



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 1 Wolfe Street, North Stoneham Park
EASTLEIGH, SO50 9RE

Contact: Scott Spearing
Scott Spearing
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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 227				Issued on Date	20/02/2023
Assessment Reference	AB		Prop Type Ref	FOG 4		
Property	1 Wolfe Street, North Stoneham Park, EASTLEIGH, SO50 9RE					
SAP Rating	85 B	DER	17.10	TER	21.48	
Environmental	86 B	% DER<TER	20.39			
CO ₂ Emissions (t/year)	1.19	DFEE	56.28	TFEE	68.55	
General Requirements Compliance	Pass	% DFEE<TFEE	17.90			
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	21.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.10	kgCO ₂ /m ²	Pass
	-4.38 (-20.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	68.55	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	56.28	kWh/m ² /yr	
	-12.2 (-17.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.86 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

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Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing South East

5.63 m², No overhang

Windows facing North West

4.57 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.86 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.10

W/m²K

Photovoltaic array

0.96

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 East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Detached
2.0 Number of Storeys	2
3.0 Date Built	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:	13.44 m	6.30 m ²	2.40 m
1st Storey:	36.90 m	80.15 m ²	2.40 m

7.0 Living Area	24.50	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	52.59	kJ/m ² K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	120.82	108.46

9.2 Internal Walls

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

10.0 External Roofs

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

11.0 Heat Loss Floors

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Wall	South East							2.16	
Front Elevation	Window	[1] External Wall	South East	None	0.00					5.63	
Rear Elevation	Window	[1] External Wall	North West	None	0.00					4.57	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

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

Y-value 0.083 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 6.00 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 4.86 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows fully open

Cross ventilation possible Yes

Night Ventilation Yes

Air change rate 8.00

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

SUMMARY FOR INPUT DATA

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22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

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

29.0 Hot Water Cylinder

None

32.0 Photovoltaic Unit

One Dwelling

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

PV Cells kWp

0.96

Orientation

North West

Elevation

45°

Overshading

None Or Little

Connected to Dwelling

Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

U-VALUE CALCULATOR REPORT

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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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Client	Highwood Construction Ltd, HIGHWOOD
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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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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

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

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.18 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.18 W/m² K

Kappa: n/a

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Building Elements

Floor Suspended Exposed Floors

Floor Type: Exposed Floor

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

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

Unheated space: GarageSingle1Outside

Total thickness: 316 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

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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

Top-floor flat, total floor area 86 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.10 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)68.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.3 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.86 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing South East: 5.63 m², No overhang
Windows facing North West: 4.57 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Photovoltaic array 0.96 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.0964 (8)
Pressure test					Yes
Measured/design AP50					4.8600
Infiltration rate					0.3394 (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) =				0.3394 (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	0.4327	0.4242	0.4158	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (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)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3600	108.4600	0.2000	21.6920	9.0000	976.1400 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2037		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5947 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6415 (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	40.6447	40.3958	40.1518	39.0057	38.7913	37.7931	37.7931	37.6083	38.1776	38.7913	39.2251	39.6786 (38)
Heat transfer coeff	123.2862	123.0373	122.7933	121.6472	121.4328	120.4346	120.4346	120.2498	120.8191	121.4328	121.8666	122.3201 (39)
Average = Sum(39)m / 12 =												121.6462 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4261	1.4232	1.4204	1.4071	1.4047	1.3931	1.3931	1.3910	1.3976	1.4047	1.4097	1.4149 (40)
HLP (average)												1.4071 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
Southeast				5.6300	36.7938	0.6300		0.7000	0.7700		63.3075
Northwest				4.5700	11.2829	0.6300		0.7000	0.7700		15.7583
Solar gains	79.0658	139.9127	205.3378	277.7274	332.3485	339.3014	323.2291	281.0489	230.1813	158.3820	95.6559
Total gains	473.3975	531.8689	582.8042	631.9745	663.0312	647.4703	616.9476	581.1389	542.3830	494.0205	458.0940

