



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 79 Highwood Avenue
EASTLEIGH, SO50 9QY

Contact: Scott Spearing | BEAT Solutions
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Report Issue Date: 20/02/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 214	Issued on Date	20/02/2023
Assessment Reference	AB	Prop Type Ref	Type 10
Property	79 Highwood Avenue, EASTLEIGH, SO50 9QY		

SAP Rating	88 B	DER	13.52	TER	17.59
Environmental	88 B	% DER<TER	23.16		
CO ₂ Emissions (t/year)	1.35	DFEE	53.24	TFEE	62.81
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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)	17.59	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.52	kgCO ₂ /m ²	Pass
	-4.07 (-23.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	62.81	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	53.24	kWh/m ² /yr	
	-9.6 (-15.3%)	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)	0.22 (max. 0.70)	Pass
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.26 (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 Heat 15 Efficiency: 89.3% SEDBUK2009 Minimum: 88.0%	Pass
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Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.27 kWh/day
Permitted by DBSCG 2.10

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North East

11.33 m², No overhang

Windows facing South

0.87 m², No overhang

Windows facing South West

6.70 m², No overhang

Windows facing West

0.87 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.26 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.10

W/m²K

Roof U-value

0.10

W/m²K

Photovoltaic array

1.60

kW

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

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SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	35.98 m	58.46 m ²	2.40 m
	1st Storey:	37.28 m	76.54 m ²	2.66 m

7.0 Living Area	19.25	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	78.02	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	165.46	143.53
Garage Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.24	9.00	20.06	20.06

9.2 Internal Walls		Construction	Kappa (kJ/m ² K)	Area (m ²)
Description				
Internal Wall - GF		Plasterboard on timber frame	9.00	52.99
Internal Wall - FF		Plasterboard on timber frame	9.00	123.40

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	75.34	75.34
Bay Roof	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	1.20	1.20

10.2 Internal Ceilings		Construction	Kappa (kJ/m ² K)	Area (m ²)
Description				
Internal Ceiling		Plasterboard ceiling, carpeted chipboard floor	9.00	57.26

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.17	75.00	58.46
Exposed Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.16	20.00	16.88

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	57.26

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Wall	South West							2.16	
Front Elevation	Window	[1] External Wall	South West	None	0.00					6.70	
Bay 1	Window	[1] External Wall	South	None	0.00					0.87	
Bay 2	Window	[1] External Wall	West	None	0.00					0.87	
Rear Elevation	Window	[1] External Wall	North East	None	0.00					11.33	

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)	15.88	0.300	Yes
Table K1 - Approved	E3 Sill	14.86	0.040	Yes
Table K1 - Approved	E4 Jamb	35.66	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	35.98	0.160	Yes
Table K1 - Default	E20 Exposed floor (normal)	9.68	0.320	No
Table K1 - Default	E21 Exposed floor (inverted)	7.83	0.320	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	27.60	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	37.28	0.060	No
Table K1 - Default	E15 Flat roof with parapet	3.06	0.560	No
Table K1 - Approved	E16 Corner (normal)	32.76	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	12.52	-0.090	No

Y-value 0.078 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 6.00 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 5.26 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows fully open

Cross ventilation possible Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
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

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Description

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heat Emitter

Flow Temperature

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery

SUMMARY FOR INPUT DATA

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Instantaneous System 1	
Waste Water Heat Recovery	No
Instantaneous System 2	
Waste Water Heat Recovery	No
Storage System	
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	180.00	L
Loss	1.27	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store	None
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32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.60	South West	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£112	B 90	

U-VALUE CALCULATOR REPORT

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Client	Highwood Construction Ltd, HIGHWOOD		

Building Elements

Roof Pitched Roof - 400mm Quilt

Roof Type: Pitched Roof, insulated flat ceiling

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

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

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

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Building Elements

Wall External Walls - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

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

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

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

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Client	Highwood Construction Ltd, HIGHWOOD
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Building Elements

Wall Garage Wall

Wall Type: Timber framed Wall with I-beams

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 2	Mineral wool				
	Main construction	90	0.0400	2.2500	87.50
	Main construction	90	0.1300	0.6923	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Standard cavity				
	Main construction	70	0.3889	0.1800	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Mineral wool				
	Main construction	90	0.0400	2.2500	87.50
	Main construction	90	0.1300	0.6923	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 6	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 4.420 m ² K/W	Lower limit = 3.989 m ² K/W	Average = 4.205 m ² K/W
	Total correction = 0.0035 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None

Total thickness: 278 mm

U-value: 0.24 W/m² K

Kappa: n/a

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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 58.46 m², Perimeter = 35.98 m, Wall thickness = 275.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.17 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.17 W/m² K

Kappa: n/a

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Building Elements

Floor Exposed Floor

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Layer 2	Joist Void				
	Main construction	35	0.1768	0.1980	87.50
	Main construction	35	0.1300	0.2692	12.50
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Mineral wool				
	Main construction	200	0.0400	5.0000	87.50
	Main construction	200	0.1300	1.5385	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Celotex TB4000				
	Main construction	25	0.0220	1.1364	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	airspace/timber battens				
	Main construction	22	0.1222	0.1800	89.63
	Main construction	22	0.1196	0.1840	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 6.261 m ² K/W	Lower limit = 5.922 m ² K/W	Average = 6.092 m ² K/W
	Total correction = 0.0045 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: GarageSingle1Outside

Total thickness: 329 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 135 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) 17.59 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 53.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.22 (max. 0.70)	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.26 (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 Heat 15

Efficiency: 89.3% SEDBUK2009
Minimum: 88.0%

OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.27 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North East: 11.33 m², No overhang
Windows facing South: 0.87 m², No overhang
Windows facing South West: 6.70 m², No overhang
Windows facing West: 0.87 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Photovoltaic array 1.60 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.4084 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4084 (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	0.5207	0.5105	0.5003	0.4492	0.4390	0.3880	0.3880	0.3778	0.4084	0.4390	0.4594	0.4799 (22b)
Effective ac	0.6356	0.6303	0.6251	0.6009	0.5964	0.5753	0.5753	0.5714	0.5834	0.5964	0.6055	0.6151 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			18.0000	1030.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10532.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.0159 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss						(33) + (36) =	108.7643 (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	72.1283	71.5309	70.9453	68.1948	67.6803	65.2847	65.2847	64.8411	66.2074	67.6803	68.7213	69.8096 (38)
Heat transfer coeff	180.8925	180.2951	179.7095	176.9591	176.4445	174.0490	174.0490	173.6053	174.9717	176.4445	177.4855	178.5739 (39)
Average = Sum(39)m / 12 =												176.9566 (39)
HLP	1.3399	1.3355	1.3312	1.3108	1.3070	1.2893	1.2893	1.2860	1.2961	1.3070	1.3147	1.3228 (40)
HLP (average)												1.3108 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6858 (55)
Total storage loss												
If cylinder contains dedicated solar storage	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (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	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
Heat gains from water heating, kWh/month	91.6141	81.1456	86.1553	78.5287	77.8942	70.9502	69.4231	74.4099	73.7243	81.3662	84.4068	89.8472 (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	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.7618	25.5460	20.7754	15.7283	11.7571	9.9258	10.7252	13.9410	18.7116	23.7587	27.7299	29.5612 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345 (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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	123.1372	120.7524	115.8002	109.0676	104.6966	98.5419	93.3107	100.0133	102.3948	109.3632	117.2317	120.7624 (72)
Total internal gains	525.1538	522.7041	505.0409	476.3574	446.6769	418.6361	400.8063	407.5739	422.6662	451.5857	484.7636	510.1804 (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	
Northeast				11.3300	11.2829	0.6300		0.7000		0.7700	39.0683 (75)	
South				0.8700	46.7521	0.6300		0.7000		0.7700	12.4306 (78)	
Southwest				6.7000	36.7938	0.6300		0.7000		0.7700	75.3393 (79)	
West				0.8700	19.6403	0.6300		0.7000		0.7700	5.2220 (80)	

