



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 93 Highwood Avenue
EASTLEIGH, SO50 9QY

Contact: Scott Spearing
Scott Spearing
scott@beatsolutions.co.uk

Report Issue Date: 31/01/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BLOCK COMPLIANCE

Calculation Type: New Build (As Built)

Block Reference	SAP-0796 (Stoneham) - 200-208	Issued on Date	31/01/2023
Block Name	3B4A - Plots 200-208		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD		

Block Compliance Report - DER

Block Reference: SAP-0796 (Stoneham) - 200-208		Block Name: 3B4A - Plots 200-208			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
SAP-0796 (3B4A) - Plot 200-AB	1	66.3	14.62	18.48	20.88 %
SAP-0796 (3B4A) - Plot 201-AB	1	47.74	16.37	19.99	18.13 %
SAP-0796 (3B4A) - Plot 202-AB	1	58.42	15.23	19.16	20.50 %
SAP-0796 (3B4A) - Plot 203-AB	1	66.3	11.99	16.40	26.89 %
SAP-0796 (3B4A) - Plot 204-AB	1	47.74	13.19	17.56	24.88 %
SAP-0796 (3B4A) - Plot 205-AB	1	58.42	11.95	16.17	26.11 %
SAP-0796 (3B4A) - Plot 206-AB	1	65.03	12.10	16.10	24.84 %
SAP-0796 (3B4A) - Plot 207-AB	1	47.74	14.69	19.09	23.06 %
SAP-0796 (3B4A) - Plot 208-AB	1	57.27	12.82	17.28	25.80 %
Totals:	9	514.96	122.96	160.23	
Average DER = 13.57 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 17.70 kgCO ₂ /m ²		23.33 %			

Block Compliance Report - DFEE

Block Reference: SAP-0796 (Stoneham) - 200-208		Block Name: 3B4A - Plots 200-208			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
SAP-0796 (3B4A) - Plot 200-AB	1	66.3	40.90	45.37	9.87 %
SAP-0796 (3B4A) - Plot 201-AB	1	47.74	44.09	46.90	6.00 %
SAP-0796 (3B4A) - Plot 202-AB	1	58.42	43.10	48.06	10.32 %
SAP-0796 (3B4A) - Plot 203-AB	1	66.3	29.87	34.36	13.07 %
SAP-0796 (3B4A) - Plot 204-AB	1	47.74	31.27	34.56	9.51 %
SAP-0796 (3B4A) - Plot 205-AB	1	58.42	29.95	32.84	8.80 %
SAP-0796 (3B4A) - Plot 206-AB	1	65.03	30.52	32.85	7.08 %
SAP-0796 (3B4A) - Plot 207-AB	1	47.74	37.26	42.33	11.98 %
SAP-0796 (3B4A) - Plot 208-AB	1	57.27	33.15	38.10	13.00 %
Totals:	9	514.96	320.10	355.37	
Average DFEE = 35.38 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 39.30 kWh/m ² /yr		9.97 %			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 206				Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B4P Top Floor			
Property	93 Highwood Avenue, EASTLEIGH, SO50 9QY					
SAP Rating	85 B	DER	12.10	TER	16.10	
Environmental	91 B	% DER<TER	24.84			
CO ₂ Emissions (t/year)	0.65	DFEE	30.52	TFEE	32.85	
General Requirements Compliance	Pass	% DFEE<TFEE	7.08			
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)	16.10	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.10	kgCO ₂ /m ²	Pass
	-4.00 (-24.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	32.85	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	30.52	kWh/m ² /yr	
	-2.3 (-7.0%)	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
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.12 (max. 0.20)	0.18 (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	2.54 (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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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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)

Slight

Pass

Based on:

Overshading

Average

Windows facing South

6.76 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

2.54 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Air permeability

2.5

m³/m²h

Photovoltaic array

413.40

kWh/Year

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 206				Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B4P Top Floor			
Property	93 Highwood Avenue, EASTLEIGH, SO50 9QY					
SAP Rating		85 B	DER	12.10	TER	16.10
Environmental		91 B	% DER<TER	24.84		
CO ₂ Emissions (t/year)		0.65	DFEE	30.52	TFEE	32.85
General Requirements Compliance		Pass	% DFEE<TFEE	7.08		
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)

Orientation	South					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, End-Terrace					
2.0 Number of Storeys	1					
3.0 Date Built	2023					
4.0 Sheltered Sides	1					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
		Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
			24.16 m	65.03 m²	2.17 m	
7.0 Living Area	27.40			m²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	60.17			kJ/m²K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)		0.20	9.00	43.02
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board		0.00	20.00	18.62
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Walls	Plasterboard on timber frame				9.00	74.40
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	45.43
Sloping Roof	External Slope Roof	Plasterboard, insulated slope		0.16	9.00	16.84
Dormer Roofs	External Flat Roof	Plasterboard, insulated flat roof		0.18	9.00	3.70

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor	Timber I-joists, carpeted	30.00	65.03

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
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
North	Window	[1] External Wall	South	None	0.00					4.01	
South	Window	[1] External Wall	South	None	0.00					2.75	

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)	5.22	0.300	Yes
Table K1 - Approved	E3 Sill	5.22	0.040	Yes
Table K1 - Approved	E4 Jamb	10.28	0.050	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	24.16	0.070	Yes
Table K1 - Approved	E11 Eaves (insulation at rafter level)	11.87	0.040	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	5.90	0.240	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	2.40	0.040	No
Table K1 - Approved	E16 Corner (normal)	2.60	0.090	No
Table K1 - Default	E25 Staggered party wall between dwellings	2.60	0.120	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.65	0.000	No
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	7.25	0.240	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	2.40	0.080	No

Y-value 0.077 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	6.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	2.54	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
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Number of intermittent fans	2
Number of passive vents	0
Number of flueless gas fires	0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	413.40	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

U-VALUE CALCULATOR REPORT

Property Reference	SAP-0796 (3B4A) - Plot 206	Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B4P Top Floor
Project	93 Highwood Avenue, EASTLEIGH, SO50 9QY		
Calculation Type	New Build (As Built)		

SAP Rating	85 B	DER	12.10	TER	16.10
Environmental	91 B	% DER<TER	24.84		
CO ₂ Emissions (t/year)	0.65	DFEE	30.52	TFEE	32.85
General Requirements Compliance	Pass	% DFEE<TFEE	7.08		

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

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
Int surface				0.1000	

Total resistance: Upper limit = 10.039 m² K/W Lower limit = 9.825 m² K/W Average = 9.932 m² K/W
Total correction = 0.0005 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 413 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP-0796 (3B4A) - Plot 206	Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B4P Top Floor
Project	93 Highwood Avenue, EASTLEIGH, SO50 9QY		
Calculation Type	New Build (As Built)		

SAP Rating	85 B	DER	12.10	TER	16.10
Environmental	91 B	% DER<TER	24.84		
CO ₂ Emissions (t/year)	0.65	DFEE	30.52	TFEE	32.85
General Requirements Compliance	Pass	% DFEE<TFEE	7.08		

