664	19.7681	19.7646	(88)
util rest of house	0.8636	0.8462	0.8091	0.7466	0.6382	0.4625	0.2999	0.3046	0.5430	0.7268	0.8250	0.8708	(89)
MIT 2	16.8511	17.0779	17.6027	18.2739	18.9910	19.5057	19.6985	19.7002	19.3778	18.6379	17.6833	16.8448	(90)
Living area fraction									fLA = Living area / (4) =			0.2834	(91)
MIT	17.1026	17.3299	17.8579	18.5344	19.2631	19.7982	20.0107	20.0110	19.6593	18.8998	17.9358	17.0942	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1026	17.3299	17.8579	18.5344	19.2631	19.7982	20.0107	20.0110	19.6593	18.8998	17.9358	17.0942	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	567.7372	587.9584	588.2004	561.1218	480.2729	364.3610	242.8266	241.3888	376.1794	468.4008	520.3497	543.9526	(94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1427.4805	1386.5462	1244.3683	1031.7103	745.0499	469.6899	278.4124	277.5736	523.5975	832.7001	1148.9457	1401.5940	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	639.6490	536.6510	488.1889	338.8237	196.9940	0.0000	0.0000	0.0000	0.0000	271.0387	452.5891	638.0853	(98)
Space heating												3562.0198	(98)
RHI space heating demand												3562	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					4.1200
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4470	0.4382	0.4295	0.3857	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4119 (22b)
	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1700	1.4000	3.0380		(26)
Windows (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3700	108.4500	0.2000	21.6900	9.0000	976.0500 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2157		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5936 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6535 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.0747	40.8090	40.5487	39.3258	39.0969	38.0318	38.0318	37.8346	38.4421	39.0969	39.5598	40.0437 (38)
Heat transfer coeff	123.7282	123.4626	123.2022	121.9793	121.7505	120.6854	120.6854	120.4881	121.0956	121.7505	122.2133	122.6973 (39)
Average = Sum(39)m / 12 =												121.9782 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4312	1.4281	1.4251	1.4110	1.4083	1.3960	1.3960	1.3937	1.4008	1.4083	1.4137	1.4193 (40)
HLP (average)												1.4110 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1499.9312 (45)
Water storage loss:	23.3266	20.4016	21.0526	18.3542	17.6113	15.1972	14.0824	16.1598	16.3528	19.0576	20.8029	22.5906 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1298	12.7517	14.0841	13.5872	14.0091	13.5214	13.9499	13.9883	13.5572	14.0531	13.6456	14.1180 (61)
Total heat required for water heating calculated for each month	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219 (64)
Heat gains from water heating, kWh/month	55.2398	48.4115	50.1877	44.0819	42.5406	37.0675	34.7035	39.3180	39.6380	45.7577	49.5245	53.6053 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7061	51.2540	41.6826	31.5564	23.5888	19.9146	21.5185	27.9705	37.5420	47.6682	55.6358	59.3099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.8552	350.4545	341.3845	322.0754	297.7012	274.7928	259.4887	255.8894	264.9595	284.2685	308.6427	331.5511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	(71)
Water heating gains (Table 5)	74.2470	72.0409	67.4566	61.2249	57.1783	51.4826	46.6446	52.8467	55.0528	61.5022	68.7840	72.0501	(72)
Total internal gains	586.3049	581.2460	558.0202	522.3532	485.9647	453.6866	435.1482	444.2032	465.0508	500.9354	540.5590	570.4076	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				5.6300	10.6334	0.6300	0.7000	0.7700	18.2958 (74)			
South				4.5700	46.7521	0.6300	0.7000	0.7700	65.2963 (78)			
Solar gains	83.5922	141.9028	195.6336	249.3913	288.9908	292.0197	279.3436	248.4404	213.7322	156.9637	99.9687	71.6743 (83)
Total gains	669.8970	723.1488	753.6538	771.7445	774.9556	745.7063	714.4918	692.6436	678.7829	657.8991	640.5277	642.0820 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.2077	10.2296	10.2513	10.3540	10.3735	10.4650	10.4650	10.4822	10.4296	10.3735	10.3342	10.2934	
alpha	1.6805	1.6820	1.6834	1.6903	1.6916	1.6977	1.6977	1.6988	1.6953	1.6916	1.6889	1.6862	
util living area	0.8930	0.8756	0.8500	0.8068	0.7402	0.6403	0.5339	0.5580	0.6924	0.8084	0.8707	0.8993	(86)
