



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 6, Rowe Way
EASTLEIGH, Hampshire, SO50 9RG

Contact: Scott Spearing | BEAT Solutions
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Report Issue Date: 20/02/2020

EXCELLENCE
IN ENERGY
ASSESSMENT

BLOCK COMPLIANCE

Calculation Type: New Build (As Built)

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

Block Compliance Report - DER

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

Block Compliance Report - DFEE

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

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 297				Issued on Date	20/02/2020
Assessment Reference	AB	Prop Type Ref	Flats A - 2B3P Ground Floor			
Property	6, Rowe Way, EASTLEIGH, Hampshire, SO50 9RG					
SAP Rating	83 B	DER	15.71	TER	18.98	
Environmental	89 B	% DER<TER	17.23			
CO ₂ Emissions (t/year)	0.76	DFEE	44.84	TFEE	48.80	
General Requirements Compliance	Pass	% DFEE<TFEE	8.12			
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)	18.98	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.71	kgCO ₂ /m ²	Pass
	-3.27 (-17.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.80	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.84	kWh/m ² /yr	
	-4.0 (-8.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.37 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.62 m², No overhang

Windows facing East

3.24 m², No overhang

Windows facing West

5.49 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

5.37 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Door U-value

0.60

W/m²K

Photovoltaic array

350.16

kWh/Year

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 297				Issued on Date	20/02/2020
Assessment Reference	AB		Prop Type Ref	Flats A - 2B3P Ground Floor		
Property	6, Rowe Way, EASTLEIGH, Hampshire, SO50 9RG					
SAP Rating	83 B	DER	15.71	TER	18.98	
Environmental	89 B	% DER<TER	17.23			
CO ₂ Emissions (t/year)	0.76	DFEE	44.84	TFEE	48.80	
General Requirements Compliance	Pass	% DFEE<TFEE	8.12			
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
		24.47 m	61.72 m ²	2.40 m
7.0 Living Area	22.64	m ²		
8.0 Thermal Mass Parameter	Precise calculation			
Thermal Mass	130.81	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	58.73	48.38

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	18.36

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Walls	Plasterboard on timber frame	9.00	87.79

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Ceilings	Timber I-joists, carpeted	20.00	61.72

11.0 Heat Loss Floors

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.16	75.00	61.72

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Side Elevation	Window	[1] External Wall	East	None	0.00					3.24	
Side Elevation	Window	[1] External Wall	West	None	0.00					5.49	
Rear Elevation	Window	[1] External Wall	North	None	0.00					1.62	

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)	8.03	0.300	Yes
Table K1 - Approved	E3 Sill	8.03	0.040	Yes
Table K1 - Approved	E4 Jamb	17.70	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	24.47	0.160	Yes
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	24.47	0.070	No
Table K1 - Approved	E16 Corner (normal)	9.60	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	4.80	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	4.80	0.060	Yes
Table K1 - Default	P1 Party wall - Ground floor	7.65	0.160	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	7.65	0.000	No

Y-value 0.093 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	4.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	5.37	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted	No
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23.0 Electricity Tariff

24.0 Main Heating 1

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

25.0 Main Heating 2

Community Heating	None
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28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	350.16	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 297		Issued on Date	20/02/2020
Assessment Reference	AB	Prop Type Ref	Flats A - 2B3P Ground Floor	
Project	6, Rowe Way, EASTLEIGH, Hampshire, SO50 9RG			
Calculation Type	New Build (As Built)			

SAP Rating	83 B	DER	15.71	TER	18.98
Environmental	89 B	% DER<TER	17.23		
CO ₂ Emissions (t/year)	0.76	DFEE	44.84	TFEE	48.80
General Requirements Compliance	Pass	% DFEE<TFEE	8.12		

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

Building Elements

Wall External Walls - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

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

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

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP-0796 (3B4A) - Plot 297	Issued on Date	20/02/2020
Assessment Reference	AB	Prop Type Ref	Flats A - 2B3P Ground Floor
Project	6, Rowe Way, EASTLEIGH, Hampshire, SO50 9RG		
Calculation Type	New Build (As Built)		

SAP Rating	83 B	DER	15.71	TER	18.98
Environmental	89 B	% DER<TER	17.23		
CO ₂ Emissions (t/year)	0.76	DFEE	44.84	TFEE	48.80
General Requirements Compliance	Pass	% DFEE<TFEE	8.12		

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

Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 61.72 m², Perimeter = 24.47 m, Wall thickness = 275.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.16 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 297				Issued on Date	20/02/2020
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SAP Rating	83 B	DER	15.71	TER	18.98	
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General Requirements Compliance	Pass	% DFEE<TFEE	8.12			
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Ground-floor flat, total floor area 62 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) 18.98 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.71 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.37 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.62 m², No overhang
Windows facing East: 3.24 m², No overhang
Windows facing West: 5.49 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.60 W/m²K
Photovoltaic array 350.16 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	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					5.3700
Infiltration rate					0.4035 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3430 (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	0.4373	0.4287	0.4202	0.3773	0.3687	0.3258	0.3258	0.3173	0.3430	0.3687	0.3859	0.4030 (22b)
Effective ac	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5744	0.5812 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.3500	1.1450	11.8511		(27)
Heat Loss Floor			61.7200	0.1600	9.8752	75.0000	4629.0000 (28a)
External Wall	58.7300	10.3500	48.3800	0.2000	9.6760	9.0000	435.4200 (29a)
Total net area of external elements Aum(A, m ²)			120.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4023		(33)
Party Wall			18.3600	0.0000	0.0000	20.0000	367.2000 (32)
Party Ceilings			61.7200			30.0000	1851.6000 (32b)
Internal Walls			87.7900			9.0000	790.1100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8073.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.8057 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1873 (36)
Total fabric heat loss							(33) + (36) = 42.5896 (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	29.1153	28.9338	28.7559	27.9203	27.7639	27.0361	27.0361	26.9013	27.3164	27.7639	28.0802	28.4109 (38)
Heat transfer coeff	71.7050	71.5234	71.3455	70.5099	70.3536	69.6257	69.6257	69.4910	69.9061	70.3536	70.6698	71.0005 (39)
Average = Sum(39)m / 12 =												70.5091 (39)
HLP	1.1618	1.1588	1.1560	1.1424	1.1399	1.1281	1.1281	1.1259	1.1326	1.1399	1.1450	1.1504 (40)
HLP (average)												1.1424 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
Daily hot water use	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy conte	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6039 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1645	17.6360	18.1988	15.8661	15.2239	13.1371	12.1735	13.9692	14.1361	16.4742	17.9829	19.5283 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0490	12.6718	14.0013	13.5178	13.9452	13.4687	13.9010	13.9297	13.4955	13.9781	13.5641	14.0398 (61)
Total heat required for water heating calculated for each month	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (64)
Heat gains from water heating, kWh/month	48.2103	42.2611	43.8410	38.5494	37.2327	32.4878	30.4598	34.4475	34.7088	40.0124	43.2531	46.7976 (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	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3396	14.5127	11.8025	8.9353	6.6792	5.6389	6.0930	7.9199	10.6301	13.4973	15.7534	16.7937 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2630	179.1025	174.4672	164.5991	152.1425	140.4350	132.6137	130.7742	135.4096	145.2776	157.7342	169.4417 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491 (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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930 (71)
Water heating gains (Table 5)	64.7987	62.8885	58.9260	53.5408	50.0440	45.1219	40.9405	46.3004	48.2067	53.7801	60.0738	62.9000 (72)
Total internal gains	314.8487	312.9511	301.6431	283.5226	265.3130	247.6431	236.0946	241.4420	250.6937	269.0024	290.0087	305.5828 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)			
East				3.2400	19.6403	0.6300	0.7000	0.7700	19.4475 (76)			
West				5.4900	19.6403	0.6300	0.7000	0.7700	32.9527 (80)			
Solar gains	57.6648	112.5668	185.9085	273.6635	338.7227	348.4761	331.0343	281.9277	216.8908	133.6080	71.8314	47.4802 (83)
Total gains	372.5135	425.5178	487.5516	557.1860	604.0358	596.1192	567.1289	523.3697	467.5845	402.6104	361.8402	353.0630 (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	31.2753	31.3546	31.4328	31.8053	31.8760	32.2092	32.2092	32.2717	32.0801	31.8760	31.7334	31.5856
alpha	3.0850	3.0903	3.0955	3.1204	3.1251	3.1473	3.1473	3.1514	3.1387	3.1251	3.1156	3.1057
util living area	0.9811	0.9704	0.9460	0.8890	0.7869	0.6397	0.5014	0.5530	0.7700	0.9240	0.9714	0.9838 (86)
MIT	18.9751	19.2009	19.6024	20.1242	20.5617	20.8421	20.9460	20.9257	20.6998	20.1191	19.4572	18.9355 (87)
Th 2	19.9507	19.9531	19.9554	19.9663	19.9684	19.9780	19.9780	19.9797	19.9743	19.9684	19.9642	19.9599 (88)
util rest of house	0.9775	0.9649	0.9356	0.8668	0.7431	0.5649	0.3991	0.4502	0.7071	0.9040	0.9651	0.9808 (89)
MIT 2	18.1057	18.3306	18.7271	19.2386	19.6430	19.8853	19.9562	19.9475	19.7779	19.2455	18.5949	18.0732 (90)
Living area fraction	18.4246	18.6499	19.0482	19.5635	19.9800	20.2363	20.3193	20.3063	20.1160	19.5660	18.9112	18.3895 (92)
Temperature adjustment	18.4246	18.6499	19.0482	19.5635	19.9800	20.2363	20.3193	20.3063	20.1160	19.5660	18.9112	18.3895 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9706	0.9560	0.9243	0.8567	0.7437	0.5850	0.4347	0.4849	0.7168	0.8945	0.9567	0.9746 (94)
Ext temp.	361.5670	406.7789	450.6488	477.3153	449.2065	348.7449	246.5400	253.7901	335.1600	360.1472	346.1768	344.1071 (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	1012.8047	983.4385	895.2560	751.8794	582.5289	392.4292	258.9561	271.4524	420.5583	630.7870	834.6968	1007.4613 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	484.5208	387.5152	330.7878	197.6862	99.1919	0.0000	0.0000	0.0000	0.0000	201.3560	351.7344	493.5355 (98)
												2546.3278 (98)
												41.2561 (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													2813.6218 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.5208	387.5152	330.7878	197.6862	99.1919	0.0000	0.0000	0.0000	0.0000	201.3560	351.7344	493.5355	(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)	535.3821	428.1936	365.5114	218.4378	109.6043	0.0000	0.0000	0.0000	0.0000	222.4928	388.6568	545.3431	(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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282	(64)
Efficiency of water heater (217)m	89.7285	89.6731	89.5470	89.2686	88.7503	87.3000	87.3000	87.3000	87.3000	89.2543	89.5967	89.7560	(216)
Fuel for water heating, kWh/month	165.4760	145.2444	151.1234	133.6328	130.0708	115.7496	108.8859	122.6321	123.4088	138.7117	148.9453	160.6892	(219)
Water heating fuel used												1644.5700	(219)
Annual totals kWh/year													
Space heating fuel - main system												2813.6218	(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)												288.5622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4821.7540	(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	2813.6218	0.2160	607.7423 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1644.5700	0.2160	355.2271 (264)
Space and water heating			962.9694 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	288.5622	0.5190	149.7638 (268)
Energy saving/generation technologies			
PV Unit	-350.1600	0.5190	-181.7330 (269)
Total CO2, kg/year			969.9252 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.7100 (273)

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

DER		15.7100	ZC1
Total Floor Area	TFA	61.7200	
Assumed number of occupants	N	2.0298	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.0192	ZC2
CO2 emissions from cooking, equation (L16)		2.7174	ZC3
Total CO2 emissions		35.4465	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.4465	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1350 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3850 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3273 (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												
	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3845 (22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			10.3500	1.3258	13.7216		(27)					
Heat Loss Floor			61.7200	0.1300	8.0236		(28a)					
External Wall	58.7300	10.3500	48.3800	0.1800	8.7084		(29a)					
Total net area of external elements Aum(A, m2)			120.4500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		30.4536		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6481 (36)					
Total fabric heat loss						(33) + (36) =	39.1017 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.6965	28.5313	28.3693	27.6086	27.4662	26.8036	26.8036	26.6809	27.0588	27.4662	27.7542	28.0552 (38)
Average = Sum(39)m / 12 =	67.7982	67.6330	67.4710	66.7102	66.5679	65.9053	65.9053	65.7826	66.1605	66.5679	66.8559	67.1569 (39)
												66.7096 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0985	1.0958	1.0932	1.0809	1.0785	1.0678	1.0678	1.0658	1.0719	1.0785	1.0832	1.0881 (40)
Days in month												1.0808 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy content (annual)	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1296.6039 (45)
Water storage loss:	20.1645	17.6360	18.1988	15.8661	15.2239	13.1371	12.1735	13.9692	14.1361	16.4742	17.9829	19.5283 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	46.1938	40.2062	42.8343	39.8269	39.4747	36.5758	37.7949	39.4747	39.8269	42.8343	43.0781	46.1938 (61)
Total heat required for water heating calculated for each month												

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Solar input	180.6239	157.7797	164.1595	145.6012	140.9677	124.1564	118.9513	132.6029	134.0673	152.6624	162.9640	176.3822 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.6239	157.7797	164.1595	145.6012	140.9677	124.1564	118.9513	132.6029	134.0673	152.6624	162.9640	176.3822 (64)
Heat gains from water heating, kWh/month	56.2465	49.1447	51.0492	45.1267	43.6151	38.2645	36.4332	40.8338	41.2917	47.2264	50.6316	54.8361 (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	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3396	14.5127	11.8025	8.9353	6.6792	5.6389	6.0930	7.9199	10.6301	13.4973	15.7534	16.7937 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2630	179.1025	174.4672	164.5991	152.1425	140.4350	132.6137	130.7742	135.4096	145.2776	157.7342	169.4417 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491 (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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930 (71)
Water heating gains (Table 5)	75.6001	73.1320	68.6145	62.6759	58.6224	53.1452	48.9694	54.8841	57.3495	63.4763	70.3217	73.7044 (72)
Total internal gains	325.6501	323.1945	311.3315	292.6577	273.8915	255.6664	244.1234	250.0256	259.8365	278.6987	300.2567	316.3872 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	1.6200	10.6334	0.6300		0.7000	0.7700	5.2645 (74)
East	3.2400	19.6403	0.6300		0.7000	0.7700	19.4475 (76)
West	5.4900	19.6403	0.6300		0.7000	0.7700	32.9527 (80)

Solar gains	57.6648	112.5668	185.9085	273.6635	338.7227	348.4761	331.0343	281.9277	216.8908	133.6080	71.8314	47.4802 (83)
Total gains	383.3148	435.7613	497.2400	566.3211	612.6142	604.1425	575.1577	531.9534	476.7274	412.3067	372.0881	363.8674 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	63.2186	63.3731	63.5252	64.2497	64.3871	65.0344	65.0344	65.1557	64.7835	64.3871	64.1097	63.8224
alpha	5.2146	5.2249	5.2350	5.2833	5.2925	5.3356	5.3356	5.3437	5.3189	5.2925	5.2740	5.2548
util living area	0.9977	0.9950	0.9856	0.9486	0.8455	0.6636	0.4976	0.5565	0.8230	0.9729	0.9952	0.9982 (86)
MIT	19.8482	19.9929	20.2493	20.5839	20.8441	20.9678	20.9942	20.9898	20.9009	20.5511	20.1389	19.8226 (87)
Th 2	20.0021	20.0043	20.0064	20.0165	20.0184	20.0272	20.0272	20.0288	20.0238	20.0184	20.0146	20.0106 (88)
util rest of house	0.9969	0.9933	0.9805	0.9303	0.7957	0.5768	0.3911	0.4453	0.7494	0.9599	0.9932	0.9976 (89)
MIT 2	18.4667	18.6791	19.0521	19.5319	19.8688	20.0063	20.0251	20.0247	19.9455	19.4963	18.9004	18.4355 (90)
Living area fraction									fLA = Living area / (4) =			0.3668 (91)
MIT	18.9735	19.1610	19.4913	19.9178	20.2265	20.3590	20.3806	20.3787	20.2960	19.8832	19.3547	18.9443 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9735	19.1610	19.4913	19.9178	20.2265	20.3590	20.3806	20.3787	20.2960	19.8832	19.3547	18.9443 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9957	0.9913	0.9771	0.9281	0.8073	0.6076	0.4304	0.4863	0.7721	0.9576	0.9914	0.9967 (94)
Ext temp.	381.6798	431.9735	485.8439	525.6309	494.5748	367.0778	247.5239	258.6928	368.0702	394.8193	368.9047	362.6701 (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	994.8358	964.5168	876.5334	734.9983	567.5932	379.5481	249.1591	261.7309	409.9278	617.9659	819.2997	990.1812 (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	456.1880	357.8692	290.6729	150.7445	54.3257	0.0000	0.0000	0.0000	0.0000	166.0211	324.2844	466.8683 (98)
												2266.9741 (98)
												36.7300 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2427.1672 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	456.1880	357.8692	290.6729	150.7445	54.3257	0.0000	0.0000	0.0000	0.0000	166.0211	324.2844	466.8683	(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)	488.4240	383.1576	311.2130	161.3967	58.1646	0.0000	0.0000	0.0000	0.0000	177.7528	347.1996	499.8589	(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	180.6239	157.7797	164.1595	145.6012	140.9677	124.1564	118.9513	132.6029	134.0673	152.6624	162.9640	176.3822	(64)
Efficiency of water heater	87.2860	87.0498	86.4744	85.1386	82.8757	80.3000	80.3000	80.3000	80.3000	85.2627	86.7506	87.3861	(217)
Fuel for water heating, kWh/month	206.9334	181.2522	189.8360	171.0166	170.0953	154.6157	148.1337	165.1343	166.9580	179.0495	187.8535	201.8423	(219)
Water heating fuel used												2122.7204	(219)
Annual totals kWh/year													
Space heating fuel - main system												2427.1672	(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)												288.5622	(232)
Total delivered energy for all uses												4913.4497	(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	2427.1672	0.2160	524.2681 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2122.7204	0.2160	458.5076 (264)
Space and water heating			982.7757 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	288.5622	0.5190	149.7638 (268)
Total CO2, kg/m2/year			1171.4645 (272)
Emissions per m2 for space and water heating			15.9231 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4265 (272b)
Emissions per m2 for pumps and fans			0.6307 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9231 * 1.00) + 2.4265 + 0.6307, rounded to 2 d.p.			18.9800 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1350 (8)
Measured/design AP50					Yes
Infiltration rate					5.3700
Number of sides sheltered					0.4035 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3430 (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	0.4373	0.4287	0.4202	0.3773	0.3687	0.3258	0.3258	0.3173	0.3430	0.3687	0.3859	0.4030 (22b)
	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5744	0.5812 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.3500	1.1450	11.8511		(27)
Heat Loss Floor			61.7200	0.1600	9.8752	75.0000	4629.0000 (28a)
External Wall	58.7300	10.3500	48.3800	0.2000	9.6760	9.0000	435.4200 (29a)
Total net area of external elements Aum(A, m ²)			120.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4023		(33)
Party Wall			18.3600	0.0000	0.0000	20.0000	367.2000 (32)
Party Ceilings			61.7200			20.0000	1234.4000 (32b)
Internal Walls			87.7900			9.0000	790.1100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7456.1300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							120.8057 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1873 (36)
Total fabric heat loss							(33) + (36) = 42.5896 (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	29.1153	28.9338	28.7559	27.9203	27.7639	27.0361	27.0361	26.9013	27.3164	27.7639	28.0802	28.4109 (38)
Heat transfer coeff	71.7050	71.5234	71.3455	70.5099	70.3536	69.6257	69.6257	69.4910	69.9061	70.3536	70.6698	71.0005 (39)
Average = Sum(39)m / 12 =												70.5091 (39)
HLP	1.1618	1.1588	1.1560	1.1424	1.1399	1.1281	1.1281	1.1259	1.1326	1.1399	1.1450	1.1504 (40)
HLP (average)												1.1424 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
Daily hot water use	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy conte	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6039 (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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)
Heat gains from water heating, kWh/month	28.5664	24.9844	25.7816	22.4770	21.5672	18.6109	17.2457	19.7897	20.0261	23.3385	25.4758	(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	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3396	14.5127	11.8025	8.9353	6.6792	5.6389	6.0930	7.9199	10.6301	13.4973	15.7534	16.7937	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2630	179.1025	174.4672	164.5991	152.1425	140.4350	132.6137	130.7742	135.4096	145.2776	157.7342	169.4417	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	(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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	(71)
Water heating gains (Table 5)	38.3957	37.1791	34.6527	31.2181	28.9882	25.8485	23.1797	26.5991	27.8140	31.3689	35.3830	37.1842	(72)
Total internal gains	285.4457	284.2416	274.3697	258.1998	241.2573	225.3697	215.3338	218.7406	227.3010	243.5912	262.3180	276.8670	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	1.6200	10.6334	0.6300	0.7000	0.7700	5.2645 (74)
East	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475 (76)
West	5.4900	19.6403	0.6300	0.7000	0.7700	32.9527 (80)

Solar gains	57.6648	112.5668	185.9085	273.6635	338.7227	348.4761	331.0343	281.9277	216.8908	133.6080	71.8314	47.4802	(83)
Total gains	343.1104	396.8084	460.2782	531.8633	579.9800	573.8458	546.3681	500.6684	444.1919	377.1993	334.1494	324.3472	(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	28.8843	28.9576	29.0298	29.3739	29.4391	29.7469	29.7469	29.8046	29.6276	29.4391	29.3074	29.1709	
alpha	2.9256	2.9305	2.9353	2.9583	2.9626	2.9831	2.9831	2.9870	2.9752	2.9626	2.9538	2.9447	
util living area	0.9814	0.9707	0.9463	0.8900	0.7908	0.6480	0.5120	0.5659	0.7784	0.9266	0.9723	0.9842	(86)
MIT	18.7936	19.0338	19.4619	20.0206	20.4951	20.8089	20.9311	20.9058	20.6467	20.0138	19.3061	18.7528	(87)
Th 2	19.9507	19.9531	19.9554	19.9663	19.9684	19.9780	19.9780	19.9797	19.9743	19.9684	19.9642	19.9599	(88)
util rest of house	0.9781	0.9654	0.9363	0.8688	0.7488	0.5749	0.4099	0.4639	0.7183	0.9081	0.9665	0.9813	(89)
MIT 2	17.9343	18.1736	18.5969	19.1457	19.5879	19.8626	19.9489	19.9369	19.7374	19.1514	18.4539	17.9003	(90)
Living area fraction													
MIT	18.2495	18.4891	18.9142	19.4667	19.9207	20.2097	20.3092	20.2924	20.0710	19.4677	18.7665	18.2130	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2495	18.4891	18.9142	19.4667	19.9207	20.2097	20.3092	20.2924	20.0710	19.4677	18.7665	18.2130	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9708	0.9558	0.9239	0.8567	0.7466	0.5926	0.4446	0.4971	0.7247	0.8969	0.9575	0.9749	(94)
Useful gains	333.1085	379.2857	425.2422	455.6419	433.0069	340.0855	242.9130	248.8606	321.9106	338.3166	319.9573	316.1911	(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	1000.2489	971.9427	885.6967	745.0534	578.3522	390.5814	258.2531	270.4836	417.4071	623.8774	824.4701	994.9305	(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	496.3524	398.2655	342.5781	208.3763	108.1369	0.0000	0.0000	0.0000	0.0000	212.4572	363.2492	504.9821	(98)
Space heating												2634.3978	(98)
Space heating per m2												42.6830	(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	654.4819	515.2305	528.1313	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7959	0.8550	0.8261	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	520.9285	440.5383	436.2635	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	746.6651	713.0716	660.9155	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	162.5303	202.7647	167.1411	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												532.4361 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	40.6326	50.6912	41.7853	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.1090 (107)
Space cooling per m2												2.1567 (108)
Energy for space heating												42.6830 (99)
Energy for space cooling												2.1567 (108)
Total												44.8397 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.8 (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	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1350 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3850 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3273 (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	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3845 (22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			10.3500	1.3258	13.7216		(27)					
Heat Loss Floor			61.7200	0.1300	8.0236		(28a)					
External Wall	58.7300	10.3500	48.3800	0.1800	8.7084		(29a)					
Total net area of external elements Aum(A, m2)			120.4500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		30.4536		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6481 (36)					
Total fabric heat loss						(33) + (36) =	39.1017 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.6965	28.5313	28.3693	27.6086	27.4662	26.8036	26.8036	26.6809	27.0588	27.4662	27.7542	28.0552 (38)
Average = Sum(39)m / 12 =	67.7982	67.6330	67.4710	66.7102	66.5679	65.9053	65.9053	65.7826	66.1605	66.5679	66.8559	67.1569 (39)
												66.7096 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0985	1.0958	1.0932	1.0809	1.0785	1.0678	1.0678	1.0658	1.0719	1.0785	1.0832	1.0881 (40)
Days in month												1.0808 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy content (annual)	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1296.6039 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												

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28.5664 24.9844 25.7816 22.4770 21.5672 18.6109 17.2457 19.7897 20.0261 23.3385 25.4758 27.6650 (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	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	101.4912	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3396	14.5127	11.8025	8.9353	6.6792	5.6389	6.0930	7.9199	10.6301	13.4973	15.7534	16.7937	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.2630	179.1025	174.4672	164.5991	152.1425	140.4350	132.6137	130.7742	135.4096	145.2776	157.7342	169.4417	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	33.1491	(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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	(71)
Water heating gains (Table 5)	38.3957	37.1791	34.6527	31.2181	28.9882	25.8485	23.1797	26.5991	27.8140	31.3689	35.3830	37.1842	(72)
Total internal gains	285.4457	284.2416	274.3697	258.1998	241.2573	225.3697	215.3338	218.7406	227.3010	243.5912	262.3180	276.8670	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.6200	10.6334		0.6300	0.7000	0.7700		5.2645 (74)	
East					3.2400	19.6403		0.6300	0.7000	0.7700		19.4475 (76)	
West					5.4900	19.6403		0.6300	0.7000	0.7700		32.9527 (80)	
Solar gains	57.6648	112.5668	185.9085	273.6635	338.7227	348.4761	331.0343	281.9277	216.8908	133.6080	71.8314	47.4802	(83)
Total gains	343.1104	396.8084	460.2782	531.8633	579.9800	573.8458	546.3681	500.6684	444.1919	377.1993	334.1494	324.3472	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.2186	63.3731	63.5252	64.2497	64.3871	65.0344	65.0344	65.1557	64.7835	64.3871	64.1097	63.8224	21.0000 (85)
alpha	5.2146	5.2249	5.2350	5.2833	5.2925	5.3356	5.3356	5.3437	5.3189	5.2925	5.2740	5.2548	
util living area	0.9986	0.9967	0.9897	0.9594	0.8672	0.6911	0.5221	0.5875	0.8530	0.9813	0.9971	0.9990	(86)
MIT	19.7871	19.9344	20.1962	20.5424	20.8210	20.9611	20.9927	20.9869	20.8802	20.5033	20.0817	19.7623	(87)
Th 2	20.0021	20.0043	20.0064	20.0165	20.0184	20.0272	20.0272	20.0288	20.0238	20.0184	20.0146	20.0106	(88)
util rest of house	0.9981	0.9956	0.9859	0.9443	0.8210	0.6035	0.4112	0.4720	0.7847	0.9718	0.9959	0.9986	(89)
MIT 2	18.8929	19.0415	19.3030	19.6476	19.8988	20.0096	20.0254	20.0251	19.9569	19.6169	19.1972	18.8750	(90)
Living area fraction	19.2209	19.3690	19.6306	19.9759	20.2371	20.3586	20.3802	20.3779	20.2956	19.9421	19.5217	19.2005	(91)
MIT	19.2209	19.3690	19.6306	19.9759	20.2371	20.3586	20.3802	20.3779	20.2956	19.9421	19.5217	19.2005	(92)
Temperature adjustment													0.0000
adjusted MIT	19.2209	19.3690	19.6306	19.9759	20.2371	20.3586	20.3802	20.3779	20.2956	19.9421	19.5217	19.2005	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9947	0.9841	0.9435	0.8324	0.6348	0.4522	0.5147	0.8061	0.9708	0.9951	0.9982	(94)
Useful gains	342.3025	394.6896	452.9783	501.8175	482.7734	364.2562	247.0684	257.7156	358.0570	366.1998	332.5028	323.7766	(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	1011.6116	978.5831	885.9369	738.8727	568.2937	379.5237	249.1354	261.6782	409.9032	621.8818	830.4602	1007.3841	(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	497.9660	392.3764	322.1212	170.6797	63.6271	0.0000	0.0000	0.0000	0.0000	190.2274	358.5293	508.6040	(98)
Space heating												2504.1312	(98)
Space heating per m2												40.5724	(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	619.5098	487.6992	499.9477	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9093	0.9542	0.9340	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	563.3323	465.3815	466.9274	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	746.6651	713.0716	660.9155	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	131.9996	184.2814	144.3272	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												460.6082	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.9999	46.0704	36.0818	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													115.1521 (107)
Space cooling per m2													1.8657 (108)
Energy for space heating													40.5724 (99)
Energy for space cooling													1.8657 (108)
Total													42.4382 (109)
Target Fabric Energy Efficiency (TFEE)													48.8 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					5.3700
Infiltration rate					0.4035 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3430 (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	0.3773	0.3516	0.3516	0.3344	0.3344	0.3173	0.3173	0.3001	0.3001	0.3258	0.3173	0.3344 (22b)
Effective ac	0.5712	0.5618	0.5618	0.5559	0.5559	0.5503	0.5503	0.5450	0.5450	0.5531	0.5503	0.5559 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.3500	1.1450	11.8511		(27)
Heat Loss Floor			61.7200	0.1600	9.8752	75.0000	4629.0000 (28a)
External Wall	58.7300	10.3500	48.3800	0.2000	9.6760	9.0000	435.4200 (29a)
Total net area of external elements Aum(A, m ²)			120.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	31.4023			(33)
Party Wall			18.3600	0.0000	0.0000	20.0000	367.2000 (32)
Party Ceilings			61.7200			30.0000	1851.6000 (32b)
Internal Walls			87.7900			9.0000	790.1100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8073.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.8057 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1873 (36)
Total fabric heat loss							(33) + (36) = 42.5896 (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	27.9203	27.4620	27.4620	27.1745	27.1745	26.9013	26.9013	26.6425	26.6425	27.0361	26.9013	27.1745 (38)
Heat transfer coeff	70.5099	70.0516	70.0516	69.7641	69.7641	69.4910	69.4910	69.2322	69.2322	69.6257	69.4910	69.7641 (39)
Average = Sum(39)m / 12 =												69.7057 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1424	1.1350	1.1350	1.1303	1.1303	1.1259	1.1259	1.1217	1.1217	1.1281	1.1259	1.1303 (40)
HLP (average)												1.1294 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
Daily hot water use	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy conte	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6039 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1645	17.6360	18.1988	15.8661	15.2239	13.1371	12.1735	13.9692	14.1361	16.4742	17.9829	19.5283 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0490	12.6718	14.0013	13.5178	13.9452	13.4687	13.9010	13.9297	13.4955	13.9781	13.5641	14.0398 (61)
Total heat required for water heating calculated for each month	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (64)
RHI water heating demand	48.2103	42.2611	43.8410	38.5494	37.2327	32.4878	30.4598	34.4475	34.7088	40.0124	43.2531	46.7976 (65)
Heat gains from water heating, kWh/month												1461.1660 (64)
												1461 (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	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8490	36.2817	29.5063	22.3381	16.6980	14.0972	15.2325	19.7998	26.5752	33.7433	39.3834	41.9843	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.5717	267.3171	260.3987	245.6703	227.0783	209.6045	197.9309	195.1854	202.1038	216.8322	235.4242	252.8981	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	(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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	(71)
Water heating gains (Table 5)	64.7987	62.8885	58.9260	53.5408	50.0440	45.1219	40.9405	46.3004	48.2067	53.7801	60.0738	62.9000	(72)
Total internal gains	463.0247	459.2926	441.6363	414.3545	386.6256	361.6288	346.9091	354.0909	369.6909	397.1609	427.6867	450.5876	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.6200	13.4839	0.6300	0.7000			0.7700			6.6758 (74)
East					3.2400	25.1925	0.6300	0.7000			0.7700			24.9453 (76)
West					5.4900	25.1925	0.6300	0.7000			0.7700			42.2684 (80)
Solar gains	73.8895	122.8281	204.2373	301.5259	351.9519	396.5219	363.5890	323.8594	249.5110	155.2683	91.7687			57.5697 (83)
Total gains	536.9142	582.1207	645.8736	715.8804	738.5774	758.1507	710.4981	677.9503	619.2020	552.4292	519.4554			508.1573 (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	31.8053	32.0134	32.0134	32.1453	32.1453	32.2717	32.2717	32.3923	32.3923	32.2092	32.2717	32.1453	
alpha	3.1204	3.1342	3.1342	3.1430	3.1430	3.1514	3.1514	3.1595	3.1595	3.1473	3.1514	3.1430	
util living area	0.9424	0.9244	0.8772	0.7843	0.6388	0.4438	0.3165	0.3297	0.5715	0.8044	0.9114	0.9484	(86)
MIT	19.5462	19.7254	20.0872	20.4942	20.8052	20.9559	20.9891	20.9879	20.8997	20.5520	20.0109	19.5277	(87)
Th 2	19.9663	19.9724	19.9724	19.9761	19.9761	19.9797	19.9797	19.9831	19.9831	19.9780	19.9797	19.9761	(88)
util rest of house	0.9323	0.9114	0.8559	0.7478	0.5791	0.3632	0.2214	0.2314	0.4890	0.7610	0.8934	0.9391	(89)
MIT 2	18.6777	18.8557	19.2024	19.5816	19.8484	19.9597	19.9771	19.9801	19.9303	19.6459	19.1421	18.6677	(90)
Living area fraction	18.9963	19.1747	19.5270	19.9164	20.1993	20.3251	20.3483	20.3498	20.2859	19.9783	19.4608	18.9831	(91)
MIT	18.9963	19.1747	19.5270	19.9164	20.1993	20.3251	20.3483	20.3498	20.2859	19.9783	19.4608	18.9831	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9963	19.1747	19.5270	19.9164	20.1993	20.3251	20.3483	20.3498	20.2859	19.9783	19.4608	18.9831	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9206	0.8993	0.8454	0.7455	0.5928	0.3912	0.2563	0.2674	0.5148	0.7610	0.8826	0.9280	(94)
Ext temp.	494.3054	523.5171	546.0026	533.6893	437.8445	296.6109	182.0933	181.2888	318.7497	420.3837	458.4846	471.5738	(95)
Heat loss rate W	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)
Month fracti	958.6715	929.9153	835.5048	691.8062	495.2797	307.5065	184.0317	183.4506	345.1845	555.4935	768.6252	940.6397	(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)
RHI space heating demand	345.4884	273.0996	215.3896	113.8442	42.7318	0.0000	0.0000	0.0000	0.0000	100.5217	223.3013	348.9850	(98)
												1663.3615	(98)
												1663	(98)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					5.3700
Infiltration rate					0.4035 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3430 (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	0.4373	0.4287	0.4202	0.3773	0.3687	0.3258	0.3258	0.3173	0.3430	0.3687	0.3859	0.4030 (22b)
	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5744	0.5812 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.3500	1.1450	11.8511		(27)
Heat Loss Floor			61.7200	0.1600	9.8752	75.0000	4629.0000 (28a)
External Wall	58.7300	10.3500	48.3800	0.2000	9.6760	9.0000	435.4200 (29a)
Total net area of external elements Aum(A, m ²)			120.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	31.4023			(33)
Party Wall			18.3600	0.0000	0.0000	20.0000	367.2000 (32)
Party Ceilings			61.7200			30.0000	1851.6000 (32b)
Internal Walls			87.7900			9.0000	790.1100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8073.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.8057 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1873 (36)
Total fabric heat loss							(33) + (36) = 42.5896 (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	29.1153	28.9338	28.7559	27.9203	27.7639	27.0361	27.0361	26.9013	27.3164	27.7639	28.0802	28.4109 (38)
Heat transfer coeff	71.7050	71.5234	71.3455	70.5099	70.3536	69.6257	69.6257	69.4910	69.9061	70.3536	70.6698	71.0005 (39)
Average = Sum(39)m / 12 =												70.5091 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1618	1.1588	1.1560	1.1424	1.1399	1.1281	1.1281	1.1259	1.1326	1.1399	1.1450	1.1504 (40)
HLP (average)												1.1424 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy conte	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Energy content (annual)										Total = Sum(45)m =		1296.6039 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	20.1645	17.6360	18.1988	15.8661	15.2239	13.1371	12.1735	13.9692	14.1361	16.4742	17.9829	19.5283 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0490	12.6718	14.0013	13.5178	13.9452	13.4687	13.9010	13.9297	13.4955	13.9781	13.5641	14.0398 (61)
Total heat required for water heating calculated for each month	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (64)
Heat gains from water heating, kWh/month	48.2103	42.2611	43.8410	38.5494	37.2327	32.4878	30.4598	34.4475	34.7088	40.0124	43.2531	46.7976 (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	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8490	36.2817	29.5063	22.3381	16.6980	14.0972	15.2325	19.7998	26.5752	33.7433	39.3834	41.9843 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.5717	267.3171	260.3987	245.6703	227.0783	209.6045	197.9309	195.1854	202.1038	216.8322	235.4242	252.8981 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088 (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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930 (71)
Water heating gains (Table 5)	64.7987	62.8885	58.9260	53.5408	50.0440	45.1219	40.9405	46.3004	48.2067	53.7801	60.0738	62.9000 (72)
Total internal gains	463.0247	459.2926	441.6363	414.3545	386.6256	361.6288	346.9091	354.0909	369.6909	397.1609	427.6867	450.5876 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				1.6200	10.6334	0.6300	0.7000	0.7700		5.2645 (74)		
East				3.2400	19.6403	0.6300	0.7000	0.7700		19.4475 (76)		
West				5.4900	19.6403	0.6300	0.7000	0.7700		32.9527 (80)		
Solar gains	57.6648	112.5668	185.9085	273.6635	338.7227	348.4761	331.0343	281.9277	216.8908	133.6080	71.8314	47.4802 (83)
Total gains	520.6894	571.8594	627.5448	688.0180	725.3483	710.1049	677.9434	636.0187	586.5818	530.7689	499.5181	498.0678 (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	31.2753	31.3546	31.4328	31.8053	31.8760	32.2092	32.2092	32.2717	32.0801	31.8760	31.7334	31.5856
alpha	3.0850	3.0903	3.0955	3.1204	3.1251	3.1473	3.1473	3.1514	3.1387	3.1251	3.1156	3.1057
util living area	0.9552	0.9386	0.9039	0.8317	0.7172	0.5645	0.4308	0.4723	0.6798	0.8628	0.9363	0.9602 (86)
MIT	19.2962	19.5025	19.8608	20.3124	20.6716	20.8899	20.9648	20.9525	20.7949	20.3296	19.7414	19.2552 (87)
Th 2	19.9507	19.9531	19.9554	19.9663	19.9684	19.9780	19.9780	19.9797	19.9743	19.9684	19.9642	19.9599 (88)
util rest of house	0.9476	0.9283	0.8874	0.8027	0.6686	0.4915	0.3387	0.3785	0.6112	0.8325	0.9238	0.9534 (89)
MIT 2	18.4203	18.6236	18.9726	19.4082	19.7315	19.9155	19.9643	19.9600	19.8463	19.4363	18.8694	18.3871 (90)
Living area fraction	18.7416	18.9460	19.2984	19.7399	20.0764	20.2730	20.3313	20.3241	20.1942	19.7639	19.1893	18.7055 (92)
Temperature adjustment	18.7416	18.9460	19.2984	19.7399	20.0764	20.2730	20.3313	20.3241	20.1942	19.7639	19.1893	18.7055 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9366	0.9161	0.8752	0.7955	0.6741	0.5135	0.3714	0.4112	0.6270	0.8255	0.9124	0.9430 (94)
Ext temp.	487.6556	523.8913	549.2205	547.3449	488.9519	364.6521	251.8163	261.5582	367.7877	438.1717	455.7375	469.6904 (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	1035.5312	1004.6175	913.1116	764.3193	589.3067	394.9838	259.7951	272.6880	426.0250	644.7155	854.3465	1029.9005 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	407.6195	323.0480	270.7350	156.2216	74.6640	0.0000	0.0000	0.0000	0.0000	153.6686	286.9984	416.7963 (98)
												2089.7514 (98)
												33.8586 (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													2309.1176 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	407.6195	323.0480	270.7350	156.2216	74.6640	0.0000	0.0000	0.0000	0.0000	153.6686	286.9984	416.7963	(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)	450.4083	356.9591	299.1546	172.6206	82.5016	0.0000	0.0000	0.0000	0.0000	169.7996	317.1253	460.5484	(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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282	(64)
Efficiency of water heater (217)m	89.6229	89.5568	89.4078	89.0861	88.5295	87.3000	87.3000	87.3000	87.3000	89.0437	89.4592	89.6552	(216)
Fuel for water heating, kWh/month	165.6710	145.4331	151.3588	133.9065	130.3952	115.7496	108.8859	122.6321	123.4088	139.0399	149.1742	160.8699	(219)
Water heating fuel used												1646.5250	(219)
Annual totals kWh/year													
Space heating fuel - main system												2309.1176	(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)												288.5622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4319.2047	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2309.1176	3.4800	80.3573 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1646.5250	3.4800	57.2991 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	288.5622	13.1900	38.0613 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			305.6102 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2027 (257)
SAP value		83.2218
SAP rating (Section 12)		83 (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	2309.1176	0.2160	498.7694 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1646.5250	0.2160	355.6494 (264)
Space and water heating			854.4188 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	288.5622	0.5190	149.7638 (268)
Energy saving/generation technologies			
PV Unit	-350.1600	0.5190	-181.7330 (269)
Total kg/year			861.3745 (272)
CO2 emissions per m2			13.9600 (273)
EI value			89.1844
EI rating			89 (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	$3.48 / 0.8863 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8863 = 0.2437$, stars = 4

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.7200 (1b)	x 2.4000 (2b)	= 148.1280 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.1280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1350 (8)
Measured/design AP50					Yes
Infiltration rate					5.3700
Number of sides sheltered					0.4035 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3430 (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	0.3773	0.3516	0.3516	0.3344	0.3344	0.3173	0.3173	0.3001	0.3001	0.3258	0.3173	0.3344 (22b)
Effective ac	0.5712	0.5618	0.5618	0.5559	0.5559	0.5503	0.5503	0.5450	0.5450	0.5531	0.5503	0.5559 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			10.3500	1.1450	11.8511		(27)
Heat Loss Floor			61.7200	0.1600	9.8752	75.0000	4629.0000 (28a)
External Wall	58.7300	10.3500	48.3800	0.2000	9.6760	9.0000	435.4200 (29a)
Total net area of external elements Aum(A, m ²)			120.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4023		(33)
Party Wall			18.3600	0.0000	0.0000	20.0000	367.2000 (32)
Party Ceilings			61.7200			30.0000	1851.6000 (32b)
Internal Walls			87.7900			9.0000	790.1100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8073.3300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.8057 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1873 (36)
Total fabric heat loss							(33) + (36) = 42.5896 (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	27.9203	27.4620	27.4620	27.1745	27.1745	26.9013	26.9013	26.6425	26.6425	27.0361	26.9013	27.1745 (38)
Heat transfer coeff	70.5099	70.0516	70.0516	69.7641	69.7641	69.4910	69.4910	69.2322	69.2322	69.6257	69.4910	69.7641 (39)
Average = Sum(39)m / 12 =												69.7057 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1424	1.1350	1.1350	1.1303	1.1303	1.1259	1.1259	1.1217	1.1217	1.1281	1.1259	1.1303 (40)
HLP (average)												1.1294 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0298 (42)
Average daily hot water use (litres/day)												82.4083 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.6492	87.3528	84.0565	80.7602	77.4638	74.1675	74.1675	77.4638	80.7602	84.0565	87.3528	90.6492 (44)
Energy content (annual)	134.4301	117.5734	121.3252	105.7743	101.4929	87.5807	81.1564	93.1281	94.2404	109.8281	119.8859	130.1884 (45)
Distribution loss (46)m = 0.15 x (45)m	20.1645	17.6360	18.1988	15.8661	15.2239	13.1371	12.1735	13.9692	14.1361	16.4742	17.9829	19.5283 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0490	12.6718	14.0013	13.5178	13.9452	13.4687	13.9010	13.9297	13.4955	13.9781	13.5641	14.0398 (61)
Total heat required for water heating calculated for each month	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282 (64)
Heat gains from water heating, kWh/month	48.2103	42.2611	43.8410	38.5494	37.2327	32.4878	30.4598	34.4475	34.7088	40.0124	43.2531	46.7976 (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	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895	121.7895 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8490	36.2817	29.5063	22.3381	16.6980	14.0972	15.2325	19.7998	26.5752	33.7433	39.3834	41.9843 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.5717	267.3171	260.3987	245.6703	227.0783	209.6045	197.9309	195.1854	202.1038	216.8322	235.4242	252.8981 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088	49.2088 (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)	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930	-81.1930 (71)
Water heating gains (Table 5)	64.7987	62.8885	58.9260	53.5408	50.0440	45.1219	40.9405	46.3004	48.2067	53.7801	60.0738	62.9000 (72)
Total internal gains	463.0247	459.2926	441.6363	414.3545	386.6256	361.6288	346.9091	354.0909	369.6909	397.1609	427.6867	450.5876 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				1.6200	13.4839	0.6300	0.7000	0.7700		6.6758 (74)		
East				3.2400	25.1925	0.6300	0.7000	0.7700		24.9453 (76)		
West				5.4900	25.1925	0.6300	0.7000	0.7700		42.2684 (80)		
Solar gains	73.8895	122.8281	204.2373	301.5259	351.9519	396.5219	363.5890	323.8594	249.5110	155.2683	91.7687	57.5697 (83)
Total gains	536.9142	582.1207	645.8736	715.8804	738.5774	758.1507	710.4981	677.9503	619.2020	552.4292	519.4554	508.1573 (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	31.8053	32.0134	32.0134	32.1453	32.1453	32.2717	32.2717	32.3923	32.3923	32.2092	32.2717	32.1453
alpha	3.1204	3.1342	3.1342	3.1430	3.1430	3.1514	3.1514	3.1595	3.1595	3.1473	3.1514	3.1430
util living area	0.9424	0.9244	0.8772	0.7843	0.6388	0.4438	0.3165	0.3297	0.5715	0.8044	0.9114	0.9484 (86)
MIT	19.5462	19.7254	20.0872	20.4942	20.8052	20.9559	20.9891	20.9879	20.8997	20.5520	20.0109	19.5277 (87)
Th 2	19.9663	19.9724	19.9724	19.9761	19.9761	19.9797	19.9797	19.9831	19.9831	19.9780	19.9797	19.9761 (88)
util rest of house	0.9323	0.9114	0.8559	0.7478	0.5791	0.3632	0.2214	0.2314	0.4890	0.7610	0.8934	0.9391 (89)
MIT 2	18.6777	18.8557	19.2024	19.5816	19.8484	19.9597	19.9771	19.9801	19.9303	19.6459	19.1421	18.6677 (90)
Living area fraction	18.9963	19.1747	19.5270	19.9164	20.1993	20.3251	20.3483	20.3498	20.2859	19.9783	19.4608	18.9831 (92)
Temperature adjustment	18.9963	19.1747	19.5270	19.9164	20.1993	20.3251	20.3483	20.3498	20.2859	19.9783	19.4608	18.9831 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9206	0.8993	0.8454	0.7455	0.5928	0.3912	0.2563	0.2674	0.5148	0.7610	0.8826	0.9280 (94)
Ext temp.	494.3054	523.5171	546.0026	533.6893	437.8445	296.6109	182.0933	181.2888	318.7497	420.3837	458.4846	471.5738 (95)
Heat loss rate W	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)
Month fracti	958.6715	929.9153	835.5048	691.8062	495.2797	307.5065	184.0317	183.4506	345.1845	555.4935	768.6252	940.6397 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	345.4884	273.0996	215.3896	113.8442	42.7318	0.0000	0.0000	0.0000	0.0000	100.5217	223.3013	348.9850 (98)
Space heating	1663.3615 (98)											
Space heating per m2	(98) / (4) = 26.9501 (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													1837.9685 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	345.4884	273.0996	215.3896	113.8442	42.7318	0.0000	0.0000	0.0000	0.0000	100.5217	223.3013	348.9850	(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)	381.7551	301.7675	237.9996	125.7947	47.2174	0.0000	0.0000	0.0000	0.0000	111.0737	246.7417	385.6188	(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	148.4791	130.2452	135.3266	119.2921	115.4382	101.0494	95.0574	107.0578	107.7358	123.8062	133.4501	144.2282	(64)
Efficiency of water heater (217)m	89.5137	89.4413	89.2378	88.8338	88.1420	87.3000	87.3000	87.3000	87.3000	88.7055	89.2759	89.5402	(216)
Fuel for water heating, kWh/month	165.8730	145.6208	151.6470	134.2868	130.9684	115.7496	108.8859	122.6321	123.4088	139.5699	149.4805	161.0764	(219)
Water heating fuel used												1649.1993	(219)
Annual totals kWh/year													
Space heating fuel - main system												1837.9685	(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)													288.5622 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3850.7300 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1837.9685	3.9700	72.9674 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1649.1993	3.9700	65.4732 (247)
Pumps and fans for heating	75.0000	18.2700	13.7025 (249)
Energy for lighting	288.5622	18.2700	52.7203 (250)
Additional standing charges			90.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.2700	0.0000 (252)
Total energy cost			294.8634 (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	1837.9685	0.2160	397.0012 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1649.1993	0.2160	356.2270 (264)
Space and water heating			753.2282 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	288.5622	0.5190	149.7638 (268)
Energy saving/generation technologies			
PV Unit	-350.1600	0.5190	-181.7330 (269)
Total kg/year			760.1840 (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	1837.9685	1.2200	2242.3216 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1649.1993	1.2200	2012.0231 (264)
Space and water heating			4254.3447 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	288.5622	3.0700	885.8858 (268)
Energy saving/generation technologies			
PV Unit	-350.1600	3.0700	-1074.9912 (269)
Primary energy kWh/year			4295.4894 (272)
Primary energy kWh/m2/year			69.5964 (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 83
Current environmental impact rating: B 89

(For testing purposes):			
A			Not considered
B			Not considered
C			Not considered
D			Not considered
E	Low energy lighting		Already installed
F			Not considered
G			Not considered
H			Not considered
I			Not considered
J			Not considered
K			Not considered
M			Not considered
N	Solar water heating		Not applicable
O			Not considered
P			Not considered
R			Not considered
S			Not considered
T			Not considered
U	Solar photovoltaic panels		Not applicable
A2			Not considered
A3			Not considered
T2			Not considered
W			Not considered
X			Not considered
Y			Not considered
J2			Not considered
Q2			Not considered
Z1			Not considered
Z2			Not considered
Z3			Not considered
Z4			Not considered
Z5			Not considered
V2	Wind turbine		Not applicable
L2			Not considered
Q3			Not considered
O3			Not considered
Recommended measures: (none)			
	SAP change	Cost change	CO2 change

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

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 455 TEST (23 Jan 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£66	£66	£0
Mains gas	£228	£228	£0
Space heating	£177	£177	£0
Water heating	£65	£65	£0
Lighting	£53	£53	£0
Total cost of fuels	£294	£294	£0
Total cost of uses	£295	£295	£0
Delivered energy	62 kWh/m²	62 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	70 kWh/m²	70 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	130.8 (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	293.29 (P1)
Transmission heat loss coefficient	42.59 (37)
Summer heat loss coefficient	335.88 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
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
North	1.6200	87.1704	0.6300	0.7000	0.9000	50.4438
East	3.2400	125.2818	0.6300	0.7000	0.9000	144.9962
West	5.4900	125.2818	0.6300	0.7000	0.9000	245.6880
total:						441.1280

	Jun	Jul	Aug	
Solar gains	475	441	385	(P3)
Internal gains	359	344	351	
Total summer gains	834	785	736	(P5)
Summer gain/loss ratio	2.48	2.34	2.19	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 130.8)	1.08	1.08	1.08	
Threshold temperature	18.97	20.72	20.57	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			