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.2445	10.2652	10.2856	10.3825	10.4008	10.4870	10.4870	10.5032	10.4537	10.4008	10.3638	10.3254	
alpha	1.6830	1.6843	1.6857	1.6922	1.6934	1.6991	1.6991	1.7002	1.6969	1.6934	1.6909	1.6884	
util living area	0.9338	0.9177	0.8923	0.8479	0.7800	0.6830	0.5810	0.6140	0.7545	0.8650	0.9176	0.9389	(86)
MIT	16.9695	17.2733	17.8489	18.6445	19.4577	20.1675	20.5654	20.5020	19.9269	18.8948	17.7992	16.9069	(87)
Th 2	19.7434	19.7456	19.7477	19.7579	19.7598	19.7686	19.7686	19.7703	19.7652	19.7598	19.7559	19.7519	(88)
util rest of house	0.9260	0.9079	0.8786	0.8263	0.7432	0.6171	0.4750	0.5136	0.6999	0.8416	0.9062	0.9317	(89)
MIT 2	16.0898	16.3912	16.9611	17.7483	18.5355	19.2037	19.5442	19.4993	18.9944	18.0048	16.9230	16.0334	(90)
Living area fraction									fLA = Living area / (4) =			0.2834	(91)
MIT	16.3391	16.6412	17.2127	18.0023	18.7969	19.4768	19.8336	19.7835	19.2587	18.2571	17.1713	16.2810	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.3391	16.6412	17.2127	18.0023	18.7969	19.4768	19.8336	19.7835	19.2587	18.2571	17.1713	16.2810	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	423.9766	464.8396	490.0987	497.1658	469.3535	387.5273	297.0255	299.1960	364.5435	397.0088	399.7398	405.8368	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1484.2569	1444.6047	1315.4428	1107.2643	861.7912	587.3394	389.4377	406.8633	623.2687	929.8183	1227.3561	1477.7435	(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	788.8485	658.4021	614.0560	439.2709	291.9737	0.0000	0.0000	0.0000	0.0000	396.4103	595.8837	797.4986	(98)
Space heating												4582.3439	(98)
Space heating per m2												53.0057	(99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5063.3634 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	788.8485	658.4021	614.0560	439.2709	291.9737	0.0000	0.0000	0.0000	0.0000	396.4103	595.8837	797.4986	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	871.6558	727.5162	678.5149	485.3823	322.6228	0.0000	0.0000	0.0000	0.0000	438.0224	658.4351	881.2139	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Efficiency of water heater (217)m	89.9167	89.8927	89.8382	89.7227	89.4819	87.3000	87.3000	87.3000	87.3000	89.6375	89.8296	87.3000	(216)
Fuel for water heating, kWh/month	188.6642	165.4889	171.9034	151.5207	146.8650	131.5419	123.5198	139.4276	140.4077	157.4162	169.5783	183.1553	(219)
Water heating fuel used												1869.4890	(219)
Annual totals kWh/year													
Space heating fuel - main system												5063.3634	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.6430	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.96 * 677 * 1.00) =										-519.5557		-519.5557	(233)
Total delivered energy for all uses												6895.9397	(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	5063.3634	0.2160	1093.6865 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1869.4890	0.2160	403.8096 (264)
Space and water heating			1497.4961 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Energy saving/generation technologies			
PV Unit	-519.5557	0.5190	-269.6494 (269)
Total CO2, kg/year			1478.3384 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1000 (273)

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

DER		17.1000 ZC1
Total Floor Area	TFA	86.4500
Assumed number of occupants	N	2.5739
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.9296 ZC2
CO2 emissions from cooking, equation (L16)		2.0911 ZC3
Total CO2 emissions		35.1207 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.1207 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1300	0.8190		(28a)
Suspended Floor			73.8500	0.1300	9.6005		(28b)
External Wall	120.8200	12.3600	108.4600	0.1800	19.5228		(29a)
External Roof	80.1500		80.1500	0.1300	10.4195		(30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.0445	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4159 (36)
Total fabric heat loss						(33) + (36) =	74.4604 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.8994	42.5629	42.2331	40.6839	40.3941	39.0449	39.0449	38.7950	39.5646	40.3941	40.9804	41.5934 (38)
Heat transfer coeff	117.3598	117.0233	116.6935	115.1444	114.8545	113.5053	113.5053	113.2554	114.0250	114.8545	115.4409	116.0539 (39)
Average = Sum(39)m / 12 =												115.1430 (39)
HLP	1.3575	1.3537	1.3498	1.3319	1.3286	1.3130	1.3130	1.3101	1.3190	1.3286	1.3353	1.3424 (40)
HLP (average)												1.3319 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

