



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 91 Highwood Avenue
EASTLEIGH, SO50 9QY

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

Report Issue Date: 31/01/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BLOCK COMPLIANCE

Calculation Type: New Build (As Built)

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

Block Compliance Report - DER

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

Block Compliance Report - DFEE

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

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 208				Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B3P Top Floor			
Property	91 Highwood Avenue, EASTLEIGH, SO50 9QY					
SAP Rating	84 B	DER	12.82	TER	17.28	
Environmental	91 B	% DER<TER	25.80			
CO ₂ Emissions (t/year)	0.60	DFEE	33.15	TFEE	38.10	
General Requirements Compliance	Pass	% DFEE<TFEE	13.00			
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)	17.28	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.82	kgCO ₂ /m ²	Pass
	-4.46 (-25.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	38.10	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	33.15	kWh/m ² /yr	
	-4.9 (-12.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.10 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.18 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

3.24 m², No overhang

Windows facing West

5.55 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

3.18 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Roof U-value

0.00

W/m²K

Air permeability

3.2

m³/m²h

Photovoltaic array

364.07

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

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General Requirements Compliance	Pass	% DFEE<TFEE	13.00			
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	2023
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	22.87 m	57.27 m ²	2.17 m

7.0 Living Area	21.94	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	64.33	kJ/m ² K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	41.62	32.83

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board	0.00	20.00	18.41

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Walls	Plasterboard on timber frame	9.00	88.92

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	39.30	39.30
Sloping Roof	External Slope Roof	Plasterboard, insulated slope	0.16	9.00	11.53	11.53
Dormer Roofs	External Flat Roof	Plasterboard, insulated flat roof	0.00	9.00	4.96	4.96

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor	Timber I-joists, carpeted	30.00	57.27

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
East	Window	[1] External Wall	East	None	0.00					3.24	
West	Window	[1] External Wall	West	None	0.00					5.55	

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)	6.46	0.300	Yes
Table K1 - Approved	E3 Sill	6.46	0.040	Yes
Table K1 - Approved	E4 Jamb	13.60	0.050	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	15.46	0.070	No
Table K1 - Approved	E16 Corner (normal)	3.60	0.090	No
Table K1 - Approved	E18 Party wall between dwellings	3.60	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.82	0.000	No
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	5.07	0.240	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	2.40	0.080	No

Y-value	0.064	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	6.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	3.18	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Description

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heat Emitter

Flow Temperature

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)



32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	364.07	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 208	Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B3P Top Floor
Project	91 Highwood Avenue, EASTLEIGH, SO50 9QY		
Calculation Type	New Build (As Built)		

SAP Rating	84 B	DER	12.82	TER	17.28
Environmental	91 B	% DER<TER	25.80		
CO ₂ Emissions (t/year)	0.60	DFEE	33.15	TFEE	38.10
General Requirements Compliance	Pass	% DFEE<TFEE	13.00		

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

Roof Pitched Roof

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool				
	Main construction	200	0.0400	5.0000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	200	0.0400	5.0000	91.67
	Main construction	200	0.1300	1.5385	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 9.788 m ² K/W	Lower limit = 9.418 m ² K/W	Average = 9.603 m ² K/W
	Total correction = 0.0019 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP-0796 (3B4A) - Plot 208		Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B3P Top Floor	
Project	91 Highwood Avenue, EASTLEIGH, SO50 9QY			
Calculation Type	New Build (As Built)			

SAP Rating	84 B	DER	12.82	TER	17.28
Environmental	91 B	% DER<TER	25.80		
CO ₂ Emissions (t/year)	0.60	DFEE	33.15	TFEE	38.10
General Requirements Compliance	Pass	% DFEE<TFEE	13.00		

