



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 7, Rowe Way
EASTLEIGH, Hampshire, SO50 9RG

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

Report Issue Date: 20/02/2020

EXCELLENCE
IN ENERGY
ASSESSMENT

BLOCK COMPLIANCE

Calculation Type: New Build (As Built)

Block Reference	SAP-0796 (Stoneham) - Block G	Issued on Date	20/02/2020
Block Name	3B4A Plots 297-305 (Flats)		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD		

Block Compliance Report - DER

Block Reference: SAP-0796 (Stoneham) - Block G		Block Name: 3B4A Plots 297-305 (Flats)		
Property-Assessment Reference	Multiplier	Floor Area (m²)	DER (kgCO₂/m²)	TER (kgCO₂/m²)
SAP-0796 (3B4A) - Plot 297-AB	1	61.72	15.71	18.98
SAP-0796 (3B4A) - Plot 298-AB	1	69.98	14.53	17.91
SAP-0796 (3B4A) - Plot 299-AB	1	50.67	15.38	18.69
SAP-0796 (3B4A) - Plot 300-AB	1	60.9	13.57	17.46
SAP-0796 (3B4A) - Plot 301-AB	1	69.15	12.57	16.44
SAP-0796 (3B4A) - Plot 302-AB	1	50.67	13.57	17.27
SAP-0796 (3B4A) - Plot 303-AB	1	60.9	13.36	17.22
SAP-0796 (3B4A) - Plot 304-AB	1	69.15	12.56	16.33
SAP-0796 (3B4A) - Plot 305-AB	1	50.67	15.05	18.79
Totals:	9	543.81	126.30	159.09
Average DER = 13.96 kgCO₂/m²			PASS	
Average TER = 17.61 kgCO₂/m²				

Block Compliance Report - DFEE

Block Reference: SAP-0796 (Stoneham) - Block G		Block Name: 3B4A Plots 297-305 (Flats)		
Property-Assessment Reference	Multiplier	Floor Area (m²)	DFEE (kWh/m²/yr)	TFEE (kWh/m²/yr)
SAP-0796 (3B4A) - Plot 297-AB	1	61.72	44.84	48.80
SAP-0796 (3B4A) - Plot 298-AB	1	69.98	40.03	43.80
SAP-0796 (3B4A) - Plot 299-AB	1	50.67	39.92	41.96
SAP-0796 (3B4A) - Plot 300-AB	1	60.9	35.43	40.09
SAP-0796 (3B4A) - Plot 301-AB	1	69.15	31.92	36.00
SAP-0796 (3B4A) - Plot 302-AB	1	50.67	32.64	34.73
SAP-0796 (3B4A) - Plot 303-AB	1	60.9	34.62	38.90
SAP-0796 (3B4A) - Plot 304-AB	1	69.15	31.85	35.46
SAP-0796 (3B4A) - Plot 305-AB	1	50.67	38.55	42.46
Totals:	9	543.81	329.79	362.20
Average DFEE = 36.55 kWh/m²/yr			PASS	
Average TFEE = 40.21 kWh/m²/yr				

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 298			Issued on Date	20/02/2020
Assessment Reference	AB	Prop Type Ref	Flats A - 1B2P Ground Floor WC		
Property	7, Rowe Way, EASTLEIGH, Hampshire, SO50 9RG				
SAP Rating	84 B	DER	14.53	TER	17.91
Environmental	90 B	% DER<TER	18.87		
CO ₂ Emissions (t/year)	0.79	DFEE	40.03	TFEE	43.80
General Requirements Compliance	Pass	% DFEE<TFEE	8.61		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.91	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.53	kgCO ₂ /m ²	Pass
	-3.38 (-18.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.80	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	40.03	kWh/m ² /yr	
	-3.8 (-8.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Openings	1.20 (max. 2.00)	1.20 (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	4.37 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

3.24 m², No overhang

Windows facing South

4.05 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.37 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Door U-value

0.60

W/m²K

Photovoltaic array

397.02

kWh/Year

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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Environmental		90 B	% DER<TER	18.87		
CO ₂ Emissions (t/year)		0.79	DFEE	40.03	TFEE	43.80
General Requirements Compliance		Pass	% DFEE<TFEE	8.61		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

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

Orientation	North					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, End-Terrace					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
		Ground Floor:	Heat Loss Perimeter 25.82 m	Internal Floor Area 69.98 m²	Average Storey Height 2.40 m	
7.0 Living Area	27.40			m²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	130.28			kJ/m²K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)		0.20	9.00	61.97
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board		0.00	20.00	23.80
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Walls	Plasterboard on timber frame				9.00	88.99
10.1 Party Ceilings						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Party Ceilings	Timber I-joists, carpeted				20.00	69.98
11.0 Heat Loss Floors						

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.16	75.00	69.98

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.20
Front Door	Manufacturer	Solid Door							0.60

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Window	[1] External Wall	North	None	0.00					3.24	
Rear Elevation	Window	[1] External Wall	South	None	0.00					4.05	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	5.40	0.300	Yes
Table K1 - Approved	E3 Sill	5.40	0.040	Yes
Table K1 - Approved	E4 Jamb	10.80	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	25.82	0.160	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	25.82	0.070	No
Table K1 - Approved	E16 Corner (normal)	9.60	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	4.80	-0.090	No
Table K1 - Default	E25 Staggered party wall between dwellings	4.80	0.120	No
Table K1 - Default	P1 Party wall - Ground floor	9.92	0.160	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.92	0.000	No

Y-value 0.083 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 4.00 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 4.37 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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Number of passive vents 0
Number of flueless gas fires 0

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings 7
Total number of L.E.L. fittings 7
Percentage of L.E.L. fittings 100.00 %

External

External lights fitted No

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

SAP Code	901
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	More Dwellings, One Block
Apportioned	397.02

kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

U-VALUE CALCULATOR REPORT

Property Reference	SAP-0796 (3B4A) - Plot 298		Issued on Date	20/02/2020
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Project	7, Rowe Way, EASTLEIGH, Hampshire, SO50 9RG			
Calculation Type	New Build (As Built)			

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General Requirements Compliance	Pass	% DFEE<TFEE	8.61		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD		

Building Elements

Wall 000001 - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

Layer	Description	Thickness (mm)	Conductivity (W/m²K)	Resistance (m²K/W)	Fraction (%)
Ext surface				0.2900	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.0000	82.81
	Main construction	100	0.9407	0.0000	17.19
Layer 2	Standard cavity				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Low Emissivity (BR443)				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 6	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 8	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 9	Service Void				
	Main construction	25	0.0321	0.7800	89.63
	Main construction	25	0.1300	0.1923	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 11	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

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

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

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CO ₂ Emissions (t/year)	0.79	DFEE	40.03	TFEE	43.80
General Requirements Compliance	Pass	% DFEE<TFEE	8.61		