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

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

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W	
Southeast												5.6300	36.7938	0.6300	0.7000	0.7700	63.3075	(77)
Northwest												4.5700	11.2829	0.6300	0.7000	0.7700	15.7583	(81)
Solar gains	79.0658	139.9127	205.3378	277.7274	332.3485	339.3014	323.2291	281.0489	230.1813	158.3820	95.6559	67.0471	(83)					
Total gains	485.7729	544.2482	594.7220	643.2541	673.6683	657.4668	626.9516	591.7830	553.6730	505.9487	470.4792	461.9489	(84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.1544	51.3015	51.4465	52.1387	52.2702	52.8916	52.8916	53.0083	52.6505	52.2702	52.0047	51.7300	
alpha	4.4103	4.4201	4.4298	4.4759	4.4847	4.5261	4.5261	4.5339	4.5100	4.4847	4.4670	4.4487	
util living area	0.9984	0.9971	0.9937	0.9828	0.9492	0.8574	0.7157	0.7635	0.9290	0.9877	0.9971	0.9987	(86)
MIT	19.4561	19.5948	19.8458	20.1997	20.5490	20.8283	20.9465	20.9270	20.7129	20.2690	19.8067	19.4379	(87)
Th 2	19.7960	19.7990	19.8020	19.8159	19.8185	19.8307	19.8307	19.8330	19.8260	19.8185	19.8132	19.8077	(88)
util rest of house	0.9978	0.9960	0.9912	0.9750	0.9224	0.7749	0.5623	0.6198	0.8789	0.9806	0.9958	0.9983	(89)
MIT 2	17.7509	17.9557	18.3239	18.8461	19.3391	19.7006	19.8088	19.7989	19.5693	18.9515	18.2754	17.7322	(90)
Living area fraction	18.2342	18.4202	18.7552	19.2297	19.6820	20.0202	20.1312	20.1186	19.8934	19.3249	18.7094	18.2156	(91)
MIT	18.2342	18.4202	18.7552	19.2297	19.6820	20.0202	20.1312	20.1186	19.8934	19.3249	18.7094	18.2156	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2342	18.4202	18.7552	19.2297	19.6820	20.0202	20.1312	20.1186	19.8934	19.3249	18.7094	18.2156	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	484.1548	541.0456	587.5345	623.7200	618.6567	519.9432	379.9682	390.5138	488.6978	493.9785	467.6258	460.7244	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1635.3118	1582.1842	1430.1003	1189.4073	916.7686	615.2177	400.8124	421.1554	660.5960	1002.0904	1340.1954	1626.5611	(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	856.4608	699.6452	626.8690	407.2948	221.7952	0.0000	0.0000	0.0000	0.0000	378.0353	628.2501	867.3826	(98)
Space heating												4685.7330	(98)
Space heating per m2												54.2017	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5016.8447 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	856.4608	699.6452	626.8690	407.2948	221.7952	0.0000	0.0000	0.0000	0.0000	378.0353	628.2501	867.3826 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	916.9816	749.0847	671.1659	436.0758	237.4681	0.0000	0.0000	0.0000	0.0000	404.7487	672.6447	928.6751 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	206.4697	182.0381	189.9022	168.4337	163.0735	143.6261	137.6047	153.3970	155.0911	176.6021	188.0010	201.5628 (64)
Efficiency of water heater (217)m	88.2440	88.1118	87.8315	87.1916	85.8260	80.3000	80.3000	80.3000	80.3000	86.9190	87.8549	80.3000 (216)
Fuel for water heating, kWh/month	233.9758	206.5990	216.2121	193.1766	190.0048	178.8619	171.3633	191.0299	193.1396	203.1802	213.9903	228.2558 (219)
Water heating fuel used												2419.7893 (219)
Annual totals kWh/year												
Space heating fuel - main system												5016.8447 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												407.6430 (232)
Total delivered energy for all uses												7919.2769 (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	5016.8447	0.2160	1083.6385 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2419.7893	0.2160	522.6745 (264)
Space and water heating			1606.3129 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Total CO2, kg/m2/year			1856.8046 (272)
Emissions per m2 for space and water heating			18.5808 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4473 (272b)
Emissions per m2 for pumps and fans			0.4503 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.5808 * 1.00) + 2.4473 + 0.4503, rounded to 2 d.p.			21.4800 (273)

FULL SAP CALCULATION PRINTOUT

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1446 (8)
Pressure test					Yes
Measured/design AP50					4.8600
Infiltration rate					0.3876 (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) =	0.3876 (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	0.4942	0.4845	0.4748	0.4264	0.4167	0.3682	0.3682	0.3585	0.3876	0.4167	0.4360	0.4554 (22b)
Effective ac	0.6221	0.6174	0.6127	0.5909	0.5868	0.5678	0.5678	0.5643	0.5751	0.5868	0.5951	0.6037 (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)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3600	108.4600	0.2000	21.6920	9.0000	976.1400 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2037		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5947 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6415 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.5947	42.2700	41.9518	40.4571	40.1775	38.8757	38.8757	38.6346	39.3771	40.1775	40.7432	41.3347 (38)
Heat transfer coeff	125.2362	124.9116	124.5933	123.0987	122.8190	121.5172	121.5172	121.2761	122.0187	122.8190	123.3847	123.9762 (39)
Average = Sum(39)m / 12 =												123.0973 (39)
HLP	1.4487	1.4449	1.4412	1.4239	1.4207	1.4056	1.4056	1.4028	1.4114	1.4207	1.4272	1.4341 (40)
HLP (average)												1.4239 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