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

Roof Sloping Roof

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	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 2	Celotex GA4000				
	Main construction	50	0.0220	2.2727	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Layer 4	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 6.439 m ² K/W	Lower limit = 5.763 m ² K/W	Average = 6.101 m ² K/W
	Total correction = 0.0043 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: None

Total thickness: 166 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP-0796 (3B4A) - Plot 206		Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B4P Top Floor	
Project	93 Highwood Avenue, EASTLEIGH, SO50 9QY			
Calculation Type	New Build (As Built)			

SAP Rating	85 B	DER	12.10	TER	16.10
Environmental	91 B	% DER<TER	24.84		
CO ₂ Emissions (t/year)	0.65	DFEE	30.52	TFEE	32.85
General Requirements Compliance	Pass	% DFEE<TFEE	7.08		

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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/m²K)	Resistance (m²K/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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
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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 65 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) 16.10 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.10 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 32.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 30.5 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.18 (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: 2.54 (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 ESP1 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): Slight OK
Based on:
Overshading: Average
Windows facing South: 6.76 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Air permeability 2.5 m³/m²h
Photovoltaic array 413.40 kWh/Year

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	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					2.5400
Number of sides sheltered					0.2687 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2486 (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	0.3169	0.3107	0.3045	0.2734	0.2672	0.2361	0.2361	0.2299	0.2486	0.2672	0.2796	0.2921 (22b)
	0.5502	0.5483	0.5464	0.5374	0.5357	0.5279	0.5279	0.5264	0.5309	0.5357	0.5391	0.5427 (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
Windows (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.2000	7.2520	9.0000	326.3400 (29a)
Pitched Roof	45.4300		45.4300	0.1000	4.5430	9.0000	408.8700 (30)
Sloping Roof	16.8400		16.8400	0.1600	2.6944	9.0000	151.5600 (30)
Dormer Roofs	3.7000		3.7000	0.1800	0.6660	9.0000	33.3000 (30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.1175		(33)
Party Wall			18.6200	0.0000	0.0000	20.0000	372.4000 (32)
Party Floor			65.0300			30.0000	1950.9000 (32d)
Internal Walls			74.4000			9.0000	669.6000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							3912.9700 (34)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							60.1718 (35)
Total fabric heat loss							8.4448 (36)
							(33) + (36) =
							32.5623 (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	25.6228	25.5319	25.4429	25.0248	24.9466	24.5824	24.5824	24.5150	24.7227	24.9466	25.1048	25.2703 (38)
Heat transfer coeff	58.1851	58.0943	58.0052	57.5871	57.5089	57.1447	57.1447	57.0773	57.2850	57.5089	57.6672	57.8326 (39)
Average = Sum(39)m / 12 =												57.5868 (39)
HLP	0.8947	0.8933	0.8920	0.8855	0.8843	0.8787	0.8787	0.8777	0.8809	0.8843	0.8868	0.8893 (40)
HLP (average)												0.8855 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy content (annual)	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1330.1932 (45)
Water storage loss:	20.6869	18.0929	18.6702	16.2772	15.6183	13.4774	12.4888	14.3311	14.5023	16.9010	18.4487	20.0341 (46)

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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	14.0644	12.6847	14.0142	13.5286	13.9552	13.4769	13.9086	13.9388	13.5050	13.9898	13.5773	14.0547 (61)
Total heat required for water heating calculated for each month	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (64)
Heat gains from water heating, kWh/month	49.3720	43.2771	44.8892	39.4632	38.1094	33.2442	31.1607	35.2520	35.5229	40.9613	44.2891	47.9227 (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	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9330	16.8161	13.6758	10.3535	7.7393	6.5339	7.0601	9.1770	12.3173	15.6396	18.2537	19.4592 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.4318	187.3560	182.5071	172.1843	159.1536	146.9066	138.7249	136.8007	141.6496	151.9724	165.0031	177.2501 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986 (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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885 (71)
Water heating gains (Table 5)	66.3603	64.4004	60.3350	54.8100	51.2223	46.1725	41.8827	47.3817	49.3374	55.0555	61.5126	64.4122 (72)
Total internal gains	328.5207	326.3682	314.3135	295.1434	275.9110	257.4087	245.4633	251.1550	261.1000	280.4632	302.5651	318.9172 (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
South				6.7600	46.7521	0.6300	0.7000			0.7700		96.5871 (78)
Solar gains	96.5871	158.1849	201.4994	227.7381	237.3172	228.3855	223.1465	216.7062	210.4900	170.6172	114.4887	83.4602 (83)
Total gains	425.1079	484.5531	515.8130	522.8815	513.2282	485.7942	468.6099	467.8612	471.5900	451.0804	417.0538	402.3774 (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	18.6807	18.7099	18.7386	18.8746	18.9003	19.0208	19.0208	19.0432	18.9742	18.9003	18.8484	18.7945
alpha	2.2454	2.2473	2.2492	2.2583	2.2600	2.2681	2.2681	2.2695	2.2649	2.2600	2.2566	2.2530
util living area	0.9057	0.8753	0.8382	0.7852	0.7074	0.5912	0.4669	0.4830	0.6306	0.7839	0.8753	0.9148 (86)
MIT	18.6014	18.9086	19.3266	19.8242	20.2940	20.6763	20.8654	20.8491	20.5969	19.9951	19.2080	18.5257 (87)
Th 2	20.1720	20.1732	20.1743	20.1798	20.1808	20.1856	20.1856	20.1865	20.1838	20.1808	20.1788	20.1766 (88)
util rest of house	0.8972	0.8644	0.8236	0.7642	0.6754	0.5406	0.3969	0.4151	0.5841	0.7592	0.8626	0.9070 (89)
MIT 2	17.9556	18.2567	18.6661	19.1530	19.6009	19.9524	20.1076	20.0961	19.8829	19.3237	18.5594	17.8847 (90)
Living area fraction	18.2277	18.5314	18.9444	19.4358	19.8929	20.2574	20.4269	20.4134	20.1837	19.6066	18.8327	18.1548 (92)
Temperature adjustment	18.2277	18.5314	18.9444	19.4358	19.8929	20.2574	20.4269	20.4134	20.1837	19.6066	18.8327	18.1548 (93)
adjusted MIT	18.2277	18.5314	18.9444	19.4358	19.8929	20.2574	20.4269	20.4134	20.1837	19.6066	18.8327	18.1548 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8726	0.8386	0.7983	0.7428	0.6631	0.5453	0.4185	0.4349	0.5841	0.7396	0.8377	0.8834 (94)
Ext temp.	370.9636	406.3262	411.7611	388.4078	340.3333	264.9268	196.1078	203.4753	275.4379	333.6280	349.3619	355.4417 (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	810.3833	791.9048	721.8401	606.7276	471.1657	323.2916	218.6850	229.0739	348.5063	517.9595	676.5915	807.0426 (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 per m2	326.9283	259.1088	230.6988	157.1902	97.3393	0.0000	0.0000	0.0000	0.0000	137.1426	235.6053	335.9911 (98)
												1780.0045 (98)
												27.3721 (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													1966.8557 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	326.9283	259.1088	230.6988	157.1902	97.3393	0.0000	0.0000	0.0000	0.0000	137.1426	235.6053	335.9911	(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)	361.2467	286.3081	254.9158	173.6909	107.5572	0.0000	0.0000	0.0000	0.0000	151.5388	260.3373	371.2608	(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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156	(64)
Efficiency of water heater (217)m	89.4594	89.3870	89.2725	89.0730	88.7175	87.3000	87.3000	87.3000	87.3000	88.9348	89.2989	89.4986	(216)
Fuel for water heating, kWh/month	169.8837	149.1313	155.1232	137.0146	133.0936	118.3578	111.3029	125.4060	126.2162	142.4223	152.9347	164.9362	(219)
Water heating fuel used												1685.8226	(219)
Annual totals kWh/year													
Space heating fuel - main system												1966.8557	(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)												334.3627	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4062.0411	(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	1966.8557	0.2160	424.8408 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1685.8226	0.2160	364.1377 (264)
Space and water heating			788.9785 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.3627	0.5190	173.5342 (268)
Energy saving/generation technologies			
PV Unit	-413.4000	0.5190	-214.5546 (269)
Total CO2, kg/year			786.8832 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1000 (273)