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

Wall External Walls - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

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

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

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 208				Issued on Date	31/01/2023
Assessment Reference	AB	Prop Type Ref	2B3P Top Floor			
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Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Top-floor flat, total floor area 57 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) 17.28 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.82 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)38.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.2 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	(no floor)		
Roof	0.10 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.18 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 3.24 m², No overhang
Windows facing West: 5.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Roof U-value 0.00 W/m²K
Air permeability 3.2 m³/m²h
Photovoltaic array 364.07 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	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1609 (8)
Pressure test					Yes
Measured/design AP50					3.1800
Infiltration rate					0.3199 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2959 (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												
	0.3773	0.3699	0.3625	0.3255	0.3181	0.2811	0.2811	0.2737	0.2959	0.3181	0.3329	0.3477 (22b)
Effective ac	0.5712	0.5684	0.5657	0.5530	0.5506	0.5395	0.5395	0.5375	0.5438	0.5506	0.5554	0.5605 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.2000	6.5660	9.0000	295.4700 (29a)
Pitched Roof	39.3000		39.3000	0.1000	3.9300	9.0000	353.7000 (30)
Sloping Roof	11.5300		11.5300	0.1600	1.8448	9.0000	103.7700 (30)
Dormer Roofs	4.9600		4.9600	0.0000	0.0000	9.0000	44.6400 (30)
Total net area of external elements Aum(A, m ²)			92.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.9942		(33)
Party Wall			18.4100	0.0000	0.0000	20.0000	368.2000 (32)
Party Floor			57.2700			30.0000	1718.1000 (32d)
Internal Walls			88.9200			9.0000	800.2800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3684.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.3297 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9074 (36)
Total fabric heat loss						(33) + (36) =	29.9016 (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	23.4249	23.3115	23.2004	22.6785	22.5809	22.1263	22.1263	22.0421	22.3014	22.5809	22.7784	22.9849 (38)
Heat transfer coeff	53.3265	53.2132	53.1020	52.5801	52.4825	52.0279	52.0279	51.9437	52.2030	52.4825	52.6800	52.8865 (39)
Average = Sum(39)m / 12 =												52.5796 (39)
HLP	0.9311	0.9292	0.9272	0.9181	0.9164	0.9085	0.9085	0.9070	0.9115	0.9164	0.9199	0.9235 (40)
HLP (average)												0.9181 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.4303	16.9939	17.5362	15.2885	14.6697	12.6588	11.7302	13.4606	13.6214	15.8744	17.3281	18.8172 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0281	12.6541	13.9838	13.5032	13.9318	13.4576	13.8907	13.9173	13.4824	13.9623	13.5462	14.0195 (61)
Total heat required for water heating calculated for each month	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (64)
Heat gains from water heating, kWh/month	46.5776	40.8334	42.3678	37.2652	36.0007	31.4247	29.4747	33.3170	33.5647	38.6788	41.7973	45.2165 (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	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5708	13.8299	11.2472	8.5148	6.3649	5.3736	5.8063	7.5473	10.1299	12.8623	15.0122	16.0036 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.0132	167.7359	163.3948	154.1530	142.4869	131.5224	124.1975	122.4748	126.8159	136.0577	147.7238	158.6883 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175 (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)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396 (71)
Water heating gains (Table 5)	62.6043	60.7639	56.9460	51.7573	48.3880	43.6454	39.6165	44.7809	46.6176	51.9877	58.0518	60.7748 (72)
Total internal gains	298.7407	296.8820	286.1403	268.9775	251.7922	235.0938	224.1727	229.3554	238.1158	255.4600	275.3401	290.0190 (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			
East				3.2400	19.6403	0.6300	0.7000	0.7700	19.4475 (76)			
West				5.5500	19.6403	0.6300	0.7000	0.7700	33.3129 (80)			
Solar gains	52.7604	103.2105	169.9730	247.8955	303.8053	310.9988	296.0835	254.3313	197.6857	122.4680	65.7860	43.3876 (83)
Total gains	351.5011	400.0926	456.1134	516.8730	555.5975	546.0925	520.2562	483.6867	435.8015	377.9280	341.1261	333.4066 (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	19.1908	19.2317	19.2719	19.4632	19.4994	19.6698	19.6698	19.7017	19.6038	19.4994	19.4263	19.3504
alpha	2.2794	2.2821	2.2848	2.2975	2.3000	2.3113	2.3113	2.3134	2.3069	2.3000	2.2951	2.2900
util living area	0.9237	0.8978	0.8499	0.7653	0.6507	0.5156	0.4005	0.4399	0.6289	0.8120	0.8994	0.9311 (86)
MIT	18.5122	18.8107	19.3160	19.9353	20.4396	20.7715	20.9085	20.8835	20.6177	19.9420	19.1192	18.4491 (87)
Th 2	20.1411	20.1428	20.1444	20.1521	20.1536	20.1603	20.1603	20.1616	20.1577	20.1536	20.1507	20.1476 (88)
util rest of house	0.9161	0.8880	0.8353	0.7423	0.6156	0.4644	0.3343	0.3728	0.5803	0.7881	0.8880	0.9242 (89)
MIT 2	17.8431	18.1368	18.6312	19.2320	19.7034	20.0017	20.1099	20.0946	19.8766	19.2522	18.4506	17.7856 (90)
Living area fraction									fLA = Living area / (4) =			0.3831 (91)
MIT	18.0994	18.3950	18.8935	19.5014	19.9854	20.2966	20.4159	20.3968	20.1605	19.5165	18.7067	18.0398 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0994	18.3950	18.8935	19.5014	19.9854	20.2966	20.4159	20.3968	20.1605	19.5165	18.7067	18.0398 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	314.1080	345.4464	369.5866	373.4915	337.8463	258.3518	184.7169	189.7812	252.9754	290.0160	294.8456	300.9809 (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	735.8750	718.1112	658.1207	557.4230	434.8397	296.3821	198.5310	207.6103	316.3765	467.9599	611.4418	731.9368 (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	313.7947	250.4307	214.6693	132.4307	72.1630	0.0000	0.0000	0.0000	0.0000	132.3903	227.9493	320.6312 (98)
Space heating												1664.4592 (98)
Space heating per m2										(98) / (4) =		29.0634 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1839.1815 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	313.7947	250.4307	214.6693	132.4307	72.1630	0.0000	0.0000	0.0000	0.0000	132.3903	227.9493	320.6312	(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)	346.7345	276.7190	237.2037	146.3323	79.7382	0.0000	0.0000	0.0000	0.0000	146.2876	251.8777	354.2886	(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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679	(64)
Efficiency of water heater (217)m	89.4706	89.4034	89.2607	88.9811	88.5284	87.3000	87.3000	87.3000	87.3000	88.9512	89.3164	87.3000	(216)
Fuel for water heating, kWh/month	160.4592	140.8748	146.6398	129.7200	126.2075	112.0842	105.4894	118.7340	119.4634	134.6712	144.5055	155.8205	(219)
Water heating fuel used												1594.6695	(219)
Annual totals kWh/year													
Space heating fuel - main system												1839.1815	(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)												274.9853	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3783.8362	(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	1839.1815	0.2160	397.2632	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1594.6695	0.2160	344.4486	(264)
Space and water heating			741.7118	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.9853	0.5190	142.7174	(268)
Energy saving/generation technologies				
PV Unit	-364.0700	0.5190	-188.9523	(269)
Total CO2, kg/year			734.4018	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8200	(273)

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

DER			12.8200	ZC1
Total Floor Area		TFA	57.2700	
Assumed number of occupants		N	1.9035	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.1776	ZC2
CO2 emissions from cooking, equation (L16)			2.8756	ZC3
Total CO2 emissions			32.8731	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			32.8731	ZC8

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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	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1609 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4109 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3801 (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	0.4846	0.4751	0.4656	0.4181	0.4086	0.3611	0.3611	0.3516	0.3801	0.4086	0.4276	0.4466 (22b)
Effective ac	0.6174	0.6129	0.6084	0.5874	0.5835	0.5652	0.5652	0.5618	0.5722	0.5835	0.5914	0.5997 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.1800	5.9094		(29a)
Pitched Roof	39.3000		39.3000	0.1300	5.1090		(30)
Sloping Roof	11.5300		11.5300	0.1300	1.4989		(30)
Dormer Roofs	4.9600		4.9600	0.1300	0.6448		(30)
Total net area of external elements Aum(A, m ²)			97.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.8155		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7486 (36)
Total fabric heat loss						(33) + (36) =	28.5641 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	25.3218	25.1348	24.9515	24.0904	23.9293	23.1794	23.1794	23.0405	23.4683	23.9293	24.2553	24.5960 (38)
Heat transfer coeff	53.8860	53.6989	53.5156	52.6546	52.4935	51.7435	51.7435	51.6046	52.0324	52.4935	52.8194	53.1601 (39)
Average = Sum(39)m / 12 =												52.6538 (39)
HLP	0.9409	0.9376	0.9344	0.9194	0.9166	0.9035	0.9035	0.9011	0.9085	0.9166	0.9223	0.9282 (40)
HLP (average)												0.9194 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (45)
Distribution loss (46)m = 0.15 x (45)m	19.4303	16.9939	17.5362	15.2885	14.6697	12.6588	11.7302	13.4606	13.6214	15.8744	17.3281	18.8172 (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)