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

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast					5.6300	36.7938	0.6300		0.7000		0.7700		63.3075
Northwest					4.5700	11.2829	0.6300		0.7000		0.7700		15.7583 (77)
Solar gains	79.0658	139.9127	205.3378	277.7274	332.3485	339.3014	323.2291	281.0489	230.1813	158.3820	95.6559	67.0471	(83)
Total gains	440.5672	499.8373	552.4344	603.8632	636.3870	622.8896	594.1178	556.0624	516.5058	465.8063	427.2416	417.5347	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.0850	10.1112	10.1370	10.2601	10.2834	10.3936	10.3936	10.4143	10.3509	10.2834	10.2363	10.1875	
alpha	1.6723	1.6741	1.6758	1.6840	1.6856	1.6929	1.6929	1.6943	1.6901	1.6856	1.6824	1.6792	
util living area	0.9407	0.9251	0.9005	0.8574	0.7914	0.6962	0.5952	0.6299	0.7686	0.8757	0.9258	0.9455	(86)
MIT	16.8654	17.1748	17.7606	18.5749	19.4039	20.1336	20.5440	20.4764	19.8827	18.8269	17.7124	16.8084	(87)
Th 2	19.7262	19.7291	19.7319	19.7450	19.7475	19.7590	19.7590	19.7612	19.7546	19.7475	19.7425	19.7373	(88)
util rest of house	0.9336	0.9160	0.8875	0.8366	0.7555	0.6307	0.4883	0.5291	0.7152	0.8535	0.9152	0.9389	(89)
MIT 2	15.9772	16.2847	16.8657	17.6741	18.4787	19.1696	19.5229	19.4751	18.9496	17.9330	16.8302	15.9276	(90)
Living area fraction									fLA = Living area / (4) =			0.2834	(91)
MIT	16.2289	16.5370	17.1193	17.9294	18.7409	19.4428	19.8123	19.7589	19.2141	18.1863	17.0802	16.1772	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.2289	16.5370	17.1193	17.9294	18.7409	19.4428	19.8123	19.7589	19.2141	18.1863	17.0802	16.1772	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9049	0.8834	0.8508	0.7971	0.7193	0.6107	0.4936	0.5289	0.6861	0.8160	0.8831	0.9117	(94)
Ext temp.	398.6553	441.5664	470.0150	481.3240	457.7597	380.3880	293.2732	294.0771	354.3632	380.0894	377.3164	380.6505	(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	1493.9318	1453.5921	1323.0993	1111.5097	864.7560	588.4796	390.3439	407.3528	624.0110	931.7465	1231.4084	1484.8861	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	814.8857	680.0812	634.6947	453.7337	302.8053	0.0000	0.0000	0.0000	0.0000	410.4329	614.9462	821.5513	(98)
Space heating per m2												4733.1310	(98)
												54.7499	(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	1142.2619	899.2274	921.6987	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5244	0.5875	0.5619	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	598.9873	528.2830	517.8606	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	825.6920	790.1186	747.6254	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	163.2274	194.8057	170.9450	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												528.9781 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.8068	48.7014	42.7363	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												132.2445 (107)
Energy for space heating												1.5297 (108)
Energy for space cooling												54.7499 (99)
Total												1.5297 (108)
Dwelling Fabric Energy Efficiency (DFEE)												56.2796 (109)
												56.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1300	0.8190		(28a)
Suspended Floor			73.8500	0.1300	9.6005		(28b)
External Wall	120.8200	12.3600	108.4600	0.1800	19.5228		(29a)
External Roof	80.1500		80.1500	0.1300	10.4195		(30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	56.0445	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.4159 (36)
Total fabric heat loss						(33) + (36) =	74.4604 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.8994	42.5629	42.2331	40.6839	40.3941	39.0449	39.0449	38.7950	39.5646	40.3941	40.9804	41.5934 (38)
Heat transfer coeff	117.3598	117.0233	116.6935	115.1444	114.8545	113.5053	113.5053	113.2554	114.0250	114.8545	115.4409	116.0539 (39)
Average = Sum(39)m / 12 =												115.1430 (39)
HLP	1.3575	1.3537	1.3498	1.3319	1.3286	1.3130	1.3130	1.3101	1.3190	1.3286	1.3353	1.3424 (40)
HLP (average)												1.3319 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains												

[Jan]	Area			Solar flux		g		FF		Access		Gains
	m2			Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
Southeast	5.6300			36.7938		0.6300		0.7000		0.7700		63.3075 (77)
Northwest	4.5700			11.2829		0.6300		0.7000		0.7700		15.7583 (81)