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

DER		12.1000	ZC1
Total Floor Area		65.0300	
Assumed number of occupants		2.1197	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.8973	ZC2
CO2 emissions from cooking, equation (L16)		2.6122	ZC3
Total CO2 emissions		31.6095	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		31.6095	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	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3917 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3623 (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	0.4620	0.4529	0.4439	0.3986	0.3895	0.3442	0.3442	0.3352	0.3623	0.3895	0.4076	0.4258 (22b)
Effective ac	0.6067	0.6026	0.5985	0.5794	0.5759	0.5592	0.5592	0.5562	0.5656	0.5759	0.5831	0.5906 (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 Opening Type (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.1800	6.5268		(29a)
Pitched Roof	45.4300		45.4300	0.1300	5.9059		(30)
Sloping Roof	16.8400		16.8400	0.1300	2.1892		(30)
Dormer Roofs	3.7000		3.7000	0.1300	0.4810		(30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0650	(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)							5.2000 (36)
Total fabric heat loss						(33) + (36) =	29.2650 (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	28.2537	28.0607	27.8716	26.9831	26.8169	26.0430	26.0430	25.8997	26.3411	26.8169	27.1531	27.5047 (38)
Heat transfer coeff	57.5187	57.3257	57.1366	56.2481	56.0819	55.3081	55.3081	55.1648	55.6061	56.0819	56.4182	56.7697 (39)
Average = Sum(39)m / 12 =												56.2473 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8845	0.8815	0.8786	0.8650	0.8624	0.8505	0.8505	0.8483	0.8551	0.8624	0.8676	0.8730 (40)
HLP (average)												0.8649 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy conte	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Energy content (annual)										Total = Sum(45)m =		1330.1932 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.6869	18.0929	18.6702	16.2772	15.6183	13.4774	12.4888	14.3311	14.5023	16.9010	18.4487	20.0341 (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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	47.3905	41.2478	43.9439	40.8587	40.4973	37.5233	38.7740	40.4973	40.8587	43.9439	44.1941	47.3905 (61)
Total heat required for water heating calculated for each month	185.3031	161.8670	168.4122	149.3731	144.6195	127.3728	122.0328	136.0380	137.5404	156.6172	167.1857	180.9515 (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	185.3031	161.8670	168.4122	149.3731	144.6195	127.3728	122.0328	136.0380	137.5404	156.6172	167.1857	180.9515 (64)
Heat gains from water heating, kWh/month	57.7036	50.4178	52.3717	46.2957	44.7450	39.2558	37.3771	41.8916	42.3613	48.4498	51.9432	56.2566 (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	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9330	16.8161	13.6758	10.3535	7.7393	6.5339	7.0601	9.1770	12.3173	15.6396	18.2537	19.4592 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.4318	187.3560	182.5071	172.1843	159.1536	146.9066	138.7249	136.8007	141.6496	151.9724	165.0031	177.2501 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986 (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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885 (71)
Water heating gains (Table 5)	77.5585	75.0266	70.3920	64.2996	60.1411	54.5219	50.2380	56.3059	58.8352	65.1207	72.1434	75.6138 (72)
Total internal gains	339.7190	336.9944	324.3706	304.6330	284.8297	265.7581	253.8186	260.0792	270.5978	290.5285	313.1959	330.1187 (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
South	6.7600				46.7521		0.6300		0.7000		0.7700		96.5871 (78)
Solar gains	96.5871	158.1849	201.4994	227.7381	237.3172	228.3855	223.1465	216.7062	210.4900	170.6172	114.4887	83.4602 (83)	
Total gains	436.3062	495.1792	525.8700	532.3711	522.1469	494.1436	476.9652	476.7855	481.0877	461.1457	427.6846	413.5789 (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	78.5131	78.7774	79.0382	80.2866	80.5246	81.6513	81.6513	81.8634	81.2136	80.5246	80.0446	79.5489
alpha	6.2342	6.2518	6.2692	6.3524	6.3683	6.4434	6.4434	6.4576	6.4142	6.3683	6.3363	6.3033
util living area	0.9960	0.9904	0.9781	0.9453	0.8638	0.6905	0.5069	0.5279	0.7510	0.9430	0.9901	0.9971 (86)
MIT	20.2017	20.3433	20.5227	20.7298	20.8925	20.9805	20.9976	20.9969	20.9658	20.7738	20.4508	20.1766 (87)
Th 2	20.1807	20.1832	20.1857	20.1974	20.1996	20.2098	20.2098	20.2117	20.2058	20.1996	20.1952	20.1905 (88)
util rest of house	0.9948	0.9875	0.9712	0.9276	0.8219	0.6159	0.4177	0.4398	0.6817	0.9214	0.9866	0.9962 (89)
MIT 2	19.1151	19.3223	19.5821	19.8814	20.0935	20.1965	20.2088	20.2103	20.1800	19.9463	19.4886	19.0861 (90)
Living area fraction	19.5729	19.7525	19.9784	20.2389	20.4302	20.5268	20.5412	20.5417	20.5111	20.2950	19.8940	19.5456 (92)
Temperature adjustment	19.5729	19.7525	19.9784	20.2389	20.4302	20.5268	20.5412	20.5417	20.5111	20.2950	19.8940	19.5456 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9935	0.9856	0.9691	0.9286	0.8349	0.6467	0.4554	0.4770	0.7095	0.9243	0.9849	0.9952 (94)
Useful gains	433.4905	488.0443	509.5956	494.3800	435.9624	319.5743	217.2143	227.4448	341.3546	426.2425	421.2217	411.5862 (95)
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	878.4802	851.4289	770.1116	637.7902	489.6039	327.8012	217.9786	228.4782	356.4972	543.7117	721.8126	871.1643 (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	331.0723	244.1944	193.8239	103.2554	39.9093	0.0000	0.0000	0.0000	0.0000	87.3971	216.4255	341.9261 (98)
Space heating												1558.0040 (98)
Space heating per m2												23.9582 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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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													1668.0985 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	331.0723	244.1944	193.8239	103.2554	39.9093	0.0000	0.0000	0.0000	0.0000	87.3971	216.4255	341.9261	(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)	354.4672	261.4501	207.5203	110.5518	42.7294	0.0000	0.0000	0.0000	0.0000	93.5729	231.7189	366.0879	(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	185.3031	161.8670	168.4122	149.3731	144.6195	127.3728	122.0328	136.0380	137.5404	156.6172	167.1857	180.9515	(64)
Efficiency of water heater	86.4959	86.0839	85.4057	84.1424	82.2884	80.3000	80.3000	80.3000	80.3000	83.6472	85.7021	86.6292	(216)
Fuel for water heating, kWh/month	214.2333	188.0341	197.1908	177.5243	175.7472	158.6212	151.9711	169.4122	171.2832	187.2353	195.0778	208.8804	(219)
Water heating fuel used												2195.2108	(219)
Annual totals kWh/year													
Space heating fuel - main system												1668.0985	(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)												334.3627	(232)
Total delivered energy for all uses												4272.6721	(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	1668.0985	0.2160	360.3093 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2195.2108	0.2160	474.1655 (264)
Space and water heating			834.4748 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.3627	0.5190	173.5342 (268)
Total CO2, kg/m2/year			1046.9341 (272)
Emissions per m2 for space and water heating			12.8322 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6685 (272b)
Emissions per m2 for pumps and fans			0.5986 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.8322 * 1.00) + 2.6685 + 0.5986, rounded to 2 d.p.			16.1000 (273)