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Combi loss	44.5119	38.7424	41.2747	38.3769	38.0375	35.2441	36.4189	38.0375	38.3769	41.2747	41.5097	44.5119 (61)
Total heat required for water heating calculated for each month	174.0476	152.0350	158.1826	140.3000	135.8352	119.6360	114.6204	127.7749	129.1860	147.1040	157.0307	169.9603 (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	174.0476	152.0350	158.1826	140.3000	135.8352	119.6360	114.6204	127.7749	129.1860	147.1040	157.0307	169.9603 (64)
Heat gains from water heating, kWh/month	54.1986	47.3554	49.1906	43.4837	42.0271	36.8713	35.1067	39.3471	39.7883	45.5069	48.7881	52.8396 (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	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5708	13.8299	11.2472	8.5148	6.3649	5.3736	5.8063	7.5473	10.1299	12.8623	15.0122	16.0036 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.0132	167.7359	163.3948	154.1530	142.4869	131.5224	124.1975	122.4748	126.8159	136.0577	147.7238	158.6883 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175 (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)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396 (71)
Water heating gains (Table 5)	72.8475	70.4694	66.1163	60.3940	56.4880	51.2102	47.1865	52.8858	55.2615	61.1652	67.7613	71.0209 (72)
Total internal gains	308.9839	306.5875	295.3107	277.6142	259.8922	242.6585	231.7426	237.4603	246.7597	264.6376	285.0497	300.2651 (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
East				3.2400	19.6403	0.6300	0.7000			0.7700			19.4475 (76)
West				5.5500	19.6403	0.6300	0.7000			0.7700			33.3129 (80)
Solar gains	52.7604	103.2105	169.9730	247.8955	303.8053	310.9988	296.0835	254.3313	197.6857	122.4680	65.7860	43.3876 (83)	
Total gains	361.7443	409.7980	465.2837	525.5097	563.6975	553.6573	527.8261	491.7916	444.4454	387.1056	350.8357	343.6527 (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	73.8056	74.0626	74.3163	75.5316	75.7634	76.8615	76.8615	77.0683	76.4348	75.7634	75.2959	74.8133
alpha	5.9204	5.9375	5.9544	6.0354	6.0509	6.1241	6.1241	6.1379	6.0957	6.0509	6.0197	5.9876
util living area	0.9973	0.9937	0.9804	0.9262	0.7898	0.5875	0.4299	0.4798	0.7536	0.9601	0.9938	0.9980 (86)
MIT	20.0809	20.2199	20.4541	20.7425	20.9264	20.9899	20.9987	20.9976	20.9587	20.7015	20.3404	20.0599 (87)
Th 2	20.1329	20.1356	20.1383	20.1510	20.1534	20.1645	20.1645	20.1666	20.1602	20.1534	20.1486	20.1436 (88)
util rest of house	0.9964	0.9917	0.9740	0.9038	0.7389	0.5155	0.3491	0.3944	0.6816	0.9432	0.9915	0.9973 (89)
MIT 2	18.9026	19.1069	19.4467	19.8566	20.0851	20.1581	20.1640	20.1656	20.1291	19.8114	19.2932	18.8800 (90)
Living area fraction	19.3540	19.5333	19.8326	20.1960	20.4074	20.4768	20.4838	20.4843	20.4469	20.1524	19.6944	0.3831 (91)
MIT	19.3540	19.5333	19.8326	20.1960	20.4074	20.4768	20.4838	20.4843	20.4469	20.1524	19.6944	19.3320 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3540	19.5333	19.8326	20.1960	20.4074	20.4768	20.4838	20.4843	20.4469	20.1524	19.6944	19.3320 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9953	0.9899	0.9713	0.9051	0.7550	0.5428	0.3801	0.4272	0.7075	0.9432	0.9898	0.9965 (94)
Useful gains	360.0571	405.6441	451.9070	475.6638	425.5873	300.5431	200.6249	210.1043	314.4422	365.1211	347.2727	342.4402 (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	811.1977	785.7908	713.5029	594.7844	457.0806	304.0855	200.9615	210.7700	330.2454	501.4378	665.2284	804.4189 (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	335.6486	255.4586	194.6274	85.7668	23.4310	0.0000	0.0000	0.0000	0.0000	101.4196	228.9281	343.7122 (98)
Space heating												1568.9923 (98)
Space heating per m2										(98) / (4) =		27.3964 (99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1679.8632 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	335.6486	255.4586	194.6274	85.7668	23.4310	0.0000	0.0000	0.0000	0.0000	101.4196	228.9281	343.7122	(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)	359.3668	273.5103	208.3805	91.8274	25.0868	0.0000	0.0000	0.0000	0.0000	108.5863	245.1050	368.0002	(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	174.0476	152.0350	158.1826	140.3000	135.8352	119.6360	114.6204	127.7749	129.1860	147.1040	157.0307	169.9603	(64)
Efficiency of water heater	86.6772	86.3479	85.5742	83.8544	81.6419	80.3000	80.3000	80.3000	80.3000	84.1361	85.9991	80.3000	(216)
(217)m												86.7882	(217)
Fuel for water heating, kWh/month	200.7997	176.0727	184.8484	167.3139	166.3791	148.9863	142.7402	159.1219	160.8793	174.8406	182.5957	195.8335	(219)
Water heating fuel used												2060.4113	(219)
Annual totals kWh/year													
Space heating fuel - main system												1679.8632	(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)												274.9853	(232)
Total delivered energy for all uses												4090.2598	(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	1679.8632	0.2160	362.8505 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2060.4113	0.2160	445.0488 (264)
Space and water heating			807.8993 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	274.9853	0.5190	142.7174 (268)
Total CO2, kg/m2/year			989.5417 (272)
Emissions per m2 for space and water heating			14.1068 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4920 (272b)
Emissions per m2 for pumps and fans			0.6797 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1068 * 1.00) + 2.4920 + 0.6797, rounded to 2 d.p.			17.2800 (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	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (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) =				20.0000 / (5) = 0.1609 (8)
Pressure test					Yes
Measured/design AP50					3.1800
Infiltration rate					0.3199 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2959 (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	0.3773	0.3699	0.3625	0.3255	0.3181	0.2811	0.2811	0.2737	0.2959	0.3181	0.3329	0.3477 (22b)
	0.5712	0.5684	0.5657	0.5530	0.5506	0.5395	0.5395	0.5375	0.5438	0.5506	0.5554	0.5605 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.2000	6.5660	9.0000	295.4700 (29a)
Pitched Roof	39.3000		39.3000	0.1000	3.9300	9.0000	353.7000 (30)
Sloping Roof	11.5300		11.5300	0.1600	1.8448	9.0000	103.7700 (30)
Dormer Roofs	4.9600		4.9600	0.0000	0.0000	9.0000	44.6400 (30)
Total net area of external elements Aum(A, m ²)			92.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.9942		(33)
Party Wall			18.4100	0.0000	0.0000	20.0000	368.2000 (32)
Party Floor			57.2700			30.0000	1718.1000 (32d)
Internal Walls			88.9200			9.0000	800.2800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3684.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.3297 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9074 (36)
Total fabric heat loss							(33) + (36) = 29.9016 (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	23.4249	23.3115	23.2004	22.6785	22.5809	22.1263	22.1263	22.0421	22.3014	22.5809	22.7784	22.9849 (38)
Heat transfer coeff	53.3265	53.2132	53.1020	52.5801	52.4825	52.0279	52.0279	51.9437	52.2030	52.4825	52.6800	52.8865 (39)
Average = Sum(39)m / 12 =												52.5796 (39)
HLP	0.9311	0.9292	0.9272	0.9181	0.9164	0.9085	0.9085	0.9070	0.9115	0.9164	0.9199	0.9235 (40)
HLP (average)												0.9181 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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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	27.5263	24.0747	24.8429	21.6587	20.7820	17.9333	16.6178	19.0692	19.2969	22.4887	24.5482	26.6578 (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	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.5708	13.8299	11.2472	8.5148	6.3649	5.3736	5.8063	7.5473	10.1299	12.8623	15.0122	16.0036	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	166.0132	167.7359	163.3948	154.1530	142.4869	131.5224	124.1975	122.4748	126.8159	136.0577	147.7238	158.6883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	(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)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	(71)
Water heating gains (Table 5)	36.9977	35.8254	33.3910	30.0815	27.9328	24.9073	22.3358	25.6306	26.8013	30.2268	34.0947	35.8303	(72)
Total internal gains	270.1341	268.9436	259.5853	244.3017	228.3370	213.3557	203.8920	207.2051	215.2995	230.6991	248.3831	262.0745	(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