Solar gains	79.0658	139.9127	205.3378	277.7274	332.3485	339.3014	323.2291	281.0489	230.1813	158.3820	95.6559	67.0471 (83)
Total gains	440.5672	499.8373	552.4344	603.8632	636.3870	622.8896	594.1178	556.0624	516.5058	465.8063	427.2416	417.5347 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.1544	51.3015	51.4465	52.1387	52.2702	52.8916	52.8916	53.0083	52.6505	52.2702	52.0047	51.7300
alpha	4.4103	4.4201	4.4298	4.4759	4.4847	4.5261	4.5261	4.5339	4.5100	4.4847	4.4670	4.4487
util living area	0.9989	0.9979	0.9953	0.9864	0.9579	0.8759	0.7416	0.7916	0.9429	0.9910	0.9980	0.9992 (86)
MIT	19.4091	19.5489	19.8027	20.1613	20.5175	20.8092	20.9380	20.9147	20.6841	20.2289	19.7618	19.3915 (87)
Th 2	19.7960	19.7990	19.8020	19.8159	19.8185	19.8307	19.8307	19.8330	19.8260	19.8185	19.8132	19.8077 (88)
util rest of house	0.9985	0.9971	0.9933	0.9801	0.9347	0.7989	0.5886	0.6510	0.8999	0.9858	0.9971	0.9989 (89)
MIT 2	18.3528	18.4948	18.7501	19.1166	19.4633	19.7293	19.8128	19.8047	19.6277	19.1876	18.7186	18.3443 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.6522	18.7935	19.0484	19.4127	19.7621	20.0353	20.1317	20.1193	19.9271	19.4827	19.0143	18.6411 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6522	18.7935	19.0484	19.4127	19.7621	20.0353	20.1317	20.1193	19.9271	19.4827	19.0143	18.6411 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9980	0.9962	0.9917	0.9772	0.9333	0.8151	0.6330	0.6911	0.9047	0.9836	0.9963	0.9984 (94)
Ext temp.	439.6882	497.9502	547.8275	590.0963	593.9386	507.7097	376.0726	384.2828	467.2888	458.1804	425.6504	416.8869 (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	1684.3683	1625.8651	1464.3196	1210.4756	925.9674	616.9392	400.8614	421.2268	664.4358	1020.2227	1375.3939	1675.9471 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	926.0420	757.9588	681.8701	446.6731	247.0294	0.0000	0.0000	0.0000	0.0000	418.1595	683.8153	936.7408 (98)
Space heating per m2	(98) / (4) =											5098.2890 (98)

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	1066.9497	839.9391	860.7412	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7015	0.7931	0.7573	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	748.4366	666.1875	651.8272	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	825.6920	790.1186	747.6254	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	55.6239	92.2047	71.2738	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												219.1025 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	13.9060	23.0512	17.8185	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												54.7756 (107)
Space cooling per m2												0.6336 (108)
Energy for space heating												58.9738 (99)
Energy for space cooling												0.6336 (108)
Total												59.6075 (109)
Target Fabric Energy Efficiency (TFEE)												68.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							2 * 10 =	20.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						20.0000 / (5) =	0.0964 (8)				
Pressure test							Yes					
Measured/design AP50								4.8600				
Infiltration rate								0.3394 (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) =	0.3394 (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	0.3733	0.3479	0.3479	0.3309	0.3309	0.3139	0.3139	0.2970	0.2970	0.3224	0.3139	0.3309 (22b)
Effective ac	0.5697	0.5605	0.5605	0.5548	0.5548	0.5493	0.5493	0.5441	0.5441	0.5520	0.5493	0.5548 (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)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3600	108.4600	0.2000	21.6920	9.0000	976.1400 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2037		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5947 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6415 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.0057	38.3772	38.3772	37.9829	37.9829	37.6083	37.6083	37.2534	37.2534	37.7931	37.6083	37.9829 (38)
Heat transfer coeff	121.6472	121.0188	121.0188	120.6244	120.6244	120.2498	120.2498	119.8949	119.8949	120.4346	120.2498	120.6244 (39)
Average = Sum(39)m / 12 =												120.5443 (39)
HLP	1.4071	1.3999	1.3999	1.3953	1.3953	1.3910	1.3910	1.3869	1.3869	1.3931	1.3910	1.3953 (40)
HLP (average)												1.3944 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

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

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

6. Solar gains

[Jan]													Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast													5.6300	45.1778		0.6300		0.7000		0.7700		77.7330 (77)	
Northwest													4.5700	14.6176		0.6300		0.7000		0.7700		20.4158 (81)	
Solar gains	98.1488	148.2613	220.6400	302.3384	343.5950	385.1206	353.7623	320.0266	260.0344		179.1394	118.4456	78.7344 (83)										
Total gains	684.4537	729.5073	778.6602	824.6916	829.5598	838.8073	788.9105	764.2298	725.0852		680.0749	659.0046	649.1420 (84)										

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.3825	10.4364	10.4364	10.4705	10.4705	10.5032	10.5032	10.5343	10.5343	10.4870	10.5032	10.4705	
alpha	1.6922	1.6958	1.6958	1.6980	1.6980	1.7002	1.7002	1.7023	1.7023	1.6991	1.7002	1.6980	
util living area	0.8783	0.8618	0.8261	0.7665	0.6722	0.5289	0.4109	0.4198	0.6112	0.7643	0.8466	0.8851	(86)
MIT	17.7375	17.9727	18.5291	19.2415	19.9994	20.5697	20.8156	20.8097	20.3893	19.5704	18.5718	17.7218	(87)
Th 2	19.7579	19.7634	19.7634	19.7669	19.7669	19.7703	19.7703	19.7734	19.7734	19.7686	19.7703	19.7669	(88)
util rest of house	0.8645	0.8460	0.8050	0.7351	0.6196	0.4409	0.2838	0.2912	0.5329	0.7248	0.8260	0.8718	(89)
MIT 2	16.8518	17.0850	17.6289	18.3193	19.0323	19.5278	19.7066	19.7072	19.3923	18.6469	17.6827	16.8434	(90)
Living area fraction									fLA = Living area / (4) =			0.2834	(91)
MIT	17.1028	17.3366	17.8841	18.5807	19.3064	19.8231	20.0209	20.0197	19.6748	18.9087	17.9347	17.0923	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1028	17.3366	17.8841	18.5807	19.3064	19.8231	20.0209	20.0197	19.6748	18.9087	17.9347	17.0923	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8253	0.8058	0.7645	0.6985	0.5967	0.4451	0.3122	0.3196	0.5257	0.6911	0.7862	0.8334	(94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1423.6134	1384.0436	1244.5630	1035.0368	748.6380	471.7496	279.0893	278.1160	524.5201	832.0412	1146.5459	1398.3177	(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	638.8940	535.0512	483.0836	330.4946	188.6927	0.0000	0.0000	0.0000	0.0000	269.3344	452.4612	637.8408	(98)
Space heating												3535.8524	(98)
RHI space heating demand												3536	(98)

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1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0964 (8)
Pressure test					Yes
Measured/design AP50					4.8600
Infiltration rate					0.3394 (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) =	0.3394 (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	0.4327	0.4242	0.4158	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988 (22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5666	0.5520	0.5520	0.5493	0.5576	0.5666	0.5729	0.5795 (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)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3600	108.4600	0.2000	21.6920	9.0000	976.1400 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2037		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5947 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6415 (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	40.6447	40.3958	40.1518	39.0057	38.7913	37.7931	37.7931	37.6083	38.1776	38.7913	39.2251	39.6786 (38)
Heat transfer coeff	123.2862	123.0373	122.7933	121.6472	121.4328	120.4346	120.4346	120.2498	120.8191	121.4328	121.8666	122.3201 (39)
Average = Sum(39)m / 12 =												121.6462 (39)
HLP	1.4261	1.4232	1.4204	1.4071	1.4047	1.3931	1.3931	1.3910	1.3976	1.4047	1.4097	1.4149 (40)
HLP (average)												1.4071 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