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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	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					2.5400
Number of sides sheltered					0.2687 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2486 (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	0.3169	0.3107	0.3045	0.2734	0.2672	0.2361	0.2361	0.2299	0.2486	0.2672	0.2796	0.2921 (22b)
	0.5502	0.5483	0.5464	0.5374	0.5357	0.5279	0.5279	0.5264	0.5309	0.5357	0.5391	0.5427 (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
Windows (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.2000	7.2520	9.0000	326.3400 (29a)
Pitched Roof	45.4300		45.4300	0.1000	4.5430	9.0000	408.8700 (30)
Sloping Roof	16.8400		16.8400	0.1600	2.6944	9.0000	151.5600 (30)
Dormer Roofs	3.7000		3.7000	0.1800	0.6660	9.0000	33.3000 (30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.1175		(33)
Party Wall			18.6200	0.0000	0.0000	20.0000	372.4000 (32)
Party Floor			65.0300			30.0000	1950.9000 (32d)
Internal Walls			74.4000			9.0000	669.6000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3912.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							60.1718 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4448 (36)
Total fabric heat loss					(33) + (36) =		32.5623 (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	25.6228	25.5319	25.4429	25.0248	24.9466	24.5824	24.5824	24.5150	24.7227	24.9466	25.1048	25.2703 (38)
Heat transfer coeff	58.1851	58.0943	58.0052	57.5871	57.5089	57.1447	57.1447	57.0773	57.2850	57.5089	57.6672	57.8326 (39)
Average = Sum(39)m / 12 =												57.5868 (39)
HLP	0.8947	0.8933	0.8920	0.8855	0.8843	0.8787	0.8787	0.8777	0.8809	0.8843	0.8868	0.8893 (40)
HLP (average)												0.8855 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy content (annual)	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1330.1932 (45)
	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)
Water storage loss:												