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

Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 69.98 m², Perimeter = 25.82 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) = 0.16 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Ground-floor flat, total floor area 70 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.91 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.53 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)43.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.37 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North: 3.24 m², No overhang
Windows facing South: 4.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.60 W/m²K
Photovoltaic array 397.02 kWh/Year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3376 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2869 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3659	0.3587	0.3515	0.3156	0.3085	0.2726	0.2726	0.2654	0.2869	0.3085	0.3228	0.3372 (22b)
Effective ac	0.5669	0.5643	0.5618	0.5498	0.5476	0.5372	0.5372	0.5352	0.5412	0.5476	0.5521	0.5568 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			7.2900	1.1450	8.3473		(27)
Heat Loss Floor			69.9800	0.1600	11.1968	75.0000	5248.5000 (28a)
External Wall	61.9700	7.2900	54.6800	0.2000	10.9360	9.0000	492.1200 (29a)
Total net area of external elements Aum(A, m ²)			131.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4801		(33)
Party Wall			23.8000	0.0000	0.0000	20.0000	476.0000 (32)
Party Ceilings			69.9800			30.0000	2099.4000 (32b)
Internal Walls			88.9900			9.0000	800.9100 (32c)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 9116.9300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.2791 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9098 (36)
Total fabric heat loss							(33) + (36) = 41.3899 (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	31.4213	31.2773	31.1361	30.4730	30.3489	29.7713	29.7713	29.6644	29.9938	30.3489	30.5999	30.8623 (38)
Heat transfer coeff	72.8112	72.6672	72.5260	71.8629	71.7388	71.1613	71.1613	71.0543	71.3837	71.7388	71.9898	72.2522 (39)
Average = Sum(39)m / 12 =												71.8623 (39)
HLP	1.0405	1.0384	1.0364	1.0269	1.0251	1.0169	1.0169	1.0154	1.0201	1.0251	1.0287	1.0325 (40)
HLP (average)												1.0269 (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												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.2873	92.7860	89.2846	85.7833	82.2819	78.7805	78.7805	82.2819	85.7833	89.2846	92.7860	96.2873 (44)
Energy content (annual)	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4187	18.7329	19.3307	16.8530	16.1708	13.9542	12.9306	14.8381	15.0153	17.4989	19.1014	20.7429 (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)

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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 (57)
Combi loss	14.0865	12.7034	14.0327	13.5441	13.9695	13.4887	13.9195	13.9519	13.5189	14.0065	13.5964	14.0761 (61)
Total heat required for water heating calculated for each month	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (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	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (64)
Heat gains from water heating, kWh/month	50.9997	44.7005	46.3579	40.7435	39.3377	34.3040	32.1428	36.3790	36.6636	42.2908	45.7405	49.4990 (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	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1306	17.8798	14.5408	11.0083	8.2289	6.9472	7.5066	9.7574	13.0964	16.6289	19.4084	20.6901 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2504	199.2972	194.1392	183.1585	169.2973	156.2698	147.5666	145.5197	150.6777	161.6584	175.5196	188.5472 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282 (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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256 (71)
Water heating gains (Table 5)	68.5480	66.5186	62.3090	56.5881	52.8733	47.6444	43.2026	48.8966	50.9217	56.8425	63.5285	66.5310 (72)
Total internal gains	345.6136	343.3802	330.6737	310.4396	290.0841	270.5460	257.9604	263.8583	274.3804	294.8144	318.1410	335.4528 (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
North													3.2400	10.6334	0.6300	0.7000	0.7700	10.5290
South													4.0500	46.7521	0.6300	0.7000	0.7700	57.8666 (78)

Solar gains	68.3956	114.8920	154.9122	191.3609	216.1622	216.0290	207.6336	188.4963	167.2163	126.1709	81.5805	58.7796	(83)					
Total gains	414.0092	458.2723	485.5859	501.8005	506.2462	486.5750	465.5940	452.3546	441.5967	420.9853	399.7216	394.2324	(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	34.7814	34.8504	34.9182	35.2404	35.3014	35.5879	35.5879	35.6415	35.4770	35.3014	35.1783	35.0506
alpha	3.3188	3.3234	3.3279	3.3494	3.3534	3.3725	3.3725	3.3761	3.3651	3.3534	3.3452	3.3367
util living area	0.9814	0.9725	0.9574	0.9262	0.8633	0.7452	0.6023	0.6344	0.8111	0.9303	0.9716	0.9840 (86)
MIT	19.1934	19.3830	19.6892	20.0931	20.4841	20.7913	20.9266	20.9103	20.6983	20.2054	19.6289	19.1527 (87)
Th 2	20.0498	20.0515	20.0531	20.0610	20.0624	20.0693	20.0693	20.0706	20.0667	20.0624	20.0595	20.0564 (88)
util rest of house	0.9780	0.9676	0.9492	0.9105	0.8309	0.6789	0.4990	0.5348	0.7568	0.9126	0.9656	0.9812 (89)
MIT 2	18.3945	18.5832	18.8869	19.2877	19.6605	19.9370	20.0366	20.0281	19.8607	19.4019	18.8346	18.3591 (90)
Living area fraction	18.7073	18.8964	19.2010	19.6030	19.9830	20.2715	20.3851	20.3735	20.1887	19.7165	19.1456	0.3915 (91)
MIT	18.7073	18.8964	19.2010	19.6030	19.9830	20.2715	20.3851	20.3735	20.1887	19.7165	19.1456	18.6698 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7073	18.8964	19.2010	19.6030	19.9830	20.2715	20.3851	20.3735	20.1887	19.7165	19.1456	18.6698 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	402.3440	439.8883	456.4994	452.3643	419.0374	337.9969	249.6209	257.5777	337.7090	380.8495	382.9909	384.6107 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1049.0138	1017.0774	921.1545	769.1508	594.2135	403.5934	269.3490	282.3335	434.6310	654.0096	867.1640	1045.4762 (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	481.1223	387.8711	345.7034	228.0863	130.3310	0.0000	0.0000	0.0000	0.0000	203.2311	348.6046	491.6840 (98)
Space heating												2616.6337 (98)
Space heating per m2												37.3912 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2891.3080 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	481.1223	387.8711	345.7034	228.0863	130.3310	0.0000	0.0000	0.0000	0.0000	203.2311	348.6046	491.6840 (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)	531.6268	428.5868	381.9927	252.0290	144.0122	0.0000	0.0000	0.0000	0.0000	224.5648	385.1985	543.2972 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (64)
Efficiency of water heater (217)m	89.6916	89.6396	89.5401	89.3354	88.9255	87.3000	87.3000	87.3000	87.3000	89.2202	89.5549	87.3000 (216)
Fuel for water heating, kWh/month	174.9081	153.4919	159.5979	140.9266	136.9404	122.0122	114.6892	129.2925	130.1498	146.4530	157.3771	169.8156 (219)
Water heating fuel used												1735.6545 (219)
Annual totals kWh/year												
Space heating fuel - main system												2891.3080 (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)												355.5124 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												5057.4748 (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	2891.3080	0.2160	624.5225 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1735.6545	0.2160	374.9014 (264)	
Space and water heating			999.4239 (265)	
Pumps and fans	75.0000	0.5190	38.9250 (267)	
Energy for lighting	355.5124	0.5190	184.5109 (268)	
Energy saving/generation technologies				
PV Unit	-397.0200	0.5190	-206.0534 (269)	
Total CO2, kg/year			1016.8064 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			14.5300 (273)	