Solar gains	132.0602	238.4288	361.6216	506.7105	620.5932	639.3024	606.7119	518.2908	411.3666	273.0977	160.6428	111.4154 (83)
Total gains	657.2140	761.1329	866.6625	983.0679	1067.2701	1057.9385	1007.5182	925.8647	834.0329	724.6833	645.4064	621.5958 (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	16.1731	16.2267	16.2796	16.5326	16.5808	16.8090	16.8090	16.8520	16.7204	16.5808	16.4836	16.3831
alpha	2.0782	2.0818	2.0853	2.1022	2.1054	2.1206	2.1206	2.1235	2.1147	2.1054	2.0989	2.0922
util living area	0.9668	0.9538	0.9305	0.8844	0.8082	0.6969	0.5829	0.6284	0.7932	0.9094	0.9550	0.9703 (86)
MIT	17.6184	17.9092	18.4409	19.1774	19.8830	20.4558	20.7420	20.6864	20.2136	19.3123	18.3518	17.5805 (87)
Th 2	19.8097	19.8131	19.8165	19.8324	19.8354	19.8493	19.8493	19.8518	19.8439	19.8354	19.8293	19.8230 (88)
util rest of house	0.9621	0.9471	0.9198	0.8649	0.7716	0.6286	0.4747	0.5252	0.7397	0.8903	0.9474	0.9661 (89)
MIT 2	16.7289	17.0189	17.5468	18.2785	18.9571	19.4900	19.7231	19.6885	19.2847	18.4227	17.4714	16.6996 (90)
Living area fraction	16.8557	17.1459	17.6743	18.4067	19.0891	19.6277	19.8684	19.8308	19.4171	18.5496	17.5969	16.8252 (92)
MIT	16.8557	17.1459	17.6743	18.4067	19.0891	19.6277	19.8684	19.8308	19.4171	18.5496	17.5969	16.8252 (93)
Temperature adjustment												0.0000
adjusted MIT	16.8557	17.1459	17.6743	18.4067	19.0891	19.6277	19.8684	19.8308	19.4171	18.5496	17.5969	16.8252 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	620.9245	704.6849	774.3447	820.2355	792.8565	648.7417	480.2850	484.2763	596.5091	624.5964	598.0497	590.6295 (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	2271.2378	2207.8714	2008.1216	1682.3000	1303.7742	875.0720	568.8640	595.5978	930.3449	1402.6592	1863.0528	2254.5316 (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	1227.8330	1010.1414	917.9300	620.6865	380.1228	0.0000	0.0000	0.0000	0.0000	578.8787	910.8022	1237.9431 (98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 6884.3378 (98)
50.9951 (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)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 90.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 7623.8514 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1227.8330	1010.1414	917.9300	620.6865	380.1228	0.0000	0.0000	0.0000	0.0000	578.8787	910.8022	1237.9431 (98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)
Space heating fuel (main heating system)	1359.7265	1118.6505	1016.5338	687.3605	420.9555	0.0000	0.0000	0.0000	0.0000	641.0617	1008.6403	1370.9226 (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	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
Efficiency of water heater (217)m	88.5410	88.4388	88.2092	87.7003	86.6752	79.6000	79.6000	79.6000	79.6000	87.4857	88.2240	79.6000 (216)
Fuel for water heating, kWh/month	240.4899	212.0180	222.7828	200.2238	198.0607	191.9654	183.6589	202.5004	202.4467	208.1614	219.0737	234.3595 (219)
Water heating fuel used												2515.7413 (219)
Annual totals kWh/year												
Space heating fuel - main system												7623.8514 (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)												507.9421 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.60 * 1004 * 1.00) =									-1285.1151			-1285.1151 (233)
Total delivered energy for all uses												9437.4197 (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	7623.8514	0.2160	1646.7519 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2515.7413	0.2160	543.4001 (264)
Space and water heating			2190.1520 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	507.9421	0.5190	263.6219 (268)
Energy saving/generation technologies			
PV Unit	-1285.1151	0.5190	-666.9748 (269)
Total CO2, kg/year			1825.7242 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5200 (273)

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

	DER	TFA	N	EF	CO2 emissions
Total Floor Area		135.0000			13.5200 ZC1
Assumed number of occupants			2.9069		135.0000
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190	2.9069
CO2 emissions from appliances, equation (L14)					0.5190
CO2 emissions from cooking, equation (L16)					13.3287 ZC2
Total CO2 emissions					1.3983 ZC3
Residual CO2 emissions offset from biofuel CHP					28.2470 ZC4
Additional allowable electricity generation, kWh/m²/year					0.0000 ZC5
Resulting CO2 emissions offset from additional allowable electricity generation					0.0000 ZC6
Net CO2 emissions					0.0000 ZC7
					28.2470 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	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1163 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3663 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3663 (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	0.4670	0.4579	0.4487	0.4029	0.3938	0.3480	0.3480	0.3388	0.3663	0.3938	0.4121	0.4304 (22b)
Effective ac	0.6091	0.6048	0.6007	0.5812	0.5775	0.5606	0.5606	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1300	7.5998		(28a)
Exposed Floor			16.8800	0.1300	2.1944		(28b)
External Wall	165.4600	21.9300	143.5300	0.1800	25.8354		(29a)
Garage Wall	20.0600		20.0600	0.1800	3.6108		(29a)
External Roof	75.3400		75.3400	0.1300	9.7942		(30)
Bay Roof	1.2000		1.2000	0.1300	0.1560		(30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	77.5608	(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)							20.4520 (36)
Total fabric heat loss						(33) + (36) =	98.0128 (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	69.1213	68.6407	68.1695	65.9567	65.5427	63.6153	63.6153	63.2584	64.3577	65.5427	66.3802	67.2558 (38)
Heat transfer coeff	167.1341	166.6535	166.1824	163.9695	163.5555	161.6282	161.6282	161.2712	162.3705	163.5555	164.3930	165.2687 (39)
Average = Sum(39)m / 12 =												163.9675 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2380	1.2345	1.2310	1.2146	1.2115	1.1972	1.1972	1.1946	1.2027	1.2115	1.2177	1.2242 (40)
HLP (average)												1.2146 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)
Energy conte	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Energy content (annual)												Total = Sum(45)m = 1624.3468 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												

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Store volume													180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5520 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8381 (55)
Total storage loss													
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	(56)
If cylinder contains dedicated solar storage													
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month													
217.6527	191.7697	201.2353	180.1651	176.3900	157.3727	150.9130	165.9108	165.7157	186.8320	197.8437	212.3388	212.3388	(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)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h													
217.6527	191.7697	201.2353	180.1651	176.3900	157.3727	150.9130	165.9108	165.7157	186.8320	197.8437	212.3388	212.3388	(64)
Heat gains from water heating, kWh/month													
95.3905	84.5565	89.9317	82.1832	81.6706	74.6048	73.1995	78.1863	77.3788	85.1426	88.0614	93.6236	93.6236	(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	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
28.7618	25.5460	20.7754	15.7283	11.7571	9.9258	10.7252	13.9410	18.7116	23.7587	27.7299	29.5612	29.5612	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535	290.2535	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	(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)													
-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	(71)
Water heating gains (Table 5)													
128.2130	125.8282	120.8759	114.1434	109.7723	103.6177	98.3864	105.0891	107.4706	114.4390	122.3075	125.8382	125.8382	(72)
Total internal gains													
530.2295	527.7799	510.1167	481.4331	451.7527	423.7119	405.8821	412.6497	427.7420	456.6614	489.8393	515.2562	515.2562	(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			
Northeast				11.3300	11.2829	0.6300		0.7000	0.7700	39.0683 (75)			
South				0.8700	46.7521	0.6300		0.7000	0.7700	12.4306 (78)			
Southwest				6.7000	36.7938	0.6300		0.7000	0.7700	75.3393 (79)			
West				0.8700	19.6403	0.6300		0.7000	0.7700	5.2220 (80)			