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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	29.3064	25.6316	26.4495	23.0593	22.1260	19.0930	17.6925	20.3024	20.5449	23.9431	26.1357	28.3817 (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	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9330	16.8161	13.6758	10.3535	7.7393	6.5339	7.0601	9.1770	12.3173	15.6396	18.2537	19.4592	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.4318	187.3560	182.5071	172.1843	159.1536	146.9066	138.7249	136.8007	141.6496	151.9724	165.0031	177.2501	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	(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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	(71)
Water heating gains (Table 5)	39.3904	38.1422	35.5504	32.0268	29.7392	26.5181	23.7802	27.2882	28.5345	32.1815	36.2996	38.1475	(72)
Total internal gains	298.5508	297.1101	286.5290	269.3603	251.4278	234.7543	224.3609	228.0615	237.2971	254.5892	274.3521	289.6524	(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			
South				6.7600	46.7521	0.6300	0.7000	0.7700	96.5871 (78)			
Solar gains	96.5871	158.1849	201.4994	227.7381	237.3172	228.3855	223.1465	216.7062	210.4900	170.6172	114.4887	83.4602 (83)
Total gains	395.1380	455.2949	488.0284	497.0984	488.7450	463.1398	447.5074	444.7677	447.7871	425.2064	388.8408	373.1126 (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	18.6807	18.7099	18.7386	18.8746	18.9003	19.0208	19.0208	19.0432	18.9742	18.9003	18.8484	18.7945	
alpha	2.2454	2.2473	2.2492	2.2583	2.2600	2.2681	2.2681	2.2695	2.2649	2.2600	2.2566	2.2530	
util living area	0.9168	0.8874	0.8512	0.7997	0.7239	0.6089	0.4833	0.5013	0.6494	0.8008	0.8888	0.9254	(86)
MIT	18.5085	18.8262	19.2573	19.7705	20.2558	20.6549	20.8551	20.8367	20.5699	19.9412	19.1281	18.4322	(87)
Th 2	20.1720	20.1732	20.1743	20.1798	20.1808	20.1856	20.1856	20.1865	20.1838	20.1808	20.1788	20.1766	(88)
util rest of house	0.9092	0.8772	0.8374	0.7795	0.6925	0.5583	0.4121	0.4323	0.6033	0.7772	0.8772	0.9184	(89)
MIT 2	17.8650	18.1771	18.6001	19.1032	19.5673	19.9358	20.1012	20.0881	19.8611	19.2744	18.4827	17.7934	(90)
Living area fraction													
MIT	18.1361	18.4506	18.8770	19.3843	19.8574	20.2388	20.4189	20.4035	20.1597	19.5553	18.7547	18.0625	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1361	18.4506	18.8770	19.3843	19.8574	20.2388	20.4189	20.4035	20.1597	19.5553	18.7547	18.0625	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	349.9481	387.8112	396.2526	376.4366	331.8250	260.2188	193.9747	200.8693	269.4830	321.6994	331.5275	334.2838	(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	805.0572	787.2113	717.9296	603.7636	469.1234	322.2255	218.2273	228.5115	347.1305	515.0110	672.0908	801.7066	(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	338.6011	268.3969	239.3277	163.6754	102.1500	0.0000	0.0000	0.0000	0.0000	143.8238	245.2056	347.7625	(98)
Space heating												1848.9431	(98)
Space heating per m2												28.4322	(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	537.1605	422.8710	433.7874	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7428	0.8047	0.7970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	398.9781	340.2948	345.7374	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	621.2927	601.5354	599.9359	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	160.0665	194.3630	189.1236	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												543.5531 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	40.0166	48.5907	47.2809	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												135.8883 (107)
Space cooling per m2												2.0896 (108)
Energy for space heating												28.4322 (99)
Energy for space cooling												2.0896 (108)
Total												30.5218 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.5 (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	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3917 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3623 (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	0.4620	0.4529	0.4439	0.3986	0.3895	0.3442	0.3442	0.3352	0.3623	0.3895	0.4076	0.4258 (22b)
Effective ac	0.6067	0.6026	0.5985	0.5794	0.5759	0.5592	0.5592	0.5562	0.5656	0.5759	0.5831	0.5906 (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 Opening Type (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.1800	6.5268		(29a)
Pitched Roof	45.4300		45.4300	0.1300	5.9059		(30)
Sloping Roof	16.8400		16.8400	0.1300	2.1892		(30)
Dormer Roofs	3.7000		3.7000	0.1300	0.4810		(30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0650	(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)							5.2000 (36)
Total fabric heat loss						(33) + (36) =	29.2650 (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	28.2537	28.0607	27.8716	26.9831	26.8169	26.0430	26.0430	25.8997	26.3411	26.8169	27.1531	27.5047 (38)
Heat transfer coeff	57.5187	57.3257	57.1366	56.2481	56.0819	55.3081	55.3081	55.1648	55.6061	56.0819	56.4182	56.7697 (39)
Average = Sum(39)m / 12 =												56.2473 (39)
HLP	0.8845	0.8815	0.8786	0.8650	0.8624	0.8505	0.8505	0.8483	0.8551	0.8624	0.8676	0.8730 (40)
HLP (average)												0.8649 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
Daily hot water use	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy conte	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Energy content (annual)										Total = Sum(45)m =		1330.1932 (45)
Distribution loss (46)m = 0.15 x (45)m												
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 (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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	29.3064	25.6316	26.4495	23.0593	22.1260	19.0930	17.6925	20.3024	20.5449	23.9431	26.1357	28.3817 (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	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	105.9856	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9330	16.8161	13.6758	10.3535	7.7393	6.5339	7.0601	9.1770	12.3173	15.6396	18.2537	19.4592	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.4318	187.3560	182.5071	172.1843	159.1536	146.9066	138.7249	136.8007	141.6496	151.9724	165.0031	177.2501	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	33.5986	(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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	(71)
Water heating gains (Table 5)	39.3904	38.1422	35.5504	32.0268	29.7392	26.5181	23.7802	27.2882	28.5345	32.1815	36.2996	38.1475	(72)
Total internal gains	298.5508	297.1101	286.5290	269.3603	251.4278	234.7543	224.3609	228.0615	237.2971	254.5892	274.3521	289.6524	(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
South				6.7600	46.7521		0.6300		0.7000		0.7700		96.5871 (78)
Solar gains	96.5871	158.1849	201.4994	227.7381	237.3172	228.3855	223.1465	216.7062	210.4900	170.6172	114.4887	83.4602	(83)
Total gains	395.1380	455.2949	488.0284	497.0984	488.7450	463.1398	447.5074	444.7677	447.7871	425.2064	388.8408	373.1126	(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	78.5131	78.7774	79.0382	80.2866	80.5246	81.6513	81.6513	81.8634	81.2136	80.5246	80.0446	79.5489	
alpha	6.2342	6.2518	6.2692	6.3524	6.3683	6.4434	6.4434	6.4576	6.4142	6.3683	6.3363	6.3033	
util living area	0.9977	0.9939	0.9848	0.9593	0.8907	0.7274	0.5389	0.5639	0.7901	0.9599	0.9940	0.9984	(86)
MIT	20.1405	20.2856	20.4715	20.6897	20.8686	20.9739	20.9966	20.9955	20.9544	20.7331	20.3945	20.1160	(87)
Th 2	20.1807	20.1832	20.1857	20.1974	20.1996	20.2098	20.2098	20.2117	20.2058	20.1996	20.1952	20.1905	(88)
util rest of house	0.9969	0.9919	0.9798	0.9452	0.8532	0.6523	0.4448	0.4708	0.7226	0.9433	0.9918	0.9978	(89)
MIT 2	19.3923	19.5386	19.7242	19.9452	20.1087	20.1973	20.2088	20.2103	20.1815	19.9903	19.6575	19.3761	(90)
Living area fraction													
MIT	19.7076	19.8534	20.0390	20.2589	20.4288	20.5245	20.5408	20.5411	20.5071	20.3033	19.9680	19.6878	(91)
Temperature adjustment												0.0000	
adjusted MIT	19.7076	19.8534	20.0390	20.2589	20.4288	20.5245	20.5408	20.5411	20.5071	20.3033	19.9680	19.6878	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9909	0.9787	0.9465	0.8650	0.6834	0.4846	0.5102	0.7497	0.9458	0.9910	0.9974	(94)
Useful gains	393.7101	451.1663	477.6303	470.4923	422.7526	316.5136	216.8663	226.9308	335.6959	402.1420	385.3495	372.1436	(95)
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	886.2233	857.2138	773.5742	638.9143	489.5297	327.6743	217.9562	228.4454	356.2761	544.1804	725.9904	879.2410	(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	366.4298	272.8639	220.1822	121.2638	49.6821	0.0000	0.0000	0.0000	0.0000	105.6765	245.2614	377.2804	(98)
Space heating												1758.6403	(98)
Space heating per m ²												27.0435	(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	519.8957	409.2796	419.2521	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9295	0.9717	0.9680	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.2479	397.6790	405.8432	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	621.2927	601.5354	599.9359	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	99.3923	151.6691	144.4049	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												395.4663	(104)
Cooled fraction												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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.8481	37.9173	36.1012	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.8666 (107)
Space cooling per m2												1.5203 (108)
Energy for space heating												27.0435 (99)
Energy for space cooling												1.5203 (108)
Total												28.5638 (109)
Target Fabric Energy Efficiency (TFEE)												32.8 (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	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					2.5400
Number of sides sheltered					0.2687 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2486 (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	0.2734	0.2548	0.2548	0.2424	0.2424	0.2299	0.2299	0.2175	0.2175	0.2361	0.2299	0.2424 (22b)
Effective ac	0.5374	0.5325	0.5325	0.5294	0.5294	0.5264	0.5264	0.5237	0.5237	0.5279	0.5264	0.5294 (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
Windows (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.2000	7.2520	9.0000	326.3400 (29a)
Pitched Roof	45.4300		45.4300	0.1000	4.5430	9.0000	408.8700 (30)
Sloping Roof	16.8400		16.8400	0.1600	2.6944	9.0000	151.5600 (30)
Dormer Roofs	3.7000		3.7000	0.1800	0.6660	9.0000	33.3000 (30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.1175		(33)
Party Wall			18.6200	0.0000	0.0000	20.0000	372.4000 (32)
Party Floor			65.0300			30.0000	1950.9000 (32d)
Internal Walls			74.4000			9.0000	669.6000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3912.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							60.1718 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4448 (36)
Total fabric heat loss							(33) + (36) = 32.5623 (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	25.0248	24.7955	24.7955	24.6516	24.6516	24.5150	24.5150	24.3855	24.3855	24.5824	24.5150	24.6516 (38)
Heat transfer coeff	57.5871	57.3578	57.3578	57.2140	57.2140	57.0773	57.0773	56.9478	56.9478	57.1447	57.0773	57.2140 (39)
Average = Sum(39)m / 12 =												57.1847 (39)
HLP	0.8855	0.8820	0.8820	0.8798	0.8798	0.8777	0.8777	0.8757	0.8757	0.8787	0.8777	0.8798 (40)
HLP (average)												0.8794 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy content (annual)	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1330.1932 (45)
Water storage loss:	20.6869	18.0929	18.6702	16.2772	15.6183	13.4774	12.4888	14.3311	14.5023	16.9010	18.4487	20.0341 (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	14.0644	12.6847	14.0142	13.5286	13.9552	13.4769	13.9086	13.9388	13.5050	13.9898	13.5773	14.0547 (61)
Total heat required for water heating calculated for each month	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (64)
RHI water heating demand	49.3720	43.2771	44.8892	39.4632	38.1094	33.2442	31.1607	35.2520	35.5229	40.9613	44.2891	47.9227 (65)
Heat gains from water heating, kWh/month	49.3720	43.2771	44.8892	39.4632	38.1094	33.2442	31.1607	35.2520	35.5229	40.9613	44.2891	47.9227 (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	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.7639	279.6358	272.3986	256.9915	237.5427	219.2636	207.0521	204.1801	211.4173	226.8245	246.2732	264.5523	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	(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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	(71)
Water heating gains (Table 5)	66.3603	64.4004	60.3350	54.8100	51.2223	46.1725	41.8827	47.3817	49.3374	55.0555	61.5126	64.4122	(72)
Total internal gains	485.6889	481.3088	462.1553	432.9173	403.3456	377.0030	361.8171	369.7364	386.7802	416.2113	448.6524	472.8448	(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
South					6.7600	56.7559	0.6300	0.7000			0.7700			117.2544 (78)
Solar gains	117.2544	162.8637	208.6584	238.2890	236.8829	251.2636	236.2891	237.4718	228.6755	186.8714	138.3823	96.0177	(83)	
Total gains	602.9433	644.1725	670.8137	671.2064	640.2285	628.2666	598.1062	607.2082	615.4556	603.0827	587.0347	568.8625	(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	18.8746	18.9501	18.9501	18.9977	18.9977	19.0432	19.0432	19.0865	19.0865	19.0208	19.0432	18.9977	
alpha	2.2583	2.2633	2.2633	2.2665	2.2665	2.2695	2.2695	2.2724	2.2724	2.2681	2.2695	2.2665	
util living area	0.8163	0.7883	0.7392	0.6712	0.5672	0.4161	0.2989	0.2943	0.4610	0.6372	0.7611	0.8288	(86)
MIT	19.3314	19.5255	19.8777	20.2633	20.6339	20.8777	20.9604	20.9619	20.8312	20.4639	19.8765	19.2887	(87)
Th 2	20.1798	20.1828	20.1828	20.1847	20.1847	20.1865	20.1865	20.1882	20.1882	20.1856	20.1865	20.1847	(88)
util rest of house	0.8016	0.7719	0.7185	0.6435	0.5268	0.3601	0.2303	0.2267	0.4082	0.6022	0.7399	0.8147	(89)
MIT 2	18.6689	18.8576	19.1962	19.5635	19.9043	20.1105	20.1693	20.1716	20.0761	19.7546	19.2033	18.6327	(90)
Living area fraction									fLA = Living area / (4) =			0.4213	(91)
MIT	18.9480	19.1390	19.4834	19.8584	20.2117	20.4338	20.5026	20.5046	20.3942	20.0535	19.4869	18.9091	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9480	19.1390	19.4834	19.8584	20.2117	20.4338	20.5026	20.5046	20.3942	20.0535	19.4869	18.9091	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.7766	0.7484	0.6991	0.6317	0.5282	0.3776	0.2575	0.2536	0.4221	0.5962	0.7198	0.7895	(94)
Useful gains	468.2275	482.0766	468.9527	423.9726	338.1748	237.2637	154.0119	153.9832	259.7547	359.5657	422.5283	449.1335	(95)
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	780.1929	759.3627	681.6042	564.0365	406.8871	258.7758	159.9663	159.7156	290.1060	460.2124	632.8107	767.1873	(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	232.1022	186.3363	158.2127	100.8460	51.1219	0.0000	0.0000	0.0000	0.0000	74.8812	151.4033	236.6321	(98)
Space heating												1191.5357	(98)
RHI space heating demand												1192	(98)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					2.5400
Number of sides sheltered					0.2687 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2486 (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												
	0.3169	0.3107	0.3045	0.2734	0.2672	0.2361	0.2361	0.2299	0.2486	0.2672	0.2796	0.2921 (22b)
Effective ac	0.5502	0.5483	0.5464	0.5374	0.5357	0.5279	0.5279	0.5264	0.5309	0.5357	0.5391	0.5427 (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
Windows (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.2000	7.2520	9.0000	326.3400 (29a)
Pitched Roof	45.4300		45.4300	0.1000	4.5430	9.0000	408.8700 (30)
Sloping Roof	16.8400		16.8400	0.1600	2.6944	9.0000	151.5600 (30)
Dormer Roofs	3.7000		3.7000	0.1800	0.6660	9.0000	33.3000 (30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.1175		(33)
Party Wall			18.6200	0.0000	0.0000	20.0000	372.4000 (32)
Party Floor			65.0300			30.0000	1950.9000 (32d)
Internal Walls			74.4000			9.0000	669.6000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							3912.9700 (34)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							60.1718 (35)
Total fabric heat loss							8.4448 (36)
							(33) + (36) =
							32.5623 (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	25.6228	25.5319	25.4429	25.0248	24.9466	24.5824	24.5824	24.5150	24.7227	24.9466	25.1048	25.2703 (38)
Heat transfer coeff	58.1851	58.0943	58.0052	57.5871	57.5089	57.1447	57.1447	57.0773	57.2850	57.5089	57.6672	57.8326 (39)
Average = Sum(39)m / 12 =												57.5868 (39)
HLP	0.8947	0.8933	0.8920	0.8855	0.8843	0.8787	0.8787	0.8777	0.8809	0.8843	0.8868	0.8893 (40)
HLP (average)												0.8855 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy conte	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Energy content (annual)										Total = Sum(45)m =		1330.1932 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.6869	18.0929	18.6702	16.2772	15.6183	13.4774	12.4888	14.3311	14.5023	16.9010	18.4487	20.0341 (46)
Water storage loss:												