East					3.2400	19.6403	0.6300	0.7000	0.7700				19.4475 (76)
West					5.5500	19.6403	0.6300	0.7000	0.7700				33.3129 (80)

Solar gains	52.7604	103.2105	169.9730	247.8955	303.8053	310.9988	296.0835	254.3313	197.6857	122.4680	65.7860	43.3876 (83)	
Total gains	322.8945	372.1541	429.5584	492.1972	532.1423	524.3544	499.9755	461.5364	412.9852	353.1671	314.1691	305.4621 (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	19.1908	19.2317	19.2719	19.4632	19.4994	19.6698	19.6698	19.7017	19.6038	19.4994	19.4263	19.3504	
alpha	2.2794	2.2821	2.2848	2.2975	2.3000	2.3113	2.3113	2.3134	2.3069	2.3000	2.2951	2.2900	
util living area	0.9345	0.9098	0.8634	0.7802	0.6663	0.5307	0.4137	0.4563	0.6487	0.8299	0.9128	0.9413	(86)
MIT	18.4115	18.7199	19.2421	19.8841	20.4088	20.7568	20.9019	20.8740	20.5902	19.8809	19.0306	18.3481	(87)
Th 2	20.1411	20.1428	20.1444	20.1521	20.1536	20.1603	20.1603	20.1616	20.1577	20.1536	20.1507	20.1476	(88)
util rest of house	0.9279	0.9009	0.8497	0.7579	0.6315	0.4790	0.3461	0.3879	0.6004	0.8074	0.9026	0.9354	(89)
MIT 2	17.7446	18.0488	18.5607	19.1850	19.6771	19.9908	20.1061	20.0887	19.8547	19.1959	18.3650	17.6867	(90)
Living area fraction									fLA = Living area / (4) =			0.3831	(91)
MIT	18.0001	18.3059	18.8217	19.4528	19.9574	20.2843	20.4109	20.3896	20.1365	19.4583	18.6200	17.9401	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0001	18.3059	18.8217	19.4528	19.9574	20.2843	20.4109	20.3896	20.1365	19.4583	18.6200	17.9401	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9068	0.8771	0.8247	0.7373	0.6228	0.4870	0.3670	0.4073	0.5991	0.7858	0.8798	0.9155	(94)
Ext temp.	292.8092	326.4299	354.2427	362.8994	331.4417	255.3602	183.4748	187.9648	247.4340	277.5264	276.4178	279.6369	(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	730.5780	713.3695	654.3098	554.8679	433.3698	295.7407	198.2756	207.2323	315.1241	464.9074	606.8753	726.6644	(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	325.7000	260.0234	223.2499	138.2173	75.8345	0.0000	0.0000	0.0000	0.0000	139.4115	237.9294	332.5885	(98)
Space heating per m2										(98) / (4) =		1732.9545	(98)
												30.2594	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	489.0622	385.0064	394.7722	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8045	0.8541	0.8315	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	393.4681	328.8306	328.2651	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	684.5427	654.6868	610.9617	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	209.5737	242.4371	210.3263	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			662.3370 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	52.3934	60.6093	52.5816	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												165.5843 (107)
Energy for space heating												2.8913 (108)
Energy for space cooling												30.2594 (99)
Total												2.8913 (108)
Dwelling Fabric Energy Efficiency (DFEE)												33.1507 (109)
												33.2 (109)

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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	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (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) =				20.0000 / (5) =	0.1609 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4109 (18)	
Number of sides sheltered				1 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3801 (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	0.4846	0.4751	0.4656	0.4181	0.4086	0.3611	0.3611	0.3516	0.3801	0.4086	0.4276	0.4466 (22b)
Effective ac	0.6174	0.6129	0.6084	0.5874	0.5835	0.5652	0.5652	0.5618	0.5722	0.5835	0.5914	0.5997 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.1800	5.9094		(29a)
Pitched Roof	39.3000		39.3000	0.1300	5.1090		(30)
Sloping Roof	11.5300		11.5300	0.1300	1.4989		(30)
Dormer Roofs	4.9600		4.9600	0.1300	0.6448		(30)
Total net area of external elements Aum(A, m ²)			97.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.8155		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7486 (36)
Total fabric heat loss						(33) + (36) =	28.5641 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	25.3218	25.1348	24.9515	24.0904	23.9293	23.1794	23.1794	23.0405	23.4683	23.9293	24.2553	24.5960 (38)
Heat transfer coeff	53.8860	53.6989	53.5156	52.6546	52.4935	51.7435	51.7435	51.6046	52.0324	52.4935	52.8194	53.1601 (39)
Average = Sum(39)m / 12 =												52.6538 (39)
HLP	0.9409	0.9376	0.9344	0.9194	0.9166	0.9035	0.9035	0.9011	0.9085	0.9166	0.9223	0.9282 (40)
HLP (average)												0.9194 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (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)

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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	27.5263	24.0747	24.8429	21.6587	20.7820	17.9333	16.6178	19.0692	19.2969	22.4887	24.5482	26.6578 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746	95.1746 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	15.5708	13.8299	11.2472	8.5148	6.3649	5.3736	5.8063	7.5473	10.1299	12.8623	15.0122	16.0036 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	166.0132	167.7359	163.3948	154.1530	142.4869	131.5224	124.1975	122.4748	126.8159	136.0577	147.7238	158.6883 (68)
Pumps, fans	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175	32.5175 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396 (71)
Total internal gains	36.9977	35.8254	33.3910	30.0815	27.9328	24.9073	22.3358	25.6306	26.8013	30.2268	34.0947	35.8303 (72)
	270.1341	268.9436	259.5853	244.3017	228.3370	213.3557	203.8920	207.2051	215.2995	230.6991	248.3831	262.0745 (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	
East					3.2400	19.6403	0.6300	0.7000	0.7700		19.4475 (76)	
West					5.5500	19.6403	0.6300	0.7000	0.7700		33.3129 (80)	

Solar gains	52.7604	103.2105	169.9730	247.8955	303.8053	310.9988	296.0835	254.3313	197.6857	122.4680	65.7860	43.3876 (83)
Total gains	322.8945	372.1541	429.5584	492.1972	532.1423	524.3544	499.9755	461.5364	412.9852	353.1671	314.1691	305.4621 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	73.8056	74.0626	74.3163	75.5316	75.7634	76.8615	76.8615	77.0683	76.4348	75.7634	75.2959	74.8133
util living area	5.9204	5.9375	5.9544	6.0354	6.0509	6.1241	6.1241	6.1379	6.0957	6.0509	6.0197	5.9876
	0.9985	0.9962	0.9866	0.9428	0.8187	0.6171	0.4534	0.5101	0.7925	0.9735	0.9965	0.9989 (86)
MIT	20.0155	20.1576	20.3989	20.7037	20.9100	20.9869	20.9983	20.9966	20.9456	20.6538	20.2796	19.9952 (87)
Th 2	20.1329	20.1356	20.1383	20.1510	20.1534	20.1645	20.1645	20.1666	20.1602	20.1534	20.1486	20.1436 (88)
util rest of house	0.9980	0.9949	0.9820	0.9241	0.7700	0.5427	0.3684	0.4199	0.7226	0.9613	0.9952	0.9986 (89)
MIT 2	19.2278	19.3716	19.6126	19.9156	20.0952	20.1588	20.1641	20.1656	20.1313	19.8760	19.5044	19.2164 (90)
Living area fraction	19.5295	19.6727	19.9138	20.2175	20.4073	20.4760	20.4837	20.4840	20.4432	20.1740	19.8013	19.5148 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5295	19.6727	19.9138	20.2175	20.4073	20.4760	20.4837	20.4840	20.4432	20.1740	19.8013	19.5148 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9976	0.9940	0.9806	0.9258	0.7855	0.5710	0.4010	0.4546	0.7478	0.9617	0.9944	0.9982 (94)
Ext temp.	322.1106	369.9343	421.2155	455.6693	418.0150	299.4137	200.5009	209.8170	308.8238	339.6235	312.4250	304.9226 (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	820.6585	793.2791	717.8471	595.9176	457.0782	304.0472	200.9540	210.7523	330.0535	502.5700	670.8762	814.1354 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	370.9196	284.4877	220.6939	100.9788	29.0630	0.0000	0.0000	0.0000	0.0000	121.2321	258.0849	378.8543 (98)
												1764.3143 (98)
												30.8070 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	486.3890	382.9020	392.1952	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9609	0.9841	0.9754	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	467.3565	376.8163	382.5435	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	684.5427	654.6868	610.9617	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	156.3740	206.7357	169.9431	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												533.0528 (104)
Intermittency factor (Table 10b)												1.0000 (105)
												fC = cooled area / (4) =

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.0935	51.6839	42.4858	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												133.2632 (107)
Energy for space heating												2.3269 (108)
Energy for space cooling												30.8070 (99)
Total												2.3269 (108)
Target Fabric Energy Efficiency (TFEE)												33.1339 (109)
												38.1 (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	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1609 (8)
Pressure test					Yes
Measured/design AP50					3.1800
Infiltration rate					0.3199 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2959 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.3255	0.3033	0.3033	0.2885	0.2885	0.2737	0.2737	0.2589	0.2589	0.2811	0.2737	0.2885 (22b)
Effective ac	0.5530	0.5460	0.5460	0.5416	0.5416	0.5375	0.5375	0.5335	0.5335	0.5395	0.5375	0.5416 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.2000	6.5660	9.0000	295.4700 (29a)
Pitched Roof	39.3000		39.3000	0.1000	3.9300	9.0000	353.7000 (30)
Sloping Roof	11.5300		11.5300	0.1600	1.8448	9.0000	103.7700 (30)
Dormer Roofs	4.9600		4.9600	0.0000	0.0000	9.0000	44.6400 (30)
Total net area of external elements Aum(A, m ²)			92.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.9942		(33)
Party Wall			18.4100	0.0000	0.0000	20.0000	368.2000 (32)
Party Floor			57.2700			30.0000	1718.1000 (32d)
Internal Walls			88.9200			9.0000	800.2800 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3684.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.3297 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9074 (36)
Total fabric heat loss					(33) + (36) =		29.9016 (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	22.6785	22.3923	22.3923	22.2127	22.2127	22.0421	22.0421	21.8805	21.8805	22.1263	22.0421	22.2127 (38)
Heat transfer coeff	52.5801	52.2939	52.2939	52.1143	52.1143	51.9437	51.9437	51.7821	51.7821	52.0279	51.9437	52.1143 (39)
Average = Sum(39)m / 12 =												52.0778 (39)
HLP	0.9181	0.9131	0.9131	0.9100	0.9100	0.9070	0.9070	0.9042	0.9042	0.9085	0.9070	0.9100 (40)
HLP (average)												0.9093 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (45)
Distribution loss (46)m = 0.15 x (45)m	19.4303	16.9939	17.5362	15.2885	14.6697	12.6588	11.7302	13.4606	13.6214	15.8744	17.3281	18.8172 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0281	12.6541	13.9838	13.5032	13.9318	13.4576	13.8907	13.9173	13.4824	13.9623	13.5462	14.0195 (61)
Total heat required for water heating calculated for each month	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (64)
RHI water heating demand	46.5776	40.8334	42.3678	37.2652	36.0007	31.4247	29.4747	33.3170	33.5647	38.6788	41.7973	45.2165 (65)
Heat gains from water heating, kWh/month	46.5776	40.8334	42.3678	37.2652	36.0007	31.4247	29.4747	33.3170	33.5647	38.6788	41.7973	45.2165 (65)
												1414 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.9270	34.5746	28.1180	21.2871	15.9124	13.4339	14.5158	18.8682	25.3248	32.1557	37.5304	40.0089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.7809	250.3521	243.8728	230.0791	212.6670	196.3021	185.3694	182.7982	189.2775	203.0712	220.4833	236.8482	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	(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)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	(71)
Water heating gains (Table 5)	62.6043	60.7639	56.9460	51.7573	48.3880	43.6454	39.6165	44.7809	46.6176	51.9877	58.0518	60.7748	(72)
Total internal gains	438.7065	435.0849	418.3310	392.5177	366.3616	342.7757	328.8959	335.8416	350.6142	376.6088	405.4597	427.0261	(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
East					3.2400	25.1925	0.6300	0.7000			0.7700	24.9453
West					5.5500	25.1925	0.6300	0.7000			0.7700	42.7304 (76)

Solar gains	67.6757	112.6120	186.4465	272.4246	314.7560	352.8685	324.2623	291.3426	226.9541	142.2322	84.1064	52.6785 (83)
Total gains	506.3822	547.6969	604.7776	664.9423	681.1177	695.6442	653.1582	627.1842	577.5682	518.8410	489.5661	479.7046 (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	19.4632	19.5697	19.5697	19.6372	19.6372	19.7017	19.7017	19.7632	19.7632	19.6698	19.7017	19.6372	
alpha	2.2975	2.3046	2.3046	2.3091	2.3091	2.3134	2.3134	2.3175	2.3175	2.3113	2.3134	2.3091	
util living area	0.8413	0.8120	0.7469	0.6446	0.5123	0.3545	0.2536	0.2626	0.4519	0.6615	0.7917	0.8516	(86)
MIT	19.2558	19.4703	19.8955	20.3575	20.7211	20.9185	20.9742	20.9724	20.8479	20.4441	19.8126	19.2265	(87)
Th 2	20.1521	20.1564	20.1564	20.1590	20.1590	20.1616	20.1616	20.1640	20.1640	20.1603	20.1616	20.1590	(88)
util rest of house	0.8274	0.7960	0.7255	0.6152	0.4712	0.3025	0.1921	0.1994	0.3977	0.6255	0.7711	0.8383	(89)
MIT 2	18.5739	18.7834	19.1902	19.6243	19.9507	20.1130	20.1510	20.1526	20.0652	19.7157	19.1231	18.5518	(90)
Living area fraction	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103	(91)
MIT	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103	(92)
Temperature adjustment	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103	(93)
adjusted MIT	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	406.2437	422.8364	427.0588	402.7872	323.9649	221.8938	140.2981	139.6279	237.4947	320.5960	367.0353	390.1343	(94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	706.4216	687.4845	620.2259	516.2028	372.3989	234.8669	143.6956	143.2639	262.2798	415.9493	570.7167	693.6547	(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	223.3323	177.8436	143.7163	81.6592	36.0349	0.0000	0.0000	0.0000	0.0000	70.9429	146.6506	225.8192	(98)
Space heating												1105.9991	(98)
RHI space heating demand												1106	(98)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1609 (8)
Pressure test					Yes
Measured/design AP50					3.1800
Infiltration rate					0.3199 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2959 (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	0.3773	0.3699	0.3625	0.3255	0.3181	0.2811	0.2811	0.2737	0.2959	0.3181	0.3329	0.3477 (22b)
	0.5712	0.5684	0.5657	0.5530	0.5506	0.5395	0.5395	0.5375	0.5438	0.5506	0.5554	0.5605 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.2000	6.5660	9.0000	295.4700 (29a)
Pitched Roof	39.3000		39.3000	0.1000	3.9300	9.0000	353.7000 (30)
Sloping Roof	11.5300		11.5300	0.1600	1.8448	9.0000	103.7700 (30)
Dormer Roofs	4.9600		4.9600	0.0000	0.0000	9.0000	44.6400 (30)
Total net area of external elements Aum(A, m ²)			92.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.9942		(33)
Party Wall			18.4100	0.0000	0.0000	20.0000	368.2000 (32)
Party Floor			57.2700			30.0000	1718.1000 (32d)
Internal Walls			88.9200			9.0000	800.2800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3684.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.3297 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9074 (36)
Total fabric heat loss							(33) + (36) = 29.9016 (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	23.4249	23.3115	23.2004	22.6785	22.5809	22.1263	22.1263	22.0421	22.3014	22.5809	22.7784	22.9849 (38)
Heat transfer coeff	53.3265	53.2132	53.1020	52.5801	52.4825	52.0279	52.0279	51.9437	52.2030	52.4825	52.6800	52.8865 (39)
Average = Sum(39)m / 12 =												52.5796 (39)
HLP	0.9311	0.9292	0.9272	0.9181	0.9164	0.9085	0.9085	0.9070	0.9115	0.9164	0.9199	0.9235 (40)
HLP (average)												0.9181 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (45)
Distribution loss (46)m = 0.15 x (45)m	19.4303	16.9939	17.5362	15.2885	14.6697	12.6588	11.7302	13.4606	13.6214	15.8744	17.3281	18.8172 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0281	12.6541	13.9838	13.5032	13.9318	13.4576	13.8907	13.9173	13.4824	13.9623	13.5462	14.0195 (61)
Total heat required for water heating calculated for each month	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (64)
Heat gains from water heating, kWh/month	46.5776	40.8334	42.3678	37.2652	36.0007	31.4247	29.4747	33.3170	33.5647	38.6788	41.7973	45.2165 (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	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.9270	34.5746	28.1180	21.2871	15.9124	13.4339	14.5158	18.8682	25.3248	32.1557	37.5304	40.0089 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.7809	250.3521	243.8728	230.0791	212.6670	196.3021	185.3694	182.7982	189.2775	203.0712	220.4833	236.8482 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244 (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)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396 (71)
Water heating gains (Table 5)	62.6043	60.7639	56.9460	51.7573	48.3880	43.6454	39.6165	44.7809	46.6176	51.9877	58.0518	60.7748 (72)
Total internal gains	438.7065	435.0849	418.3310	392.5177	366.3616	342.7757	328.8959	335.8416	350.6142	376.6088	405.4597	427.0261 (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
East					3.2400	19.6403	0.6300	0.7000			0.7700	19.4475 (76)
West					5.5500	19.6403	0.6300	0.7000			0.7700	33.3129 (80)
Solar gains	52.7604	103.2105	169.9730	247.8955	303.8053	310.9988	296.0835	254.3313	197.6857	122.4680	65.7860	43.3876 (83)
Total gains	491.4669	538.2954	588.3040	640.4132	670.1669	653.7745	624.9794	590.1729	548.2998	499.0768	471.2457	470.4137 (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	19.1908	19.2317	19.2719	19.4632	19.4994	19.6698	19.6698	19.7017	19.6038	19.4994	19.4263	19.3504
alpha	2.2794	2.2821	2.2848	2.2975	2.3000	2.3113	2.3113	2.3134	2.3069	2.3000	2.2951	2.2900
util living area	0.8652	0.8355	0.7826	0.6945	0.5812	0.4505	0.3427	0.3736	0.5431	0.7275	0.8308	0.8749 (86)
MIT	18.9543	19.2091	19.6365	20.1528	20.5634	20.8290	20.9343	20.9178	20.7229	20.1908	19.4937	18.8953 (87)
Th 2	20.1411	20.1428	20.1444	20.1521	20.1536	20.1603	20.1603	20.1616	20.1577	20.1536	20.1507	20.1476 (88)
util rest of house	0.8535	0.8216	0.7642	0.6687	0.5455	0.4023	0.2836	0.3135	0.4949	0.6986	0.8143	0.8639 (89)
MIT 2	18.2715	18.5196	18.9334	19.4292	19.8078	20.0435	20.1248	20.1153	19.9585	19.4772	18.8078	18.2192 (90)
Living area fraction									fLA = Living area / (4) =			0.3831 (91)
MIT	18.5331	18.7838	19.2027	19.7064	20.0973	20.3444	20.4349	20.4227	20.2513	19.7506	19.0706	18.4782 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5331	18.7838	19.2027	19.7064	20.0973	20.3444	20.4349	20.4227	20.2513	19.7506	19.0706	18.4782 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8277	0.7961	0.7416	0.6541	0.5430	0.4132	0.3034	0.3327	0.5005	0.6835	0.7901	0.8384 (94)
Useful gains	406.7746	428.5439	436.2774	418.8989	363.9019	270.1470	189.5957	196.3313	274.4349	341.0963	372.3472	394.3877 (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	759.0014	738.7982	674.5405	568.2035	440.7092	298.8711	199.5243	208.9556	321.1185	480.2451	630.6087	755.1245 (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	262.0567	208.4909	177.2677	107.4993	57.1446	0.0000	0.0000	0.0000	0.0000	103.5267	185.9483	268.3882 (98)
Space heating												1370.3225 (98)
Space heating per m2										(98) / (4) =		23.9274 (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													1514.1685 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	262.0567	208.4909	177.2677	107.4993	57.1446	0.0000	0.0000	0.0000	0.0000	103.5267	185.9483	268.3882	(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)	289.5654	230.3767	195.8759	118.7837	63.1432	0.0000	0.0000	0.0000	0.0000	114.3942	205.4677	296.5616	(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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679	(64)
Efficiency of water heater (217)m	89.3409	89.2677	89.1126	88.8144	88.3572	87.3000	87.3000	87.3000	87.3000	88.7549	89.1610	87.3000	(216)
Fuel for water heating, kWh/month	160.6920	141.0888	146.8836	129.9635	126.4520	112.0842	105.4894	118.7340	119.4634	134.9691	144.7575	156.0398	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1514.1685 (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)													274.9853 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3460.7711 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1514.1685	3.4800	52.6931	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1596.6173	3.4800	55.5623	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	274.9853	13.1900	36.2706	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			274.4184	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1270 (257)
SAP value		84.2787
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	1514.1685	0.2160	327.0604	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1596.6173	0.2160	344.8693	(264)
Space and water heating			671.9297	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	274.9853	0.5190	142.7174	(268)
Energy saving/generation technologies				
PV Unit	-364.0700	0.5190	-188.9523	(269)
Total kg/year			664.6198	(272)
CO2 emissions per m2			11.6100	(273)
EI value			91.2918	
EI rating			91 (274)	
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8845 = 3.934$, stars = 4
Water heating environmental impact	$0.216 / 0.8845 = 0.2442$, stars = 4

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	57.2700 (1b)	x 2.1700 (2b)	= 124.2759 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	57.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 124.2759 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1609 (8)
Pressure test					Yes
Measured/design AP50					3.1800
Infiltration rate					0.3199 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2959 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.3255	0.3033	0.3033	0.2885	0.2885	0.2737	0.2737	0.2589	0.2589	0.2811	0.2737	0.2885 (22b)
Effective ac	0.5530	0.5460	0.5460	0.5416	0.5416	0.5375	0.5375	0.5335	0.5335	0.5395	0.5375	0.5416 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.7900	1.3258	11.6534		(27)
External Wall	41.6200	8.7900	32.8300	0.2000	6.5660	9.0000	295.4700 (29a)
Pitched Roof	39.3000		39.3000	0.1000	3.9300	9.0000	353.7000 (30)
Sloping Roof	11.5300		11.5300	0.1600	1.8448	9.0000	103.7700 (30)
Dormer Roofs	4.9600		4.9600	0.0000	0.0000	9.0000	44.6400 (30)
Total net area of external elements Aum(A, m ²)			92.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	23.9942			(33)
Party Wall			18.4100	0.0000	0.0000	20.0000	368.2000 (32)
Party Floor			57.2700			30.0000	1718.1000 (32d)
Internal Walls			88.9200			9.0000	800.2800 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3684.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							64.3297 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9074 (36)
Total fabric heat loss							(33) + (36) = 29.9016 (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	22.6785	22.3923	22.3923	22.2127	22.2127	22.0421	22.0421	21.8805	21.8805	22.1263	22.0421	22.2127 (38)
Heat transfer coeff	52.5801	52.2939	52.2939	52.1143	52.1143	51.9437	51.9437	51.7821	51.7821	52.0279	51.9437	52.1143 (39)
Average = Sum(39)m / 12 =												52.0778 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9181	0.9131	0.9131	0.9100	0.9100	0.9070	0.9070	0.9042	0.9042	0.9085	0.9070	0.9100 (40)
HLP (average)												0.9093 (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												1.9035 (42)
Average daily hot water use (litres/day)												79.4079 (43)
Daily hot water use	87.3487	84.1724	80.9961	77.8198	74.6434	71.4671	71.4671	74.6434	77.8198	80.9961	84.1724	87.3487 (44)
Energy conte	129.5356	113.2927	116.9079	101.9231	97.7977	84.3920	78.2016	89.7374	90.8092	105.8293	115.5210	125.4483 (45)
Energy content (annual)										Total = Sum(45)m =		1249.3957 (45)
Distribution loss (46)m = 0.15 x (45)m												
	19.4303	16.9939	17.5362	15.2885	14.6697	12.6588	11.7302	13.4606	13.6214	15.8744	17.3281	18.8172 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

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

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0281	12.6541	13.9838	13.5032	13.9318	13.4576	13.8907	13.9173	13.4824	13.9623	13.5462	14.0195 (61)
Total heat required for water heating calculated for each month	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679 (64)
Heat gains from water heating, kWh/month	46.5776	40.8334	42.3678	37.2652	36.0007	31.4247	29.4747	33.3170	33.5647	38.6788	41.7973	45.2165 (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	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095	114.2095 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.9270	34.5746	28.1180	21.2871	15.9124	13.4339	14.5158	18.8682	25.3248	32.1557	37.5304	40.0089 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.7809	250.3521	243.8728	230.0791	212.6670	196.3021	185.3694	182.7982	189.2775	203.0712	220.4833	236.8482 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244	48.3244 (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)	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396	-76.1396 (71)
Water heating gains (Table 5)	62.6043	60.7639	56.9460	51.7573	48.3880	43.6454	39.6165	44.7809	46.6176	51.9877	58.0518	60.7748 (72)
Total internal gains	438.7065	435.0849	418.3310	392.5177	366.3616	342.7757	328.8959	335.8416	350.6142	376.6088	405.4597	427.0261 (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	
East				3.2400	25.1925	0.6300	0.7000			0.7700	24.9453 (76)	
West				5.5500	25.1925	0.6300	0.7000			0.7700	42.7304 (80)	

Solar gains	67.6757	112.6120	186.4465	272.4246	314.7560	352.8685	324.2623	291.3426	226.9541	142.2322	84.1064	52.6785 (83)
Total gains	506.3822	547.6969	604.7776	664.9423	681.1177	695.6442	653.1582	627.1842	577.5682	518.8410	489.5661	479.7046 (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	19.4632	19.5697	19.5697	19.6372	19.6372	19.7017	19.7017	19.7632	19.7632	19.6698	19.7017	19.6372
alpha	2.2975	2.3046	2.3046	2.3091	2.3091	2.3134	2.3134	2.3175	2.3175	2.3113	2.3134	2.3091
util living area	0.8413	0.8120	0.7469	0.6446	0.5123	0.3545	0.2536	0.2626	0.4519	0.6615	0.7917	0.8516 (86)
MIT	19.2558	19.4703	19.8955	20.3575	20.7211	20.9185	20.9742	20.9724	20.8479	20.4441	19.8126	19.2265 (87)
Th 2	20.1521	20.1564	20.1564	20.1590	20.1590	20.1616	20.1616	20.1640	20.1640	20.1603	20.1616	20.1590 (88)
util rest of house	0.8274	0.7960	0.7255	0.6152	0.4712	0.3025	0.1921	0.1994	0.3977	0.6255	0.7711	0.8383 (89)
MIT 2	18.5739	18.7834	19.1902	19.6243	19.9507	20.1130	20.1510	20.1526	20.0652	19.7157	19.1231	18.5518 (90)
Living area fraction	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103 (91)
MIT	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8351	19.0466	19.4604	19.9052	20.2458	20.4216	20.4664	20.4667	20.3651	19.9947	19.3872	18.8103 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	406.2437	422.8364	427.0588	402.7872	323.9649	221.8938	140.2981	139.6279	237.4947	320.5960	367.0353	390.1343 (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	706.4216	687.4845	620.2259	516.2028	372.3989	234.8669	143.6956	143.2639	262.2798	415.9493	570.7167	693.6547 (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	223.3323	177.8436	143.7163	81.6592	36.0349	0.0000	0.0000	0.0000	0.0000	70.9429	146.6506	225.8192 (98)
Space heating												1105.9991 (98)
Space heating per m2										(98) / (4) =		19.3120 (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													1222.0984 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	223.3323	177.8436	143.7163	81.6592	36.0349	0.0000	0.0000	0.0000	0.0000	70.9429	146.6506	225.8192	(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)	246.7761	196.5122	158.8026	90.2312	39.8176	0.0000	0.0000	0.0000	0.0000	78.3899	162.0449	249.5240	(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	143.5637	125.9468	130.8917	115.4263	111.7294	97.8495	92.0922	103.6547	104.2916	119.7916	129.0672	139.4679	(64)
Efficiency of water heater (217)m	89.2203	89.1453	88.9460	88.5980	88.0593	87.3000	87.3000	87.3000	87.3000	88.4634	88.9733	87.3000	(216)
Fuel for water heating, kWh/month	160.9092	141.2826	147.1587	130.2809	126.8797	112.0842	105.4894	118.7340	119.4634	135.4137	145.0628	156.2649	(219)
Water heating fuel used												1599.0235	(219)
Annual totals kWh/year													
Space heating fuel - main system												1222.0984	(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)												274.9853	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3171.1072	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1222.0984	4.2600	52.0614 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1599.0235	4.2600	68.1184 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	274.9853	22.5500	62.0092 (250)
Additional standing charges			96.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	22.5500	0.0000 (252)
Total energy cost			295.1015 (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	1222.0984	0.2160	263.9733 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1599.0235	0.2160	345.3891 (264)
Space and water heating			609.3623 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	274.9853	0.5190	142.7174 (268)
Energy saving/generation technologies			
PV Unit	-364.0700	0.5190	-188.9523 (269)
Total kg/year			602.0524 (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	1222.0984	1.2200	1490.9600 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1599.0235	1.2200	1950.8087 (264)
Space and water heating			3441.7688 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	274.9853	3.0700	844.2049 (268)
Energy saving/generation technologies			
PV Unit	-364.0700	3.0700	-1117.6949 (269)
Primary energy kWh/year			3398.5287 (272)
Primary energy kWh/m2/year			59.3422 (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 91

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

Recommended measures:	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 91

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

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

	Current	Potential	Saving
Electricity	£79	£79	£0
Mains gas	£216	£216	£0
Space heating	£165	£165	£0
Water heating	£68	£68	£0
Lighting	£62	£62	£0
Total cost of fuels	£295	£295	£0
Total cost of uses	£295	£295	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	59 kWh/m²	59 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	64.3 (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	246.07 (P1)
Transmission heat loss coefficient	29.90 (37)
Summer heat loss coefficient	275.97 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.2400	125.2818	0.6300	0.7000	0.9000	144.9962
West	5.5500	125.2818	0.6300	0.7000	0.9000	248.3731
total:						393.3693

	Jun	Jul	Aug	
Solar gains	423	393	346	(P3)
Internal gains	340	326	333	
Total summer gains	763	719	679	(P5)
Summer gain/loss ratio	2.76	2.61	2.46	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 64.3)	1.55	1.55	1.55	
Threshold temperature	19.71	21.46	21.31	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			