Solar gains	132.0602	238.4288	361.6216	506.7105	620.5932	639.3024	606.7119	518.2908	411.3666	273.0977	160.6428	111.4154	(83)
Total gains	662.2897	766.2087	871.7383	988.1436	1072.3459	1063.0143	1012.5940	930.9405	839.1087	729.7591	650.4822	626.6716	(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	56.0927	56.2545	56.4139	57.1753	57.3200	58.0035	58.0035	58.1319	57.7383	57.3200	57.0280	56.7258	
alpha	4.7395	4.7503	4.7609	4.8117	4.8213	4.8669	4.8669	4.8755	4.8492	4.8213	4.8019	4.7817	
util living area	0.9992	0.9981	0.9949	0.9821	0.9371	0.8180	0.6595	0.7242	0.9242	0.9903	0.9983	0.9994	(86)
MIT	19.5420	19.6857	19.9426	20.3031	20.6449	20.8863	20.9701	20.9533	20.7624	20.3270	19.8760	19.5241	(87)
Th 2	19.8897	19.8925	19.8953	19.9083	19.9108	19.9222	19.9222	19.9243	19.9178	19.9108	19.9058	19.9007	(88)
util rest of house	0.9989	0.9975	0.9930	0.9743	0.9067	0.7317	0.5186	0.5878	0.8742	0.9848	0.9975	0.9992	(89)
MIT 2	17.9402	18.1522	18.5292	19.0601	19.5374	19.8390	19.9103	19.9030	19.7047	19.1005	18.4401	17.9215	(90)
Living area fraction									fLA = Living area / (4) =			0.1426	(91)
MIT	18.1686	18.3709	18.7308	19.2374	19.6953	19.9883	20.0614	20.0527	19.8556	19.2754	18.6448	18.1500	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1686	18.3709	18.7308	19.2374	19.6953	19.9883	20.0614	20.0527	19.8556	19.2754	18.6448	18.1500	(93)

8. Space heating requirement

Utilisation	0.9981	0.9960	0.9898	0.9675	0.8991	0.7379	0.5383	0.6060	0.8704	0.9799	0.9961	0.9986	(94)
Useful gains	661.0403	763.1453	862.8246	956.0329	964.0945	784.3796	545.0697	564.1536	730.3769	715.0897	647.9772	625.7713	(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													
2317.9102	2244.9672	2032.5410	1695.0104	1307.6755	870.9069	559.4612	589.0816	934.5334	1418.9039	1897.8872	2305.5005	2305.5005	(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													
1232.7112	995.7843	870.2690	532.0637	255.6242	0.0000	0.0000	0.0000	0.0000	0.0000	523.6378	899.9352	1249.7185	(98)
Space heating												6559.7441	(98)
Space heating per m2												(98) / (4) =	48.5907 (99)

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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)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7015.7691 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1232.7112	995.7843	870.2690	532.0637	255.6242	0.0000	0.0000	0.0000	0.0000	523.6378	899.9352	1249.7185	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1318.4077	1065.0100	930.7690	569.0521	273.3949	0.0000	0.0000	0.0000	0.0000	560.0404	962.4976	1336.5974	(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	217.6527	191.7697	201.2353	180.1651	176.3900	157.3727	150.9130	165.9108	165.7157	186.8320	197.8437	212.3388	(64)
Efficiency of water heater (217)m	88.7149	88.5820	88.2770	87.5311	85.8026	79.8000	79.8000	79.8000	79.8000	87.4176	88.3647	79.8000	(216)
Fuel for water heating, kWh/month	245.3395	216.4884	227.9589	205.8298	205.5765	197.2089	189.1140	207.9083	207.6638	213.7235	223.8946	239.1975	(219)
Water heating fuel used												2579.9038	(219)
Annual totals kWh/year													
Space heating fuel - main system												7015.7691	(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)												507.9421	(232)
Total delivered energy for all uses												10178.6150	(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	7015.7691	0.2160	1515.4061 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2579.9038	0.2160	557.2592 (264)
Space and water heating			2072.6653 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	507.9421	0.5190	263.6219 (268)
Total CO2, kg/m2/year			2375.2123 (272)
Emissions per m2 for space and water heating			15.3531 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9528 (272b)
Emissions per m2 for pumps and fans			0.2883 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3531 * 1.00) + 1.9528 + 0.2883, rounded to 2 d.p.			17.5900 (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	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =				40.0000 / (5) =	0.1163 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.3793 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3793 (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	0.4836	0.4741	0.4647	0.4172	0.4078	0.3603	0.3603	0.3509	0.3793	0.4078	0.4267	0.4457 (22b)
Effective ac	0.6169	0.6124	0.6080	0.5870	0.5831	0.5649	0.5649	0.5616	0.5719	0.5831	0.5910	0.5993 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			9.0000	515.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10016.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							74.1985 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss						(33) + (36) =	108.7643 (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	70.0154	69.5001	68.9949	66.6222	66.1783	64.1117	64.1117	63.7290	64.9077	66.1783	67.0763	68.0152 (38)
Heat transfer coeff	178.7797	178.2643	177.7592	175.3865	174.9425	172.8760	172.8760	172.4933	173.6720	174.9425	175.8406	176.7795 (39)
Average = Sum(39)m / 12 =												175.3843 (39)
HLP	1.3243	1.3205	1.3167	1.2992	1.2959	1.2806	1.2806	1.2777	1.2865	1.2959	1.3025	1.3095 (40)
HLP (average)												1.2991 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Energy content (annual)										Total =	Sum (45)m =	1624.3468 (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 (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)
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	35.7871	31.2997	32.2984	28.1586	27.0188	23.3152	21.6049	24.7920	25.0881	29.2377	31.9153	34.6579 (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	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.7618	25.5460	20.7754	15.7283	11.7571	9.9258	10.7252	13.9410	18.7116	23.7587	27.7299	29.5612 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345 (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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	48.1010	46.5769	43.4119	39.1091	36.3156	32.3822	29.0389	33.3226	34.8446	39.2980	44.3268	46.5832 (72)
Total internal gains	447.1175	445.5285	429.6527	403.3989	375.2960	349.4764	333.5346	337.8831	352.1160	378.5205	408.8586	433.0013 (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	
Northeast				11.3300	11.2829	0.6300		0.7000		0.7700	39.0683 (75)	
South				0.8700	46.7521	0.6300		0.7000		0.7700	12.4306 (78)	
Southwest				6.7000	36.7938	0.6300		0.7000		0.7700	75.3393 (79)	
West				0.8700	19.6403	0.6300		0.7000		0.7700	5.2220 (80)	

Solar gains	132.0602	238.4288	361.6216	506.7105	620.5932	639.3024	606.7119	518.2908	411.3666	273.0977	160.6428	111.4154 (83)
Total gains	579.1777	683.9573	791.2742	910.1094	995.8891	988.7787	940.2464	856.1739	763.4826	651.6181	569.5015	544.4166 (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	15.5635	15.6085	15.6529	15.8646	15.9049	16.0950	16.0950	16.1307	16.0213	15.9049	15.8237	15.7396
alpha	2.0376	2.0406	2.0435	2.0576	2.0603	2.0730	2.0730	2.0754	2.0681	2.0603	2.0549	2.0493
util living area	0.9713	0.9587	0.9362	0.8918	0.8185	0.7117	0.6010	0.6488	0.8093	0.9191	0.9611	0.9746 (86)
MIT	17.4579	17.7581	18.3071	19.0654	19.8000	20.4012	20.7092	20.6458	20.1389	19.1960	18.2036	17.4135 (87)
Th 2	19.8219	19.8248	19.8277	19.8415	19.8441	19.8561	19.8561	19.8583	19.8515	19.8441	19.8389	19.8334 (88)
util rest of house	0.9672	0.9528	0.9266	0.8738	0.7838	0.6457	0.4941	0.5480	0.7593	0.9022	0.9546	0.9710 (89)
MIT 2	16.5842	16.8838	17.4292	18.1827	18.8920	19.4543	19.7099	19.6687	19.2296	18.3227	17.3380	16.5473 (90)
Living area fraction									fLA =	Living area / (4) =		0.1426 (91)
MIT	16.7088	17.0085	17.5544	18.3086	19.0215	19.5893	19.8524	19.8080	19.3593	18.4472	17.4614	16.6708 (92)
Temperature adjustment												0.0000
adjusted MIT	16.7088	17.0085	17.5544	18.3086	19.0215	19.5893	19.8524	19.8080	19.3593	18.4472	17.4614	16.6708 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9513	0.9325	0.9007	0.8427	0.7533	0.6275	0.4937	0.5427	0.7322	0.8740	0.9351	0.9565 (94)
Useful gains	550.9652	637.7799	712.6765	766.9271	750.2306	620.4990	464.2174	464.6759	559.0521	569.4854	532.5590	520.7485 (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	2218.4352	2158.5053	1965.0171	1650.1334	1280.8337	862.5352	562.2617	587.8613	913.3888	1372.8098	1821.9533	2204.5846 (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	1240.5976	1021.9275	931.7414	635.9085	394.7687	0.0000	0.0000	0.0000	0.0000	597.6733	928.3639	1252.7741 (98)
Space heating												7003.7550 (98)
Space heating per m2										(98) / (4) =		51.8797 (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