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

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
Southeast					5.6300	36.7938	0.6300	0.7000			0.7700	63.3075	(77)
Northwest					4.5700	11.2829	0.6300	0.7000			0.7700	15.7583	(81)
Solar gains	79.0658	139.9127	205.3378	277.7274	332.3485	339.3014	323.2291	281.0489	230.1813	158.3820	95.6559	67.0471	(83)
Total gains	665.3707	721.1587	763.3580	800.0806	818.3132	792.9880	758.3773	725.2521	695.2321	659.3174	636.2149	637.4547	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	10.2445	10.2652	10.2856	10.3825	10.4008	10.4870	10.4870	10.5032	10.4537	10.4008	10.3638	10.3254	
alpha	1.6830	1.6843	1.6857	1.6922	1.6934	1.6991	1.6991	1.7002	1.6969	1.6934	1.6909	1.6884	
util living area	0.8937	0.8758	0.8473	0.7982	0.7248	0.6205	0.5141	0.5426	0.6849	0.8076	0.8716	0.9001	(86)
MIT	17.3499	17.6315	18.1657	18.9031	19.6491	20.2938	20.6452	20.5951	20.0961	19.1597	18.1364	17.2871	(87)
Th 2	19.7434	19.7456	19.7477	19.7579	19.7598	19.7686	19.7686	19.7703	19.7652	19.7598	19.7559	19.7519	(88)
util rest of house	0.8821	0.8621	0.8294	0.7721	0.6836	0.5518	0.4109	0.4431	0.6243	0.7777	0.8552	0.8892	(89)
MIT 2	16.4601	16.7378	17.2638	17.9886	18.7033	19.3001	19.5913	19.5574	19.1320	18.2492	17.2471	16.4042	(90)
Living area fraction	16.7123	16.9911	17.5194	18.2478	18.9713	19.5817	19.8899	19.8515	19.4052	18.5072	17.4991	16.6544	(91)
MIT	16.7123	16.9911	17.5194	18.2478	18.9713	19.5817	19.8899	19.8515	19.4052	18.5072	17.4991	16.6544	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7123	16.9911	17.5194	18.2478	18.9713	19.5817	19.8899	19.8515	19.4052	18.5072	17.4991	16.6544	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	561.6903	593.0833	601.8893	586.2853	533.8671	428.1044	320.2650	326.7527	419.5197	487.6381	519.0757	543.2424	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1530.2644	1487.6527	1353.1085	1137.1330	882.9768	599.9699	396.2238	415.0405	640.9725	960.1958	1267.3079	1523.4254	(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	720.6191	601.1506	558.9071	396.6103	259.7376	0.0000	0.0000	0.0000	0.0000	351.5830	538.7272	729.2561	(98)
Space heating												4156.5910	(98)
Space heating per m2												(98) / (4) =	48.0809 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4592.9182 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	720.6191	601.1506	558.9071	396.6103	259.7376	0.0000	0.0000	0.0000	0.0000	351.5830	538.7272	729.2561	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	796.2642	664.2548	617.5769	438.2435	287.0029	0.0000	0.0000	0.0000	0.0000	388.4895	595.2786	805.8078	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Efficiency of water heater (217)m	89.8723	89.8467	89.7875	89.6610	89.3990	87.3000	87.3000	87.3000	87.3000	89.5598	89.7746	87.3000	(216)
Fuel for water heating, kWh/month	188.7574	165.5736	172.0006	151.6249	147.0012	131.5419	123.5198	139.4276	140.4077	157.5527	169.6822	183.2425	(219)
Water heating fuel used												1870.3322	(219)
Annual totals kWh/year													
Space heating fuel - main system												4592.9182	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												407.6430	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.96 * 677 * 1.00) =										-519.5557		-519.5557	(233)
Total delivered energy for all uses												6426.3376	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4592.9182	3.4800	159.8336 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1870.3322	3.4800	65.0876 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	407.6430	13.1900	53.7681 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-519.5557	13.1900	-68.5294 (252)
Total energy cost			340.0523 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0865 (257)
SAP value		84.8432
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4592.9182	0.2160	992.0703 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1870.3322	0.2160	403.9917 (264)
Space and water heating			1396.0621 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Energy saving/generation technologies			
PV Unit	-519.5557	0.5190	-269.6494 (269)
Total kg/year			1376.9044 (272)
CO2 emissions per m2			15.9300 (273)
EI value			85.9639
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0964 (8)
Pressure test					Yes
Measured/design AP50					4.8600
Infiltration rate					0.3394 (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)	=	0.3394 (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	0.3733	0.3479	0.3479	0.3309	0.3309	0.3139	0.3139	0.2970	0.2970	0.3224	0.3139	0.3309 (22b)
Effective ac	0.5697	0.5605	0.5605	0.5548	0.5548	0.5493	0.5493	0.5441	0.5441	0.5520	0.5493	0.5548 (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)			10.2000	1.3258	13.5227		(27)
Ground Floor			6.3000	0.1800	1.1340	75.0000	472.5000 (28a)
Suspended Floor			73.8500	0.1600	11.8160	20.0000	1477.0000 (28b)
External Wall	120.8200	12.3600	108.4600	0.2000	21.6920	9.0000	976.1400 (29a)
External Roof	80.1500		80.1500	0.1000	8.0150	9.0000	721.3500 (30)
Total net area of external elements Aum(A, m ²)			281.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.2037		(33)
Internal Wall - FF			99.9800			9.0000	899.8200 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		4546.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.5947 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							23.4378 (36)
Total fabric heat loss						(33) + (36) =	82.6415 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	39.0057	38.3772	38.3772	37.9829	37.9829	37.6083	37.6083	37.2534	37.2534	37.7931	37.6083	37.9829 (38)
Heat transfer coeff	121.6472	121.0188	121.0188	120.6244	120.6244	120.2498	120.2498	119.8949	119.8949	120.4346	120.2498	120.6244 (39)
Average = Sum(39)m / 12 =												120.5443 (39)
HLP	1.4071	1.3999	1.3999	1.3953	1.3953	1.3910	1.3910	1.3869	1.3869	1.3931	1.3910	1.3953 (40)
HLP (average)												1.3944 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