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

DER	14.5300	ZC1
Total Floor Area	69.9800	TFA
Assumed number of occupants	2.2456	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.7028	ZC2
CO2 emissions from cooking, equation (L16)	2.4706	ZC3
Total CO2 emissions	33.7035	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	33.7035	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	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1191 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3691 (18)
Shelter factor					2 (19)
Infiltration rate adjusted to include shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
					(21) = (18) x (20) = 0.3137 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686 (22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			7.2900	1.3258	9.6648		(27)					
Heat Loss Floor			69.9800	0.1300	9.0974		(28a)					
External Wall	61.9700	7.2900	54.6800	0.1800	9.8424		(29a)					
Total net area of external elements Aum(A, m2)			131.9500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			28.6046	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5322 (36)					
Total fabric heat loss							(33) + (36) = 37.1368 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	32.1458	31.9737	31.8049	31.0123	30.8640	30.1736	30.1736	30.0457	30.4395	30.8640	31.1640	31.4776 (38)
Average = Sum(39)m / 12 =	69.2826	69.1104	68.9417	68.1490	68.0007	67.3103	67.3103	67.1825	67.5763	68.0007	68.3007	68.6144 (39)
												68.1483 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9900	0.9876	0.9852	0.9738	0.9717	0.9619	0.9619	0.9600	0.9657	0.9717	0.9760	0.9805 (40)
Days in month												0.9738 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.2873	92.7860	89.2846	85.7833	82.2819	78.7805	78.7805	82.2819	85.7833	89.2846	92.7860	96.2873 (44)
Energy content (annual)	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1377.2496 (45)
Water storage loss:	21.4187	18.7329	19.3307	16.8530	16.1708	13.9542	12.9306	14.8381	15.0153	17.4989	19.1014	20.7429 (46)
Total storage loss												
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 (56)
Combi 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)
Total heat required for water heating calculated for each month	49.0670	42.7070	45.4985	42.3041	41.9300	38.8507	40.1457	41.9300	42.3041	45.4985	45.7575	49.0670 (61)

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Solar input	191.8583	167.5932	174.3698	154.6573	149.7355	131.8787	126.3498	140.8504	142.4060	162.1576	173.1000	187.3527 (62)
	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	191.8583	167.5932	174.3698	154.6573	149.7355	131.8787	126.3498	140.8504	142.4060	162.1576	173.1000	187.3527 (64)
Heat gains from water heating, kWh/month	59.7449	52.2014	54.2243	47.9335	46.3278	40.6445	38.6993	43.3735	43.8599	50.1638	53.7808	58.2468 (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	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1306	17.8798	14.5408	11.0083	8.2289	6.9472	7.5066	9.7574	13.0964	16.6289	19.4084	20.6901 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2504	199.2972	194.1392	183.1585	169.2973	156.2698	147.5666	145.5197	150.6777	161.6584	175.5196	188.5472 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282 (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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256 (71)
Water heating gains (Table 5)	80.3022	77.6807	72.8822	66.5742	62.2686	56.4507	52.0152	58.2978	60.9165	67.4244	74.6955	78.2887 (72)
Total internal gains	357.3678	354.5423	341.2469	320.4257	299.4794	279.3522	266.7730	273.2595	284.3752	305.3963	329.3081	347.2105 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.2400	10.6334	0.6300	0.7000	0.7700	10.5290 (74)
South	4.0500	46.7521	0.6300	0.7000	0.7700	57.8666 (78)

Solar gains	68.3956	114.8920	154.9122	191.3609	216.1622	216.0290	207.6336	188.4963	167.2163	126.1709	81.5805	58.7796 (83)
Total gains	425.7634	469.4343	496.1591	511.7866	515.6415	495.3812	474.4066	461.7558	451.5915	431.5673	410.8886	405.9900 (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	70.1435	70.3182	70.4903	71.3102	71.4657	72.1987	72.1987	72.3361	71.9146	71.4657	71.1518	70.8266
alpha	5.6762	5.6879	5.6994	5.7540	5.7644	5.8132	5.8132	5.8224	5.7943	5.7644	5.7435	5.7218
util living area	0.9978	0.9957	0.9906	0.9746	0.9240	0.7876	0.6085	0.6464	0.8661	0.9766	0.9954	0.9983 (86)
MIT	19.9879	20.1076	20.2969	20.5483	20.7836	20.9436	20.9896	20.9853	20.8956	20.6036	20.2510	19.9650 (87)
Th 2	20.0916	20.0937	20.0957	20.1052	20.1070	20.1152	20.1152	20.1168	20.1121	20.1070	20.1034	20.0996 (88)
util rest of house	0.9971	0.9943	0.9873	0.9647	0.8923	0.7086	0.4943	0.5337	0.8042	0.9654	0.9935	0.9978 (89)
MIT 2	18.7361	18.9122	19.1890	19.5570	19.8803	20.0741	20.1110	20.1102	20.0244	19.6400	19.1292	18.7086 (90)
Living area fraction									fLA = Living area / (4) =			0.3915 (91)
MIT	19.2262	19.3803	19.6228	19.9451	20.2340	20.4145	20.4550	20.4528	20.3655	20.0173	19.5684	19.2005 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2262	19.3803	19.6228	19.9451	20.2340	20.4145	20.4550	20.4528	20.3655	20.0173	19.5684	19.2005 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9962	0.9928	0.9850	0.9625	0.8975	0.7373	0.5394	0.5782	0.8240	0.9640	0.9921	0.9970 (94)
Useful gains	424.1331	466.0499	488.7237	492.5719	462.8020	365.2508	255.8989	266.9767	372.1011	416.0223	407.6305	404.7881 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1034.1268	1000.7389	904.7061	752.7151	580.3198	391.3776	259.4805	272.2795	423.4004	640.3837	851.6037	1029.2510 (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	453.8353	359.3110	309.4909	187.3031	87.4332	0.0000	0.0000	0.0000	0.0000	166.9248	319.6607	464.6004 (98)
Space heating												2348.5595 (98)
Space heating per m2										(98) / (4) =		33.5604 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2514.5177 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	453.8353	359.3110	309.4909	187.3031	87.4332	0.0000	0.0000	0.0000	0.0000	166.9248	319.6607	464.6004 (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)	485.9051	384.7013	331.3607	200.5387	93.6116	0.0000	0.0000	0.0000	0.0000	178.7204	342.2491	497.4308 (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	191.8583	167.5932	174.3698	154.6573	149.7355	131.8787	126.3498	140.8504	142.4060	162.1576	173.1000	187.3527 (64)
Efficiency of water heater	87.1432	86.9225	86.4801	85.5343	83.7495	80.3000	80.3000	80.3000	80.3000	85.1242	86.5748	87.2465 (216)
Fuel for water heating, kWh/month	220.1644	192.8075	201.6300	180.8130	178.7898	164.2325	157.3472	175.4053	177.3424	190.4954	199.9428	214.7396 (219)
Water heating fuel used												2253.7099 (219)
Annual totals kWh/year												2514.5177 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
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)												355.5124 (232)
Total delivered energy for all uses												5198.7399 (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	2514.5177	0.2160	543.1358 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2253.7099	0.2160	486.8013 (264)
Space and water heating			1029.9372 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.5124	0.5190	184.5109 (268)
Total CO2, kg/m2/year			1253.3731 (272)
Emissions per m2 for space and water heating			14.7176 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6366 (272b)
Emissions per m2 for pumps and fans			0.5562 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7176 * 1.00) + 2.6366 + 0.5562, rounded to 2 d.p.			17.9100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.1191 (8)
Measured/design AP50				Yes	4.3700
Infiltration rate					0.3376 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2869 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3659	0.3587	0.3515	0.3156	0.3085	0.2726	0.2726	0.2654	0.2869	0.3085	0.3228	0.3372 (22b)
Effective ac	0.5669	0.5643	0.5618	0.5498	0.5476	0.5372	0.5372	0.5352	0.5412	0.5476	0.5521	0.5568 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			7.2900	1.1450	8.3473		(27)
Heat Loss Floor			69.9800	0.1600	11.1968	75.0000	5248.5000 (28a)
External Wall	61.9700	7.2900	54.6800	0.2000	10.9360	9.0000	492.1200 (29a)
Total net area of external elements Aum(A, m ²)			131.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	30.4801			(33)
Party Wall			23.8000	0.0000	0.0000	20.0000	476.0000 (32)
Party Ceilings			69.9800			20.0000	1399.6000 (32b)
Internal Walls			88.9900			9.0000	800.9100 (32c)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 8417.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							120.2791 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9098 (36)
Total fabric heat loss							(33) + (36) = 41.3899 (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	31.4213	31.2773	31.1361	30.4730	30.3489	29.7713	29.7713	29.6644	29.9938	30.3489	30.5999	30.8623 (38)
Heat transfer coeff	72.8112	72.6672	72.5260	71.8629	71.7388	71.1613	71.1613	71.0543	71.3837	71.7388	71.9898	72.2522 (39)
Average = Sum(39)m / 12 =												71.8623 (39)
HLP	1.0405	1.0384	1.0364	1.0269	1.0251	1.0169	1.0169	1.0154	1.0201	1.0251	1.0287	1.0325 (40)
HLP (average)												1.0269 (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												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.2873	92.7860	89.2846	85.7833	82.2819	78.7805	78.7805	82.2819	85.7833	89.2846	92.7860	96.2873 (44)
Energy content (annual)	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1377.2496 (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)