MIT	17.3494	17.6266	18.1421	18.8568	19.5951	20.2538	20.6216	20.5751	20.0771	19.1531	18.1379	17.2883	(87)
Th 2	19.7395	19.7418	19.7441	19.7549	19.7569	19.7664	19.7664	19.7681	19.7628	19.7569	19.7529	19.7486	(88)
util rest of house	0.8812	0.8619	0.8323	0.7813	0.7000	0.5721	0.4293	0.4578	0.6322	0.7785	0.8542	0.8882	(89)
MIT 2	16.4572	16.7305	17.2389	17.9438	18.6542	19.2682	19.5757	19.5434	19.1150	18.2412	17.2465	16.4032	(90)
Living area fraction										fLA = Living area / (4) =		0.2834	(91)
MIT	16.7101	16.9845	17.4949	18.2026	18.9208	19.5475	19.8721	19.8357	19.3876	18.4997	17.4991	16.6541	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7101	16.9845	17.4949	18.2026	18.9208	19.5475	19.8721	19.8357	19.3876	18.4997	17.4991	16.6541	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	564.8352	594.4853	596.4544	572.4087	517.2388	416.1560	314.0043	321.4286	414.4100	487.0820	521.8573	546.4914	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1535.4744	1491.9808	1354.5950	1134.7185	879.1400	597.0918	394.8943	413.9670	640.3100	961.7882	1270.9141	1528.0784	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	722.1555	603.1170	564.0566	404.8631	269.2545	0.0000	0.0000	0.0000	0.0000	353.1814	539.3209	730.3008	(98)
Space heating												4186.2498	(98)
Space heating per m2												(98) / (4) =	48.4239 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4625.6904 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	722.1555	603.1170	564.0566	404.8631	269.2545	0.0000	0.0000	0.0000	0.0000	353.1814	539.3209	730.3008	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	797.9619	666.4276	623.2670	447.3625	297.5188	0.0000	0.0000	0.0000	0.0000	390.2557	595.9347	806.9622	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Efficiency of water heater (217)m	89.8733	89.8484	89.7925	89.6737	89.4249	87.3000	87.3000	87.3000	87.3000	89.5628	89.7752	87.3000	(216)
Fuel for water heating, kWh/month	188.7552	165.5705	171.9909	151.6035	146.9587	131.5419	123.5198	139.4276	140.4077	157.5474	169.6810	183.2410	(219)
Water heating fuel used												1870.2453	(219)
Annual totals kWh/year													
Space heating fuel - main system												4625.6904	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.6430	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1068 * 1.00) =										-546.8521		-546.8521	(233)
Total delivered energy for all uses												6431.7265	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4625.6904	3.4800	160.9740 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1870.2453	3.4800	65.0845 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	407.6430	13.1900	53.7681 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-546.8521	13.1900	-72.1298 (252)
Total energy cost			337.5894 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0786 (257)
SAP value		84.9529
SAP rating (Section 12)		85 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4625.6904	0.2160	999.1491 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1870.2453	0.2160	403.9730 (264)
Space and water heating			1403.1221 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Energy saving/generation technologies			
PV Unit	-546.8521	0.5190	-283.8162 (269)
Total kg/year			1369.7976 (272)
CO2 emissions per m2			15.8400 (273)
EI value			86.0363
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8892 = 3.914$, stars = 4
Water heating environmental impact	$0.216 / 0.8892 = 0.2429$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	6.3000 (1b)	x 2.4000 (2b)	= 15.1200 (1b) - (3b)
First floor	80.1500 (1c)	x 2.4000 (2c)	= 192.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 207.4800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					4.1200
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.3857	0.3594	0.3594	0.3418	0.3418	0.3243	0.3243	0.3068	0.3068	0.3331	0.3243	0.3418 (22b)
Effective ac	0.5744	0.5646	0.5646	0.5584	0.5584	0.5526	0.5526	0.5471	0.5471	0.5555	0.5526	0.5584 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1700	1.4000	3.0380		(26)