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1625.0342	1279.2822	1310.9490	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5906	0.6578	0.6210	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	959.8076	841.4598	814.1319	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1276.9716	1217.5371	1121.8081	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	228.3580	279.8015	228.9111	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												737.0707	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	57.0895	69.9504	57.2278	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												184.2677	(107)
Space cooling per m2												1.3649	(108)
Energy for space heating												51.8797	(99)
Energy for space cooling												1.3649	(108)
Total												53.2446	(109)
Dwelling Fabric Energy Efficiency (DFEE)												53.2	(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	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (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					4 * 10 = 40.0000 (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)					40.0000 / (5) = 0.1163 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3663 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3663 (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	0.4670	0.4579	0.4487	0.4029	0.3938	0.3480	0.3480	0.3388	0.3663	0.3938	0.4121	0.4304 (22b)
Effective ac	0.6091	0.6048	0.6007	0.5812	0.5775	0.5606	0.5606	0.5574	0.5671	0.5775	0.5849	0.5926 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1300	7.5998		(28a)
Exposed Floor			16.8800	0.1300	2.1944		(28b)
External Wall	165.4600	21.9300	143.5300	0.1800	25.8354		(29a)
Garage Wall	20.0600		20.0600	0.1800	3.6108		(29a)
External Roof	75.3400		75.3400	0.1300	9.7942		(30)
Bay Roof	1.2000		1.2000	0.1300	0.1560		(30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	77.5608	(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)							20.4520 (36)
Total fabric heat loss						(33) + (36) =	98.0128 (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	69.1213	68.6407	68.1695	65.9567	65.5427	63.6153	63.6153	63.2584	64.3577	65.5427	66.3802	67.2558 (38)
Heat transfer coeff	167.1341	166.6535	166.1824	163.9695	163.5555	161.6282	161.6282	161.2712	162.3705	163.5555	164.3930	165.2687 (39)
Average = Sum(39)m / 12 =												163.9675 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2380	1.2345	1.2310	1.2146	1.2115	1.1972	1.1972	1.1946	1.2027	1.2115	1.2177	1.2242 (40)
HLP (average)												1.2146 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)
Energy conte	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Energy content (annual)												Total = Sum(45)m = 1624.3468 (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 (46)
Water storage loss:												

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.7871	31.2997	32.2984	28.1586	27.0188	23.3152	21.6049	24.7920	25.0881	29.2377	31.9153	34.6579 (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	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	145.3446	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.7618	25.5460	20.7754	15.7283	11.7571	9.9258	10.7252	13.9410	18.7116	23.7587	27.7299	29.5612	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	303.6514	306.8023	298.8620	281.9581	260.6199	240.5650	227.1671	224.0161	231.9564	248.8604	270.1986	290.2535	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	37.5345	(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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	(71)
Water heating gains (Table 5)	48.1010	46.5769	43.4119	39.1091	36.3156	32.3822	29.0389	33.3226	34.8446	39.2980	44.3268	46.5832	(72)
Total internal gains	447.1175	445.5285	429.6527	403.3989	375.2960	349.4764	333.5346	337.8831	352.1160	378.5205	408.8586	433.0013	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	11.3300	11.2829	0.6300	0.7000	0.7700	39.0683 (75)
South	0.8700	46.7521	0.6300	0.7000	0.7700	12.4306 (78)
Southwest	6.7000	36.7938	0.6300	0.7000	0.7700	75.3393 (79)
West	0.8700	19.6403	0.6300	0.7000	0.7700	5.2220 (80)

Solar gains	132.0602	238.4288	361.6216	506.7105	620.5932	639.3024	606.7119	518.2908	411.3666	273.0977	160.6428	111.4154	(83)
Total gains	579.1777	683.9573	791.2742	910.1094	995.8891	988.7787	940.2464	856.1739	763.4826	651.6181	569.5015	544.4166	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0927	56.2545	56.4139	57.1753	57.3200	58.0035	58.0035	58.1319	57.7383	57.3200	57.0280	56.7258	
alpha	4.7395	4.7503	4.7609	4.8117	4.8213	4.8669	4.8669	4.8755	4.8492	4.8213	4.8019	4.7817	
util living area	0.9995	0.9989	0.9966	0.9871	0.9510	0.8477	0.6976	0.7654	0.9445	0.9939	0.9990	0.9997	(86)
MIT	19.4853	19.6298	19.8887	20.2535	20.6051	20.8647	20.9619	20.9403	20.7249	20.2754	19.8207	19.4678	(87)
Th 2	19.8897	19.8925	19.8953	19.9083	19.9108	19.9222	19.9222	19.9243	19.9178	19.9108	19.9058	19.9007	(88)
util rest of house	0.9994	0.9985	0.9953	0.9813	0.9259	0.7671	0.5544	0.6306	0.9041	0.9904	0.9986	0.9995	(89)
MIT 2	18.5020	18.6486	18.9091	19.2813	19.6212	19.8521	19.9114	19.9047	19.7425	19.3071	18.8500	18.4931	(90)
Living area fraction									fLA = Living area / (4) =			0.1426	(91)
MIT	18.6422	18.7885	19.0488	19.4199	19.7615	19.9964	20.0612	20.0523	19.8826	19.4452	18.9884	18.6321	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6422	18.7885	19.0488	19.4199	19.7615	19.9964	20.0612	20.0523	19.8826	19.4452	18.9884	18.6321	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9991	0.9978	0.9938	0.9777	0.9214	0.7737	0.5748	0.6490	0.9023	0.9881	0.9981	0.9993	(94)
Ext temp.	578.6539	682.4840	786.3870	889.7873	917.6256	765.0200	540.4205	555.6336	688.9244	643.8875	568.4181	544.0572	(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	2397.0708	2314.5623	2085.3879	1724.9467	1318.5096	872.2175	559.4267	589.0166	938.9249	1446.6778	1954.3707	2385.1728	(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	(98)
Space heating per m2	1352.9022	1096.7566	966.4567	601.3148	298.2577	0.0000	0.0000	0.0000	0.0000	597.2760	997.8859	1369.7900	(99)
												7280.6398	(98)
												53.9307	(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	1519.3046	1196.0483	1225.6614	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7505	0.8369	0.7911	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1140.1874	1000.9160	969.6142	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1276.9716	1217.5371	1121.8081	0.0000	0.0000	0.0000	0.0000	(103)

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Month fraction	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	98.4846	161.1661	113.2323	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												372.8830 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.6212	40.2915	28.3081	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.2207 (107)
Space cooling per m2												0.6905 (108)
Energy for space heating												53.9307 (99)
Energy for space cooling												0.6905 (108)
Total												54.6212 (109)
Target Fabric Energy Efficiency (TFEE)												62.8 (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	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.4084 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4084 (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	0.4492	0.4186	0.4186	0.3982	0.3982	0.3778	0.3778	0.3573	0.3573	0.3880	0.3778	0.3982 (22b)
Effective ac	0.6009	0.5876	0.5876	0.5793	0.5793	0.5714	0.5714	0.5638	0.5638	0.5753	0.5714	0.5793 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			18.0000	1030.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10532.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.0159 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss						(33) + (36) =	108.7643 (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	68.1948	66.6865	66.6865	65.7402	65.7402	64.8411	64.8411	63.9893	63.9893	65.2847	64.8411	65.7402 (38)
Heat transfer coeff	176.9591	175.4508	175.4508	174.5044	174.5044	173.6053	173.6053	172.7536	172.7536	174.0490	173.6053	174.5044 (39)
Average = Sum(39)m / 12 =												174.3122 (39)
HLP	1.3108	1.2996	1.2996	1.2926	1.2926	1.2860	1.2860	1.2797	1.2797	1.2893	1.2860	1.2926 (40)
HLP (average)												1.2912 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