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.3432	26.5383	27.3852	23.8751	22.9087	19.7684	18.3184	21.0206	21.2717	24.7901	27.0603	29.3857	(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	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1306	17.8798	14.5408	11.0083	8.2289	6.9472	7.5066	9.7574	13.0964	16.6289	19.4084	20.6901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2504	199.2972	194.1392	183.1585	169.2973	156.2698	147.5666	145.5197	150.6777	161.6584	175.5196	188.5472	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	(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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	(71)
Water heating gains (Table 5)	40.7838	39.4915	36.8080	33.1598	30.7912	27.4562	24.6215	28.2535	29.5440	33.3200	37.5837	39.4969	(72)
Total internal gains	314.8494	313.3532	302.1727	284.0113	265.0020	247.3577	236.3793	240.2152	250.0027	268.2919	289.1963	305.4188	(73)

6. Solar gains													

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.2400	10.6334		0.6300		0.7000		0.7700		10.5290 (74)
South				4.0500	46.7521		0.6300		0.7000		0.7700		57.8666 (78)

Solar gains	68.3956	114.8920	154.9122	191.3609	216.1622	216.0290	207.6336	188.4963	167.2163	126.1709	81.5805	58.7796	(83)
Total gains	383.2450	428.2452	457.0849	475.3721	481.1642	463.3867	444.0129	428.7115	417.2189	394.4628	370.7768	364.1983	(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	32.1117	32.1753	32.2380	32.5354	32.5917	32.8562	32.8562	32.9057	32.7538	32.5917	32.4781	32.3601	
alpha	3.1408	3.1450	3.1492	3.1690	3.1728	3.1904	3.1904	3.1937	3.1836	3.1728	3.1652	3.1573	
util living area	0.9816	0.9727	0.9577	0.9273	0.8672	0.7547	0.6164	0.6503	0.8199	0.9329	0.9724	0.9843	(86)
MIT	19.0223	19.2245	19.5524	19.9859	20.4086	20.7492	20.9065	20.8859	20.6433	20.1052	19.4868	18.9804	(87)
Th 2	20.0498	20.0515	20.0531	20.0610	20.0624	20.0693	20.0693	20.0706	20.0667	20.0624	20.0595	20.0564	(88)
util rest of house	0.9785	0.9680	0.9499	0.9125	0.8366	0.6913	0.5145	0.5527	0.7688	0.9165	0.9668	0.9815	(89)
MIT 2	18.2322	18.4337	18.7591	19.1899	19.5953	19.9059	20.0256	20.0139	19.8173	19.3115	18.7014	18.1954	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.5416	18.7434	19.0697	19.5015	19.9137	20.2361	20.3705	20.3553	20.1407	19.6223	19.0089	18.5027	(92)
Temperature adjustment													
adjusted MIT	18.5416	18.7434	19.0697	19.5015	19.9137	20.2361	20.3705	20.3553	20.1407	19.6223	19.0089	18.5027	(93)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9719	0.9597	0.9399	0.9019	0.8310	0.7038	0.5497	0.5849	0.7734	0.9071	0.9588	0.9756	(94)
Useful gains	372.4678	410.9803	429.6026	428.7488	399.8542	326.1364	244.0920	250.7600	322.6631	357.8069	355.4909	355.3209	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1036.9459	1005.9578	911.6286	761.8563	589.2443	401.0698	268.3127	281.0440	431.2098	647.2465	857.3218	1033.4047	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	494.3718	399.8249	358.6274	239.8374	140.9062	0.0000	0.0000	0.0000	0.0000	215.3431	361.3183	504.4944	(98)
Space heating													2714.7233 (98)
Space heating per m2													38.7928 (99)

8c. Space cooling requirement													

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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	668.9160	526.5934	540.0128	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7357	0.8096	0.7916	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	492.0963	426.3155	427.4522	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	626.1963	601.9576	585.7933	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	96.5520	130.6777	117.8058	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													345.0355 (104)