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

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

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast	5.6300				45.1778		0.6300		0.7000		0.7700		77.7330 (77)	
Northwest	4.5700				14.6176		0.6300		0.7000		0.7700		20.4158 (81)	
Solar gains	98.1488	148.2613	220.6400	302.3384	343.5950	385.1206	353.7623	320.0266	260.0344	179.1394	118.4456	78.7344	(83)	
Total gains	684.4537	729.5073	778.6602	824.6916	829.5598	838.8073	788.9105	764.2298	725.0852	680.0749	659.0046	649.1420	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	10.3825	10.4364	10.4364	10.4705	10.4705	10.5032	10.5032	10.5343	10.5343	10.4870	10.5032	10.4705		
alpha	1.6922	1.6958	1.6958	1.6980	1.6980	1.7002	1.7002	1.7023	1.7023	1.6991	1.7002	1.6980		
util living area	0.8783	0.8618	0.8261	0.7665	0.6722	0.5289	0.4109	0.4198	0.6112	0.7643	0.8466	0.8851	(86)	
MIT	17.7375	17.9727	18.5291	19.2415	19.9994	20.5697	20.8156	20.8097	20.3893	19.5704	18.5718	17.7218	(87)	
Th 2	19.7579	19.7634	19.7634	19.7669	19.7669	19.7703	19.7703	19.7734	19.7734	19.7686	19.7703	19.7669	(88)	
util rest of house	0.8645	0.8460	0.8050	0.7351	0.6196	0.4409	0.2838	0.2912	0.5329	0.7248	0.8260	0.8718	(89)	
MIT 2	16.8518	17.0850	17.6289	18.3193	19.0323	19.5278	19.7066	19.7072	19.3923	18.6469	17.6827	16.8434	(90)	
Living area fraction									fLA = Living area / (4) =			0.2834	(91)	
MIT	17.1028	17.3366	17.8841	18.5807	19.3064	19.8231	20.0209	20.0197	19.6748	18.9087	17.9347	17.0923	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.1028	17.3366	17.8841	18.5807	19.3064	19.8231	20.0209	20.0197	19.6748	18.9087	17.9347	17.0923	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	564.8850	587.8364	595.2571	576.0165	495.0187	373.3595	246.2845	244.2562	381.1475	470.0326	518.1276	541.0048	(94)	
Ext temp.	5.4000	5.9000	7.6000	13.1000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)	
Heat loss rate W	1423.6134	1384.0436	1244.5630	1035.0368	748.6380	471.7496	279.0893	278.1160	524.5201	832.0412	1146.5459	1398.3177	(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	638.8940	535.0512	483.0836	330.4946	188.6927	0.0000	0.0000	0.0000	0.0000	269.3344	452.4612	637.8408	(98)	
Space heating												3535.8524	(98)	
Space heating per m2												(98) / (4) =	40.9005	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3907.0193 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	638.8940	535.0512	483.0836	330.4946	188.6927	0.0000	0.0000	0.0000	0.0000	269.3344	452.4612	637.8408	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	705.9602	591.2168	533.7940	365.1874	208.5002	0.0000	0.0000	0.0000	0.0000	297.6071	499.9571	704.7965	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	169.6406	148.7624	154.4350	135.9485	131.4177	114.8361	107.8328	121.7203	122.5760	141.1039	152.3315	164.7219	(64)
Efficiency of water heater (217)m	89.8093	89.7840	89.7035	89.5434	89.1583	87.3000	87.3000	87.3000	87.3000	89.3737	89.6721	87.3000	(216)
Fuel for water heating, kWh/month	188.8898	165.6892	172.1616	151.8242	147.3981	131.5419	123.5198	139.4276	140.4077	157.8807	169.8762	183.3825	(219)
Water heating fuel used												1871.9993	(219)
Annual totals kWh/year													
Space heating fuel - main system												3907.0193	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													407.6430 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.96 * 776 * 1.00) =										-595.8111		-595.8111	(233)
Total delivered energy for all uses												5665.8503	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3907.0193	9.7400	380.5437 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1871.9993	9.7400	182.3327 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	407.6430	36.8500	150.2164 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-595.8111	36.8500	-219.5564 (252)
Total energy cost			625.1739 (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	3907.0193	0.2160	843.9162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1871.9993	0.2160	404.3518 (264)
Space and water heating			1248.2680 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	407.6430	0.5190	211.5667 (268)
Energy saving/generation technologies			
PV Unit	-595.8111	0.5190	-309.2260 (269)
Total kg/year			1189.5337 (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	3907.0193	1.2200	4766.5635 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1871.9993	1.2200	2283.8391 (264)
Space and water heating			7050.4026 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	407.6430	3.0700	1251.4639 (268)
Energy saving/generation technologies			
PV Unit	-595.8111	3.0700	-1829.1402 (269)
Primary energy kWh/year			6702.9763 (272)
Primary energy kWh/m2/year			77.5359 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

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

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

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

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

Fuel prices for cost data on this page from database revision number 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	£178	£178	£0
Mains gas	£667	£667	£0
Space heating	£512	£512	£0
Water heating	£182	£182	£0
Lighting	£150	£150	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£625	£625	£0
Total cost of uses	£624	£624	£0
Delivered energy	66 kWh/m²	66 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	78 kWh/m²	78 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

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

Overheating Calculation

Summer ventilation heat loss coefficient	547.75 (P1)
Transmission heat loss coefficient	82.64 (37)
Summer heat loss coefficient	630.39 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
North 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
South East	5.6300	127.3119	0.6300	0.7000	0.9000	256.0359
North West	4.5700	106.0502	0.6300	0.7000	0.9000	173.1216
total:						429.1575

	Jun	Jul	Aug	
Solar gains	462	429	380	(P3)
Internal gains	451	432	441	
Total summer gains	912	861	821	(P5)
Summer gain/loss ratio	1.45	1.37	1.30	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 52.6)	1.63	1.63	1.63	
Threshold temperature	18.48	20.30	20.23	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			