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Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Energy content (annual)										Total =	Sum (45)m =	1624.3468 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6858 (55)
Total storage loss												
	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (56)
If cylinder contains dedicated solar storage												
	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (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)
												0.0000 (63)
Output from w/h												
	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
RHI water heating demand												2149 (64)
Heat gains from water heating, kWh/month												
	91.6141	81.1456	86.1553	78.5287	77.8942	70.9502	69.4231	74.4099	73.7243	81.3662	84.4068	89.8472 (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	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	71.9045	63.8649	51.9384	39.3207	29.3927	24.8146	26.8130	34.8526	46.7790	59.3967	69.3248	73.9029 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482 (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)												
	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)												
	123.1372	120.7524	115.8002	109.0676	104.6966	98.5419	93.3107	100.0133	102.3948	109.3632	117.2317	120.7624 (72)
Total internal gains												
	764.7388	759.0173	730.2874	685.7074	639.5603	598.8948	575.6651	585.7044	611.8636	656.6794	706.3240	744.3655 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	Specific data	factor	W						
		W/m2		or Table 6c	Table 6d							
Northeast	11.3300	14.6176	0.6300	0.7000	0.7700	50.6150 (75)						
South	0.8700	56.7559	0.6300	0.7000	0.7700	15.0904 (78)						
Southwest	6.7000	45.1778	0.6300	0.7000	0.7700	92.5064 (79)						
West	0.8700	25.1925	0.6300	0.7000	0.7700	6.6983 (80)						
Solar gains	164.9102	254.4520	391.6215	555.4703	645.0728	728.9489	667.3089	593.9323	468.3013	311.2189	200.1728	131.5671 (83)
Total gains	929.6489	1013.4694	1121.9089	1241.1777	1284.6331	1327.8437	1242.9741	1179.6367	1080.1649	967.8984	906.4968	875.9326 (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	16.5326	16.6747	16.6747	16.7652	16.7652	16.8520	16.8520	16.9351	16.9351	16.8090	16.8520	16.7652
alpha	2.1022	2.1116	2.1116	2.1177	2.1177	2.1235	2.1235	2.1290	2.1290	2.1206	2.1235	2.1177
util living area	0.9303	0.9145	0.8782	0.8111	0.7029	0.5359	0.4083	0.4241	0.6484	0.8229	0.9036	0.9360 (86)
MIT	18.2834	18.5212	19.0345	19.6829	20.3137	20.7486	20.9053	20.8988	20.5878	19.8877	19.0207	18.2802 (87)
Th 2	19.8324	19.8411	19.8411	19.8466	19.8466	19.8518	19.8518	19.8568	19.8568	19.8493	19.8518	19.8466 (88)
util rest of house	0.9205	0.9026	0.8603	0.7812	0.6492	0.4463	0.2838	0.2968	0.5684	0.7869	0.8877	0.9269 (89)
MIT 2	17.3988	17.6376	18.1393	18.7664	19.3512	19.7166	19.8217	19.8241	19.6056	18.9760	18.1400	17.4057 (90)
Living area fraction									fLA =	Living area / (4) =		0.1426 (91)
MIT	17.5250	17.7636	18.2669	18.8970	19.4884	19.8638	19.9762	19.9774	19.7457	19.1060	18.2656	17.5304 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5250	17.7636	18.2669	18.8970	19.4884	19.8638	19.9762	19.9774	19.7457	19.1060	18.2656	17.5304 (93)

8. Space heating requirement

Utilisation	0.8944	0.8744	0.8293	0.7515	0.6300	0.4473	0.2983	0.3113	0.5595	0.7582	0.8587	0.9020 (94)
Useful gains	831.5159	886.1454	930.4374	932.7224	809.3168	593.9538	370.8375	367.2681	604.3372	733.8773	778.4403	790.1315 (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												
	2145.6209	2081.4710	1871.5222	1552.5744	1114.8101	688.1353	395.1643	393.4240	768.0045	1236.7857	1712.7164	2099.3647 (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												

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	977.6941	803.2588	700.1671	446.2935	227.2871	0.0000	0.0000	0.0000	0.0000	374.1638	672.6788	974.0695 (98)
RHI space heating demand												5175.6126 (98)
												5176 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.4084 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4084 (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	0.5207	0.5105	0.5003	0.4492	0.4390	0.3880	0.3880	0.3778	0.4084	0.4390	0.4594	0.4799 (22b)
Effective ac	0.6356	0.6303	0.6251	0.6009	0.5964	0.5753	0.5753	0.5714	0.5834	0.5964	0.6055	0.6151 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			18.0000	1030.6800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10532.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.0159 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss							(33) + (36) = 108.7643 (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	72.1283	71.5309	70.9453	68.1948	67.6803	65.2847	65.2847	64.8411	66.2074	67.6803	68.7213	69.8096 (38)
Heat transfer coeff	180.8925	180.2951	179.7095	176.9591	176.4445	174.0490	174.0490	173.6053	174.9717	176.4445	177.4855	178.5739 (39)
Average = Sum(39)m / 12 =												176.9566 (39)
HLP	1.3399	1.3355	1.3312	1.3108	1.3070	1.2893	1.2893	1.2860	1.2961	1.3070	1.3147	1.3228 (40)
HLP (average)												1.3108 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6858 (55)
Total storage loss												
If cylinder contains dedicated solar storage	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (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	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
Heat gains from water heating, kWh/month	91.6141	81.1456	86.1553	78.5287	77.8942	70.9502	69.4231	74.4099	73.7243	81.3662	84.4068	89.8472 (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	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.9045	63.8649	51.9384	39.3207	29.3927	24.8146	26.8130	34.8526	46.7790	59.3967	69.3248	73.9029 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482 (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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	123.1372	120.7524	115.8002	109.0676	104.6966	98.5419	93.3107	100.0133	102.3948	109.3632	117.2317	120.7624 (72)
Total internal gains	764.7388	759.0173	730.2874	685.7074	639.5603	598.8948	575.6651	585.7044	611.8636	656.6794	706.3240	744.3655 (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
Northeast	11.3300	11.2829	0.6300	0.7000	0.7700	39.0683 (75)
South	0.8700	46.7521	0.6300	0.7000	0.7700	12.4306 (78)
Southwest	6.7000	36.7938	0.6300	0.7000	0.7700	75.3393 (79)
West	0.8700	19.6403	0.6300	0.7000	0.7700	5.2220 (80)

Solar gains	132.0602	238.4288	361.6216	506.7105	620.5932	639.3024	606.7119	518.2908	411.3666	273.0977	160.6428	111.4154 (83)
Total gains	896.7990	997.4461	1091.9090	1192.4179	1260.1535	1238.1972	1182.3770	1103.9952	1023.2302	929.7771	866.9669	855.7809 (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	16.1731	16.2267	16.2796	16.5326	16.5808	16.8090	16.8090	16.8520	16.7204	16.5808	16.4836	16.3831
alpha	2.0782	2.0818	2.0853	2.1022	2.1054	2.1206	2.1206	2.1235	2.1147	2.1054	2.0989	2.0922
util living area	0.9423	0.9262	0.8983	0.8454	0.7621	0.6430	0.5253	0.5653	0.7331	0.8659	0.9248	0.9471 (86)
MIT	17.9156	18.1902	18.6891	19.3762	20.0234	20.5409	20.7909	20.7475	20.3412	19.5219	18.6171	17.8763 (87)
Th 2	19.8097	19.8131	19.8165	19.8324	19.8354	19.8493	19.8493	19.8518	19.8439	19.8354	19.8293	19.8230 (88)
util rest of house	0.9345	0.9162	0.8838	0.8215	0.7209	0.5722	0.4203	0.4632	0.6728	0.8403	0.9130	0.9399 (89)
MIT 2	17.0205	17.2930	17.7855	18.4638	19.0791	19.5529	19.7501	19.7247	19.3877	18.6180	17.7290	16.9905 (90)
Living area fraction	17.1482	17.4209	17.9144	18.5939	19.2138	19.6938	19.8985	19.8705	19.5237	18.7469	17.8557	17.1168 (92)
MIT	17.1482	17.4209	17.9144	18.5939	19.2138	19.6938	19.8985	19.8705	19.5237	18.7469	17.8557	17.1168 (93)
Temperature adjustment												0.0000
adjusted MIT	17.1482	17.4209	17.9144	18.5939	19.2138	19.6938	19.8985	19.8705	19.5237	18.7469	17.8557	17.1168 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	816.3939	886.8580	931.9172	942.1825	875.8273	695.0632	502.8036	513.4255	668.2108	752.8207	768.1276	784.8545 (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	2324.1381	2257.4638	2051.2720	1715.4235	1325.7654	886.5645	574.1060	602.5056	948.9920	1437.4720	1908.9765	2306.5986 (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	1121.7617	921.0471	832.8000	556.7335	334.7539	0.0000	0.0000	0.0000	0.0000	509.3805	821.4112	1132.1777 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 6230.0657 (98)
Space heating per m2 (98) / (4) = 46.1486 (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)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 90.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 6899.2975 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1121.7617	921.0471	832.8000	556.7335	334.7539	0.0000	0.0000	0.0000	0.0000	509.3805	821.4112	1132.1777 (98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)
Space heating fuel (main heating system)	1242.2610	1019.9858	922.2591	616.5377	370.7131	0.0000	0.0000	0.0000	0.0000	564.0980	909.6470	1253.7959 (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	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
Efficiency of water heater (217)m	88.4042	88.2925	88.0406	87.4804	86.3646	79.6000	79.6000	79.6000	79.6000	87.2125	88.0456	79.6000 (216)
Fuel for water heating, kWh/month	240.8622	212.3692	223.2094	200.7272	198.7730	191.9654	183.6589	202.5004	202.4467	208.8135	219.5174	234.7099 (219)
Water heating fuel used												2519.5533 (219)
Annual totals kWh/year												
Space heating fuel - main system												6899.2975 (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)												507.9421 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.60 * 1004 * 1.00) =									-1285.1151			-1285.1151 (233)
Total delivered energy for all uses												8716.6778 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6899.2975	3.4800	240.0956 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2519.5533	3.4800	87.6805 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	507.9421	13.1900	66.9976 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1285.1151	13.1900	-169.5067 (252)
Total energy cost			355.1594 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.8287 (257)
SAP value 88.4396
SAP rating (Section 12) 88 (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	6899.2975	0.2160	1490.2483 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2519.5533	0.2160	544.2235 (264)
Space and water heating			2034.4718 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	507.9421	0.5190	263.6219 (268)
Energy saving/generation technologies			
PV Unit	-1285.1151	0.5190	-666.9748 (269)
Total kg/year			1670.0440 (272)
CO2 emissions per m2			12.3700 (273)
EI value			87.5675
EI rating			88 (274)