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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	14.0644	12.6847	14.0142	13.5286	13.9552	13.4769	13.9086	13.9388	13.5050	13.9898	13.5773	14.0547 (61)
Total heat required for water heating calculated for each month	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (64)
Heat gains from water heating, kWh/month	49.3720	43.2771	44.8892	39.4632	38.1094	33.2442	31.1607	35.2520	35.5229	40.9613	44.2891	47.9227 (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
(66)m	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.7639	279.6358	272.3986	256.9915	237.5427	219.2636	207.0521	204.1801	211.4173	226.8245	246.2732	264.5523	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	(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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	(71)
Water heating gains (Table 5)	66.3603	64.4004	60.3350	54.8100	51.2223	46.1725	41.8827	47.3817	49.3374	55.0555	61.5126	64.4122	(72)
Total internal gains	485.6889	481.3088	462.1553	432.9173	403.3456	377.0030	361.8171	369.7364	386.7802	416.2113	448.6524	472.8448	(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			
South				6.7600	46.7521	0.6300	0.7000	0.7700	96.5871 (78)			
Solar gains	96.5871	158.1849	201.4994	227.7381	237.3172	228.3855	223.1465	216.7062	210.4900	170.6172	114.4887	83.4602 (83)
Total gains	582.2760	639.4936	663.6548	660.6554	640.6628	605.3885	584.9637	586.4426	597.2701	586.8285	563.1411	556.3050 (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	18.6807	18.7099	18.7386	18.8746	18.9003	19.0208	19.0208	19.0432	18.9742	18.9003	18.8484	18.7945	
alpha	2.2454	2.2473	2.2492	2.2583	2.2600	2.2681	2.2681	2.2695	2.2649	2.2600	2.2566	2.2530	
util living area	0.8434	0.8102	0.7694	0.7113	0.6287	0.5097	0.3913	0.4047	0.5431	0.6998	0.8037	0.8546	(86)
MIT	19.0350	19.2931	19.6470	20.0681	20.4572	20.7643	20.9070	20.8959	20.7080	20.2296	19.5674	18.9658	(87)
Th 2	20.1720	20.1732	20.1743	20.1798	20.1808	20.1856	20.1856	20.1865	20.1838	20.1808	20.1788	20.1766	(88)
util rest of house	0.8310	0.7957	0.7513	0.6872	0.5947	0.4607	0.3285	0.3434	0.4968	0.6711	0.7865	0.8430	(89)
MIT 2	18.3746	18.6248	18.9683	19.3764	19.7422	20.0194	20.1331	20.1258	19.9706	19.5349	18.9008	18.3111	(90)
Living area fraction	18.6528	18.9064	19.2543	19.6679	20.0435	20.3333	20.4592	20.4503	20.2813	19.8276	19.1817	18.5869	(92)
Temperature adjustment	18.6528	18.9064	19.2543	19.6679	20.0435	20.3333	20.4592	20.4503	20.2813	19.8276	19.1817	18.5869	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8047	0.7704	0.7289	0.6709	0.5887	0.4699	0.3502	0.3639	0.5026	0.6577	0.7628	0.8167	(94)
Ext temp.	468.5478	492.6747	483.7421	443.2061	377.1288	284.4807	204.8505	213.3974	300.2009	385.9673	429.5675	454.3470	(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	835.1208	813.6890	739.8143	620.0909	479.8232	327.6264	220.5317	231.1783	354.0969	530.6701	696.7162	832.0347	(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 per m2	272.7303	215.7216	190.5177	127.3571	76.4046	0.0000	0.0000	0.0000	0.0000	107.6588	192.3471	280.9997	(98)
												1463.7369	(98)
												22.5086	(99)

8c. Space cooling requirement

Not applicable

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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													1617.3888 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	272.7303	215.7216	190.5177	127.3571	76.4046	0.0000	0.0000	0.0000	0.0000	107.6588	192.3471	280.9997	(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)	301.3594	238.3664	210.5168	140.7261	84.4250	0.0000	0.0000	0.0000	0.0000	118.9600	212.5382	310.4969	(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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156	(64)
Efficiency of water heater (217)m	89.3283	89.2505	89.1249	88.9053	88.5298	87.3000	87.3000	87.3000	87.3000	88.7417	89.1433	89.3718	(216)
Fuel for water heating, kWh/month	170.1330	149.3593	155.3801	137.2730	133.3758	118.3578	111.3029	125.4060	126.2162	142.7323	153.2017	165.1703	(219)
Water heating fuel used												1687.9085	(219)
Annual totals kWh/year													
Space heating fuel - main system												1617.3888	(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)												334.3627	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3714.6601	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1617.3888	3.4800	56.2851 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1687.9085	3.4800	58.7392 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	334.3627	13.1900	44.1024 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			289.0193 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.1032 (257)
SAP value		84.6100
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	1617.3888	0.2160	349.3560 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1687.9085	0.2160	364.5882 (264)
Space and water heating			713.9442 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.3627	0.5190	173.5342 (268)
Energy saving/generation technologies			
PV Unit	-413.4000	0.5190	-214.5546 (269)
Total kg/year			711.8489 (272)
CO2 emissions per m2			10.9500 (273)
EI value			91.3308
EI rating			91 (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	$3.48 / 0.8847 = 3.934$, stars = 4
Water heating environmental impact	$0.216 / 0.8847 = 0.2442$, stars = 4

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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	65.0300 (1b)	x 2.1700 (2b)	= 141.1151 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.1151 (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					2 * 10 = 20.0000 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1417 (8)
Measured/design AP50					Yes
Infiltration rate					2.5400
Number of sides sheltered					0.2687 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2486 (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	0.2734	0.2548	0.2548	0.2424	0.2424	0.2299	0.2299	0.2175	0.2175	0.2361	0.2299	0.2424 (22b)
Effective ac	0.5374	0.5325	0.5325	0.5294	0.5294	0.5264	0.5264	0.5237	0.5237	0.5279	0.5264	0.5294 (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
Windows (Uw = 1.40)			6.7600	1.3258	8.9621		(27)
External Wall	43.0200	6.7600	36.2600	0.2000	7.2520	9.0000	326.3400 (29a)
Pitched Roof	45.4300		45.4300	0.1000	4.5430	9.0000	408.8700 (30)
Sloping Roof	16.8400		16.8400	0.1600	2.6944	9.0000	151.5600 (30)
Dormer Roofs	3.7000		3.7000	0.1800	0.6660	9.0000	33.3000 (30)
Total net area of external elements Aum(A, m ²)			108.9900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	24.1175			(33)
Party Wall			18.6200	0.0000	0.0000	20.0000	372.4000 (32)
Party Floor			65.0300			30.0000	1950.9000 (32d)
Internal Walls			74.4000			9.0000	669.6000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3912.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							60.1718 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4448 (36)
Total fabric heat loss							(33) + (36) = 32.5623 (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	25.0248	24.7955	24.7955	24.6516	24.6516	24.5150	24.5150	24.3855	24.3855	24.5824	24.5150	24.6516 (38)
Heat transfer coeff	57.5871	57.3578	57.3578	57.2140	57.2140	57.0773	57.0773	56.9478	56.9478	57.1447	57.0773	57.2140 (39)
Average = Sum(39)m / 12 =												57.1847 (39)
HLP	0.8855	0.8820	0.8820	0.8798	0.8798	0.8777	0.8777	0.8757	0.8757	0.8787	0.8777	0.8798 (40)
HLP (average)												0.8794 (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												2.1197 (42)
Average daily hot water use (litres/day)												84.5432 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.9975	89.6158	86.2340	82.8523	79.4706	76.0889	76.0889	79.4706	82.8523	86.2340	89.6158	92.9975 (44)
Energy content (annual)	137.9126	120.6192	124.4682	108.5144	104.1222	89.8495	83.2588	95.5407	96.6817	112.6732	122.9917	133.5610 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1330.1932 (45)
Water storage loss:	20.6869	18.0929	18.6702	16.2772	15.6183	13.4774	12.4888	14.3311	14.5023	16.9010	18.4487	20.0341 (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	14.0644	12.6847	14.0142	13.5286	13.9552	13.4769	13.9086	13.9388	13.5050	13.9898	13.5773	14.0547 (61)
Total heat required for water heating calculated for each month	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156 (64)
Heat gains from water heating, kWh/month	49.3720	43.2771	44.8892	39.4632	38.1094	33.2442	31.1607	35.2520	35.5229	40.9613	44.2891	47.9227 (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	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	127.1827	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3325	42.0403	34.1895	25.8836	19.3483	16.3347	17.6502	22.9424	30.7932	39.0991	45.6344	48.6480	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.7639	279.6358	272.3986	256.9915	237.5427	219.2636	207.0521	204.1801	211.4173	226.8245	246.2732	264.5523	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	49.8380	(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)	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	-84.7885	(71)
Water heating gains (Table 5)	66.3603	64.4004	60.3350	54.8100	51.2223	46.1725	41.8827	47.3817	49.3374	55.0555	61.5126	64.4122	(72)
Total internal gains	485.6889	481.3088	462.1553	432.9173	403.3456	377.0030	361.8171	369.7364	386.7802	416.2113	448.6524	472.8448	(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
South				6.7600	56.7559		0.6300		0.7000		0.7700		117.2544 (78)
Solar gains	117.2544	162.8637	208.6584	238.2890	236.8829	251.2636	236.2891	237.4718	228.6755	186.8714	138.3823	96.0177	(83)
Total gains	602.9433	644.1725	670.8137	671.2064	640.2285	628.2666	598.1062	607.2082	615.4556	603.0827	587.0347	568.8625	(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	18.8746	18.9501	18.9501	18.9977	18.9977	19.0432	19.0432	19.0865	19.0865	19.0208	19.0432	18.9977	
alpha	2.2583	2.2633	2.2633	2.2665	2.2665	2.2695	2.2695	2.2724	2.2724	2.2681	2.2695	2.2665	
util living area	0.8163	0.7883	0.7392	0.6712	0.5672	0.4161	0.2989	0.2943	0.4610	0.6372	0.7611	0.8288	(86)
MIT	19.3314	19.5255	19.8777	20.2633	20.6339	20.8777	20.9604	20.9619	20.8312	20.4639	19.8765	19.2887	(87)
Th 2	20.1798	20.1828	20.1828	20.1847	20.1847	20.1865	20.1865	20.1882	20.1882	20.1856	20.1865	20.1847	(88)
util rest of house	0.8016	0.7719	0.7185	0.6435	0.5268	0.3601	0.2303	0.2267	0.4082	0.6022	0.7399	0.8147	(89)
MIT 2	18.6689	18.8576	19.1962	19.5635	19.9043	20.1105	20.1693	20.1716	20.0761	19.7546	19.2033	18.6327	(90)
Living area fraction	18.9480	19.1390	19.4834	19.8584	20.2117	20.4338	20.5026	20.5046	20.3942	20.0535	19.4869	18.9091	(91)
MIT	18.9480	19.1390	19.4834	19.8584	20.2117	20.4338	20.5026	20.5046	20.3942	20.0535	19.4869	18.9091	(92)
Temperature adjustment	18.9480	19.1390	19.4834	19.8584	20.2117	20.4338	20.5026	20.5046	20.3942	20.0535	19.4869	18.9091	(93)
adjusted MIT	18.9480	19.1390	19.4834	19.8584	20.2117	20.4338	20.5026	20.5046	20.3942	20.0535	19.4869	18.9091	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	468.2275	482.0766	468.9527	423.9726	338.1748	237.2637	154.0119	153.9832	259.7547	359.5657	422.5283	449.1335	(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	780.1929	759.3627	681.6042	564.0365	406.8871	258.7758	159.9663	159.7156	290.1060	460.2124	632.8107	767.1873	(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	232.1022	186.3363	158.2127	100.8460	51.1219	0.0000	0.0000	0.0000	0.0000	74.8812	151.4033	236.6321	(98)
Space heating												1191.5357	(98)
Space heating per m2												18.3229	(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													1316.6140 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	232.1022	186.3363	158.2127	100.8460	51.1219	0.0000	0.0000	0.0000	0.0000	74.8812	151.4033	236.6321	(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)	256.4665	205.8964	174.8207	111.4320	56.4883	0.0000	0.0000	0.0000	0.0000	82.7416	167.2965	261.4719	(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	151.9770	133.3039	138.4824	122.0430	118.0773	103.3264	97.1674	109.4795	110.1868	126.6630	136.5690	147.6156	(64)
Efficiency of water heater (217)m	89.2061	89.1374	88.9777	88.7194	88.2427	87.3000	87.3000	87.3000	87.3000	88.4621	88.9537	89.2433	(216)
Fuel for water heating, kWh/month	170.3660	149.5489	155.6372	137.5607	133.8097	118.3578	111.3029	125.4060	126.2162	143.1833	153.5282	165.4081	(219)
Water heating fuel used												1690.3251	(219)
Annual totals kWh/year													
Space heating fuel - main system												1316.6140	(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)													334.3627 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3416.3018 (238)

10a. Fuel costs - using BEDF prices (510)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1316.6140	4.2600	56.0878 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1690.3251	4.2600	72.0078 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	334.3627	22.5500	75.3988 (250)
Additional standing charges			96.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	22.5500	0.0000 (252)
Total energy cost			316.4069 (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	1316.6140	0.2160	284.3886 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1690.3251	0.2160	365.1102 (264)
Space and water heating			649.4988 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.3627	0.5190	173.5342 (268)
Energy saving/generation technologies			
PV Unit	-413.4000	0.5190	-214.5546 (269)
Total kg/year			647.4035 (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	1316.6140	1.2200	1606.2691 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1690.3251	1.2200	2062.1966 (264)
Space and water heating			3668.4657 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	334.3627	3.0700	1026.4935 (268)
Energy saving/generation technologies			
PV Unit	-413.4000	3.0700	-1269.1380 (269)
Primary energy kWh/year			3656.0711 (272)
Primary energy kWh/m2/year			56.2213 (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 91

(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: (none)			
	SAP change	Cost change	CO2 change

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 91

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	£92	£92	£0
Mains gas	£224	£224	£0
Space heating	£169	£169	£0
Water heating	£72	£72	£0
Lighting	£75	£75	£0
Total cost of fuels	£316	£316	£0
Total cost of uses	£316	£316	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	56 kWh/m²	56 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	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	60.2 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	279.41 (P1)
Transmission heat loss coefficient	32.56 (37)
Summer heat loss coefficient	311.97 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
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
South	6.7600	118.5567	0.6300 0.7000
total:			0.9000 286.2835

	Jun	Jul	Aug	
Solar gains	301	286	282	(P3)
Internal gains	374	359	367	
Total summer gains	675	645	648	(P5)
Summer gain/loss ratio	2.16	2.07	2.08	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 60.2)	1.58	1.58	1.58	
Threshold temperature	19.14	20.95	20.96	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			