Windows (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3700	108.4500	0.2000	21.6900	9.0000	976.0500 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2157		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5936 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6535 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.3258	38.6551	38.6551	38.2343	38.2343	37.8346	37.8346	37.4559	37.4559	38.0318	37.8346	38.2343 (38)
Heat transfer coeff	121.9793	121.3086	121.3086	120.8879	120.8879	120.4881	120.4881	120.1094	120.1094	120.6854	120.4881	120.8879 (39)
Average = Sum(39)m / 12 =												120.8024 (39)
HLP	1.4110	1.4032	1.4032	1.3984	1.3984	1.3937	1.3937	1.3894	1.3894	1.3960	1.3937	1.3984 (40)
HLP (average)												1.3974 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5739 (42)
Average daily hot water use (litres/day)												95.3312 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.8643	101.0511	97.2378	93.4246	89.6113	85.7981	85.7981	89.6113	93.4246	97.2378	101.0511	104.8643 (44)
Energy content (annual)	155.5108	136.0107	140.3509	122.3613	117.4086	101.3147	93.8829	107.7321	109.0187	127.0508	138.6859	150.6039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1499.9312 (45)
Water storage loss:	23.3266	20.4016	21.0526	18.3542	17.6113	15.1972	14.0824	16.1598	16.3528	19.0576	20.8029	22.5906 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1298	12.7517	14.0841	13.5872	14.0091	13.5214	13.9499	13.9883	13.5572	14.0531	13.6456	14.1180	(61)
Total heat required for water heating calculated for each month	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Heat gains from water heating, kWh/month	55.2398	48.4115	50.1877	44.0819	42.5406	37.0675	34.7035	39.3180	39.6380	45.7577	49.5245	53.6053	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	154.4368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.7061	51.2540	41.6826	31.5564	23.5888	19.9146	21.5185	27.9705	37.5420	47.6682	55.6358	59.3099	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.8552	350.4545	341.3845	322.0754	297.7012	274.7928	259.4887	255.8894	264.9595	284.2685	308.6427	331.5511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	53.0176	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	-102.9578	(71)
Water heating gains (Table 5)	74.2470	72.0409	67.4566	61.2249	57.1783	51.4826	46.6446	52.8467	55.0528	61.5022	68.7840	72.0501	(72)
Total internal gains	586.3049	581.2460	558.0202	522.3532	485.9647	453.6866	435.1482	444.2032	465.0508	500.9354	540.5590	570.4076	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				5.6300	13.4839	0.6300	0.7000			0.7700			23.2004 (74)
South				4.5700	56.7559	0.6300	0.7000			0.7700			79.2682 (78)
Solar gains	102.4686	148.2771	207.3119	268.6903	296.8751	329.9430	304.1045	280.4565	238.3689	175.0101	122.1756	83.1596	(83)
Total gains	688.7734	729.5231	765.3320	791.0435	782.8398	783.6297	739.2527	724.6597	703.4197	675.9455	662.7346	653.5673	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	10.3540	10.4113	10.4113	10.4475	10.4475	10.4822	10.4822	10.5152	10.5152	10.4650	10.4822	10.4475		
alpha	1.6903	1.6941	1.6941	1.6965	1.6965	1.6988	1.6988	1.7010	1.7010	1.6977	1.6988	1.6965		
util living area	0.8775	0.8620	0.8299	0.7773	0.6899	0.5514	0.4312	0.4365	0.6212	0.7661	0.8457	0.8842	(86)	
MIT	17.7388	17.9670	18.5031	19.1931	19.9513	20.5380	20.8002	20.7968	20.3713	19.5620	18.5740	17.7248	(87)	
Th 2	19.7549	19.7609	19.7609	19.7646	19.7646	19.7681	19.7681	19.7715	19.7715	19.7664	19.7681	19.7646	(88)	
util rest of house	0.8636	0.8462	0.8091	0.7466	0.6382	0.4625	0.2999	0.3046	0.5430	0.7268	0.8250	0.8708	(89)	
MIT 2	16.8511	17.0779	17.6027	18.2739	18.9910	19.5057	19.6985	19.7002	19.3778	18.6379	17.6833	16.8448	(90)	
Living area fraction									fLA = Living area / (4) =			0.2834	(91)	
MIT	17.1026	17.3299	17.8579	18.5344	19.2631	19.7982	20.0107	20.0110	19.6593	18.8998	17.9358	17.0942	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.1026	17.3299	17.8579	18.5344	19.2631	19.7982	20.0107	20.0110	19.6593	18.8998	17.9358	17.0942	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	567.7372	587.9584	588.2004	561.1218	480.2729	364.3610	242.8266	241.3888	376.1794	468.4008	520.3497	543.9526	(94)	
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)	
Heat loss rate W	1427.4805	1386.5462	1244.3683	1031.7103	745.0499	469.6899	278.4124	277.5736	523.5975	832.7001	1148.9457	1401.5940	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	639.6490	536.6510	488.1889	338.8237	196.9940	0.0000	0.0000	0.0000	0.0000	271.0387	452.5891	638.0853	(98)	
Space heating												3562.0198	(98)	
Space heating per m2												(98) / (4) =	41.2032	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3935.9335 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	639.6490	536.6510	488.1889	338.8237	196.9940	0.0000	0.0000	0.0000	0.0000	271.0387	452.5891	638.0853	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	706.7945	592.9846	539.4353	374.3909	217.6730	0.0000	0.0000	0.0000	0.0000	299.4903	500.0985	705.0666	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Efficiency of water heater (217)m	89.8099	89.7857	89.7098	89.5600	89.1917	87.3000	87.3000	87.3000	87.3000	89.3783	89.6723	87.3000	(216)
Fuel for water heating, kWh/month	188.8884	165.6861	172.1496	151.7960	147.3429	131.5419	123.5198	139.4276	140.4077	157.8725	169.8758	183.3821	(219)
Water heating fuel used												1871.8906	(219)
Annual totals kWh/year													
Space heating fuel - main system												3935.9335	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.6430	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1179 * 1.00) =												-603.6874	(233)
Total delivered energy for all uses												5686.7796	(238)

10a. Fuel costs - using BEDF prices (£10)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3935.9335	4.2600	167.6708 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1871.8906	4.2600	79.7425 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	407.6430	22.5500	91.9235 (250)
Additional standing charges			96.0000 (251)
Energy saving/generation technologies			
PV Unit	-603.6874	22.5500	-136.1315 (252)
Total energy cost			316.1178 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3935.9335	0.2160	850.1616 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1871.8906	0.2160	404.3284 (264)
Space and water heating			1254.4900 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Energy saving/generation technologies			
PV Unit	-603.6874	0.5190	-313.3138 (269)
Total kg/year			1191.6679 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3935.9335	1.2200	4801.8389 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1871.8906	1.2200	2283.7065 (264)
Space and water heating			7085.5453 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	407.6430	3.0700	1251.4639 (268)
Energy saving/generation technologies			
PV Unit	-603.6874	3.0700	-1853.3203 (269)
Primary energy kWh/year			6713.9389 (272)
Primary energy kWh/m2/year			77.6627 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0		0.00 kg/m²

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 86

Fuel prices for cost data on this page from database revision number 510 TEST (21 Dec 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£109	£109	£0
Mains gas	£343	£343	£0
Space heating	£281	£281	£0
Water heating	£80	£80	£0
Lighting	£92	£92	£0
Generated (PV)	-£136	-£136	£0
Total cost of fuels	£316	£316	£0
Total cost of uses	£317	£317	£0
Delivered energy	66 kWh/m²	66 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	78 kWh/m²	78 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	52.6 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	547.75 (P1)
Transmission heat loss coefficient	82.65 (37)
Summer heat loss coefficient	630.40 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.6300	87.1704	0.6300	0.7000	0.9000	175.3078
South	4.5700	118.5567	0.6300	0.7000	0.9000	193.5378
total:						368.8456

	Jun	Jul	Aug	
Solar gains	396	369	333	(P3)
Internal gains	451	432	441	
Total summer gains	846	801	774	(P5)

	1.34	1.27	1.23	
Summer gain/loss ratio	1.34	1.27	1.23	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 52.6)	1.63	1.63	1.63	
Threshold temperature	18.37	20.20	20.16	(P7)

Likelihood of high internal temperature	Not significant	Not significant	Not significant
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Assessment of likelihood of high internal temperature: Not significant