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EI band B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9030 = 3.854$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9030 = 0.2392$, stars = 4
Water heating energy efficiency	$3.48 / 0.8506 = 4.091$, stars = 4
Water heating environmental impact	$0.216 / 0.8506 = 0.2539$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.4084 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4084 (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	0.4492	0.4186	0.4186	0.3982	0.3982	0.3778	0.3778	0.3573	0.3573	0.3880	0.3778	0.3982 (22b)
Effective ac	0.6009	0.5876	0.5876	0.5793	0.5793	0.5714	0.5714	0.5638	0.5638	0.5753	0.5714	0.5793 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			18.0000	1030.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10532.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.0159 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss						(33) + (36) =	108.7643 (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	68.1948	66.6865	66.6865	65.7402	65.7402	64.8411	64.8411	63.9893	63.9893	65.2847	64.8411	65.7402 (38)
Heat transfer coeff	176.9591	175.4508	175.4508	174.5044	174.5044	173.6053	173.6053	172.7536	172.7536	174.0490	173.6053	174.5044 (39)
Average = Sum(39)m / 12 =												174.3122 (39)
HLP	1.3108	1.2996	1.2996	1.2926	1.2926	1.2860	1.2860	1.2797	1.2797	1.2893	1.2860	1.2926 (40)
HLP (average)												1.2912 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

FULL SAP CALCULATION PRINTOUT

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

Energy content (annual)	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6858 (55)
Total storage loss												
If cylinder contains dedicated solar storage	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (57)
Total heat required for water heating calculated for each month	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (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	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
Heat gains from water heating, kWh/month	91.6141	81.1456	86.1553	78.5287	77.8942	70.9502	69.4231	74.4099	73.7243	81.3662	84.4068	89.8472 (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	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.9045	63.8649	51.9384	39.3207	29.3927	24.8146	26.8130	34.8526	46.7790	59.3967	69.3248	73.9029 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482 (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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757 (71)
Water heating gains (Table 5)	123.1372	120.7524	115.8002	109.0676	104.6966	98.5419	93.3107	100.0133	102.3948	109.3632	117.2317	120.7624 (72)
Total internal gains	764.7388	759.0173	730.2874	685.7074	639.5603	598.8948	575.6651	585.7044	611.8636	656.6794	706.3240	744.3655 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	11.3300	14.6176	0.6300	0.7000	0.7700	50.6150 (75)
South	0.8700	56.7559	0.6300	0.7000	0.7700	15.0904 (78)
Southwest	6.7000	45.1778	0.6300	0.7000	0.7700	92.5064 (79)
West	0.8700	25.1925	0.6300	0.7000	0.7700	6.6983 (80)

Solar gains	164.9102	254.4520	391.6215	555.4703	645.0728	728.9489	667.3089	593.9323	468.3013	311.2189	200.1728	131.5671 (83)
Total gains	929.6489	1013.4694	1121.9089	1241.1777	1284.6331	1327.8437	1242.9741	1179.6367	1080.1649	967.8984	906.4968	875.9326 (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)												
tau	16.5326	16.6747	16.6747	16.7652	16.7652	16.8520	16.8520	16.9351	16.9351	16.8090	16.8520	16.7652
alpha	2.1022	2.1116	2.1116	2.1177	2.1177	2.1235	2.1235	2.1290	2.1290	2.1206	2.1235	2.1177
util living area	0.9303	0.9145	0.8782	0.8111	0.7029	0.5359	0.4083	0.4241	0.6484	0.8229	0.9036	0.9360 (86)
MIT	18.2834	18.5212	19.0345	19.6829	20.3137	20.7486	20.9053	20.8988	20.5878	19.8877	19.0207	18.2802 (87)
Th 2	19.8324	19.8411	19.8411	19.8466	19.8466	19.8518	19.8518	19.8568	19.8568	19.8493	19.8518	19.8466 (88)
util rest of house	0.9205	0.9026	0.8603	0.7812	0.6492	0.4463	0.2838	0.2968	0.5684	0.7869	0.8877	0.9269 (89)
MIT 2	17.3988	17.6376	18.1393	18.7664	19.3512	19.7166	19.8217	19.8241	19.6056	18.9760	18.1400	17.4057 (90)
Living area fraction	17.5250	17.7636	18.2669	18.8970	19.4884	19.8638	19.9762	19.9774	19.7457	19.1060	18.2656	17.5304 (92)
MIT	17.5250	17.7636	18.2669	18.8970	19.4884	19.8638	19.9762	19.9774	19.7457	19.1060	18.2656	17.5304 (93)
Temperature adjustment												0.0000
adjusted MIT	17.5250	17.7636	18.2669	18.8970	19.4884	19.8638	19.9762	19.9774	19.7457	19.1060	18.2656	17.5304 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8944	0.8744	0.8293	0.7515	0.6300	0.4473	0.2983	0.3113	0.5595	0.7582	0.8587	0.9020 (94)
Useful gains	831.5159	886.1454	930.4374	932.7224	809.3168	593.9538	370.8375	367.2681	604.3372	733.8773	778.4403	790.1315 (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	2145.6209	2081.4710	1871.5222	1552.5744	1114.8101	688.1353	395.1643	393.4240	768.0045	1236.7857	1712.7164	2099.3647 (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	977.6941	803.2588	700.1671	446.2935	227.2871	0.0000	0.0000	0.0000	0.0000	374.1638	672.6788	974.0695 (98)

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Space heating 5175.6126 (98)
Space heating per m2 (98) / (4) = 38.3379 (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)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 90.3000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 5731.5755 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	977.6941	803.2588	700.1671	446.2935	227.2871	0.0000	0.0000	0.0000	0.0000	374.1638	672.6788	974.0695 (98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)
Space heating fuel (main heating system)	1082.7177	889.5446	775.3788	494.2342	251.7022	0.0000	0.0000	0.0000	0.0000	414.3564	744.9378	1078.7038 (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	212.9322	187.5061	196.5148	175.5969	171.6695	152.8045	146.1925	161.1904	161.1475	182.1115	193.2755	207.6183 (64)
Efficiency of water heater (217)m	88.1801	88.0598	87.7159	86.9980	85.3625	79.6000	79.6000	79.6000	79.6000	86.4937	87.6697	79.6000 (216)
Fuel for water heating, kWh/month	241.4741	212.9305	224.0355	201.8402	201.1065	191.9654	183.6589	202.5004	202.4467	210.5489	220.4587	235.3508 (219)
Water heating fuel used												2528.3167 (219)
Annual totals kWh/year												
Space heating fuel - main system												5731.5755 (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)												507.9421 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.60 * 1115 * 1.00) =									-1427.0689			-1427.0689 (233)
Total delivered energy for all uses												7415.7653 (238)

