ASSESSMENT NOTES
Calculation Type: New Build (As Designed)

Property Reference	DE-18297 Plot 023 AS	**Issued on Date**	
Assessment Reference	DE-18297 Plot 023 AS	**Prop Type Ref**	T52 SH52 E END 2SW
Property	3 bed, 2 bath		

SAP Rating	85 B	**DER**	15.82	**TER**	17.01
Environmental	87 B	**% DER<TER**	6.99		
CO_2 Emissions (t/year)	1.26	**DFEE**	41.64	**TFEE**	47.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.48		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
Client			

ASSESSMENT NOTES - Last time updated on: 22.01.2021

Eaved Front
No Side Windows

PREDICTED ENERGY ASSESSMENT

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

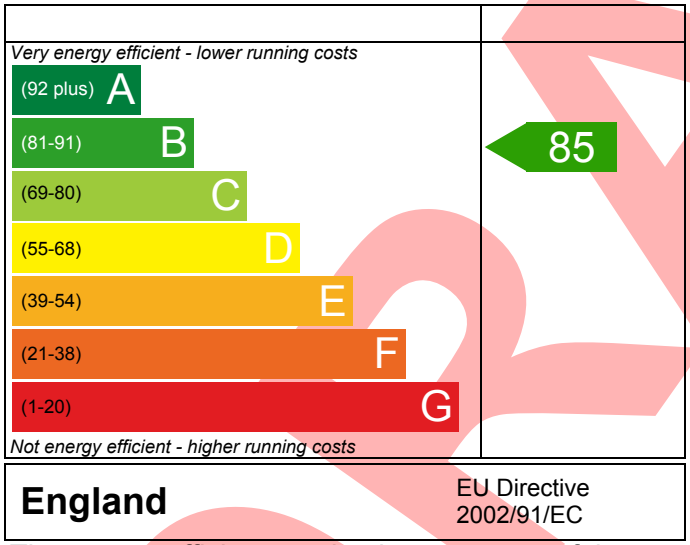
3 bed,
2 bath

Dwelling type:	House, End-Terrace
Date of assessment:	22/01/2021
Produced by:	Michael Brogden
Total floor area:	93 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

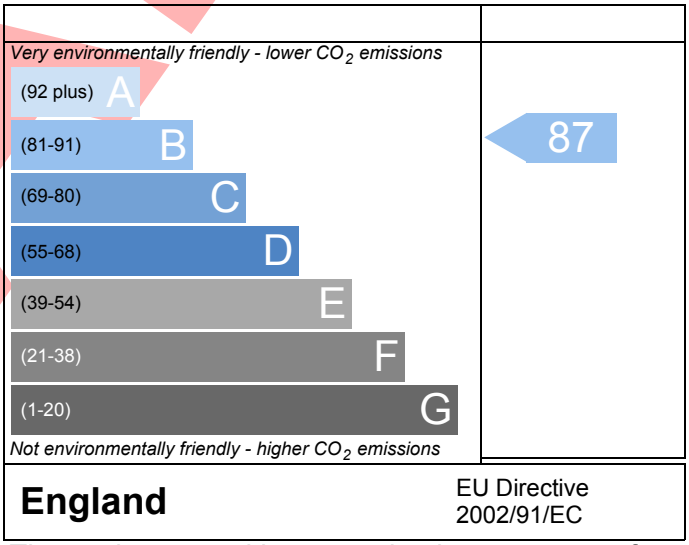
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

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 Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 023 AS	**Issued on Date**	22/01/2021
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CO_2 Emissions (t/year)	1.26	**DFEE**	41.64	**TFEE**	47.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.48		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
Client			

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2017
4.0 Sheltered Sides	4
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	19.31 m	46.50 m²	2.31 m
1st Storey:	19.31 m	46.50 m²	2.56 m

7.0 Living Area	19.29	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	192.55	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall 1	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.26	60.00	94.03	79.19

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	49.23

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	133.42
Internal Wall 2	Other	62.70	15.31

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	46.50	46.50

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	46.50

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Suspended concrete floor, carpeted	0.14	75.00	46.50

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
floor	Plasterboard ceiling, carpeted chipboard floor	18.00	46.50

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
French Door	Manufacturer	Window	Double glazed			0.71		0.70	1.41
Window	Manufacturer	Window	Double glazed			0.71		0.70	1.41
Solid door tall window	Manufacturer	Solid Door							1.00
half glazed	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front door	Solid Door	[1] External Wall 1	South							2.12	
front windows	Window	[1] External Wall 1	South	Dark-coloured curtain or roller blind	0.00					4.91	100
rear door	Window	[1] External Wall 1	North	Dark-coloured curtain or roller blind	0.00					2.12	100
rear windows	Window	[1] External Wall 1	North	Dark-coloured curtain or roller blind	0.00					4.37	100
side windows	Window	[1] External Wall 1	West	Dark-coloured curtain or roller blind	0.00					1.32	100

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

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	10.56	0.211	No	CATNIC
Independently assessed	E3 Sill	8.54	0.019	No	APA PF-WD-03
Independently assessed	E4 Jamb	27.60	0.020	No	APA PF-WD-04
Independently assessed	E5 Ground floor (normal)	19.31	0.082	No	Spantherm Bespoke
Independently assessed	E6 Intermediate floor within a dwelling	19.31	0.001	No	APA PF-IF-01
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.20	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	10.11	0.047	No	APA PF-RG-01
Independently assessed	E16 Corner (normal)	9.74	0.047	No	H+H CN01-EW01
Table K1 - Approved	E18 Party wall between dwellings	9.74	0.060	No	
Independently assessed	P1 Party wall - Ground floor	10.11	0.030	No	Spantherm Bespoke
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	10.11	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	10.11	0.036	No	Barratt Confidential Bespoke

Y-value	0.039	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	15	
Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
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	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	Yes
Sap Code	2110
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£28	B 86	
	Typical Cost	**Typical savings per year**	**Ratings after improvement SAP rating**	**Environmental Impact**
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£345	A 96	

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 023 AS	**Issued on Date**	22/01/2021
Assessment Reference	DE-18297 Plot 023 AS	**Prop Type Ref**	T52 SH52 E END 2SW
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Environmental	87 B	**% DER<TER**	6.99		
CO_2 Emissions (t/year)	1.26	**DFEE**	41.64	**TFEE**	47.57
General Requirements Compliance	Pass	**% DFEE<TFEE**	12.48		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.01	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	15.82	$kgCO_2/m^2$	Pass
	-1.19 (-7.0%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	47.57	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.64	$kWh/m^2/yr$	
	-6.0 (-12.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.35 (max. 2.00)	1.41 (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	5.00 (design value)	
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
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Time and temperature zone control		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 (Severn Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North	6.49 m², No overhang
Windows facing South	4.91 m², No overhang
Windows facing West	1.32 m², No overhang
Air change rate	4.00 ach
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours

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	5.00 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.10	W/m²K
Door U-value	1.00	W/m²K
Thermal bridging y-value	0.039	W/m²K

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

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE-18297 Plot 023 AS	**Issued on Date**	22/01/2021
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 93 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.01 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.82 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)47.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.6 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.41 (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: 5.00 (design value)
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: Time and temperature zone control 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 (Severn Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.49 m², No overhang
Windows facing South: 4.91 m², No overhang
Windows facing West: 1.32 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.039 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2677	(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	0.3414	0.3347	0.3280	0.2945	0.2878	0.2543	0.2543	0.2477	0.2677	0.2878	0.3012	0.3146	(22b)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5414	0.5323	0.5323	0.5307	0.5358	0.5414	0.5454	0.5495	(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	
French Door (Uw = 1.41)			2.1200	1.3347	2.8296			(27)
Window (Uw = 1.41)			10.6000	1.3347	14.1480			(27)
Solid door tall window			2.1200	1.0000	2.1200			(26)
Heat Loss Floor 1			46.5000	0.1400	6.5100	75.0000	3487.5000	(28a)
External Wall 1	94.0300	14.8400	79.1900	0.2600	20.5894	60.0000	4751.4000	(29a)
External Roof 1	46.5000		46.5000	0.1000	4.6500	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.8471			(33)
Party Wall 1			49.2300	0.0000	0.0000	110.0000	5415.3000	(32)
Internal Wall 1			133.4200			9.0000	1200.7800	(32c)
Internal Wall 2			15.3100			62.7000	959.9370	(32c)
floor			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			18.0000	837.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17907.4170	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.5529	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2818	(36)
Total fabric heat loss	(33) + (36) =	58.1288	(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	41.7191	41.5500	41.3843	40.6059	40.4603	39.7823	39.7823	39.6568	40.0435	40.4603	40.7549	41.0629	(38)
Heat transfer coeff	99.8479	99.6789	99.5131	98.7347	98.5891	97.9111	97.9111	97.7856	98.1723	98.5891	98.8837	99.1917	(39)
Average = Sum(39)m / 12 =												98.7340	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0718	1.0700	1.0617	1.0601	1.0528	1.0528	1.0515	1.0556	1.0601	1.0633	1.0666	(40)
HLP (average)												1.0617	(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		2.6646 (42)
Average daily hot water use (litres/day)		97.4842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1533.8058	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.8534	20.8624	21.5281	18.7687	18.0090	15.5404	14.4005	16.5248	16.7221	19.4880	21.2727	23.1008	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1382	12.7591	14.0991	13.5997	14.0206	13.5310	13.9587	13.9988	13.5684	14.0666	13.6532	14.1262	(61)
Total heat required for water heating calculated for each month													
	173.1611	151.8415	157.6196	138.7244	134.0807	117.1337	109.9619	124.1639	125.0492	143.9867	155.4711	168.1313	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	173.1611	151.8415	157.6196	138.7244	134.0807	117.1337	109.9619	124.1639	125.0492	143.9867	155.4711	168.1313	(64)
								Total per year (kWh/year) = Sum(64)m =				1699.3253	(64)
Heat gains from water heating, kWh/month													
	56.4097	49.4347	51.2454	45.0039	43.4251	37.8307	35.4107	40.1296	40.4595	46.7151	50.5678	54.7383	(65)

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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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	75.8194	73.5635	68.8782	62.5054	58.3671	52.5426	47.5951	53.9376	56.1937	62.7891	70.2330	73.5729	(72)
Total internal gains													
	409.7813	407.4346	392.4577	368.3501	343.7860	320.3174	305.2356	311.6690	324.2166	348.5468	376.4166	397.4005	(73)

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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	2.1200	10.6334	0.7100	0.7000	0.7700	7.7642	(74)
North	4.3700	10.6334	0.7100	0.7000	0.7700	16.0045	(74)
South	4.9100	46.7521	0.7100	0.7000	0.7700	79.0627	(78)
West	1.3200	19.6403	0.7100	0.7000	0.7700	8.9292	(80)

Solar gains	111.7607	192.3750	270.8916	352.3513	412.6868	418.3723	399.6929	352.8638	298.5575	214.4580	134.1717	95.4752	(83)
Total gains	521.5420	599.8096	663.3493	720.7015	756.4727	738.6897	704.9285	664.5328	622.7741	563.0048	510.5884	492.8757	(84)

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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	49.8186	49.9031	49.9862	50.3803	50.4547	50.8041	50.8041	50.8693	50.6689	50.4547	50.3044	50.1482	
alpha	4.3212	4.3269	4.3324	4.3587	4.3636	4.3869	4.3869	4.3913	4.3779	4.3636	4.3536	4.3432	
util living area													
	0.9955	0.9911	0.9811	0.9530	0.8825	0.7419	0.5817	0.6320	0.8466	0.9657	0.9915	0.9964	(86)
MIT	19.5585	19.7311	20.0048	20.3608	20.6861	20.9009	20.9738	20.9624	20.8107	20.3935	19.9075	19.5222	(87)
Th 2	20.0224	20.0239	20.0254	20.0323	20.0336	20.0396	20.0396	20.0407	20.0372	20.0336	20.0309	20.0282	(88)
util rest of house													
	0.9943	0.9888	0.9758	0.9389	0.8455	0.6632	0.4678	0.5191	0.7861	0.9526	0.9889	0.9955	(89)
MIT 2	18.0895	18.3418	18.7397	19.2534	19.6979	19.9607	20.0266	20.0203	19.8650	19.3074	18.6049	18.0405	(90)
Living area fraction									fLA = Living area / (4) =			0.2074	(91)
MIT	18.3942	18.6300	19.0021	19.4831	19.9029	20.1557	20.2231	20.2157	20.0612	19.5327	18.8751	18.3478	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2442	18.4800	18.8521	19.3331	19.7529	20.0057	20.0731	20.0657	19.9112	19.3827	18.7251	18.1978	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9910	0.9833	0.9670	0.9257	0.8327	0.6601	0.4720	0.5223	0.7767	0.9406	0.9835	0.9928	(94)
Useful gains	516.8318	589.8095	641.4335	667.1782	629.8915	487.5972	332.7187	347.0640	483.7185	529.5844	502.1890	489.3238	(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													
	1392.2960	1353.6385	1229.1989	1030.1095	793.9275	529.2757	340.0518	358.4498	570.4970	865.8793	1149.5351	1388.4676	(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													
	651.3454	513.2930	437.2975	261.3105	122.0428	0.0000	0.0000	0.0000	0.0000	250.2034	466.0892	668.9630	(98)
Space heating												3370.5449	(98)
Space heating per m2											(98) / (4) =	36.2424	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3724.3590	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	651.3454	513.2930	437.2975	261.3105	122.0428	0.0000	0.0000	0.0000	0.0000	250.2034	466.0892	668.9630	(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)													
	719.7187	567.1746	483.2017	288.7409	134.8539	0.0000	0.0000	0.0000	0.0000	276.4679	515.0157	739.1857	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	173.1611	151.8415	157.6196	138.7244	134.0807	117.1337	109.9619	124.1639	125.0492	143.9867	155.4711	168.1313	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8086	89.7490	89.6296	89.3641	88.7961	87.3000	87.3000	87.3000	87.3000	89.3043	89.6778	89.8386	(217)
Fuel for water heating, kWh/month													
	192.8112	169.1846	175.8568	155.2351	150.9985	134.1738	125.9587	142.2267	143.2408	161.2316	173.3664	187.1482	(219)
Water heating fuel used												1911.4323	(219)
Annual totals kWh/year													
Space heating fuel - main system												3724.3590	(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)	415.0697	(232)
Total delivered energy for all uses	6125.8609	(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	3724.3590	0.2160	804.4615	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.4323	0.2160	412.8694	(264)
Space and water heating			1217.3309	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.0697	0.5190	215.4212	(268)
Total CO2, kg/year			1471.6771	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8200	(273)

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

DER		15.8200	ZC1
Total Floor Area	TFA	93.0000	
Assumed number of occupants	N	2.6646	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5785	ZC2
CO2 emissions from cooking, equation (L16)		1.9672	ZC3
Total CO2 emissions		33.3657	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.3657	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2677	(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	0.3414	0.3347	0.3280	0.2945	0.2878	0.2543	0.2543	0.2477	0.2677	0.2878	0.3012	0.3146	(22b)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5414	0.5323	0.5323	0.5307	0.5358	0.5414	0.5454	0.5495	(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 Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			12.7200	1.3258	16.8636			(27)
Heat Loss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	94.0300	14.8400	79.1900	0.1800	14.2542			(29a)
External Roof 1	46.5000		46.5000	0.1300	6.0450			(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3278			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0662	(36)
Total fabric heat loss					(33) + (36) =		55.3940	(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	41.7191	41.5500	41.3843	40.6059	40.4603	39.7823	39.7823	39.6568	40.0435	40.4603	40.7549	41.0629	(38)
Heat transfer coeff	97.1131	96.9441	96.7784	95.9999	95.8543	95.1763	95.1763	95.0508	95.4375	95.8543	96.1489	96.4569	(39)
Average = Sum(39)m / 12 =												95.9993	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0442	1.0424	1.0406	1.0323	1.0307	1.0234	1.0234	1.0221	1.0262	1.0307	1.0339	1.0372	(40)
HLP (average)												1.0323	(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		2.6646 (42)
Average daily hot water use (litres/day)		97.4842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)
Energy content (annual)										Total = Sum(45)m =		1533.8058	(45)
Distribution loss (46)m = 0.15 x (45)m	23.8534	20.8624	21.5281	18.7687	18.0090	15.5404	14.4005	16.5248	16.7221	19.4880	21.2727	23.1008	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6704	47.1129	46.6963	43.2670	44.7092	46.6963	47.1129	50.6704	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	209.9818	185.1098	194.1910	172.2376	166.7564	146.8697	140.7124	156.8613	158.5937	180.5905	191.1330	204.9640	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	209.9818	185.1098	194.1910	172.2376	166.7564	146.8697	140.7124	156.8613	158.5937	180.5905	191.1330	204.9640	(64)
								Total per year (kWh/year) = Sum(64)m =				2108.0013	(64)
Heat gains from water heating, kWh/month													
	65.6148	57.7517	60.3882	53.3822	51.5941	45.2647	43.0984	48.3040	48.8456	55.8660	59.4832	63.9464	(65)

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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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	88.1920	85.9401	81.1669	74.1419	69.3469	62.8676	57.9279	64.9247	67.8411	75.0888	82.6156	85.9495	(72)
Total internal gains													
	422.1539	419.8112	404.7464	379.9867	354.7657	330.6424	315.5684	322.6560	335.8640	360.8465	388.7992	409.7771	(73)

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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	6.4900	10.6334	0.6300	0.7000	0.7700	21.0906	(74)
South	4.9100	46.7521	0.6300	0.7000	0.7700	70.1543	(78)
West	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231	(80)

Solar gains	99.1679	170.6990	240.3686	312.6498	366.1868	371.2317	354.6570	313.1045	264.9172	190.2938	119.0538	84.7174	(83)
Total gains	521.3218	590.5102	645.1151	692.6364	720.9525	701.8742	670.2255	635.7605	600.7812	551.1402	507.8530	494.4945	(84)

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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	66.5032	66.6192	66.7332	67.2743	67.3766	67.8565	67.8565	67.9461	67.6708	67.3766	67.1701	66.9556	
alpha	5.4335	5.4413	5.4489	5.4850	5.4918	5.5238	5.5238	5.5297	5.5114	5.4918	5.4780	5.4637	
util living area													
	0.9986	0.9969	0.9921	0.9755	0.9203	0.7810	0.6065	0.6581	0.8825	0.9824	0.9969	0.9989	(86)
MIT	19.8661	19.9987	20.2136	20.4985	20.7647	20.9370	20.9873	20.9805	20.8674	20.5298	20.1435	19.8385	(87)
Th 2	20.0466	20.0481	20.0496	20.0565	20.0578	20.0639	20.0639	20.0650	20.0615	20.0578	20.0552	20.0525	(88)
util rest of house													
	0.9981	0.9958	0.9892	0.9656	0.8869	0.6983	0.4869	0.5389	0.8225	0.9735	0.9956	0.9986	(89)
MIT 2	18.5251	18.7198	19.0338	19.4486	19.8133	20.0185	20.0588	20.0563	19.9483	19.4983	18.9371	18.4891	(90)
Living area fraction									fLA = Living area / (4) =			0.2074	(91)
MIT	18.8033	18.9850	19.2785	19.6664	20.0106	20.2090	20.2514	20.2480	20.1390	19.7123	19.1873	18.7690	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8033	18.9850	19.2785	19.6664	20.0106	20.2090	20.2514	20.2480	20.1390	19.7123	19.1873	18.7690	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9940	0.9860	0.9603	0.8849	0.7123	0.5118	0.5635	0.8283	0.9690	0.9939	0.9978	(94)
Useful gains	519.8367	586.9923	636.0785	665.1560	637.9380	499.9763	343.0172	358.2454	497.6353	534.0598	504.7715	493.4280	(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													
	1408.4581	1365.4618	1236.6798	1033.5714	796.6084	533.8480	347.5256	365.7521	576.3428	873.4518	1162.1812	1405.2793	(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													
	661.1343	523.1315	446.8473	265.2592	118.0508	0.0000	0.0000	0.0000	0.0000	252.5076	473.3350	678.4174	(98)
Space heating												3418.6831	(98)
Space heating per m2											(98) / (4) =	36.7600	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3660.2603	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	661.1343	523.1315	446.8473	265.2592	118.0508	0.0000	0.0000	0.0000	0.0000	252.5076	473.3350	678.4174	(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)													
	707.8526	560.0980	478.4233	284.0034	126.3928	0.0000	0.0000	0.0000	0.0000	270.3508	506.7826	726.3569	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	209.9818	185.1098	194.1910	172.2376	166.7564	146.8697	140.7124	156.8613	158.5937	180.5905	191.1330	204.9640	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.7398	87.5228	87.0820	86.1348	84.1992	80.3000	80.3000	80.3000	80.3000	85.8951	87.2435	87.8366	(217)
Fuel for water heating, kWh/month													
	239.3232	211.4990	222.9979	199.9628	198.0498	182.9013	175.2334	195.3441	197.5015	210.2454	219.0799	233.3469	(219)
Water heating fuel used												2485.4851	(219)
Annual totals kWh/year													
Space heating fuel - main system												3660.2603	(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)												415.0697	(232)
Total delivered energy for all uses												6635.8151	(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	3660.2603	0.2160	790.6162	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2485.4851	0.2160	536.8648	(264)
Space and water heating			1327.4810	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	415.0697	0.5190	215.4212	(268)
Total CO2, kg/m2/year			1581.8272	(272)
Emissions per m2 for space and water heating			14.2740	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.3164	(272b)
Emissions per m2 for pumps and fans			0.4185	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2740 * 1.00) + 2.3164 + 0.4185, rounded to 2 d.p.			17.0100	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2677	(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	0.3414	0.3347	0.3280	0.2945	0.2878	0.2543	0.2543	0.2477	0.2677	0.2878	0.3012	0.3146	(22b)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5414	0.5323	0.5323	0.5307	0.5358	0.5414	0.5454	0.5495	(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	
French Door (Uw = 1.41)			2.1200	1.3347	2.8296			(27)
Window (Uw = 1.41)			10.6000	1.3347	14.1480			(27)
Solid door tall window			2.1200	1.0000	2.1200			(26)
Heat Loss Floor 1			46.5000	0.1400	6.5100	75.0000	3487.5000	(28a)
External Wall 1	94.0300	14.8400	79.1900	0.2600	20.5894	60.0000	4751.4000	(29a)
External Roof 1	46.5000		46.5000	0.1000	4.6500	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.8471			(33)
Party Wall 1			49.2300	0.0000	0.0000	110.0000	5415.3000	(32)
Internal Wall 1			133.4200			9.0000	1200.7800	(32c)
Internal Wall 2			15.3100			62.7000	959.9370	(32c)
floor			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17488.9170 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		188.0529 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2818 (36)
Total fabric heat loss	(33) + (36) =	58.1288 (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	41.7191	41.5500	41.3843	40.6059	40.4603	39.7823	39.7823	39.6568	40.0435	40.4603	40.7549	41.0629	(38)
Heat transfer coeff	99.8479	99.6789	99.5131	98.7347	98.5891	97.9111	97.9111	97.7856	98.1723	98.5891	98.8837	99.1917	(39)
Average = Sum(39)m / 12 =												98.7340	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0718	1.0700	1.0617	1.0601	1.0528	1.0528	1.0515	1.0556	1.0601	1.0633	1.0666	(40)
HLP (average)												1.0617	(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	2.6646 (42)
Average daily hot water use (litres/day)	97.4842 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1533.8058 (45)

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)

Heat gains from water heating, kWh/month

33.7924	29.5550	30.4981	26.5890	25.5128	22.0156	20.4007	23.4101	23.6897	27.6080	30.1363	32.7261	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)

-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)

Water heating gains (Table 5)

45.4198	43.9807	40.9921	36.9292	34.2914	30.5772	27.4203	31.4652	32.9023	37.1076	41.8560	43.9867	(72)

Total internal gains

376.3817	374.8518	361.5716	339.7739	316.7102	295.3521	282.0608	286.1965	297.9252	319.8652	345.0396	364.8142	(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	2.1200	10.6334	0.7100	0.7000	0.7700	7.7642	(74)
North	4.3700	10.6334	0.7100	0.7000	0.7700	16.0045	(74)
South	4.9100	46.7521	0.7100	0.7000	0.7700	79.0627	(78)
West	1.3200	19.6403	0.7100	0.7000	0.7700	8.9292	(80)

Solar gains 111.7607	192.3750	270.8916	352.3513	412.6868	418.3723	399.6929	352.8638	298.5575	214.4580	134.1717	95.4752	(83)
Total gains 488.1424	567.2268	632.4632	692.1252	729.3969	713.7243	681.7537	639.0603	596.4827	534.3233	479.2113	460.2894	(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	48.6543	48.7368	48.8180	49.2029	49.2756	49.6168	49.6168	49.6805	49.4848	49.2756	49.1287	48.9762	
alpha	4.2436	4.2491	4.2545	4.2802	4.2850	4.3078	4.3078	4.3120	4.2990	4.2850	4.2752	4.2651	
util living area													
	0.9961	0.9922	0.9830	0.9569	0.8906	0.7554	0.5966	0.6496	0.8590	0.9697	0.9928	0.9970	(86)
MIT	19.4905	19.6678	19.9496	20.3178	20.6574	20.8876	20.9691	20.9555	20.7883	20.3498	19.8487	19.4543	(87)
Th 2	20.0224	20.0239	20.0254	20.0323	20.0336	20.0396	20.0396	20.0407	20.0372	20.0336	20.0309	20.0282	(88)
util rest of house													
	0.9951	0.9901	0.9783	0.9440	0.8557	0.6782	0.4817	0.5364	0.8018	0.9582	0.9905	0.9962	(89)
MIT 2	18.6370	18.8146	19.0952	19.4610	19.7804	19.9772	20.0288	20.0237	19.9030	19.4976	19.0010	18.6055	(90)
Living area fraction									fLA = Living area / (4) =			0.2074	(91)
MIT	18.8140	18.9916	19.2724	19.6387	19.9623	20.1660	20.2239	20.2169	20.0866	19.6744	19.1768	18.7816	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8140	18.9916	19.2724	19.6387	19.9623	20.1660	20.2239	20.2169	20.0866	19.6744	19.1768	18.7816	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9872	0.9735	0.9375	0.8527	0.6894	0.5050	0.5587	0.8052	0.9526	0.9878	0.9948	(94)
Useful gains	484.9349	559.9901	615.7257	648.8530	621.9438	492.0146	344.2758	357.0362	480.3075	509.0221	473.3779	457.9076	(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													
	1449.1965	1404.6298	1271.0259	1060.2827	814.5740	544.9765	354.8154	373.2412	587.7200	894.6340	1194.2035	1446.3692	(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													
	717.4106	567.5979	487.5433	296.2293	143.3169	0.0000	0.0000	0.0000	0.0000	286.8953	518.9944	735.4154	(98)
Space heating												3753.4032	(98)
Space heating per m2											(98) / (4) =	40.3592	(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												

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	920.3646	724.5424	743.1704	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8183	0.8868	0.8613	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	753.1598	642.5153	640.1181	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	935.9022	896.4444	848.5370	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	131.5746	188.9232	155.0637	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												475.5615 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	32.8936	47.2308	38.7659	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												118.8904 (107)
Space cooling per m2												1.2784 (108)
Energy for space heating												40.3592 (99)
Energy for space cooling												1.2784 (108)
Total												41.6376 (109)
Dwelling Fabric Energy Efficiency (DFEE)												41.6 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.3100 (2b)	=	107.4150	(1b) - (3b)
First floor	46.5000 (1c)	x	2.5600 (2c)	=	119.0400	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	226.4550	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1325	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3825	(18)
Number of sides sheltered		4	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2677	(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	0.3414	0.3347	0.3280	0.2945	0.2878	0.2543	0.2543	0.2477	0.2677	0.2878	0.3012	0.3146	(22b)
Effective ac	0.5583	0.5560	0.5538	0.5434	0.5414	0.5323	0.5323	0.5307	0.5358	0.5414	0.5454	0.5495	(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 Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			12.7200	1.3258	16.8636			(27)
Heat Loss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	94.0300	14.8400	79.1900	0.1800	14.2542			(29a)
External Roof 1	46.5000		46.5000	0.1300	6.0450			(30)
Total net area of external elements Aum(A, m2)			187.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.3278			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0662	(36)
Total fabric heat loss					(33) + (36) =		55.3940	(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	41.7191	41.5500	41.3843	40.6059	40.4603	39.7823	39.7823	39.6568	40.0435	40.4603	40.7549	41.0629	(38)
Heat transfer coeff	97.1131	96.9441	96.7784	95.9999	95.8543	95.1763	95.1763	95.0508	95.4375	95.8543	96.1489	96.4569	(39)
Average = Sum(39)m / 12 =												95.9993	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0442	1.0424	1.0406	1.0323	1.0307	1.0234	1.0234	1.0221	1.0262	1.0307	1.0339	1.0372	(40)
HLP (average)												1.0323	(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	2.6646	(42)
Average daily hot water use (litres/day)	97.4842	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2326	103.3332	99.4339	95.5345	91.6351	87.7358	87.7358	91.6351	95.5345	99.4339	103.3332	107.2326	(44)
Energy conte	159.0228	139.0824	143.5206	125.1247	120.0601	103.6028	96.0032	110.1651	111.4808	129.9201	141.8180	154.0051	(45)
Energy content (annual)										Total = Sum(45)m =		1533.8058	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	33.7924	29.5550	30.4981	26.5890	25.5128	22.0156	20.4007	23.4101	23.6897	27.6080	30.1363	32.7261	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.5030	20.8751	16.9768	12.8525	9.6074	8.1110	8.7642	11.3920	15.2904	19.4146	22.6598	24.1562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	45.4198	43.9807	40.9921	36.9292	34.2914	30.5772	27.4203	31.4652	32.9023	37.1076	41.8560	43.9867	(72)
Total internal gains													
	376.3817	374.8518	361.5716	339.7739	316.7102	295.3521	282.0608	286.1965	297.9252	319.8652	345.0396	364.8142	(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	6.4900	10.6334	0.6300	0.7000	0.7700	21.0906	(74)
South	4.9100	46.7521	0.6300	0.7000	0.7700	70.1543	(78)
West	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231	(80)

Solar gains	99.1679	170.6990	240.3686	312.6498	366.1868	371.2317	354.6570	313.1045	264.9172	190.2938	119.0538	84.7174	(83)
Total gains	475.5496	545.5507	601.9402	652.4237	682.8970	666.5838	636.7178	599.3010	562.8424	510.1590	464.0934	449.5317	(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	66.5032	66.6192	66.7332	67.2743	67.3766	67.8565	67.8565	67.9461	67.6708	67.3766	67.1701	66.9556	
alpha	5.4335	5.4413	5.4489	5.4850	5.4918	5.5238	5.5238	5.5297	5.5114	5.4918	5.4780	5.4637	
util living area													
	0.9991	0.9979	0.9943	0.9810	0.9342	0.8061	0.6339	0.6900	0.9045	0.9875	0.9980	0.9993	(86)
MIT	19.8193	19.9531	20.1708	20.4618	20.7383	20.9258	20.9843	20.9755	20.8456	20.4910	20.0990	19.7924	(87)
Th 2	20.0466	20.0481	20.0496	20.0565	20.0578	20.0639	20.0639	20.0650	20.0615	20.0578	20.0552	20.0525	(88)
util rest of house													
	0.9988	0.9971	0.9922	0.9731	0.9049	0.7259	0.5111	0.5688	0.8510	0.9809	0.9972	0.9991	(89)
MIT 2	18.9611	19.0958	19.3138	19.6065	19.8687	20.0265	20.0595	20.0573	19.9686	19.6386	19.2476	18.9390	(90)
Living area fraction									fLA = Living area / (4) =			0.2074	(91)
MIT	19.1391	19.2736	19.4916	19.7839	20.0491	20.2130	20.2513	20.2477	20.1505	19.8154	19.4242	19.1160	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1391	19.2736	19.4916	19.7839	20.0491	20.2130	20.2513	20.2477	20.1505	19.8154	19.4242	19.1160	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9984	0.9963	0.9905	0.9702	0.9045	0.7401	0.5369	0.5941	0.8570	0.9787	0.9964	0.9988	(94)
Useful gains	474.7780	543.5270	596.2210	632.9965	617.6976	493.3462	341.8424	356.0573	482.3837	499.2790	462.4274	448.9948	(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													
	1441.0732	1393.4390	1257.3046	1044.8511	800.2958	534.2270	347.5191	365.7291	577.4426	883.3351	1184.9572	1438.7537	(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													
	718.9236	571.1408	491.8462	296.5353	135.8531	0.0000	0.0000	0.0000	0.0000	285.7377	520.2215	736.3807	(98)
Space heating												3756.6389	(98)
Space heating per m2											(98) / (4) =	40.3940	(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	894.6577	704.3050	722.3861	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8400	0.9120	0.8875	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	751.5392	642.3278	641.0991	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	880.8029	843.8052	802.0651	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	93.0699	149.8992	119.7587	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												362.7278	(104)

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Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)

0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)

Space cooling kWh

0.0000	0.0000	0.0000	0.0000	0.0000	23.2675	37.4748	29.9397	0.0000	0.0000	0.0000	0.0000 (107)

Space cooling 90.6820 (107)
Space cooling per m2 0.9751 (108)
Energy for space heating 40.3940 (99)
Energy for space cooling 0.9751 (108)
Total 41.3690 (109)
Target Fabric Energy Efficiency (TFEE) 47.6 (109)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	192.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 298.92 (P1)
Transmission heat loss coefficient 58.13 (37)
Summer heat loss coefficient 357.05 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
South	0.850	0.90	1.000	0.765 (P8)
West	0.850	0.90	1.000	0.765 (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	2.1200	82.4373	0.7100	0.7000	0.7650	59.8026
North	4.3700	82.4373	0.7100	0.7000	0.7650	123.2724
South	4.9100	113.6726	0.7100	0.7000	0.7650	190.9843
West	1.3200	119.1985	0.7100	0.7000	0.7650	53.8400
total:						427.8993

	Jun	Jul	Aug	
Solar gains	465	428	383	(P3)
Internal gains	469	449	459	
Total summer gains	934	877	842	(P5)
Summer gain/loss ratio	2.62	2.46	2.36	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 192.6)	0.65	0.65	0.65	
Threshold temperature	18.27	19.81	19.71	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant