ASSESSMENT NOTES
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE19091 - 070 AS	**Issued on Date**	07/09/2020
Assessment Reference	DE19091 - 070 AS	**Prop Type Ref**	T52 Eaves 2FW MID E25+
Property	3 bed, 2 bath		

SAP Rating	86 B	**DER**	14.74	**TER**	16.34
Environmental	89 B	**% DER<TER**	9.79		
CO_2 Emissions (t/year)	1.04	**DFEE**	34.87	**TFEE**	41.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.19		

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: 07.09.2020

Celotex and ISOVER are separate legal entities to Darren Evans Assessments. Darren Evans Assessments provides the warranty and assumes responsibility for the Energy Assessments Service offered under a commercial agreement with Celotex and ISOVER.

PREDICTED ENERGY ASSESSMENT

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

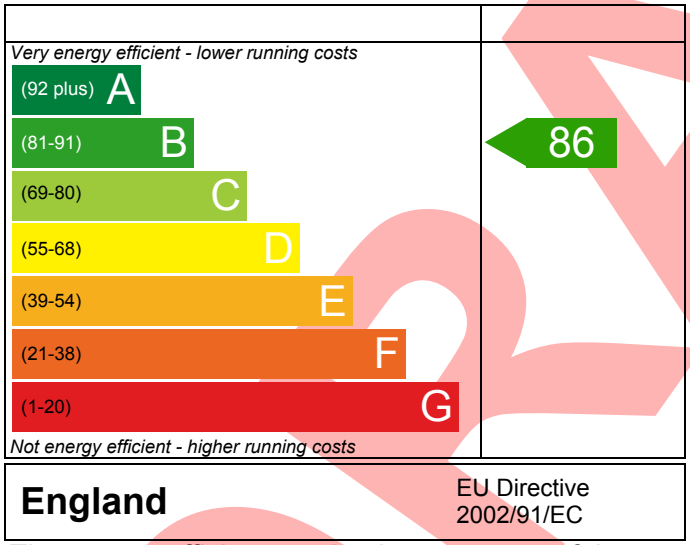
3 bed,
2 bath

Dwelling type:	House, End-Terrace
Date of assessment:	07/09/2020
Produced by:	Michael Brogden
Total floor area:	84.64 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.

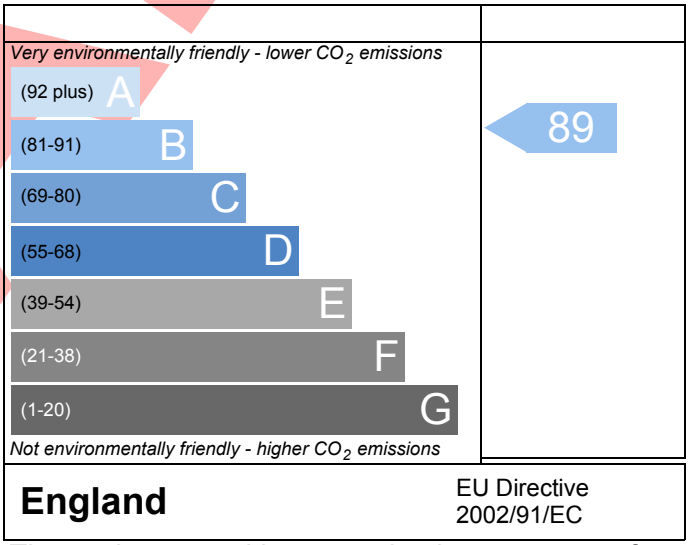
Energy Efficiency Rating



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.

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

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CO_2 Emissions (t/year)	1.04	**DFEE**	34.87	**TFEE**	41.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.19		

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)	16.34	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.74	$kgCO_2/m^2$	Pass
	-1.60 (-9.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.61	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	34.87	$kWh/m^2/yr$	
	-6.7 (-16.1%)	$kWh/m^2/yr$	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	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.34 (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)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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

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 South East Windows facing North West	4.91 m², No overhang 6.22 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)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.10	W/m²K
Floor U-value	0.12	W/m²K
Door U-value	1.00	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.

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.12r02

RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£29	B 87	B 91	Recommended
Photovoltaic	£3,500 - £5,500	£341	A 97	A 100	Recommended
Wind turbine			0	0	Not applicable
Totals	**£7,500 - £11,500**	**£370**	**A 97**	**A 100**	

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

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Assessment Reference	DE19091 - 070 AS	**Prop Type Ref**	T52 Eaves 2FW MID E25+
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Environmental	89 B	**% DER<TER**	9.79		
CO_2 Emissions (t/year)	1.04	**DFEE**	34.87	**TFEE**	41.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.19		

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 East
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:	9.20 m	42.32 m²	2.31 m
1st Storey:	9.20 m	42.32 m²	2.56 m

7.0 Living Area	20.37	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	239.58	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	44.80	31.55

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	89.61

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Plasterboard on timber frame	9.00	120.27
Internal Wall 2	Other	60.00	14.76

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	42.32	42.32

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	42.32

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Ground Floor - Solid	Slab on ground, screed over insulation	0.12	110.00	42.32

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
floor	Plasterboard ceiling, carpeted chipboard floor	18.00	42.32

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 East							2.12	
front windows	Window	[1] External Wall 1	South East	Dark-coloured curtain or roller blind	0.00					4.91	100
rear door	Window	[1] External Wall 1	North West	Dark-coloured curtain or roller blind	0.00					2.12	100
rear windows	Window	[1] External Wall 1	North West	Dark-coloured curtain or roller blind	0.00					4.10	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)	9.30	0.211	No	H+H LN01 - EW01
Independently assessed	E3 Sill	7.28	0.019	No	APA PF-WD-03
Independently assessed	E4 Jamb	23.10	0.020	No	APA PF-WD-04
Independently assessed	E5 Ground floor (normal)	9.20	0.105	No	Barratt Confidential Bespoke
Independently assessed	E6 Intermediate floor within a dwelling	9.20	0.001	No	APA PF-IF-01
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.20	0.060	No	MCI-RE-01/2
Table K1 - Approved	E18 Party wall between dwellings	14.88	0.060	No	MCI-IW-01
Table K1 - Default	E25 Staggered party wall between dwellings	4.96	0.120	No	Default
Independently assessed	P1 Party wall - Ground floor	18.40	0.056	No	Barratt Confidential Bespoke
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	18.40	0.000	No	Default
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	18.40	0.036	No	Barratt Confidential Bespoke

Y-value	0.056	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	£29	B 87	
	Typical Cost	**Typical savings per year**	**Ratings after improvement SAP rating**	**Environmental Impact**
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£341	A 97	

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

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General Requirements Compliance	Pass	**% DFEE<TFEE**	16.19		

Assessor Details	Mr. Michael Brogden, Michael Brogden, Tel: 0333 5777 577, michael@darren-evans.co.uk	**Assessor ID**	R034-0001
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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 85 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) 16.34 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.74 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)41.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)34.9 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	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.34 (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 South East: 4.91 m², No overhang
Windows facing North West: 6.22 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
Floor U-value 0.12 W/m²K
Door U-value 1.00 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	42.3200 (1b)	x	2.3100 (2b)	=	97.7592 (1b) - (3b)	
First floor	42.3200 (1c)	x	2.5600 (2c)	=	108.3392 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.6400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	206.0984	(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) =	0.1456	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3956	(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) =	0.2769	(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	0.3530	0.3461	0.3392	0.3046	0.2977	0.2630	0.2630	0.2561	0.2769	0.2977	0.3115	0.3253	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(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)			9.0100	1.3347	12.0258			(27)
Solid door tall window			2.1200	1.0000	2.1200			(26)
Heat Loss Floor 1			42.3200	0.1200	5.0784	110.0000	4655.2000	(28a)
External Wall 1	44.8000	13.2500	31.5500	0.2600	8.2030	60.0000	1893.0000	(29a)
External Roof 1	42.3200		42.3200	0.1000	4.2320	9.0000	380.8800	(30)
Total net area of external elements Aum(A, m2)			129.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.4889			(33)
Party Wall 1			89.6100	0.0000	0.0000	110.0000	9857.1000	(32)
Internal Wall 1			120.2700			9.0000	1082.4300	(32c)
Internal Wall 2			14.7600			60.0000	885.6000	(32c)
floor			42.3200			18.0000	761.7600	(32d)
Internal Ceiling 1			42.3200			18.0000	761.7600	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	20277.7300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		239.5762 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2706 (36)
Total fabric heat loss	(33) + (36) =	41.7595 (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	38.2446	38.0801	37.9187	37.1610	37.0192	36.3593	36.3593	36.2371	36.6135	37.0192	37.3060	37.6059	(38)
Heat transfer coeff	80.0041	79.8395	79.6782	78.9205	78.7787	78.1188	78.1188	77.9965	78.3730	78.7787	79.0655	79.3653	(39)
Average = Sum(39)m / 12 =												78.9198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9452	0.9433	0.9414	0.9324	0.9308	0.9230	0.9230	0.9215	0.9260	0.9308	0.9341	0.9377	(40)
HLP (average)												0.9324	(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	2.5450 (42)
Average daily hot water use (litres/day)	94.6445 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.1089	100.3232	96.5374	92.7516	88.9658	85.1800	85.1800	88.9658	92.7516	96.5374	100.3232	104.1089	(44)
Energy conte	154.3906	135.0310	139.3399	121.4799	116.5628	100.5849	93.2067	106.9560	108.2334	126.1356	137.6869	149.5190	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1489.1265	(45)
Distribution loss (46)m = 0.15 x (45)m													
	23.1586	20.2546	20.9010	18.2220	17.4844	15.0877	13.9810	16.0434	16.2350	18.9203	20.6530	22.4279	(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	14.1271	12.7494	14.0794	13.5832	14.0054	13.5184	13.9471	13.9849	13.5537	14.0488	13.6432	14.1154	(61)
Total heat required for water heating calculated for each month													
	168.5177	147.7803	153.4193	135.0631	130.5683	114.1033	107.1538	120.9409	121.7871	140.1844	151.3301	163.6344	(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													
	168.5177	147.7803	153.4193	135.0631	130.5683	114.1033	107.1538	120.9409	121.7871	140.1844	151.3301	163.6344	(64)
										Total per year (kWh/year) = Sum(64)m =		1654.4826	(64)
Heat gains from water heating, kWh/month													
	54.8666	48.0851	49.8504	43.7879	42.2585	36.8241	34.4780	39.0591	39.3760	45.4523	49.1917	53.2439	(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	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1924	19.7111	16.0301	12.1358	9.0717	7.6587	8.2755	10.7568	14.4377	18.3320	21.3962	22.8091	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.8645	231.2394	225.2547	212.5141	196.4313	181.3158	171.2177	168.8428	174.8274	187.5681	203.6508	218.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	(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)													
	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	(71)
Water heating gains (Table 5)													
	73.7455	71.5553	67.0032	60.8165	56.7991	51.1445	46.3414	52.4988	54.6889	61.0918	68.3218	71.5644	(72)
Total internal gains													
	388.9778	386.6812	372.4634	349.6418	326.4775	304.2945	290.0100	296.2738	308.1296	331.1673	357.5443	377.3154	(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	
Northwest	2.1200	11.2829	0.7100	0.7000	0.7700	8.2385	(81)
Southeast	4.9100	36.7938	0.7100	0.7000	0.7700	62.2223	(77)
Northwest	4.1000	11.2829	0.7100	0.7000	0.7700	15.9329	(81)

Solar gains	86.3937	155.1893	233.6626	325.2647	396.9503	408.4312	387.7988	332.1241	265.0388	177.2672	104.9419	72.9889	(83)
Total gains	475.3715	541.8704	606.1260	674.9065	723.4278	712.7256	677.8088	628.3979	573.1684	508.4345	462.4862	450.3043	(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	70.4052	70.5503	70.6931	71.3719	71.5003	72.1044	72.1044	72.2173	71.8705	71.5003	71.2410	70.9718	
alpha	5.6937	5.7034	5.7129	5.7581	5.7667	5.8070	5.8070	5.8145	5.7914	5.7667	5.7494	5.7315	
util living area													
	0.9982	0.9958	0.9879	0.9560	0.8576	0.6721	0.5022	0.5613	0.8268	0.9748	0.9960	0.9987	(86)
MIT	19.9718	20.1096	20.3353	20.6295	20.8656	20.9749	20.9960	20.9927	20.9199	20.6126	20.2365	19.9439	(87)
Th 2	20.1292	20.1309	20.1325	20.1400	20.1414	20.1480	20.1480	20.1493	20.1455	20.1414	20.1386	20.1356	(88)
util rest of house													
	0.9976	0.9945	0.9839	0.9412	0.8141	0.5944	0.4076	0.4624	0.7611	0.9635	0.9945	0.9983	(89)
MIT 2	18.7446	18.9468	19.2756	19.6987	20.0081	20.1309	20.1464	20.1460	20.0795	19.6825	19.1384	18.7085	(90)
Living area fraction										fLA = Living area / (4) =		0.2407	(91)
MIT	19.0399	19.2266	19.5306	19.9227	20.2145	20.3340	20.3509	20.3498	20.2818	19.9063	19.4026	19.0058	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8899	19.0766	19.3806	19.7727	20.0645	20.1840	20.2009	20.1998	20.1318	19.7563	19.2526	18.8558	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9964	0.9921	0.9792	0.9333	0.8097	0.5978	0.4135	0.4685	0.7599	0.9567	0.9922	0.9973	(94)
Useful gains	473.6745	537.6086	593.5090	629.8687	585.7409	426.0766	280.2990	294.3783	435.5332	486.4004	458.8775	449.1035	(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													
	1167.2532	1131.8538	1026.3056	858.0762	658.9416	436.2148	281.2978	296.3714	472.7294	721.3251	960.8551	1163.1647	(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													
	516.0225	399.3328	322.0007	164.3094	54.4613	0.0000	0.0000	0.0000	0.0000	174.7840	361.4239	531.2615	(98)
Space heating												2523.5961	(98)
Space heating per m2											(98) / (4) =	29.8156	(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	2788.5040	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	516.0225	399.3328	322.0007	164.3094	54.4613	0.0000	0.0000	0.0000	0.0000	174.7840	361.4239	531.2615	(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)	570.1906	441.2517	355.8019	181.5574	60.1782	0.0000	0.0000	0.0000	0.0000	193.1315	399.3634	587.0293	(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	168.5177	147.7803	153.4193	135.0631	130.5683	114.1033	107.1538	120.9409	121.7871	140.1844	151.3301	163.6344	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6907	89.6128	89.4420	89.0277	88.2181	87.3000	87.3000	87.3000	87.3000	89.0473	89.5314	89.7255	(217)
Fuel for water heating, kWh/month	187.8876	164.9099	171.5293	151.7090	148.0062	130.7025	122.7420	138.5349	139.5042	157.4270	169.0245	182.3722	(219)
Water heating fuel used												1864.3492	(219)

Annual totals kWh/year

Space heating fuel - main system	2788.5040	(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)	391.9239	(232)
Total delivered energy for all uses	5119.7771	(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	2788.5040	0.2160	602.3169	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1864.3492	0.2160	402.6994	(264)
Space and water heating			1005.0163	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	391.9239	0.5190	203.4085	(268)
Total CO2, kg/year			1247.3498	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7400	(273)

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

DER		14.7400	ZC1
Total Floor Area	TFA	84.6400	
Assumed number of occupants	N	2.5450	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0232	ZC2
CO2 emissions from cooking, equation (L16)		2.1276	ZC3
Total CO2 emissions		32.8908	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.8908	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	42.3200 (1b)	x	2.3100 (2b)	=	97.7592	(1b) - (3b)
First floor	42.3200 (1c)	x	2.5600 (2c)	=	108.3392	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.6400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	206.0984	(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) =	0.1456	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3956	(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) =	0.2769	(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	0.3530	0.3461	0.3392	0.3046	0.2977	0.2630	0.2630	0.2561	0.2769	0.2977	0.3115	0.3253	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(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)			11.1300	1.3258	14.7557			(27)
Heat Loss Floor 1			42.3200	0.1300	5.5016			(28a)
External Wall 1	44.8000	13.2500	31.5500	0.1800	5.6790			(29a)
External Roof 1	42.3200		42.3200	0.1300	5.5016			(30)
Total net area of external elements Aum(A, m2)			129.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.5579			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.8784	(36)
Total fabric heat loss (33) + (36) =	42.4363	(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	38.2446	38.0801	37.9187	37.1610	37.0192	36.3593	36.3593	36.2371	36.6135	37.0192	37.3060	37.6059	(38)
Heat transfer coeff	80.6809	80.5163	80.3550	79.5973	79.4555	78.7956	78.7956	78.6733	79.0498	79.4555	79.7423	80.0422	(39)
Average = Sum(39)m / 12 =												79.5966	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9532	0.9513	0.9494	0.9404	0.9387	0.9309	0.9309	0.9295	0.9340	0.9387	0.9421	0.9457	(40)
HLP (average)												0.9404	(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	2.5450	(42)
Average daily hot water use (litres/day)	94.6445	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.1089	100.3232	96.5374	92.7516	88.9658	85.1800	85.1800	88.9658	92.7516	96.5374	100.3232	104.1089	(44)
Energy conte	154.3906	135.0310	139.3399	121.4799	116.5628	100.5849	93.2067	106.9560	108.2334	126.1356	137.6869	149.5190	(45)
Energy content (annual)										Total = Sum(45)m =		1489.1265	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1586	20.2546	20.9010	18.2220	17.4844	15.0877	13.9810	16.0434	16.2350	18.9203	20.6530	22.4279	(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	49.1944	45.7405	45.3360	42.0066	43.4068	45.3360	45.7405	49.1944	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	205.3495	181.0584	188.5343	167.2204	161.8988	142.5915	136.6135	152.2920	153.9739	175.3300	187.0019	200.4779	(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													
	205.3495	181.0584	188.5343	167.2204	161.8988	142.5915	136.6135	152.2920	153.9739	175.3300	187.0019	200.4779	(64)
								Total per year (kWh/year) = Sum(64)m =				2052.3420	(64)
Heat gains from water heating, kWh/month													
	64.0746	56.4046	58.6291	51.8272	50.0911	43.9461	41.8429	46.8969	47.4227	54.2387	58.1096	62.4548	(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	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1924	19.7111	16.0301	12.1358	9.0717	7.6587	8.2755	10.7568	14.4377	18.3320	21.3962	22.8091	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.8645	231.2394	225.2547	212.5141	196.4313	181.3158	171.2177	168.8428	174.8274	187.5681	203.6508	218.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	(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)													
	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	(71)
Water heating gains (Table 5)													
	86.1218	83.9355	78.8026	71.9822	67.3268	61.0363	56.2405	63.0334	65.8649	72.9015	80.7078	83.9446	(72)
Total internal gains													
	401.3541	399.0614	384.2628	360.8076	337.0052	314.1862	299.9091	306.8084	319.3055	342.9770	369.9303	389.6956	(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	
Southeast		4.9100	36.7938	0.6300	0.7000	0.7700	55.2113	(77)
Northwest		6.2200	11.2829	0.6300	0.7000	0.7700	21.4479	(81)

Solar gains	76.6592	137.7031	207.3344	288.6151	352.2235	362.4107	344.1032	294.7016	235.1753	157.2934	93.1175	64.7648	(83)
Total gains	478.0133	536.7645	591.5973	649.4227	689.2287	676.5969	644.0123	601.5101	554.4808	500.2704	463.0478	454.4604	(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	72.8521	73.0010	73.1476	73.8439	73.9757	74.5953	74.5953	74.7112	74.3554	73.9757	73.7096	73.4335	
alpha	5.8568	5.8667	5.8765	5.9229	5.9317	5.9730	5.9730	5.9807	5.9570	5.9317	5.9140	5.8956	
util living area													
	0.9985	0.9967	0.9907	0.9662	0.8838	0.7077	0.5321	0.5898	0.8491	0.9793	0.9967	0.9989	(86)
MIT	19.9987	20.1235	20.3331	20.6128	20.8502	20.9706	20.9954	20.9918	20.9138	20.6117	20.2539	19.9734	(87)
Th 2	20.1225	20.1241	20.1257	20.1333	20.1347	20.1413	20.1413	20.1425	20.1387	20.1347	20.1318	20.1288	(88)
util rest of house													
	0.9980	0.9956	0.9875	0.9538	0.8435	0.6278	0.4316	0.4860	0.7851	0.9693	0.9953	0.9985	(89)
MIT 2	18.7749	18.9583	19.2643	19.6691	19.9845	20.1212	20.1395	20.1389	20.0676	19.6738	19.1550	18.7427	(90)
Living area fraction									fLA = Living area / (4) =			0.2407	(91)
MIT	19.0694	19.2387	19.5215	19.8962	20.1929	20.3256	20.3454	20.3442	20.2713	19.8995	19.4195	19.0389	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0694	19.2387	19.5215	19.8962	20.1929	20.3256	20.3454	20.3442	20.2713	19.8995	19.4195	19.0389	(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	0.9845	0.9496	0.8465	0.6458	0.4559	0.5111	0.7962	0.9658	0.9938	0.9979	(94)
Useful gains	476.6511	533.5351	582.4032	616.6635	583.4538	436.9518	293.6055	307.4052	441.4670	483.1415	460.1680	453.4858	(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													
	1191.6085	1154.5005	1046.3441	875.2667	674.8056	451.1509	295.1243	310.3014	487.8375	738.9003	982.3845	1187.7370	(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													
	531.9283	417.2887	345.1720	186.1943	67.9657	0.0000	0.0000	0.0000	0.0000	190.2846	375.9959	546.2829	(98)
Space heating												2661.1123	(98)
Space heating per m2											(98) / (4) =	31.4404	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2849.1566	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	531.9283	417.2887	345.1720	186.1943	67.9657	0.0000	0.0000	0.0000	0.0000	190.2846	375.9959	546.2829	(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)													
	569.5163	446.7759	369.5632	199.3515	72.7684	0.0000	0.0000	0.0000	0.0000	203.7308	402.5652	584.8853	(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													
	205.3495	181.0584	188.5343	167.2204	161.8988	142.5915	136.6135	152.2920	153.9739	175.3300	187.0019	200.4779	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3403	87.0855	86.5542	85.3222	83.0433	80.3000	80.3000	80.3000	80.3000	85.2575	86.7747	87.4472	(217)
Fuel for water heating, kWh/month													
	235.1143	207.9087	217.8221	195.9869	194.9571	177.5734	170.1289	189.6538	191.7483	205.6475	215.5027	229.2560	(219)
Water heating fuel used												2431.2997	(219)
Annual totals kWh/year													
Space heating fuel - main system												2849.1566	(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)												391.9239	(232)
Total delivered energy for all uses												5747.3802	(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	2849.1566	0.2160	615.4178	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2431.2997	0.2160	525.1607	(264)
Space and water heating			1140.5786	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	391.9239	0.5190	203.4085	(268)
Total CO2, kg/m2/year			1382.9121	(272)
Emissions per m2 for space and water heating			13.4756	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.4032	(272b)
Emissions per m2 for pumps and fans			0.4599	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4756 * 1.00) + 2.4032 + 0.4599, rounded to 2 d.p.			16.3400	(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	42.3200	(1b)	x 2.3100	(2b) =	97.7592	(1b) - (3b)
First floor	42.3200	(1c)	x 2.5600	(2c) =	108.3392	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.6400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	206.0984	(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) =	0.1456	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3956	(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) =	0.2769	(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	0.3530	0.3461	0.3392	0.3046	0.2977	0.2630	0.2630	0.2561	0.2769	0.2977	0.3115	0.3253	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(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)			9.0100	1.3347	12.0258			(27)
Solid door tall window			2.1200	1.0000	2.1200			(26)
Heat Loss Floor 1			42.3200	0.1200	5.0784	110.0000	4655.2000	(28a)
External Wall 1	44.8000	13.2500	31.5500	0.2600	8.2030	60.0000	1893.0000	(29a)
External Roof 1	42.3200		42.3200	0.1000	4.2320	9.0000	380.8800	(30)
Total net area of external elements Aum(A, m2)			129.4400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4889			(33)
Party Wall 1			89.6100	0.0000	0.0000	110.0000	9857.1000	(32)
Internal Wall 1			120.2700			9.0000	1082.4300	(32c)
Internal Wall 2			14.7600			60.0000	885.6000	(32c)
floor			42.3200			18.0000	761.7600	(32d)
Internal Ceiling 1			42.3200			9.0000	380.8800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	19896.8500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		235.0762 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2706 (36)
Total fabric heat loss	(33) + (36) =	41.7595 (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	38.2446	38.0801	37.9187	37.1610	37.0192	36.3593	36.3593	36.2371	36.6135	37.0192	37.3060	37.6059	(38)
Heat transfer coeff	80.0041	79.8395	79.6782	78.9205	78.7787	78.1188	78.1188	77.9965	78.3730	78.7787	79.0655	79.3653	(39)
Average = Sum(39)m / 12 =												78.9198	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9452	0.9433	0.9414	0.9324	0.9308	0.9230	0.9230	0.9215	0.9260	0.9308	0.9341	0.9377	(40)
HLP (average)												0.9324	(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	2.5450 (42)
Average daily hot water use (litres/day)	94.6445 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.1089	100.3232	96.5374	92.7516	88.9658	85.1800	85.1800	88.9658	92.7516	96.5374	100.3232	104.1089	(44)
Energy conte	154.3906	135.0310	139.3399	121.4799	116.5628	100.5849	93.2067	106.9560	108.2334	126.1356	137.6869	149.5190	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1489.1265 (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
32.8080 28.6941 29.6097 25.8145 24.7696 21.3743 19.8064 22.7282 22.9996 26.8038 29.2585 31.7728 (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	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1924	19.7111	16.0301	12.1358	9.0717	7.6587	8.2755	10.7568	14.4377	18.3320	21.3962	22.8091	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.8645	231.2394	225.2547	212.5141	196.4313	181.3158	171.2177	168.8428	174.8274	187.5681	203.6508	218.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	(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)													
	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	(71)
Water heating gains (Table 5)													
	44.0968	42.6995	39.7980	35.8534	33.2925	29.6865	26.6215	30.5486	31.9439	36.0266	40.6367	42.7054	(72)
Total internal gains													
	356.3291	354.8254	342.2583	321.6788	299.9709	279.8364	267.2901	271.3236	282.3845	303.1022	326.8592	345.4563	(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	
Northwest	2.1200	11.2829	0.7100	0.7000	0.7700	8.2385	(81)
Southeast	4.9100	36.7938	0.7100	0.7000	0.7700	62.2223	(77)
Northwest	4.1000	11.2829	0.7100	0.7000	0.7700	15.9329	(81)

Solar gains	86.3937	155.1893	233.6626	325.2647	396.9503	408.4312	387.7988	332.1241	265.0388	177.2672	104.9419	72.9889	(83)
Total gains	442.7228	510.0147	575.9209	646.9435	696.9212	688.2676	655.0889	603.4477	547.4233	480.3694	431.8011	418.4453	(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, n1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.0827	69.2251	69.3653	70.0313	70.1573	70.7500	70.7500	70.8609	70.5205	70.1573	69.9028	69.6387	
alpha	5.6055	5.6150	5.6244	5.6688	5.6772	5.7167	5.7167	5.7241	5.7014	5.6772	5.6602	5.6426	
util living area													
	0.9986	0.9966	0.9899	0.9617	0.8706	0.6902	0.5184	0.5819	0.8455	0.9795	0.9969	0.9990	(86)
MIT	19.9165	20.0578	20.2902	20.5956	20.8470	20.9697	20.9950	20.9907	20.9052	20.5760	20.1879	19.8890	(87)
Th 2	20.1292	20.1309	20.1325	20.1400	20.1414	20.1480	20.1480	20.1493	20.1455	20.1414	20.1386	20.1356	(88)
util rest of house													
	0.9982	0.9956	0.9866	0.9485	0.8296	0.6124	0.4213	0.4806	0.7831	0.9701	0.9958	0.9987	(89)
MIT 2	19.1300	19.2721	19.5041	19.8078	20.0359	20.1335	20.1466	20.1463	20.0906	19.7942	19.4086	19.1077	(90)
Living area fraction									fLA = Living area / (4) =			0.2407	(91)
MIT	19.3193	19.4612	19.6933	19.9974	20.2311	20.3347	20.3508	20.3495	20.2867	19.9824	19.5962	19.2957	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3193	19.4612	19.6933	19.9974	20.2311	20.3347	20.3508	20.3495	20.2867	19.9824	19.5962	19.2957	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9945	0.9844	0.9459	0.8344	0.6302	0.4448	0.5051	0.7947	0.9679	0.9948	0.9983	(94)
Useful gains	441.6843	507.2001	566.9267	611.9357	581.4916	433.7634	291.3696	304.8024	435.0256	464.9362	429.5480	417.7248	(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													
	1201.6032	1162.5592	1051.2191	875.8108	672.0687	447.9904	293.0057	308.0503	484.8672	739.1314	988.0184	1198.0771	(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													
	565.3797	440.4013	360.3135	189.9901	67.3894	0.0000	0.0000	0.0000	0.0000	204.0012	402.0987	580.5821	(98)
Space heating												2810.1560	(98)
Space heating per m2											(98) / (4) =	33.2013	(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	734.3163	578.0788	592.7737	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9229	0.9636	0.9466	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	677.7349	557.0419	561.1380	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	900.5567	859.8461	801.3575	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	160.4317	225.2864	178.7233	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												564.4414 (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	40.1079	56.3216	44.6808	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												141.1103 (107)
Space cooling per m2												1.6672 (108)
Energy for space heating												33.2013 (99)
Energy for space cooling												1.6672 (108)
Total												34.8685 (109)
Dwelling Fabric Energy Efficiency (DFEE)												34.9 (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	42.3200 (1b)	x	2.3100 (2b)	=	97.7592	(1b) - (3b)
First floor	42.3200 (1c)	x	2.5600 (2c)	=	108.3392	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.6400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	206.0984	(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) =	0.1456	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3956	(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)	=	0.2769	(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	0.3530	0.3461	0.3392	0.3046	0.2977	0.2630	0.2630	0.2561	0.2769	0.2977	0.3115	0.3253	(22b)
Effective ac	0.5623	0.5599	0.5575	0.5464	0.5443	0.5346	0.5346	0.5328	0.5383	0.5443	0.5485	0.5529	(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)			11.1300	1.3258	14.7557			(27)
Heat Loss Floor 1			42.3200	0.1300	5.5016			(28a)
External Wall 1	44.8000	13.2500	31.5500	0.1800	5.6790			(29a)
External Roof 1	42.3200		42.3200	0.1300	5.5016			(30)
Total net area of external elements Aum(A, m2)			129.4400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.5579			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.8784	(36)
Total fabric heat loss					(33) + (36) =		42.4363	(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	38.2446	38.0801	37.9187	37.1610	37.0192	36.3593	36.3593	36.2371	36.6135	37.0192	37.3060	37.6059	(38)
Heat transfer coeff	80.6809	80.5163	80.3550	79.5973	79.4555	78.7956	78.7956	78.6733	79.0498	79.4555	79.7423	80.0422	(39)
Average = Sum(39)m / 12 =												79.5966	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9532	0.9513	0.9494	0.9404	0.9387	0.9309	0.9309	0.9295	0.9340	0.9387	0.9421	0.9457	(40)
HLP (average)												0.9404	(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												2.5450	(42)
Average daily hot water use (litres/day)												94.6445	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.1089	100.3232	96.5374	92.7516	88.9658	85.1800	85.1800	88.9658	92.7516	96.5374	100.3232	104.1089	(44)
Energy conte	154.3906	135.0310	139.3399	121.4799	116.5628	100.5849	93.2067	106.9560	108.2334	126.1356	137.6869	149.5190	(45)
Energy content (annual)										Total = Sum(45)m =		1489.1265	(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													

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 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)
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													
	32.8080	28.6941	29.6097	25.8145	24.7696	21.3743	19.8064	22.7282	22.9996	26.8038	29.2585	31.7728	(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	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	127.2516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1924	19.7111	16.0301	12.1358	9.0717	7.6587	8.2755	10.7568	14.4377	18.3320	21.3962	22.8091	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.8645	231.2394	225.2547	212.5141	196.4313	181.3158	171.2177	168.8428	174.8274	187.5681	203.6508	218.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	35.7252	(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)													
	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	-101.8013	(71)
Water heating gains (Table 5)													
	44.0968	42.6995	39.7980	35.8534	33.2925	29.6865	26.6215	30.5486	31.9439	36.0266	40.6367	42.7054	(72)
Total internal gains													
	356.3291	354.8254	342.2583	321.6788	299.9709	279.8364	267.2901	271.3236	282.3845	303.1022	326.8592	345.4563	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	4.9100	36.7938	0.6300	0.7000	0.7700	55.2113	(77)
Northwest	6.2200	11.2829	0.6300	0.7000	0.7700	21.4479	(81)

Solar gains	76.6592	137.7031	207.3344	288.6151	352.2235	362.4107	344.1032	294.7016	235.1753	157.2934	93.1175	64.7648	(83)
Total gains	432.9883	492.5286	549.5927	610.2939	652.1944	642.2472	611.3933	566.0252	517.5598	460.3956	419.9767	410.2212	(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	72.8521	73.0010	73.1476	73.8439	73.9757	74.5953	74.5953	74.7112	74.3554	73.9757	73.7096	73.4335	
alpha	5.8568	5.8667	5.8765	5.9229	5.9317	5.9730	5.9730	5.9807	5.9570	5.9317	5.9140	5.8956	
util living area													
	0.9991	0.9979	0.9936	0.9743	0.9034	0.7364	0.5586	0.6227	0.8777	0.9860	0.9980	0.9994	(86)
MIT	19.9473	20.0734	20.2870	20.5749	20.8272	20.9638	20.9940	20.9891	20.8947	20.5703	20.2051	19.9227	(87)
Th 2	20.1225	20.1241	20.1257	20.1333	20.1347	20.1413	20.1413	20.1425	20.1387	20.1347	20.1318	20.1288	(88)
util rest of house													
	0.9988	0.9972	0.9912	0.9644	0.8671	0.6565	0.4541	0.5151	0.8195	0.9789	0.9972	0.9992	(89)
MIT 2	19.1511	19.2783	19.4922	19.7808	20.0139	20.1240	20.1396	20.1392	20.0772	19.7805	19.4164	19.1318	(90)
Living area fraction									fLA = Living area / (4) =			0.2407	(91)
MIT	19.3427	19.4697	19.6835	19.9719	20.2096	20.3261	20.3453	20.3437	20.2740	19.9706	19.6062	19.3222	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3427	19.4697	19.6835	19.9719	20.2096	20.3261	20.3453	20.3437	20.2740	19.9706	19.6062	19.3222	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9964	0.9897	0.9621	0.8707	0.6748	0.4794	0.5412	0.8300	0.9771	0.9965	0.9989	(94)
Useful gains	432.3221	490.7670	543.9389	587.1874	567.8628	433.3827	293.1291	306.3608	429.5517	449.8691	418.5122	409.7608	(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													
	1213.6582	1173.0981	1059.3581	881.2925	676.1378	451.1903	295.1105	310.2668	488.0513	744.5444	997.2717	1210.4109	(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													
	581.3140	458.5265	383.4719	211.7557	80.5566	0.0000	0.0000	0.0000	0.0000	219.2384	416.7069	595.6837	(98)
Space heating												2947.2538	(98)
Space heating per m2											(98) / (4) =	34.8211	(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	740.6783	583.0872	597.9174	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9072	0.9560	0.9367	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	671.9299	557.4143	560.0749	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	846.7666	808.7733	757.6170	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	125.8824	187.0111	146.9713	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												459.8648	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	31.4706	46.7528	36.7428	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling	114.9662 (107)
Space cooling per m2	1.3583 (108)
Energy for space heating	34.8211 (99)
Energy for space cooling	1.3583 (108)
Total	36.1793 (109)
Target Fabric Energy Efficiency (TFEE)	41.6 (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 East
Overshading	Average or unknown
Thermal mass parameter	239.6 (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	272.05 (P1)
Transmission heat loss coefficient	41.76 (37)
Summer heat loss coefficient	313.81 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	0.850	0.90	1.000	0.765 (P8)
North 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 West	2.1200	100.3588	0.7100	0.7000	0.7650	72.8034
South East	4.9100	121.5729	0.7100	0.7000	0.7650	204.2577
North West	4.1000	100.3588	0.7100	0.7000	0.7650	140.7990
total:						417.8602

	Jun	Jul	Aug	
Solar gains	457	418	364	(P3)
Internal gains	445	426	435	
Total summer gains	901	844	799	(P5)
Summer gain/loss ratio	2.87	2.69	2.55	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 239.6)	0.32	0.32	0.32	
Threshold temperature	18.20	19.71	19.57	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

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THERMAL BRIDGING
Calculation Type: New Build (As Designed)

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE19091 - 070 AS	**Issued on Date**	07/09/2020
Assessment Reference	DE19091 - 070 AS	**Prop Type Ref**	T52 Eaves 2FW MID E25+
Property	3 bed, 2 bath		

SAP Rating	86 B	**DER**	14.74	**TER**	16.34
Environmental	89 B	**% DER<TER**	9.79		
CO_2 Emissions (t/year)	1.04	**DFEE**	34.87	**TFEE**	41.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.19		

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

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.211	9.30	1.96	H+H LN01 - EW01
External wall	E3 Sill	Independently assessed	0.019	7.28	0.14	APA PF-WD-03
External wall	E4 Jamb	Independently assessed	0.020	23.10	0.46	APA PF-WD-04
External wall	E5 Ground floor (normal)	Independently assessed	0.105	9.20	0.97	Barratt Confidential Bespoke
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.001	9.20	0.01	APA PF-IF-01
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.20	0.55	MCI-RE-01/2
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	14.88	0.89	MCI-IW-01
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.120	4.96	0.60	Default
Party wall	P1 Party wall - Ground floor	Independently assessed	0.056	18.40	1.03	Barratt Confidential Bespoke
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	18.40	0.00	Default
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.036	18.40	0.66	Barratt Confidential Bespoke

Total: **7.27** **W/mK:**

Y-Value: **0.056** **W/m²K:**

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

SAINT-GOBAIN
SAINT-GOBAIN INSULATION UK

Property Reference	DE19091 - 070 AS	**Issued on Date**	07/09/2020
Assessment Reference	DE19091 - 070 AS	**Prop Type Ref**	T52 Eaves 2FW MID E25+
Property	3 bed, 2 bath		

SAP Rating	86 B	**DER**	14.74	**TER**	16.34
Environmental	89 B	**% DER<TER**	9.79		
CO_2 Emissions (t/year)	1.04	**DFEE**	34.87	**TFEE**	41.61
General Requirements Compliance	Pass	**% DFEE<TFEE**	16.19		

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)	16.34	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	14.74	$kgCO_2/m^2$	Pass
	-1.60 (-9.8%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	41.61	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	34.87	$kWh/m^2/yr$	
	-6.7 (-16.1%)	$kWh/m^2/yr$	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	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.34 (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 South East Windows facing North West	4.91 m², No overhang 6.22 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
Floor U-value	0.12	W/m²K
Door U-value	1.00	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.