10a. Fuel costs - using BEDF prices (512)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5731.5755	9.7400	558.2555 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2528.3167	9.7400	246.2580 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	507.9421	36.8500	187.1767 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1427.0689	36.8500	-525.8749 (252)
Total energy cost			597.4528 (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	5731.5755	0.2160	1238.0203 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2528.3167	0.2160	546.1164 (264)
Space and water heating			1784.1367 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	507.9421	0.5190	263.6219 (268)
Energy saving/generation technologies			
PV Unit	-1427.0689	0.5190	-740.6488 (269)
Total kg/year			1346.0349 (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	5731.5755	1.2200	6992.5221 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2528.3167	1.2200	3084.5463 (264)
Space and water heating			10077.0684 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	507.9421	3.0700	1559.3822 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies
PV Unit -1427.0689 3.0700 -4381.1016 (269)
Primary energy kWh/year 7485.5991 (272)
Primary energy kWh/m2/year 55.4489 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 112	-264 kg (19.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£112 1.96 kg/m²	B 90	B 89
Total Savings	£112 1.96 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 512 TEST (15 Feb 2023)
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	£215	£233	-£18
Mains gas	£909	£778	£131
Space heating	£690	£693	-£3
Water heating	£246	£131	£115
Lighting	£187	£187	£0
Generated (PV)	-£526	-£526	£0
Total cost of fuels	£598	£485	£113
Total cost of uses	£597	£485	£112
Delivered energy	55 kWh/m²	45 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.3 tonnes	1.1 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	44 kWh/m²	11 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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.4084 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4084 (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	0.5207	0.5105	0.5003	0.4492	0.4390	0.3880	0.3880	0.3778	0.4084	0.4390	0.4594	0.4799 (22b)
Effective ac	0.6356	0.6303	0.6251	0.6009	0.5964	0.5753	0.5753	0.5714	0.5834	0.5964	0.6055	0.6151 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			18.0000	1030.6800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10532.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.0159 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss							(33) + (36) = 108.7643 (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	72.1283	71.5309	70.9453	68.1948	67.6803	65.2847	65.2847	64.8411	66.2074	67.6803	68.7213	69.8096 (38)
Heat transfer coeff	180.8925	180.2951	179.7095	176.9591	176.4445	174.0490	174.0490	173.6053	174.9717	176.4445	177.4855	178.5739 (39)
Average = Sum(39)m / 12 =												176.9566 (39)
HLP	1.3399	1.3355	1.3312	1.3108	1.3070	1.2893	1.2893	1.2860	1.2961	1.3070	1.3147	1.3228 (40)
HLP (average)												1.3108 (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											2.9069 (42)	
Average daily hot water use (litres/day)											103.2387 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3166 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7110 (55)
Total storage loss	22.0401	19.9072	22.0401	21.3291	22.0401	21.3291	22.0401	22.0401	21.3291	22.0401	21.3291	22.0401 (56)
If cylinder contains dedicated solar storage	13.3401	12.0491	13.3401	12.9097	13.3401	12.9097	13.3401	13.3401	12.9097	13.3401	12.9097	13.3401 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	205.0125	180.3528	187.1993	161.1790	150.9555	132.5335	125.2458	141.1742	148.0804	172.7961	185.6113	199.6986 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1165 (H8)
Utilisation factor												0.5917 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												103.2387 (H14)
Volume ratio Veff/V												1.0606 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-943.5078 (H17)
Solar input	-27.3598	-45.6557	-77.7569	-104.2096	-128.7422	-126.5741	-124.9013	-109.1269	-85.4683	-58.3648	-32.4527	-22.8955 (63)
Solar input (sum of months) = Sum(63)m =												-943.5078 (63)
Output from w/h	177.6526	134.6970	109.4424	56.9694	22.2133	5.9594	0.3445	32.0472	62.6121	114.4313	153.1585	176.8030 (64)
Total per year (kWh/year) = Sum(64)m =												1046.3310 (64)
Heat gains from water heating, kWh/month	85.2783	75.4230	78.7029	66.9944	61.3230	54.7334	52.6658	58.3970	63.2705	73.9138	78.2754	83.5114 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.9045	63.8649	51.9384	39.3207	29.3927	24.8146	26.8130	34.8526	46.7790	59.3967	69.3248	73.9029	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	(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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	(71)
Water heating gains (Table 5)	114.6214	112.2366	105.7835	93.0477	82.4234	76.0186	70.7873	78.4905	87.8758	99.3465	108.7158	112.2465	(72)
Total internal gains	756.2229	750.5015	720.2708	669.6875	617.2871	576.3715	553.1418	564.1816	597.3445	646.6628	697.8082	735.8497	(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
Northeast	11.3300	11.2829	0.6300	0.7000	0.7700	39.0683 (75)
South	0.8700	46.7521	0.6300	0.7000	0.7700	12.4306 (78)
Southwest	6.7000	36.7938	0.6300	0.7000	0.7700	75.3393 (79)
West	0.8700	19.6403	0.6300	0.7000	0.7700	5.2220 (80)

Solar gains	132.0602	238.4288	361.6216	506.7105	620.5932	639.3024	606.7119	518.2908	411.3666	273.0977	160.6428	111.4154 (83)
Total gains	888.2831	988.9303	1081.8923	1176.3980	1237.8803	1215.6738	1159.8537	1082.4724	1008.7112	919.7604	858.4510	847.2650 (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	16.1731	16.2267	16.2796	16.5326	16.5808	16.8090	16.8090	16.8520	16.7204	16.5808	16.4836	16.3831
alpha	2.0782	2.0818	2.0853	2.1022	2.1054	2.1206	2.1206	2.1235	2.1147	2.1054	2.0989	2.0922
util living area	0.9432	0.9273	0.8998	0.8484	0.7674	0.6494	0.5322	0.5724	0.7376	0.8680	0.9261	0.9480 (86)
MIT	17.9054	18.1805	18.6786	19.3618	20.0083	20.5313	20.7854	20.7410	20.3324	19.5123	18.6073	17.8659 (87)
Th 2	19.8097	19.8131	19.8165	19.8324	19.8354	19.8493	19.8493	19.8518	19.8439	19.8354	19.8293	19.8230 (88)
util rest of house	0.9355	0.9174	0.8855	0.8248	0.7266	0.5788	0.4266	0.4700	0.6777	0.8427	0.9144	0.9410 (89)
MIT 2	17.0106	17.2836	17.7755	18.4505	19.0662	19.5459	19.7471	19.7210	19.3807	18.6092	17.7196	16.9803 (90)
Living area fraction												fLA = Living area / (4) = 0.1426 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	6932.2351	0.2160	1497.3628 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1193.0084	0.2160	257.6898 (264)
Space and water heating			1755.0526 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	507.9421	0.5190	263.6219 (268)
Energy saving/generation technologies			
PV Unit	-1285.1151	0.5190	-666.9748 (269)
Total kg/year			1416.5748 (272)
CO2 emissions per m2			10.4900 (273)
EI value			89.4544
EI rating			89 (274)
EI band			B

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.4600 (1b)	x 2.4000 (2b)	= 140.3040 (1b) - (3b)
First floor	76.5400 (1c)	x 2.6600 (2c)	= 203.5964 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	135.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 343.9004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1454 (8)
Pressure test					Yes
Measured/design AP50					5.2600
Infiltration rate					0.4084 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4084 (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	0.4492	0.4186	0.4186	0.3982	0.3982	0.3778	0.3778	0.3573	0.3573	0.3880	0.3778	0.3982 (22b)
Effective ac	0.6009	0.5876	0.5876	0.5793	0.5793	0.5714	0.5714	0.5638	0.5638	0.5753	0.5714	0.5793 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			19.7700	1.3258	26.2102		(27)
Heat Loss Floor			58.4600	0.1700	9.9382	75.0000	4384.5000 (28a)
Exposed Floor			16.8800	0.1520	2.5653	20.0000	337.6000 (28b)
External Wall	165.4600	21.9300	143.5300	0.2000	28.7060	9.0000	1291.7700 (29a)
Garage Wall	20.0600		20.0600	0.2224	4.4611	9.0000	180.5400 (29a)
External Roof	75.3400		75.3400	0.1000	7.5340	9.0000	678.0600 (30)
Bay Roof	1.2000		1.2000	0.1000	0.1200	9.0000	10.8000 (30)
Total net area of external elements Aum(A, m ²)			337.4000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.5589		(33)
Internal Wall - GF			52.9900			9.0000	476.9100 (32c)
Internal Wall - FF			123.4000			9.0000	1110.6000 (32c)
Internal Floor			57.2600			18.0000	1030.6800 (32d)
Internal Ceiling			57.2600			18.0000	1030.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10532.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							78.0159 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							26.2054 (36)
Total fabric heat loss						(33) + (36) =	108.7643 (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	68.1948	66.6865	66.6865	65.7402	65.7402	64.8411	64.8411	63.9893	63.9893	65.2847	64.8411	65.7402 (38)
Heat transfer coeff	176.9591	175.4508	175.4508	174.5044	174.5044	173.6053	173.6053	172.7536	172.7536	174.0490	173.6053	174.5044 (39)
Average = Sum(39)m / 12 =												174.3122 (39)
HLP	1.3108	1.2996	1.2996	1.2926	1.2926	1.2860	1.2860	1.2797	1.2797	1.2893	1.2860	1.2926 (40)
HLP (average)												1.2912 (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												2.9069 (42)
Average daily hot water use (litres/day)												103.2387 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.5626	109.4330	105.3035	101.1739	97.0444	92.9148	92.9148	97.0444	101.1739	105.3035	109.4330	113.5626 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	168.4100	147.2925	151.9926	132.5109	127.1473	109.7185	101.6703	116.6682	118.0615	137.5893	150.1895	163.0961 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2615	22.0939	22.7989	19.8766	19.0721	16.4578	15.2505	17.5002	17.7092	20.6384	22.5284	24.4644 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3166 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7110 (55)
Total storage loss	22.0401	19.9072	22.0401	21.3291	22.0401	21.3291	22.0401	22.0401	21.3291	22.0401	21.3291	22.0401 (56)
If cylinder contains dedicated solar storage	13.3401	12.0491	13.3401	12.9097	13.3401	12.9097	13.3401	13.3401	12.9097	13.3401	12.9097	13.3401 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	205.0125	180.3528	187.1993	161.1790	150.9555	132.5335	125.2458	141.1742	148.0804	172.7961	185.6113	199.6986 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2417 (H8)
Utilisation factor												0.5531 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												103.2387 (H14)
Volume ratio Veff/V												1.0606 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-980.8682 (H17)
Solar input	-32.1997	-45.7860	-78.6951	-106.1779	-124.0950	-133.7968	-127.3640	-116.0840	-90.7082	-62.3808	-38.0838	-25.4969 (63)
Solar input (sum of months) = Sum (63)m =												-980.8682 (63)
Output from w/h	172.8127	134.5668	108.5042	55.0011	26.8605	0.0000	0.0000	25.0902	57.3722	110.4153	147.5274	174.2017 (64)
Total per year (kWh/year) = Sum (64)m =												1012.3521 (64)
Heat gains from water heating, kWh/month	85.2783	75.4230	78.7029	66.9944	61.3230	54.7334	52.6658	58.3970	63.2705	73.9138	78.2754	83.5114 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	174.4136	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	71.9045	63.8649	51.9384	39.3207	29.3927	24.8146	26.8130	34.8526	46.7790	59.3967	69.3248	73.9029	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	453.2110	457.9139	446.0627	420.8330	388.9849	359.0522	339.0553	334.3524	346.2036	371.4334	403.2815	433.2141	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	55.3482	(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)	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	-116.2757	(71)
Water heating gains (Table 5)	114.6214	112.2366	105.7835	93.0477	82.4234	76.0186	70.7873	78.4905	87.8758	99.3465	108.7158	112.2465	(72)
Total internal gains	756.2229	750.5015	720.2708	669.6875	617.2871	576.3715	553.1418	564.1816	597.3445	646.6628	697.8082	735.8497	(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
Northeast	11.3300	14.6176	0.6300	0.7000	0.7700	50.6150 (75)
South	0.8700	56.7559	0.6300	0.7000	0.7700	15.0904 (78)
Southwest	6.7000	45.1778	0.6300	0.7000	0.7700	92.5064 (79)
West	0.8700	25.1925	0.6300	0.7000	0.7700	6.6983 (80)

Solar gains	164.9102	254.4520	391.6215	555.4703	645.0728	728.9489	667.3089	593.9323	468.3013	311.2189	200.1728	131.5671 (83)
Total gains	921.1331	1004.9535	1111.8923	1225.1578	1262.3599	1305.3204	1220.4507	1158.1139	1065.6458	957.8817	897.9810	867.4168 (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	16.5326	16.6747	16.6747	16.7652	16.7652	16.8520	16.8520	16.9351	16.9351	16.8090	16.8520	16.7652
alpha	2.1022	2.1116	2.1116	2.1177	2.1177	2.1235	2.1235	2.1290	2.1290	2.1206	2.1235	2.1177
util living area	0.9314	0.9157	0.8799	0.8145	0.7086	0.5421	0.4142	0.4302	0.6532	0.8255	0.9051	0.9371 (86)
MIT	18.2735	18.5118	19.0246	19.6701	20.3016	20.7428	20.9026	20.8958	20.5814	19.8793	19.0115	18.2701 (87)
Th 2	19.8324	19.8411	19.8411	19.8466	19.8466	19.8518	19.8518	19.8568	19.8568	19.8493	19.8518	19.8466 (88)
util rest of house												
	0.9218	0.9039	0.8621	0.7848	0.6553	0.4521	0.2885	0.3016	0.5733	0.7898	0.8893	0.9281 (89)
MIT 2	17.3892	17.6284	18.1299	18.7547	19.3414	19.7131	19.8207	19.8231	19.6012	18.9686	18.1312	17.3959 (90)
Living area fraction												
									fLA = Living area /	(4) =	0.1426 (91)	

MIT	17.5153	17.7544	18.2574	18.8853	19.4783	19.8599	19.9750	19.9760	19.7410	19.0984	18.2567	17.5205 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5153	17.7544	18.2574	18.8853	19.4783	19.8599	19.9750	19.9760	19.7410	19.0984	18.2567	17.5205 (93)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5761.2938	0.2160	1244.4395 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1155.1400	0.2160	249.5102 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Space and water heating			1493.9497 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	507.9421	0.5190	263.6219 (268)
Energy saving/generation technologies			
PV Unit	-1427.0689	0.5190	-740.6488 (269)
Total kg/year			1081.7979 (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	5761.2938	1.2200	7028.7784 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1155.1400	1.2200	1409.2708 (264)
Space and water heating			8438.0492 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	507.9421	3.0700	1559.3822 (268)
Energy saving/generation technologies			
PV Unit	-1427.0689	3.0700	-4381.1016 (269)
Primary energy kWh/year			6000.0799 (272)
Primary energy kWh/m2/year			44.4450 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	78.0 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	907.90 (P1)
Transmission heat loss coefficient	108.76 (37)
Summer heat loss coefficient	1016.66 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	11.3300	106.0502	0.6300	0.7000	0.9000	429.2053
South	0.8700	118.5567	0.6300	0.7000	0.9000	36.8442
South West	6.7000	127.3119	0.6300	0.7000	0.9000	304.6964
West	0.8700	125.2818	0.6300	0.7000	0.9000	38.9342

total: 809.6800

	Jun	Jul	Aug	
Solar gains	874	810	705	(P3)
Internal gains	596	573	583	
Total summer gains	1470	1382	1288	(P5)

Summer gain/loss ratio	1.45	1.36	1.27	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 78.0)	1.45	1.45	1.45	
Threshold temperature	18.30	20.11	20.02	(P7)

Likelihood of high internal temperature Not significant Not significant Not significant

Assessment of likelihood of high internal temperature: Not significant