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Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.1380	32.6694	29.4514	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.2589 (107)
Space cooling per m2												1.2326 (108)
Energy for space heating												38.7928 (99)
Energy for space cooling												1.2326 (108)
Total												40.0255 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.0 (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	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3691 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3137 (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	0.4000	0.3921	0.3843	0.3451	0.3372	0.2980	0.2980	0.2902	0.3137	0.3372	0.3529	0.3686 (22b)
Effective ac	0.5800	0.5769	0.5738	0.5595	0.5569	0.5444	0.5444	0.5421	0.5492	0.5569	0.5623	0.5679 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			7.2900	1.3258	9.6648		(27)					
Heat Loss Floor			69.9800	0.1300	9.0974		(28a)					
External Wall	61.9700	7.2900	54.6800	0.1800	9.8424		(29a)					
Total net area of external elements Aum(A, m2)			131.9500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			28.6046	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5322 (36)					
Total fabric heat loss						(33) + (36) =	37.1368 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.1458	Feb 31.9737	Mar 31.8049	Apr 31.0123	May 30.8640	Jun 30.1736	Jul 30.1736	Aug 30.0457	Sep 30.4395	Oct 30.8640	Nov 31.1640	Dec 31.4776 (38)
Heat transfer coeff	69.2826	69.1104	68.9417	68.1490	68.0007	67.3103	67.3103	67.1825	67.5763	68.0007	68.3007	68.6144 (39)
Average = Sum(39)m / 12 =												68.1483 (39)
HLP	Jan 0.9900	Feb 0.9876	Mar 0.9852	Apr 0.9738	May 0.9717	Jun 0.9619	Jul 0.9619	Aug 0.9600	Sep 0.9657	Oct 0.9717	Nov 0.9760	Dec 0.9805 (40)
HLP (average)												0.9738 (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												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan 96.2873	Feb 92.7860	Mar 89.2846	Apr 85.7833	May 82.2819	Jun 78.7805	Jul 78.7805	Aug 82.2819	Sep 85.7833	Oct 89.2846	Nov 92.7860	Dec 96.2873 (44)
Energy conte	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Energy content (annual)										Total = Sum(45)m =		1377.2496 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												

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30.3432 26.5383 27.3852 23.8751 22.9087 19.7684 18.3184 21.0206 21.2717 24.7901 27.0603 29.3857 (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	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	112.2820	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1306	17.8798	14.5408	11.0083	8.2289	6.9472	7.5066	9.7574	13.0964	16.6289	19.4084	20.6901	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2504	199.2972	194.1392	183.1585	169.2973	156.2698	147.5666	145.5197	150.6777	161.6584	175.5196	188.5472	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	34.2282	(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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	(71)
Water heating gains (Table 5)	40.7838	39.4915	36.8080	33.1598	30.7912	27.4562	24.6215	28.2535	29.5440	33.3200	37.5837	39.4969	(72)
Total internal gains	314.8494	313.3532	302.1727	284.0113	265.0020	247.3577	236.3793	240.2152	250.0027	268.2919	289.1963	305.4188	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.2400	10.6334	0.6300	0.7000	0.7700	10.5290 (74)			
South				4.0500	46.7521	0.6300	0.7000	0.7700	57.8666 (78)			

Solar gains	68.3956	114.8920	154.9122	191.3609	216.1622	216.0290	207.6336	188.4963	167.2163	126.1709	81.5805	58.7796 (83)
Total gains	383.2450	428.2452	457.0849	475.3721	481.1642	463.3867	444.0129	428.7115	417.2189	394.4628	370.7768	364.1983 (84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	70.1435	70.3182	70.4903	71.3102	71.4657	72.1987	72.1987	72.3361	71.9146	71.4657	71.1518	70.8266	
alpha	5.6762	5.6879	5.6994	5.7540	5.7644	5.8132	5.8132	5.8224	5.7943	5.7644	5.7435	5.7218	
util living area	0.9987	0.9973	0.9937	0.9818	0.9413	0.8204	0.6445	0.6873	0.8958	0.9844	0.9972	0.9991	(86)
MIT	19.9297	20.0519	20.2453	20.5038	20.7510	20.9296	20.9861	20.9800	20.8715	20.5577	20.1967	19.9076	(87)
Th 2	20.0916	20.0937	20.0957	20.1052	20.1070	20.1152	20.1152	20.1168	20.1121	20.1070	20.1034	20.0996	(88)
util rest of house	0.9983	0.9964	0.9914	0.9743	0.9148	0.7448	0.5264	0.5717	0.8412	0.9766	0.9961	0.9987	(89)
MIT 2	19.1081	19.2316	19.4258	19.6886	19.9246	20.0790	20.1112	20.1104	20.0353	19.7446	19.3843	19.0926	(90)
Living area fraction									fLA = Living area / (4) =				
MIT	19.4298	19.5528	19.7467	20.0077	20.2482	20.4120	20.4538	20.4509	20.3627	20.0629	19.7024	19.4117	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4298	19.5528	19.7467	20.0077	20.2482	20.4120	20.4538	20.4509	20.3627	20.0629	19.7024	19.4117	(93)

8. Space heating requirement

Utilisation	0.9979	0.9957	0.9902	0.9733	0.9197	0.7724	0.5733	0.6176	0.8588	0.9761	0.9955	0.9984	(94)
Useful gains	382.4397	426.3901	452.6225	462.6617	442.5354	357.9427	254.5333	264.7657	358.3189	385.0280	369.0975	363.6242	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1048.2340	1012.6609	913.2495	756.9820	581.2815	391.2102	259.3993	272.1488	423.2093	643.4867	860.7531	1043.7415	(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	495.3510	393.9740	342.7065	211.9106	103.2271	0.0000	0.0000	0.0000	0.0000	192.2933	353.9920	506.0073	(98)
Space heating												2599.4618	(98)
Space heating per m ²											(98) / (4) =	37.1458	(99)

8c. Space cooling requirement

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

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	632.7173	498.0966	510.5870	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8488	0.9208	0.9052	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	537.0321	458.6683	462.1741	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	626.1963	601.9576	585.7933	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	64.1982	106.6073	91.9727	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												262.7782	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

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	0.0000	0.0000	0.0000	0.0000	0.0000	16.0496	26.6518	22.9932	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													65.6945 (107)
Space cooling per m2													0.9388 (108)
Energy for space heating													37.1458 (99)
Energy for space cooling													0.9388 (108)
Total													38.0845 (109)
Target Fabric Energy Efficiency (TFEE)													43.8 (109)

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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	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3376 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2869 (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												
Effective ac	0.3156	0.2941	0.2941	0.2798	0.2798	0.2654	0.2654	0.2511	0.2511	0.2726	0.2654	0.2798 (22b)
	0.5498	0.5433	0.5433	0.5391	0.5391	0.5352	0.5352	0.5315	0.5315	0.5372	0.5352	0.5391 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			7.2900	1.1450	8.3473		(27)
Heat Loss Floor			69.9800	0.1600	11.1968	75.0000	5248.5000 (28a)
External Wall	61.9700	7.2900	54.6800	0.2000	10.9360	9.0000	492.1200 (29a)
Total net area of external elements Aum(A, m ²)			131.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4801		(33)
Party Wall			23.8000	0.0000	0.0000	20.0000	476.0000 (32)
Party Ceilings			69.9800			30.0000	2099.4000 (32b)
Internal Walls			88.9900			9.0000	800.9100 (32c)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 9116.9300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.2791 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9098 (36)
Total fabric heat loss							(33) + (36) = 41.3899 (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	30.4730	30.1093	30.1093	29.8812	29.8812	29.6644	29.6644	29.4590	29.4590	29.7713	29.6644	29.8812 (38)
Heat transfer coeff	71.8629	71.4993	71.4993	71.2711	71.2711	71.0543	71.0543	70.8490	70.8490	71.1613	71.0543	71.2711 (39)
Average = Sum(39)m / 12 =												71.2247 (39)
HLP	1.0269	1.0217	1.0217	1.0184	1.0184	1.0154	1.0154	1.0124	1.0124	1.0169	1.0154	1.0184 (40)
HLP (average)												1.0178 (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												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.2873	92.7860	89.2846	85.7833	82.2819	78.7805	78.7805	82.2819	85.7833	89.2846	92.7860	96.2873 (44)
Energy content (annual)	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4187	18.7329	19.3307	16.8530	16.1708	13.9542	12.9306	14.8381	15.0153	17.4989	19.1014	20.7429 (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)

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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	(57)
Combi loss	14.0865	12.7034	14.0327	13.5441	13.9695	13.4887	13.9195	13.9519	13.5189	14.0065	13.5964	14.0761	(61)
Total heat required for water heating calculated for each month	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619	(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	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619	(64)
RHI water heating demand	50.9997	44.7005	46.3579	40.7435	39.3377	34.3040	32.1428	36.3790	36.6636	42.2908	45.7405	49.4990	(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	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3265	44.6995	36.3521	27.5209	20.5722	17.3679	18.7666	24.3936	32.7410	41.5722	48.5209	51.7252	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4036	297.4585	289.7601	273.3709	252.6826	233.2385	220.2486	217.1936	224.8921	241.2812	261.9696	281.4137	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	(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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	(71)
Water heating gains (Table 5)	68.5480	66.5186	62.3090	56.5881	52.8733	47.6444	43.2026	48.8966	50.9217	56.8425	63.5285	66.5310	(72)
Total internal gains	511.9103	507.3089	487.0534	456.1122	424.7603	396.8831	380.8501	389.1160	407.1870	438.3282	472.6512	498.3021	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2400	13.4839	0.6300	0.7000	0.7700	13.3516	(74)
South	4.0500	56.7559	0.6300	0.7000	0.7700	70.2486	(78)

Solar gains	83.6001	119.5432	163.1367	204.6836	220.6082	242.6593	224.6439	211.2833	185.2145	139.9708	99.3795	68.0271	(83)
Total gains	595.5105	626.8521	650.1902	660.7958	645.3685	639.5423	605.4941	600.3993	592.4016	578.2990	572.0307	566.3292	(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	35.2404	35.4197	35.4197	35.5331	35.5331	35.6415	35.6415	35.7448	35.7448	35.5879	35.6415	35.5331		
alpha	3.3494	3.3613	3.3613	3.3689	3.3689	3.3761	3.3761	3.3830	3.3830	3.3725	3.3761	3.3689		
util living area	0.9398	0.9256	0.8930	0.8321	0.7160	0.5273	0.3775	0.3795	0.6087	0.8090	0.9074	0.9458	(86)	
MIT	19.7422	19.8793	20.1529	20.4741	20.7732	20.9434	20.9867	20.9866	20.9027	20.6121	20.1541	19.7217	(87)	
Th 2	20.0610	20.0653	20.0653	20.0680	20.0680	20.0706	20.0706	20.0730	20.0730	20.0693	20.0706	20.0680	(88)	
util rest of house	0.9298	0.9133	0.8746	0.8018	0.6619	0.4442	0.2755	0.2773	0.5306	0.7686	0.8897	0.9365	(89)	
MIT 2	18.9410	19.0773	19.3414	19.6463	19.9120	20.0430	20.0669	20.0693	20.0194	19.7777	19.3504	18.9271	(90)	
Living area fraction									fLA = Living area / (4) =			0.3915	(91)	
MIT	19.2547	19.3913	19.6591	19.9704	20.2491	20.3955	20.4270	20.4285	20.3653	20.1044	19.6651	19.2382	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2547	19.3913	19.6591	19.9704	20.2491	20.3955	20.4270	20.4285	20.3653	20.1044	19.6651	19.2382	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	547.5937	566.0189	562.7373	527.5011	434.4009	303.3110	190.9347	190.4540	329.6653	445.4302	503.8528	524.7772	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	995.6418	964.6186	862.2173	710.6011	509.5276	319.4269	193.7672	193.3081	358.8683	576.7173	800.4343	979.1386	(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	333.3477	267.8590	222.8132	131.8320	55.8943	0.0000	0.0000	0.0000	0.0000	97.6777	213.5387	338.0449	(98)
Space heating												1661.0075	(98)
RHI space heating demand												1661	(98)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1191 (8)
Measured/design AP50					Yes
Infiltration rate					4.3700
Number of sides sheltered					0.3376 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2869 (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	0.3659	0.3587	0.3515	0.3156	0.3085	0.2726	0.2726	0.2654	0.2869	0.3085	0.3228	0.3372 (22b)
Effective ac	0.5669	0.5643	0.5618	0.5498	0.5476	0.5372	0.5372	0.5352	0.5412	0.5476	0.5521	0.5568 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			7.2900	1.1450	8.3473		(27)
Heat Loss Floor			69.9800	0.1600	11.1968	75.0000	5248.5000 (28a)
External Wall	61.9700	7.2900	54.6800	0.2000	10.9360	9.0000	492.1200 (29a)
Total net area of external elements Aum(A, m ²)			131.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	30.4801			(33)
Party Wall			23.8000	0.0000	0.0000	20.0000	476.0000 (32)
Party Ceilings			69.9800			30.0000	2099.4000 (32b)
Internal Walls			88.9900			9.0000	800.9100 (32c)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 9116.9300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.2791 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9098 (36)
Total fabric heat loss							(33) + (36) = 41.3899 (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	31.4213	31.2773	31.1361	30.4730	30.3489	29.7713	29.7713	29.6644	29.9938	30.3489	30.5999	30.8623 (38)
Heat transfer coeff	72.8112	72.6672	72.5260	71.8629	71.7388	71.1613	71.1613	71.0543	71.3837	71.7388	71.9898	72.2522 (39)
Average = Sum(39)m / 12 =												71.8623 (39)
HLP	1.0405	1.0384	1.0364	1.0269	1.0251	1.0169	1.0169	1.0154	1.0201	1.0251	1.0287	1.0325 (40)
HLP (average)												1.0269 (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												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.2873	92.7860	89.2846	85.7833	82.2819	78.7805	78.7805	82.2819	85.7833	89.2846	92.7860	96.2873 (44)
Energy content (annual)	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4187	18.7329	19.3307	16.8530	16.1708	13.9542	12.9306	14.8381	15.0153	17.4989	19.1014	20.7429 (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 (57)
Combi loss	14.0865	12.7034	14.0327	13.5441	13.9695	13.4887	13.9195	13.9519	13.5189	14.0065	13.5964	14.0761 (61)
Total heat required for water heating calculated for each month	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (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	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (64)
Heat gains from water heating, kWh/month	50.9997	44.7005	46.3579	40.7435	39.3377	34.3040	32.1428	36.3790	36.6636	42.2908	45.7405	49.4990 (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	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3265	44.6995	36.3521	27.5209	20.5722	17.3679	18.7666	24.3936	32.7410	41.5722	48.5209	51.7252 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4036	297.4585	289.7601	273.3709	252.6826	233.2385	220.2486	217.1936	224.8921	241.2812	261.9696	281.4137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195 (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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256 (71)
Water heating gains (Table 5)	68.5480	66.5186	62.3090	56.5881	52.8733	47.6444	43.2026	48.8966	50.9217	56.8425	63.5285	66.5310 (72)
Total internal gains	511.9103	507.3089	487.0534	456.1122	424.7603	396.8831	380.8501	389.1160	407.1870	438.3282	472.6512	498.3021 (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
North													3.2400	10.6334	0.6300	0.7000	0.7700	10.5290 (74)
South													4.0500	46.7521	0.6300	0.7000	0.7700	57.8666 (78)

Solar gains	68.3956	114.8920	154.9122	191.3609	216.1622	216.0290	207.6336	188.4963	167.2163	126.1709	81.5805	58.7796 (83)						
Total gains	580.3059	622.2010	641.9656	647.4731	640.9225	612.9121	588.4837	577.6123	574.4033	564.4991	554.2317	557.0817 (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	34.7814	34.8504	34.9182	35.2404	35.3014	35.5879	35.5879	35.6415	35.4770	35.3014	35.1783	35.0506
alpha	3.3188	3.3234	3.3279	3.3494	3.3534	3.3725	3.3725	3.3761	3.3651	3.3534	3.3452	3.3367
util living area	0.9532	0.9386	0.9145	0.8684	0.7855	0.6466	0.5004	0.5267	0.7085	0.8641	0.9330	0.9583 (86)
MIT	19.5211	19.6918	19.9622	20.3115	20.6330	20.8671	20.9581	20.9491	20.8078	20.4210	19.9173	19.4791 (87)
Th 2	20.0498	20.0515	20.0531	20.0610	20.0624	20.0693	20.0693	20.0706	20.0667	20.0624	20.0595	20.0564 (88)
util rest of house	0.9456	0.9287	0.9002	0.8447	0.7442	0.5769	0.4062	0.4341	0.6454	0.8356	0.9206	0.9515 (89)
MIT 2	18.7154	18.8834	19.1482	19.4894	19.7869	19.9893	20.0517	20.0479	19.9427	19.5981	19.1129	18.6795 (90)
Living area fraction									fLA = Living area / (4) =			0.3915 (91)
MIT	19.0309	19.1999	19.4669	19.8113	20.1182	20.3330	20.4066	20.4008	20.2814	19.9203	19.4279	18.9926 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0309	19.1999	19.4669	19.8113	20.1182	20.3330	20.4066	20.4008	20.2814	19.9203	19.4279	18.9926 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9357	0.9181	0.8898	0.8376	0.7469	0.5978	0.4415	0.4683	0.6610	0.8307	0.9107	0.9421 (94)
Ext temp.	542.9971	571.2503	571.2320	542.3459	478.6882	366.3840	259.8318	270.4705	379.6617	468.9360	504.7511	524.8431 (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	1072.5742	1039.1333	940.4384	784.1169	603.9083	407.9678	270.8828	284.2720	441.2544	668.6293	887.4810	1068.7991 (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	394.0054	314.4174	274.6896	174.0752	93.1637	0.0000	0.0000	0.0000	0.0000	148.5718	275.5655	404.7033 (98)
Space heating per m2												2079.1918 (98)
										(98) / (4) =		29.7112 (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													2297.4495 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	394.0054	314.4174	274.6896	174.0752	93.1637	0.0000	0.0000	0.0000	0.0000	148.5718	275.5655	404.7033	(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)	435.3650	347.4225	303.5244	192.3482	102.9434	0.0000	0.0000	0.0000	0.0000	164.1677	304.4923	447.1859	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619	(64)
Efficiency of water heater (217)m	89.5651	89.5014	89.3789	89.1288	88.6588	87.3000	87.3000	87.3000	87.3000	88.9739	89.3912	87.3000	(216)
Fuel for water heating, kWh/month	175.1552	153.7290	159.8858	141.2532	137.3524	122.0122	114.6892	129.2925	130.1498	146.8584	157.6653	170.0435	(219)
Water heating fuel used												1738.0866	(219)
Annual totals kWh/year													
Space heating fuel - main system												2297.4495	(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)												355.5124	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4466.0485	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2297.4495	3.4800	79.9512 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1738.0866	3.4800	60.4854 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	355.5124	13.1900	46.8921 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			317.2212 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1587 (257)
SAP value		83.8355
SAP rating (Section 12)		84 (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	2297.4495	0.2160	496.2491 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1738.0866	0.2160	375.4267 (264)
Space and water heating			871.6758 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.5124	0.5190	184.5109 (268)
Energy saving/generation technologies			
PV Unit	-397.0200	0.5190	-206.0534 (269)
Total kg/year			889.0583 (272)
CO2 emissions per m2			12.7000 (273)
EI value			89.6387
EI rating			90 (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	$3.48 / 0.8862 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8862 = 0.2437$, stars = 4

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	69.9800 (1b)	x 2.4000 (2b)	= 167.9520 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	69.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 167.9520 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3376 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2869 (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												
Effective ac	0.3156	0.2941	0.2941	0.2798	0.2798	0.2654	0.2654	0.2511	0.2511	0.2726	0.2654	0.2798 (22b)
	0.5498	0.5433	0.5433	0.5391	0.5391	0.5352	0.5352	0.5315	0.5315	0.5372	0.5352	0.5391 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			7.2900	1.1450	8.3473		(27)
Heat Loss Floor			69.9800	0.1600	11.1968	75.0000	5248.5000 (28a)
External Wall	61.9700	7.2900	54.6800	0.2000	10.9360	9.0000	492.1200 (29a)
Total net area of external elements Aum(A, m ²)			131.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.4801		(33)
Party Wall			23.8000	0.0000	0.0000	20.0000	476.0000 (32)
Party Ceilings			69.9800			30.0000	2099.4000 (32b)
Internal Walls			88.9900			9.0000	800.9100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9116.9300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.2791 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9098 (36)
Total fabric heat loss							(33) + (36) = 41.3899 (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	30.4730	30.1093	30.1093	29.8812	29.8812	29.6644	29.6644	29.4590	29.4590	29.7713	29.6644	29.8812 (38)
Heat transfer coeff	71.8629	71.4993	71.4993	71.2711	71.2711	71.0543	71.0543	70.8490	70.8490	71.1613	71.0543	71.2711 (39)
Average = Sum(39)m / 12 =												71.2247 (39)
HLP	1.0269	1.0217	1.0217	1.0184	1.0184	1.0154	1.0154	1.0124	1.0124	1.0169	1.0154	1.0184 (40)
HLP (average)												1.0178 (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												2.2456 (42)
Average daily hot water use (litres/day)												87.5339 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.2873	92.7860	89.2846	85.7833	82.2819	78.7805	78.7805	82.2819	85.7833	89.2846	92.7860	96.2873 (44)
Energy content (annual)	142.7913	124.8862	128.8714	112.3532	107.8056	93.0280	86.2041	98.9205	100.1019	116.6591	127.3426	138.2858 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4187	18.7329	19.3307	16.8530	16.1708	13.9542	12.9306	14.8381	15.0153	17.4989	19.1014	20.7429 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0865	12.7034	14.0327	13.5441	13.9695	13.4887	13.9195	13.9519	13.5189	14.0065	13.5964	14.0761 (61)
Total heat required for water heating calculated for each month	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (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	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619 (64)
Heat gains from water heating, kWh/month	50.9997	44.7005	46.3579	40.7435	39.3377	34.3040	32.1428	36.3790	36.6636	42.2908	45.7405	49.4990 (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	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384	134.7384 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.3265	44.6995	36.3521	27.5209	20.5722	17.3679	18.7666	24.3936	32.7410	41.5722	48.5209	51.7252 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4036	297.4585	289.7601	273.3709	252.6826	233.2385	220.2486	217.1936	224.8921	241.2812	261.9696	281.4137 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195	50.7195 (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)	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256	-89.8256 (71)
Water heating gains (Table 5)	68.5480	66.5186	62.3090	56.5881	52.8733	47.6444	43.2026	48.8966	50.9217	56.8425	63.5285	66.5310 (72)
Total internal gains	511.9103	507.3089	487.0534	456.1122	424.7603	396.8831	380.8501	389.1160	407.1870	438.3282	472.6512	498.3021 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
North					3.2400	13.4839	0.6300	0.7000	0.7700			13.3516 (74)
South					4.0500	56.7559	0.6300	0.7000	0.7700			70.2486 (78)

Solar gains	83.6001	119.5432	163.1367	204.6836	220.6082	242.6593	224.6439	211.2833	185.2145	139.9708	99.3795	68.0271 (83)
Total gains	595.5105	626.8521	650.1902	660.7958	645.3685	639.5423	605.4941	600.3993	592.4016	578.2990	572.0307	566.3292 (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	35.2404	35.4197	35.4197	35.5331	35.5331	35.6415	35.6415	35.7448	35.7448	35.5879	35.6415	35.5331
alpha	3.3494	3.3613	3.3613	3.3689	3.3689	3.3761	3.3761	3.3830	3.3830	3.3725	3.3761	3.3689
util living area	0.9398	0.9256	0.8930	0.8321	0.7160	0.5273	0.3775	0.3795	0.6087	0.8090	0.9074	0.9458 (86)
MIT	19.7422	19.8793	20.1529	20.4741	20.7732	20.9434	20.9867	20.9866	20.9027	20.6121	20.1541	19.7217 (87)
Th 2	20.0610	20.0653	20.0653	20.0680	20.0680	20.0706	20.0706	20.0730	20.0730	20.0693	20.0706	20.0680 (88)
util rest of house	0.9298	0.9133	0.8746	0.8018	0.6619	0.4442	0.2755	0.2773	0.5306	0.7686	0.8897	0.9365 (89)
MIT 2	18.9410	19.0773	19.3414	19.6463	19.9120	20.0430	20.0669	20.0693	20.0194	19.7777	19.3504	18.9271 (90)
Living area fraction	19.2547	19.3913	19.6591	19.9704	20.2491	20.3955	20.4270	20.4285	20.3653	20.1044	19.6651	0.3915 (91)
MIT	19.2547	19.3913	19.6591	19.9704	20.2491	20.3955	20.4270	20.4285	20.3653	20.1044	19.6651	19.2382 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2547	19.3913	19.6591	19.9704	20.2491	20.3955	20.4270	20.4285	20.3653	20.1044	19.6651	19.2382 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	547.5937	566.0189	562.7373	527.5011	434.4009	303.3110	190.9347	190.4540	329.6653	445.4302	503.8528	524.7772 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	995.6418	964.6186	862.2173	710.6011	509.5276	319.4269	193.7672	193.3081	358.8683	576.7173	800.4343	979.1386 (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	333.3477	267.8590	222.8132	131.8320	55.8943	0.0000	0.0000	0.0000	0.0000	97.6777	213.5387	338.0449 (98)
Space heating												1661.0075 (98)
Space heating per m2										(98) / (4) =		23.7355 (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													1835.3674 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	333.3477	267.8590	222.8132	131.8320	55.8943	0.0000	0.0000	0.0000	0.0000	97.6777	213.5387	338.0449	(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)	368.3400	295.9768	246.2024	145.6707	61.7617	0.0000	0.0000	0.0000	0.0000	107.9311	235.9544	373.5303	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	156.8779	137.5896	142.9041	125.8973	121.7750	106.5167	100.1237	112.8724	113.6208	130.6657	140.9389	152.3619	(64)
Efficiency of water heater (217)m	89.4507	89.3881	89.2221	88.9080	88.2820	87.3000	87.3000	87.3000	87.3000	88.6407	89.2000	87.3000	(216)
Fuel for water heating, kWh/month	175.3791	153.9238	160.1667	141.6039	137.9386	122.0122	114.6892	129.2925	130.1498	147.4104	158.0033	170.2730	(219)
Water heating fuel used												1740.8426	(219)
Annual totals kWh/year													
Space heating fuel - main system												1835.3674	(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)												355.5124	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4006.7224	(238)

10a. Fuel costs - using BEDF prices (455)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1835.3674	3.9700	72.8641 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1740.8426	3.9700	69.1115 (247)
Pumps and fans for heating	75.0000	18.2700	13.7025 (249)
Energy for lighting	355.5124	18.2700	64.9521 (250)
Additional standing charges			90.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.2700	0.0000 (252)
Total energy cost			310.6301 (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	1835.3674	0.2160	396.4394 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1740.8426	0.2160	376.0220 (264)
Space and water heating			772.4614 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	355.5124	0.5190	184.5109 (268)
Energy saving/generation technologies			
PV Unit	-397.0200	0.5190	-206.0534 (269)
Total kg/year			789.8439 (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	1835.3674	1.2200	2239.1482 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1740.8426	1.2200	2123.8280 (264)
Space and water heating			4362.9762 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	355.5124	3.0700	1091.4230 (268)
Energy saving/generation technologies			
PV Unit	-397.0200	3.0700	-1218.8514 (269)
Primary energy kWh/year			4465.7978 (272)
Primary energy kWh/m2/year			63.8153 (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 84
Current environmental impact rating: B 90

(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 84
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 455 TEST (23 Jan 2020)
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	£79	£79	£0
Mains gas	£232	£232	£0
Space heating	£177	£177	£0
Water heating	£69	£69	£0
Lighting	£65	£65	£0
Total cost of fuels	£311	£311	£0
Total cost of uses	£311	£311	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	64 kWh/m²	64 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	130.3 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	332.54 (P1)
Transmission heat loss coefficient	41.39 (37)
Summer heat loss coefficient	373.93 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.2400	87.1704	0.6300	0.7000	0.9000	100.8876
South	4.0500	118.5567	0.6300	0.7000	0.9000	171.5160
total:						272.4036

	Jun	Jul	Aug	
Solar gains	291	272	251	(P3)
Internal gains	394	378	386	
Total summer gains	685	650	637	(P5)

	1.83	1.74	1.70	
Summer gain/loss ratio	1.83	1.74	1.70	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 130.3)	1.09	1.09	1.09	
Threshold temperature	18.32	20.13	20.09	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant