



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 5, Fieldfare Crescent
Botley, Southampton, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 05/05/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 18			Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av		
Property	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW				
SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.87	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.66	kgCO ₂ /m ²	Pass
	-4.21 (-22.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	64.29	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	53.92	kWh/m ² /yr	
	-10.4 (-16.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Floor	0.14 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	Pass
Openings	1.24 (max. 2.00)	1.80 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.18 (measured in this dwelling)	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 been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 12 S NG

Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.24

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Programmer and at least two room thermostats

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

0.80 m², No overhang

Windows facing North East

2.15 m², No overhang

Windows facing East

0.80 m², No overhang

Windows facing South East

4.89 m², Overhang twice as wide as window, ratio 0.66

Windows facing North West

8.75 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.18 (measured in this dwelling) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Photovoltaic array	1.28	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	88 B	DER	14.66
Environmental	88 B	TER	18.87
CO ₂ Emissions (t/year)	1.22	% DER<TER	22.30
General Requirements Compliance	Pass	DFEE	53.92
		TFEE	64.29
		% DFEE<TFEE	16.12
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.274	12.44	3.41	Knauf P3
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	1.76	0.53	
External wall	E3 Sill	Independently assessed	0.021	11.46	0.24	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	35.70	0.57	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	28.63	1.78	BE-E5-23902
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	12.76	4.08	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	6.03	1.93	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	22.00	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	24.32	1.46	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	1.54	0.37	
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.010	2.10	0.02	Knauf P20
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	9.98	0.44	Knauf P21
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	2.58	0.10	
External wall	E16 Corner (normal)	Independently assessed	0.039	26.31	1.03	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	6.11	-0.56	Knauf P24
External roof	R1 Head of roof window	Table K1 - Default	0.080	0.91	0.07	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	2.40	0.19	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	2.10	0.13	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.040	0.93	0.04	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	3.25	0.20	
External roof	R9 Roof to wall (flat ceiling)	Table K1 - Default	0.040	0.93	0.04	

Total: **16.06** W/mK:
Y-Value: **0.056** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	16.12		
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS BUILT

Detached House, total floor area 109 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.87 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.66 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 53.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.18 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Worcester Greenstar 4000 GR4700iW 12 S NG

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.73 kWh/day

Permitted by DBSCG 2.24 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer and at least two room thermostats OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:	Average
Windows facing North:	0.80 m ² , No overhang
Windows facing North East:	2.15 m ² , No overhang
Windows facing East:	0.80 m ² , No overhang
Windows facing South East:	4.89 m ² , Overhang twice as wide as window, ratio 0.66
Windows facing North West:	8.75 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Photovoltaic array 1.28 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1841 (8)
Pressure test					Yes
Measured/design AP50					4.1800
Infiltration rate					0.3931 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3341 (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	0.4260	0.4177	0.4093	0.3676	0.3592	0.3174	0.3174	0.3091	0.3341	0.3592	0.3759	0.3926 (22b)
Effective ac	0.5908	0.5872	0.5838	0.5676	0.5645	0.5504	0.5504	0.5478	0.5558	0.5645	0.5707	0.5771 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			17.3900	1.1450	19.9122		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000 (28a)
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000 (28b)
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514 (29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366 (29a)
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670 (29a)
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400 (30)
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900 (30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129		(33)
Ground Floor Block			48.7500			9.0000	438.7500 (32c)
Ground Floor Stud			26.4700			9.0000	238.2300 (32c)
First Floor Stud			154.0400			9.0000	1386.3600 (32c)
Internal Floor 1			44.1500			18.0000	794.7000 (32d)
Internal Ceiling 1			44.1500			18.0000	794.7000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16799.3250 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6289 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.0587 (36)
Total fabric heat loss						(33) + (36) =	88.8716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.9416	52.6258	52.3162	50.8622	50.5901	49.3237	49.3237	49.0892	49.8115	50.5901	51.1405	51.7158 (38)
Average = Sum(39)m / 12 =	141.8132	141.4974	141.1878	139.7338	139.4617	138.1953	138.1953	137.9608	138.6831	139.4617	140.0121	140.5874 (39)
												139.7325 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2969	1.2940	1.2912	1.2779	1.2754	1.2638	1.2638	1.2616	1.2682	1.2754	1.2804	1.2857 (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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)	Total = Sum (45)m =											1588.4641	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9342	(55)
Total storage loss	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(64)
Heat gains from water heating, kWh/month	96.5374	85.6279	91.1992	83.5170	83.1207	76.1059	74.8367	79.7133	78.8187	86.5159	89.2653	94.8096	(65)
Total per year (kWh/year) = Sum (64)m =													2203.3431 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2003	22.3827	18.2028	13.7807	10.3013	8.6968	9.3971	12.2148	16.3946	20.8168	24.2962	25.9007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.6188	273.4270	266.3505	251.2854	232.2685	214.3953	202.4548	199.6467	206.7232	221.7882	240.8052	258.6784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	129.7546	127.4225	122.5796	115.9958	111.7213	105.7026	100.5869	107.1415	109.4704	116.2849	123.9795	127.4322	(72)
Total internal gains	493.7368	491.3952	475.2960	449.2249	422.4541	396.9577	380.6019	387.1660	400.7512	427.0529	457.2439	480.1744	(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					0.8000	10.6334		0.6300	0.7000	0.7700		2.5998 (74)	
Northeast					2.1500	11.2829		0.6300	0.7000	0.7700		7.4137 (75)	
East					0.8000	19.6403		0.6300	0.7000	0.7700		4.8019 (76)	
Southeast					4.8900	36.7938		0.6300	0.7000	0.7700		54.9865 (77)	
Northwest					8.7500	11.2829		0.6300	0.7000	0.7700		30.1719 (81)	
Solar gains	99.9736	184.5304	289.9051	421.2830	528.0628	548.8350	518.9112	435.5721	334.8652	214.0739	122.3479	83.8673	(83)
Total gains	593.7104	675.9256	765.2010	870.5079	950.5168	945.7927	899.5131	822.7381	735.6164	641.1267	579.5918	564.0417	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	32.9058	32.9793	33.0516	33.3955	33.4606	33.7673	33.7673	33.8247	33.6485	33.4606	33.3291	33.1927
alpha	3.1937	3.1986	3.2034	3.2264	3.2307	3.2512	3.2512	3.2550	3.2432	3.2307	3.2219	3.2128
util living area	0.9909	0.9855	0.9728	0.9394	0.8662	0.7385	0.6004	0.6581	0.8534	0.9588	0.9857	0.9923 (86)
MIT	18.8827	19.0811	19.4480	19.9565	20.4335	20.7769	20.9184	20.8881	20.6057	20.0005	19.3578	18.8502 (87)
Th 2	19.8433	19.8455	19.8478	19.8582	19.8602	19.8693	19.8693	19.8710	19.8658	19.8602	19.8562	19.8521 (88)
util rest of house	0.9889	0.9821	0.9661	0.9232	0.8273	0.6571	0.4741	0.5356	0.7952	0.9447	0.9819	0.9906 (89)
MIT 2	17.9196	18.1184	18.4835	18.9885	19.4395	19.7413	19.8389	19.8252	19.6086	19.0400	18.4026	17.8936 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.0730	18.2717	18.6370	19.1426	19.5978	19.9062	20.0108	19.9944	19.7673	19.1929	18.5547	18.0459 (91)
Temperature adjustment	0.0000											
adjusted MIT	18.0730	18.2717	18.6370	19.1426	19.5978	19.9062	20.0108	19.9944	19.7673	19.1929	18.5547	18.0459 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9844	0.9758	0.9567	0.9103	0.8165	0.6601	0.4914	0.5506	0.7890	0.9337	0.9756	0.9867	(94)
Ext temp.	584.4322	659.5629	732.0778	792.3888	776.1171	624.3195	442.0298	453.0006	580.3824	598.5946	565.4622	556.5133	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	1953.1901	1892.0555	1713.6026	1431.2431	1101.4373	733.2885	471.3558	495.8861	785.9603	1198.3840	1603.7902	1946.5634 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1018.3559	828.2350	730.2544	459.9751	242.0382	0.0000	0.0000	0.0000	0.0000	446.2434	747.5961	1034.1973 (98)
Space heating												5506.8954 (98)
Space heating per m2											(98) / (4) =	50.3603 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6064.8628 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1018.3559	828.2350	730.2544	459.9751	242.0382	0.0000	0.0000	0.0000	0.0000	446.2434	747.5961	1034.1973 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	1121.5373	912.1531	804.2450	506.5805	266.5619	0.0000	0.0000	0.0000	0.0000	491.4575	823.3437	1138.9838 (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	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158 (64)
Efficiency of water heater	88.7189	88.5806	88.2568	87.5105	85.9568	80.1000	80.1000	80.1000	80.1000	87.3569	88.3350	80.1000 (216)
(217)m	88.7189	88.5806	88.2568	87.5105	85.9568	80.1000	80.1000	80.1000	80.1000	87.3569	88.3350	88.7846 (217)
Fuel for water heating, kWh/month	244.4939	215.8570	227.5833	205.8286	205.4068	197.0446	189.3220	207.6323	207.2303	213.8039	223.4786	238.4600 (219)
Water heating fuel used												2576.1414 (219)
Annual totals kWh/year												
Space heating fuel - main system												6064.8628 (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)												445.0457 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.28 * 1004 * 1.00) =									-1028.0921			-1028.0921 (233)
Total delivered energy for all uses												8132.9578 (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	6064.8628	0.2160	1310.0104 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.1414	0.2160	556.4465 (264)
Space and water heating			1866.4569 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.0457	0.5190	230.9787 (268)
Energy saving/generation technologies			
PV Unit	-1028.0921	0.5190	-533.5798 (269)
Total CO2, kg/year			1602.7808 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6600 (273)

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

DER			14.6600 ZC1
Total Floor Area		TFA	109.3500
Assumed number of occupants		N	2.8109
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.6651 ZC2
CO2 emissions from cooking, equation (L16)			1.7052 ZC3
Total CO2 emissions			31.0303 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			31.0303 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1473 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3973 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3377 (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	0.4306	0.4221	0.4137	0.3715	0.3630	0.3208	0.3208	0.3124	0.3377	0.3630	0.3799	0.3968 (22b)
Effective ac	0.5927	0.5891	0.5856	0.5690	0.5659	0.5515	0.5515	0.5488	0.5570	0.5659	0.5722	0.5787 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.7700	1.0000	1.7700		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			17.3900	1.3258	23.0549		(27)
Ground Floor			45.0000	0.1300	5.8500		(28a)
Exposed over Garage			18.1900	0.1300	2.3647		(28b)
Brick and Block	141.3800	19.5100	121.8700	0.1800	21.9366		(29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1800	2.2698		(29a)
Dormer	1.3700		1.3700	0.1800	0.2466		(29a)
Pitched Roof	62.7600		62.7600	0.1300	8.1588		(30)
Sloping Ceiling	3.1100		3.1100	0.1300	0.4043		(30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.5997		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	18.8578 (36)
Total fabric heat loss	(33) + (36) = 87.4575 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	53.1153	52.7928	52.4766	50.9915	50.7136	49.4202	49.4202	49.1806	49.9184	50.7136	51.2757	51.8634 (38)
Average = Sum(39)m / 12 =	140.5729	140.2503	139.9341	138.4490	138.1712	136.8777	136.8777	136.6382	137.3759	138.1712	138.7333	139.3209 (39)
												138.4477 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2855	1.2826	1.2797	1.2661	1.2636	1.2517	1.2517	1.2495	1.2563	1.2636	1.2687	1.2741 (40)
Days in month												1.2661 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8109	(42)
Average daily hot water use (litres/day)												100.9581	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)													
Distribution loss	Total = Sum(45)m = 1588.4641												(45)
	(46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss												
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage												
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	215.6158	190.0364	199.5611	178.8669	175.2647	156.5780	150.3504	165.0170	164.7368	185.4760	196.1551	210.4193 (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												
	215.6158	190.0364	199.5611	178.8669	175.2647	156.5780	150.3504	165.0170	164.7368	185.4760	196.1551	210.4193 (64)
								Total per year (kWh/year) =	Sum(64)m =			2188.0775 (64)
Heat gains from water heating, kWh/month												
	95.5002	84.6911	90.1620	82.5132	82.0834	75.1021	73.7995	78.6761	77.8149	85.4787	88.2615	93.7724 (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	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2003	22.3827	18.2028	13.7807	10.3013	8.6968	9.3971	12.2148	16.3946	20.8168	24.2962	25.9007 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.6188	273.4270	266.3505	251.2854	232.2685	214.3953	202.4548	199.6467	206.7232	221.7882	240.8052	258.6784 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543 (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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347 (71)
Water heating gains (Table 5)	128.3605	126.0284	121.1855	114.6017	110.3272	104.3085	99.1928	105.7474	108.0763	114.8907	122.5854	126.0381 (72)
Total internal gains	492.3427	490.0011	473.9018	447.8308	421.0600	395.5635	379.2078	385.7719	399.3571	425.6587	455.8498	478.7803 (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	0.8000	10.6334	0.6300	0.7000	0.7700	2.5998 (74)
Northeast	2.1500	11.2829	0.6300	0.7000	0.7700	7.4137 (75)
East	0.8000	19.6403	0.6300	0.7000	0.7700	4.8019 (76)
Southeast	4.8900	36.7938	0.6300	0.7000	0.7700	54.9865 (77)
Northwest	8.7500	11.2829	0.6300	0.7000	0.7700	30.1719 (81)

Solar gains	99.9736	184.5304	289.9051	421.2830	528.0628	548.8350	518.9112	435.5721	334.8652	214.0739	122.3479	83.8673 (83)
Total gains	592.3163	674.5315	763.8069	869.1138	949.1227	944.3986	898.1190	821.3440	734.2223	639.7326	578.1977	562.6475 (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	54.0200	54.1443	54.2666	54.8487	54.9590	55.4784	55.4784	55.5756	55.2772	54.9590	54.7363	54.5055
alpha	4.6013	4.6096	4.6178	4.6566	4.6639	4.6986	4.6986	4.7050	4.6851	4.6639	4.6491	4.6337
util living area												
	0.9987	0.9973	0.9931	0.9768	0.9224	0.7922	0.6329	0.7001	0.9111	0.9871	0.9974	0.9990 (86)
MIT	19.5282	19.6706	19.9340	20.3050	20.6554	20.8922	20.9715	20.9548	20.7650	20.3222	19.8637	19.5063 (87)
Th 2	19.8522	19.8545	19.8568	19.8675	19.8695	19.8788	19.8788	19.8806	19.8752	19.8695	19.8654	19.8612 (88)
util rest of house												
	0.9982	0.9964	0.9904	0.9668	0.8866	0.6998	0.4899	0.5595	0.8544	0.9800	0.9963	0.9986 (89)
MIT 2	17.8942	18.1039	18.4896	19.0320	19.5154	19.8027	19.8680	19.8608	19.6703	19.0636	18.3941	17.8683 (90)
Living area fraction												
MIT	18.1543	18.3533	18.7195	19.2347	19.6969	19.9762	20.0437	20.0350	19.8446	19.2640	18.6281	0.1592 (91)
Temperature adjustment												
adjusted MIT	18.1543	18.3533	18.7195	19.2347	19.6969	19.9762	20.0437	20.0350	19.8446	19.2640	18.6281	18.1291 (92)
												0.0000
												18.1291 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9944	0.9865	0.9590	0.8798	0.7090	0.5125	0.5809	0.8525	0.9742	0.9943	0.9977 (94)
Useful gains	590.5902	670.7386	753.4680	833.5101	835.0094	669.5566	460.2474	477.1532	625.9017	623.2339	574.9292	561.3581 (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												
	1947.5432	1886.8297	1709.9303	1430.8282	1104.9460	735.8760	471.3612	496.6748	789.1730	1197.1184	1599.3277	1940.6145 (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												
	1009.5730	817.2132	711.6080	430.0690	200.8328	0.0000	0.0000	0.0000	0.0000	426.9700	737.5669	1026.1668 (98)
Space heating												5359.9999 (98)
Space heating per m2												49.0169 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5732.6202 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1009.5730	817.2132	711.6080	430.0690	200.8328	0.0000	0.0000	0.0000	0.0000	426.9700	737.5669	1026.1668	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1079.7572	874.0248	761.0781	459.9669	214.7945	0.0000	0.0000	0.0000	0.0000	456.6524	788.8416	1097.5046	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	215.6158	190.0364	199.5611	178.8669	175.2647	156.5780	150.3504	165.0170	164.7368	185.4760	196.1551	210.4193	(64)
Efficiency of water heater (217)m	88.4137	88.2670	87.9181	87.0707	85.1777	79.8000	79.8000	79.8000	79.8000	86.9685	88.0206	88.4812	(216)
Fuel for water heating, kWh/month	243.8715	215.2972	226.9852	205.4273	205.7636	196.2131	188.4090	206.7882	206.4371	213.2681	222.8513	237.8124	(219)
Water heating fuel used												2569.1240	(219)
Annual totals kWh/year													
Space heating fuel - main system												5732.6202	(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)												445.0457	(232)
Total delivered energy for all uses												8821.7899	(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	5732.6202	0.2160	1238.2460 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2569.1240	0.2160	554.9308 (264)
Space and water heating			1793.1767 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.0457	0.5190	230.9787 (268)
Total CO2, kg/m2/year			2063.0805 (272)
Emissions per m2 for space and water heating			16.3985 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1123 (272b)
Emissions per m2 for pumps and fans			0.3560 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3985 * 1.00) + 2.1123 + 0.3560, rounded to 2 d.p.			18.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1473 (8)
Pressure test					Yes
Measured/design AP50					4.1800
Infiltration rate					0.3563 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3028 (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	0.3861	0.3786	0.3710	0.3331	0.3256	0.2877	0.2877	0.2801	0.3028	0.3256	0.3407	0.3558 (22b)
Effective ac	0.5745	0.5717	0.5688	0.5555	0.5530	0.5414	0.5414	0.5392	0.5459	0.5530	0.5580	0.5633 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			17.3900	1.1450	19.9122		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000 (28a)
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000 (28b)
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514 (29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366 (29a)
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670 (29a)
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400 (30)
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900 (30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129		(33)
Ground Floor Block			48.7500			9.0000	438.7500 (32c)
Ground Floor Stud			26.4700			9.0000	238.2300 (32c)
First Floor Stud			154.0400			9.0000	1386.3600 (32c)
Internal Floor 1			44.1500			18.0000	794.7000 (32d)
Internal Ceiling 1			44.1500			9.0000	397.3500 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16401.9750 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							149.9952 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.0587 (36)
Total fabric heat loss						(33) + (36) =	88.8716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.4893	51.2299	50.9756	49.7812	49.5577	48.5174	48.5174	48.3248	48.9181	49.5577	50.0098	50.4824 (38)
Average = Sum(39)m / 12 =	140.3609	140.1015	139.8472	138.6528	138.4293	137.3890	137.3890	137.1964	137.7897	138.4293	138.8814	139.3540 (39)
												138.6517 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2836	1.2812	1.2789	1.2680	1.2659	1.2564	1.2564	1.2547	1.2601	1.2659	1.2701	1.2744 (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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)										Total =	Sum (45)m =	1588.4641	(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													
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	(57)
Heat gains from water heating, kWh/month	34.9966	30.6082	31.5849	27.5365	26.4219	22.8001	21.1277	24.2443	24.5339	28.5919	31.2102	33.8923	(59)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	(66)
(66)m	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2003	22.3827	18.2028	13.7807	10.3013	8.6968	9.3971	12.2148	16.3946	20.8168	24.2962	25.9007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.6188	273.4270	266.3505	251.2854	232.2685	214.3953	202.4548	199.6467	206.7232	221.7882	240.8052	258.6784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	47.0384	45.5480	42.4529	38.2452	35.5134	31.6669	28.3974	32.5864	34.0748	38.4299	43.3476	45.5542	(72)
Total internal gains	408.0206	406.5207	392.1692	368.4743	343.2461	319.9219	305.4124	309.6109	322.3556	346.1979	373.6120	395.2963	(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					0.8000	10.6334	0.6300	0.7000			0.7700			2.5998 (74)
Northeast					2.1500	11.2829	0.6300	0.7000			0.7700			7.4137 (75)
East					0.8000	19.6403	0.6300	0.7000			0.7700			4.8019 (76)
Southeast					4.8900	36.7938	0.6300	0.7000			0.7700			54.9865 (77)
Northwest					8.7500	11.2829	0.6300	0.7000			0.7700			30.1719 (81)

Solar gains	99.9736	184.5304	289.9051	421.2830	528.0628	548.8350	518.9112	435.5721	334.8652	214.0739	122.3479			83.8673 (83)
Total gains	507.9942	591.0511	682.0743	789.7573	871.3089	868.7569	824.3236	745.1830	657.2208	560.2718	495.9599			479.1636 (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	32.4599	32.5200	32.5792	32.8598	32.9129	33.1621	33.1621	33.2086	33.0656	32.9129	32.8057	32.6945		
alpha	3.1640	3.1680	3.1719	3.1907	3.1942	3.2108	3.2108	3.2139	3.2044	3.1942	3.1870	3.1796		
util living area	0.9938	0.9894	0.9788	0.9501	0.8847	0.7671	0.6343	0.6960	0.8800	0.9694	0.9902	0.9949	(86)	
MIT	18.7692	18.9722	19.3483	19.8706	20.3706	20.7400	20.9002	20.8625	20.5456	19.9077	19.2481	18.7332	(87)	
Th 2	19.8537	19.8556	19.8574	19.8660	19.8676	19.8751	19.8751	19.8765	19.8722	19.8676	19.8644	19.8610	(88)	
util rest of house	0.9924	0.9869	0.9736	0.9365	0.8499	0.6895	0.5074	0.5753	0.8291	0.9588	0.9875	0.9937	(89)	
MIT 2	17.8172	18.0206	18.3954	18.9151	19.3923	19.7215	19.8364	19.8175	19.5666	18.9590	18.3028	17.7865	(90)	
Living area fraction	17.9688	18.1721	18.5471	19.0672	19.5480	19.8837	20.0058	19.9839	19.7225	19.1100	18.4533	17.9372	(92)	
MIT	17.9688	18.1721	18.5471	19.0672	19.5480	19.8837	20.0058	19.9839	19.7225	19.1100	18.4533	17.9372	(93)	
Temperature adjustment														
adjusted MIT	17.9688	18.1721	18.5471	19.0672	19.5480	19.8837	20.0058	19.9839	19.7225	19.1100	18.4533	17.9372	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9818	0.9654	0.9241	0.8379	0.6901	0.5238	0.5885	0.8206	0.9489	0.9827	0.9908	(94)
Useful gains	502.3966	580.2797	658.4737	729.7865	730.0580	599.5716	431.7425	438.5132	539.3447	531.6447	487.3708	474.7576	(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	1918.5657	1859.4367	1684.7551	1409.7108	1086.3970	725.9187	467.9131	491.6982	774.7240	1178.0377	1576.7646	1914.3389	(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	1053.6298	859.5935	763.5533	489.5455	265.1161	0.0000	0.0000	0.0000	0.0000	480.9164	784.3635	1071.0485	(98)
Space heating													5767.7667 (98)
Space heating per m2													52.7459 (99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 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	1291.4570	1016.6789	1042.6926	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7078	0.7821	0.7390	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	914.1079	795.1733	770.5255	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1125.7906	1071.4746	981.1071	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	152.4115	205.5682	156.6727	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling													(104)	
Cooled fraction									FC = cooled area / (4) =			514.6524	(104)	
Intermittency factor (Table 10b)												1.0000	(105)	
	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	38.1029	51.3920	39.1682	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling													(107)	
Space cooling per m2													128.6631	(108)
Energy for space heating													1.1766	(108)
Energy for space cooling													52.7459	(99)
Total													1.1766	(108)
Dwelling Fabric Energy Efficiency (DFEE)													53.9225	(109)
													53.9	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1473 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3973 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3377 (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	0.4306	0.4221	0.4137	0.3715	0.3630	0.3208	0.3208	0.3124	0.3377	0.3630	0.3799	0.3968 (22b)
Effective ac	0.5927	0.5891	0.5856	0.5690	0.5659	0.5515	0.5515	0.5488	0.5570	0.5659	0.5722	0.5787 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.7700	1.0000	1.7700		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			17.3900	1.3258	23.0549		(27)
Ground Floor			45.0000	0.1300	5.8500		(28a)
Exposed over Garage			18.1900	0.1300	2.3647		(28b)
Brick and Block	141.3800	19.5100	121.8700	0.1800	21.9366		(29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1800	2.2698		(29a)
Dormer	1.3700		1.3700	0.1800	0.2466		(29a)
Pitched Roof	62.7600		62.7600	0.1300	8.1588		(30)
Sloping Ceiling	3.1100		3.1100	0.1300	0.4043		(30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.5997		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	18.8578 (36)
Total fabric heat loss	(33) + (36) = 87.4575 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	53.1153	52.7928	52.4766	50.9915	50.7136	49.4202	49.4202	49.1806	49.9184	50.7136	51.2757	51.8634 (38)
Average = Sum(39)m / 12 =	140.5729	140.2503	139.9341	138.4490	138.1712	136.8777	136.8777	136.6382	137.3759	138.1712	138.7333	139.3209 (39)
												138.4477 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2855	1.2826	1.2797	1.2661	1.2636	1.2517	1.2517	1.2495	1.2563	1.2636	1.2687	1.2741 (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												2.8109	(42)		
Average daily hot water use (litres/day)												100.9581	(43)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)		
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)		
Energy content (annual)															
Distribution loss	(46)m = 0.15 x (45)m												Total = Sum(45)m =	1588.4641	(45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.9966	30.6082	31.5849	27.5365	26.4219	22.8001	21.1277	24.2443	24.5339	28.5919	31.2102	33.8923 (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	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	140.5434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.2003	22.3827	18.2028	13.7807	10.3013	8.6968	9.3971	12.2148	16.3946	20.8168	24.2962	25.9007	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.6188	273.4270	266.3505	251.2854	232.2685	214.3953	202.4548	199.6467	206.7232	221.7882	240.8052	258.6784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	37.0543	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	47.0384	45.5480	42.4529	38.2452	35.5134	31.6669	28.3974	32.5864	34.0748	38.4299	43.3476	45.5542	(72)
Total internal gains	408.0206	406.5207	392.1692	368.4743	343.2461	319.9219	305.4124	309.6109	322.3556	346.1979	373.6120	395.2963	(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					0.8000	10.6334	0.6300		0.7000	0.7700		2.5998 (74)	
Northeast					2.1500	11.2829	0.6300		0.7000	0.7700		7.4137 (75)	
East					0.8000	19.6403	0.6300		0.7000	0.7700		4.8019 (76)	
Southeast					4.8900	36.7938	0.6300		0.7000	0.7700		54.9865 (77)	
Northwest					8.7500	11.2829	0.6300		0.7000	0.7700		30.1719 (81)	
Solar gains	99.9736	184.5304	289.9051	421.2830	528.0628	548.8350	518.9112	435.5721	334.8652	214.0739	122.3479	83.8673 (83)	
Total gains	507.9942	591.0511	682.0743	789.7573	871.3089	868.7569	824.3236	745.1830	657.2208	560.2718	495.9599	479.1636 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0200	54.1443	54.2666	54.8487	54.9590	55.4784	55.4784	55.5756	55.2772	54.9590	54.7363	54.5055	
alpha	4.6013	4.6096	4.6178	4.6566	4.6639	4.6986	4.6986	4.7050	4.6851	4.6639	4.6491	4.6337	
util living area	0.9993	0.9985	0.9957	0.9838	0.9409	0.8279	0.6765	0.7481	0.9370	0.9924	0.9987	0.9995	(86)
MIT	19.4578	19.6013	19.8674	20.2445	20.6086	20.8678	20.9624	20.9400	20.7202	20.2587	19.7952	19.4364	(87)
Th 2	19.8522	19.8545	19.8568	19.8675	19.8695	19.8788	19.8788	19.8806	19.8752	19.8695	19.8654	19.8612	(88)
util rest of house	0.9991	0.9979	0.9939	0.9766	0.9114	0.7411	0.5297	0.6080	0.8919	0.9880	0.9981	0.9993	(89)
MIT 2	18.4452	18.5903	18.8574	19.2390	19.5878	19.8125	19.8686	19.8616	19.7007	19.2576	18.7927	18.4308	(90)
Living area fraction	18.6064	18.7512	19.0182	19.3991	19.7503	19.9805	20.0428	20.0333	19.8630	19.4170	18.9523	18.5909	(92)
Temperature adjustment	18.6064	18.7512	19.0182	19.3991	19.7503	19.9805	20.0428	20.0333	19.8630	19.4170	18.9523	18.5909	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	507.3181	589.3430	676.7016	768.0127	790.6376	651.8607	456.0217	469.2487	585.7504	552.0886	494.6416	478.6832	(94)
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	2011.0905	1942.6385	1751.7201	1453.5930	1112.3260	736.4705	471.2362	496.4426	791.6947	1218.2484	1644.3133	2004.9544	(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	1118.8066	909.4146	799.8138	493.6178	239.3361	0.0000	0.0000	0.0000	0.0000	495.6229	827.7636	1135.5458	(98)
Space heating												6019.9213	(98)
Space heating per m2												55.0519	(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	1286.6503	1012.8949	1038.4500	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7654	0.8469	0.8005	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	984.7582	857.7858	831.2827	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1125.7906	1071.4746	981.1071	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	101.5433	158.9845	111.4694	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												371.9971 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.3858	39.7461	27.8673	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												92.9993 (107)
Space cooling per m2												0.8505 (108)
Energy for space heating												55.0519 (99)
Energy for space cooling												0.8505 (108)
Total												55.9023 (109)
Target Fabric Energy Efficiency (TFEE)												64.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1841 (8)
Pressure test					Yes
Measured/design AP50					4.1800
Infiltration rate					0.3931 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3341 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3509	0.3258	0.3341	0.3174	0.3174	0.3091	0.3007	0.2924	0.2840	0.3091	0.2924	0.3091 (22b)
Effective ac	0.5616	0.5531	0.5558	0.5504	0.5504	0.5478	0.5452	0.5427	0.5403	0.5478	0.5427	0.5478 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			17.3900	1.1450	19.9122		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000 (28a)
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000 (28b)
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514 (29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366 (29a)
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670 (29a)
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400 (30)
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900 (30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129		(33)
Ground Floor Block			48.7500			9.0000	438.7500 (32c)
Ground Floor Stud			26.4700			9.0000	238.2300 (32c)
First Floor Stud			154.0400			9.0000	1386.3600 (32c)
Internal Floor 1			44.1500			18.0000	794.7000 (32d)
Internal Ceiling 1			44.1500			18.0000	794.7000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16799.3250 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6289 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.0587 (36)
Total fabric heat loss						(33) + (36) =	88.8716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.3243	49.5645	49.8115	49.3237	49.3237	49.0892	48.8609	48.6389	48.4231	49.0892	48.6389	49.0892 (38)
Average = Sum(39)m / 12 =	139.1960	138.4361	138.6831	138.1953	138.1953	137.9608	137.7325	137.5105	137.2948	137.9608	137.5105	137.9608 (39)
												138.0531 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2729	1.2660	1.2682	1.2638	1.2638	1.2616	1.2596	1.2575	1.2556	1.2616	1.2575	1.2616 (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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)	Total = Sum(45)m = 1588.4641												(45)
Distribution loss (46)m = 0.15 x (45)m	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7300 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9342 (55)
Total storage loss	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(64)
RHI water heating demand													2203.3431 (64)
Heat gains from water heating, kWh/month	96.5374	85.6279	91.1992	83.5170	83.1207	76.1059	74.8367	79.7133	78.8187	86.5159	89.2653	94.8096	(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	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.0008	55.9568	45.5071	34.4518	25.7531	21.7419	23.4929	30.5369	40.9866	52.0419	60.7406	64.7518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.9087	408.1000	397.5380	375.0529	346.6694	319.9929	302.1714	297.9801	308.5420	331.0272	359.4107	386.0872	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	129.7546	127.4225	122.5796	115.9958	111.7213	105.7026	100.5869	107.1415	109.4704	116.2849	123.9795	127.4322	(72)
Total internal gains	710.5575	705.3727	679.5182	639.3939	598.0373	561.3309	540.1446	549.5520	572.8925	613.2474	658.0242	692.1646	(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				0.8000	13.4839	0.6300		0.7000	0.7700		3.2967 (74)	
Northeast				2.1500	14.6176	0.6300		0.7000	0.7700		9.6048 (75)	
East				0.8000	25.1925	0.6300		0.7000	0.7700		6.1593 (76)	
Southeast				4.8900	45.1778	0.6300		0.7000	0.7700		67.5159 (77)	
Northwest				8.7500	14.6176	0.6300		0.7000	0.7700		39.0893 (81)	
Solar gains	125.6660	198.4524	316.5341	465.0729	554.5788	625.8637	587.2420	505.0728	387.1025	249.0813	153.5170	103.4839 (83)
Total gains	836.2235	903.8251	996.0523	1104.4668	1152.6160	1187.1946	1127.3866	1054.6248	959.9949	862.3287	811.5413	795.6486 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	33.5245	33.7085	33.6485	33.7673	33.7673	33.8247	33.8807	33.9354	33.9888	33.8247	33.9354	33.8247	
alpha	3.2350	3.2472	3.2432	3.2512	3.2512	3.2550	3.2587	3.2624	3.2659	3.2550	3.2624	3.2550	
util living area	0.9738	0.9654	0.9406	0.8813	0.7720	0.5916	0.4532	0.4794	0.7242	0.8971	0.9578	0.9766	(86)
MIT	19.2925	19.4403	19.7962	20.2612	20.6583	20.8991	20.9685	20.9631	20.7960	20.3389	19.7696	19.2833	(87)
Th 2	19.8621	19.8676	19.8658	19.8693	19.8693	19.8710	19.8727	19.8743	19.8758	19.8710	19.8743	19.8710	(88)
util rest of house	0.9681	0.9579	0.9272	0.8531	0.7154	0.4971	0.3321	0.3532	0.6406	0.8657	0.9470	0.9714	(89)
MIT 2	18.3384	18.4878	18.8344	19.2806	19.6369	19.8225	19.8637	19.8635	19.7609	19.3643	18.8193	18.3363	(90)
Living area fraction	fLA = Living area / (4) =												0.1592 (91)
MIT	18.4903	18.6394	18.9876	19.4368	19.7995	19.9939	20.0396	20.0386	19.9257	19.5195	18.9706	18.4871	(92)
Temperature adjustment													0.0000
adjusted MIT	18.4903	18.6394	18.9876	19.4368	19.7995	19.9939	20.0396	20.0386	19.9257	19.5195	18.9706	18.4871	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9589	0.9473	0.9141	0.8403	0.7115	0.5082	0.3508	0.3726	0.6448	0.8537	0.9356	0.9630	(94)
Useful gains	801.8739	856.1914	910.5072	928.1292	820.0931	603.2827	395.5333	392.9979	619.0083	736.1703	759.2918	766.1818	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	1891.7208	1846.6566	1662.4735	1373.2147	1008.7553	647.5712	404.8732	404.0847	717.4591	1120.1738	1522.3220	1860.6906 (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												
Space heating	810.8461	665.5926	559.4630	320.4616	140.3647	0.0000	0.0000	0.0000	0.0000	285.6986	549.3817	814.3146 (98)
Space heating												4146.1229 (98)
RHI space heating demand												4146 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1841 (8)
Pressure test					Yes
Measured/design AP50					4.1800
Infiltration rate					0.3931 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3341 (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	0.4260	0.4177	0.4093	0.3676	0.3592	0.3174	0.3174	0.3091	0.3341	0.3592	0.3759	0.3926 (22b)
Effective ac	0.5908	0.5872	0.5838	0.5676	0.5645	0.5504	0.5504	0.5478	0.5558	0.5645	0.5707	0.5771 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			17.3900	1.1450	19.9122		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000 (28a)
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000 (28b)
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514 (29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366 (29a)
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670 (29a)
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400 (30)
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900 (30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129		(33)
Ground Floor Block			48.7500			9.0000	438.7500 (32c)
Ground Floor Stud			26.4700			9.0000	238.2300 (32c)
First Floor Stud			154.0400			9.0000	1386.3600 (32c)
Internal Floor 1			44.1500			18.0000	794.7000 (32d)
Internal Ceiling 1			44.1500			18.0000	794.7000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16799.3250 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							153.6289 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.0587 (36)
Total fabric heat loss						(33) + (36) =	88.8716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.9416	52.6258	52.3162	50.8622	50.5901	49.3237	49.3237	49.0892	49.8115	50.5901	51.1405	51.7158 (38)
Average = Sum(39)m / 12 =	141.8132	141.4974	141.1878	139.7338	139.4617	138.1953	138.1953	137.9608	138.6831	139.4617	140.0121	140.5874 (39)
												139.7325 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2969	1.2940	1.2912	1.2779	1.2754	1.2638	1.2638	1.2616	1.2682	1.2754	1.2804	1.2857 (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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)										Total =	Sum (45)m =	1588.4641	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9342	(55)
Total storage loss	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(64)
Heat gains from water heating, kWh/month	96.5374	85.6279	91.1992	83.5170	83.1207	76.1059	74.8367	79.7133	78.8187	86.5159	89.2653	94.8096	(65)
										Total per year (kWh/year) =	Sum (64)m =	2203.3431	(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.0008	55.9568	45.5071	34.4518	25.7531	21.7419	23.4929	30.5369	40.9866	52.0419	60.7406	64.7518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.9087	408.1000	397.5380	375.0529	346.6694	319.9929	302.1714	297.9801	308.5420	331.0272	359.4107	386.0872	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	129.7546	127.4225	122.5796	115.9958	111.7213	105.7026	100.5869	107.1415	109.4704	116.2849	123.9795	127.4322	(72)
Total internal gains	710.5575	705.3727	679.5182	639.3939	598.0373	561.3309	540.1446	549.5520	572.8925	613.2474	658.0242	692.1646	(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					0.8000	10.6334	0.6300	0.7000	0.7700		2.5998 (74)	
Northeast					2.1500	11.2829	0.6300	0.7000	0.7700		7.4137 (75)	
East					0.8000	19.6403	0.6300	0.7000	0.7700		4.8019 (76)	
Southeast					4.8900	36.7938	0.6300	0.7000	0.7700		54.9865 (77)	
Northwest					8.7500	11.2829	0.6300	0.7000	0.7700		30.1719 (81)	
Solar gains	99.9736	184.5304	289.9051	421.2830	528.0628	548.8350	518.9112	435.5721	334.8652	214.0739	122.3479	83.8673 (83)
Total gains	810.5311	889.9031	969.4232	1060.6768	1126.1000	1110.1659	1059.0558	985.1241	907.7576	827.3213	780.3721	776.0319 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.9058	32.9793	33.0516	33.3955	33.4606	33.7673	33.7673	33.8247	33.6485	33.4606	33.3291	33.1927	
alpha	3.1937	3.1986	3.2034	3.2264	3.2307	3.2512	3.2512	3.2550	3.2432	3.2307	3.2219	3.2128	
util living area	0.9783	0.9693	0.9498	0.9038	0.8145	0.6718	0.5297	0.5795	0.7841	0.9228	0.9678	0.9810 (86)	
MIT	19.1261	19.3149	19.6581	20.1249	20.5457	20.8337	20.9435	20.9234	20.7062	20.1784	19.5774	19.0907 (87)	
Th 2	19.8433	19.8455	19.8478	19.8582	19.8602	19.8693	19.8693	19.8710	19.8658	19.8602	19.8562	19.8521 (88)	
util rest of house	0.9737	0.9627	0.9385	0.8807	0.7676	0.5872	0.4109	0.4611	0.7138	0.8995	0.9597	0.9770 (89)	
MIT 2	18.1601	18.3479	18.6866	19.1446	19.5330	19.7778	19.8493	19.8414	19.6841	19.2056	18.6174	18.1315 (90)	
Living area fraction									fLA = Living area / (4) =				0.1592 (91)
MIT	18.3139	18.5019	18.8413	19.3007	19.6942	19.9459	20.0235	20.0137	19.8468	19.3605	18.7702	18.2842 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.3139	18.5019	18.8413	19.3007	19.6942	19.9459	20.0235	20.0137	19.8468	19.3605	18.7702	18.2842 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9654	0.9525	0.9259	0.8671	0.7598	0.5935	0.4281	0.4773	0.7124	0.8866	0.9495	0.9694	(94)
Useful gains	782.5121	847.6711	897.5769	919.6964	855.6081	658.8799	453.4108	470.1523	646.7043	733.4876	740.9388	752.3002	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	1987.3523	1924.6328	1742.4393	1453.3235	1114.8859	738.7772	473.1128	498.5460	796.9842	1221.7514	1633.9757	1980.0661 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	896.4011	723.7182	628.5776	384.2115	192.9027	0.0000	0.0000	0.0000	0.0000	363.2683	642.9866	913.4578 (98)
Space heating												4745.5239 (98)
Space heating per m2												(98) / (4) = 43.3976 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5226.3479 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	896.4011	723.7182	628.5776	384.2115	192.9027	0.0000	0.0000	0.0000	0.0000	363.2683	642.9866	913.4578 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	987.2259	797.0465	692.2661	423.1404	212.4479	0.0000	0.0000	0.0000	0.0000	400.0752	708.1350	1006.0108 (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	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158 (64)
Efficiency of water heater	88.4967	88.3340	87.9548	87.0869	85.3514	80.1000	80.1000	80.1000	80.1000	86.8601	88.0375	80.1000 (216)
(217)m	88.4967	88.3340	87.9548	87.0869	85.3514	80.1000	80.1000	80.1000	80.1000	86.8601	88.0375	88.5737 (217)
Fuel for water heating, kWh/month	245.1078	216.4598	228.3647	206.8297	206.8638	197.0446	189.3220	207.6323	207.2303	215.0269	224.2337	239.0279 (219)
Water heating fuel used												2583.1437 (219)
Annual totals kWh/year												
Space heating fuel - main system												5226.3479 (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)												445.0457 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.28 * 1004 * 1.00) =									-1028.0921			-1028.0921 (233)
Total delivered energy for all uses												7301.4452 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	5226.3479	3.4800	181.8769 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2583.1437	3.4800	89.8934 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	445.0457	13.1900	58.7015 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1028.0921	13.1900	-135.6053 (252)
Total energy cost			324.7590 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8837 (257)
SAP value		87.6724
SAP rating (Section 12)		88 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	5226.3479	0.2160	1128.8911 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.1437	0.2160	557.9590 (264)
Space and water heating			1686.8502 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.0457	0.5190	230.9787 (268)
Energy saving/generation technologies			
PV Unit	-1028.0921	0.5190	-533.5798 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Total kg/year	1423.1741 (272)
CO2 emissions per m2	13.0100 (273)
EI value	87.6446
EI rating	88 (274)
EI band	B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9080 = 3.833$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9080 = 0.2379$, stars = 4
Water heating energy efficiency	$3.48 / 0.8509 = 4.090$, stars = 4
Water heating environmental impact	$0.216 / 0.8509 = 0.2538$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour										
										heating	heating													
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																5 * 10 =	50.0000 (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) =					50.0000	/ (5) =	0.1841 (8)							
Pressure test										Yes														
Measured/design AP50										4.1800														
Infiltration rate										0.3931 (18)														
Number of sides sheltered										2 (19)														
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)									
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3341 (21)									
													Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed													4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor													1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate													0.3509	0.3258	0.3341	0.3174	0.3174	0.3091	0.3007	0.2924	0.2840	0.3091	0.2924	0.3091 (22b)
Effective ac													0.5616	0.5531	0.5558	0.5504	0.5504	0.5478	0.5452	0.5427	0.5403	0.5478	0.5427	0.5478 (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						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			17.3900	1.1450	19.9122			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000	(28a)					
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000	(28b)					
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514	(29a)					
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366	(29a)					
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670	(29a)					
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400	(30)					
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900	(30)					
Total net area of external elements Aum(A, m2)			286.1900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129			(33)					
Ground Floor Block			48.7500			9.0000	438.7500	(32c)					
Ground Floor Stud			26.4700			9.0000	238.2300	(32c)					
First Floor Stud			154.0400			9.0000	1386.3600	(32c)					
Internal Floor 1			44.1500			18.0000	794.7000	(32d)					
Internal Ceiling 1			44.1500			18.0000	794.7000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16799.3250	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								153.6289	(35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.0587	(36)				
Total fabric heat loss						(33) + (36) =		88.8716	(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	50.3243	49.5645	49.8115	49.3237	49.3237	49.0892	48.8609	48.6389	48.4231	49.0892	48.6389	49.0892	(38)
Heat transfer coeff	139.1960	138.4361	138.6831	138.1953	138.1953	137.9608	137.7325	137.5105	137.2948	137.9608	137.5105	137.9608	(39)
Average = Sum(39)m / 12 =												138.0531	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2729	1.2660	1.2682	1.2638	1.2638	1.2616	1.2596	1.2575	1.2556	1.2616	1.2575	1.2616	(40)
HLP (average)												1.2625	(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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)	Total = Sum (45)m =											1588.4641	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9342	(55)
Total storage loss	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158	(64)
Heat gains from water heating, kWh/month	96.5374	85.6279	91.1992	83.5170	83.1207	76.1059	74.8367	79.7133	78.8187	86.5159	89.2653	94.8096	(65)
Total per year (kWh/year) = Sum (64)m =													2203.3431 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.0008	55.9568	45.5071	34.4518	25.7531	21.7419	23.4929	30.5369	40.9866	52.0419	60.7406	64.7518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.9087	408.1000	397.5380	375.0529	346.6694	319.9929	302.1714	297.9801	308.5420	331.0272	359.4107	386.0872	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	129.7546	127.4225	122.5796	115.9958	111.7213	105.7026	100.5869	107.1415	109.4704	116.2849	123.9795	127.4322	(72)
Total internal gains	710.5575	705.3727	679.5182	639.3939	598.0373	561.3309	540.1446	549.5520	572.8925	613.2474	658.0242	692.1646	(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				0.8000	13.4839	0.6300		0.7000	0.7700		3.2967 (74)	
Northeast				2.1500	14.6176	0.6300		0.7000	0.7700		9.6048 (75)	
East				0.8000	25.1925	0.6300		0.7000	0.7700		6.1593 (76)	
Southeast				4.8900	45.1778	0.6300		0.7000	0.7700		67.5159 (77)	
Northwest				8.7500	14.6176	0.6300		0.7000	0.7700		39.0893 (81)	
Solar gains	125.6660	198.4524	316.5341	465.0729	554.5788	625.8637	587.2420	505.0728	387.1025	249.0813	153.5170	103.4839 (83)
Total gains	836.2235	903.8251	996.0523	1104.4668	1152.6160	1187.1946	1127.3866	1054.6248	959.9949	862.3287	811.5413	795.6486 (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	33.5245	33.7085	33.6485	33.7673	33.7673	33.8247	33.8807	33.9354	33.9888	33.8247	33.9354	33.8247	
alpha	3.2350	3.2472	3.2432	3.2512	3.2512	3.2550	3.2587	3.2624	3.2659	3.2550	3.2624	3.2550	
util living area	0.9738	0.9654	0.9406	0.8813	0.7720	0.5916	0.4532	0.4794	0.7242	0.8971	0.9578	0.9766	(86)
MIT	19.2925	19.4403	19.7962	20.2612	20.6583	20.8991	20.9685	20.9631	20.7960	20.3389	19.7696	19.2833	(87)
Th 2	19.8621	19.8676	19.8658	19.8693	19.8693	19.8710	19.8727	19.8743	19.8758	19.8710	19.8743	19.8710	(88)
util rest of house	0.9681	0.9579	0.9272	0.8531	0.7154	0.4971	0.3321	0.3532	0.6406	0.8657	0.9470	0.9714	(89)
MIT 2	18.3384	18.4878	18.8344	19.2806	19.6369	19.8225	19.8637	19.8635	19.7609	19.3643	18.8193	18.3363	(90)
Living area fraction	18.4903	18.6394	18.9876	19.4368	19.7995	19.9939	20.0396	20.0386	19.9257	19.5195	18.9706	0.1592	(91)
MIT	18.4903	18.6394	18.9876	19.4368	19.7995	19.9939	20.0396	20.0386	19.9257	19.5195	18.9706	18.4871	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4903	18.6394	18.9876	19.4368	19.7995	19.9939	20.0396	20.0386	19.9257	19.5195	18.9706	18.4871	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	801.8739	856.1914	910.5072	928.1292	820.0931	603.2827	395.5333	392.9979	619.0083	736.1703	759.2918	766.1818	(94)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(95)
Heat loss rate W												0.9630	(96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fracti	1891.7208	1846.6566	1662.4735	1373.2147	1008.7553	647.5712	404.8732	404.0847	717.4591	1120.1738	1522.3220	1860.6906 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	810.8461	665.5926	559.4630	320.4616	140.3647	0.0000	0.0000	0.0000	0.0000	285.6986	549.3817	814.3146 (98)
Space heating												4146.1229 (98)
Space heating per m2											(98) / (4) =	37.9161 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4566.2147 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	810.8461	665.5926	559.4630	320.4616	140.3647	0.0000	0.0000	0.0000	0.0000	285.6986	549.3817	814.3146 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	893.0023	733.0315	616.1486	352.9313	154.5867	0.0000	0.0000	0.0000	0.0000	314.6460	605.0460	896.8222 (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	216.9123	191.2075	200.8576	180.1216	176.5612	157.8327	151.6469	166.3135	165.9915	186.7725	197.4098	211.7158 (64)
Efficiency of water heater	88.3103	88.1715	87.7050	86.6357	84.5107	80.1000	80.1000	80.1000	80.1000	86.2457	87.7030	80.1000 (216)
(217)m	88.3103	88.1715	87.7050	86.6357	84.5107	80.1000	80.1000	80.1000	80.1000	86.2457	87.7030	88.3643 (217)
Fuel for water heating, kWh/month	245.6253	216.8586	229.0152	207.9068	208.9216	197.0446	189.3220	207.6323	207.2303	216.5588	225.0888	239.5943 (219)
Water heating fuel used												2590.7987 (219)
Annual totals kWh/year												
Space heating fuel - main system												4566.2147 (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)												445.0457 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.28 * 1122 * 1.00) =									-1148.8467			-1148.8467 (233)
Total delivered energy for all uses												6528.2124 (238)

10a. Fuel costs - using BEDF prices (514)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	4566.2147	9.7400	444.7493 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2590.7987	9.7400	252.3438 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	445.0457	36.8500	163.9994 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1148.8467	36.8500	-423.3500 (252)
Total energy cost			569.3799 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4566.2147	0.2160	986.3024 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2590.7987	0.2160	559.6125 (264)
Space and water heating			1545.9149 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	445.0457	0.5190	230.9787 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	0.5190	-596.2515 (269)
Total kg/year			1219.5672 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	4566.2147	1.2200	5570.7819 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

FULL SAP CALCULATION PRINTOUT

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

Water heating (other fuel)	2590.7987	1.2200	3160.7744 (264)
Space and water heating			8731.5564 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	445.0457	3.0700	1366.2904 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	3.0700	-3526.9594 (269)
Primary energy kWh/year			6801.1374 (272)
Primary energy kWh/m2/year			62.1960 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 113	-266 kg (21.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£113	2.44 kg/m²	B 89 B 90
Total Savings	£113	2.44 kg/m²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£192	£210	-£18
Mains gas	£801	£669	£132
Space heating	£576	£581	-£5
Water heating	£252	£134	£118
Lighting	£164	£164	£0
Generated (PV)	-£423	-£423	£0
Total cost of fuels	£570	£456	£114
Total cost of uses	£569	£456	£113
Delivered energy	60 kWh/m²	48 kWh/m²	12 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.3 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	49 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1841 (8)
Pressure test					Yes
Measured/design AP50					4.1800
Infiltration rate					0.3931 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3341 (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	0.4260	0.4177	0.4093	0.3676	0.3592	0.3174	0.3174	0.3091	0.3341	0.3592	0.3759	0.3926 (22b)
Effective ac	0.5908	0.5872	0.5838	0.5676	0.5645	0.5504	0.5504	0.5478	0.5558	0.5645	0.5707	0.5771 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			17.3900	1.1450	19.9122		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000 (28a)
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000 (28b)
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514 (29a)
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366 (29a)
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670 (29a)
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400 (30)
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900 (30)
Total net area of external elements Aum(A, m ²)			286.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129		(33)
Ground Floor Block			48.7500			9.0000	438.7500 (32c)
Ground Floor Stud			26.4700			9.0000	238.2300 (32c)
First Floor Stud			154.0400			9.0000	1386.3600 (32c)
Internal Floor 1			44.1500			18.0000	794.7000 (32d)
Internal Ceiling 1			44.1500			18.0000	794.7000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16799.3250 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							153.6289 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.0587 (36)
Total fabric heat loss						(33) + (36) =	88.8716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.9416	52.6258	52.3162	50.8622	50.5901	49.3237	49.3237	49.0892	49.8115	50.5901	51.1405	51.7158 (38)
Average = Sum(39)m / 12 =	141.8132	141.4974	141.1878	139.7338	139.4617	138.1953	138.1953	137.9608	138.6831	139.4617	140.0121	140.5874 (39)
												139.7325 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2969	1.2940	1.2912	1.2779	1.2754	1.2638	1.2638	1.2616	1.2682	1.2754	1.2804	1.2857 (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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)	Total = Sum (45)m =											1588.4641	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7300 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9342 (55)
Total storage loss	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage	18.1001	16.3485	18.1001	17.5163	18.1001	17.5163	18.1001	18.1001	17.5163	18.1001	17.5163	18.1001	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	206.0523	181.3984	188.6018	162.8583	152.9068	134.7163	127.7599	143.3570	150.0789	174.5167	186.9000	200.8558	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1079.5246 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1813.6014 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.1417 (H8)
Utilisation factor													0.5835 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													112.5000 (H13)
Daily hot water demand													100.9581 (H14)
Volume ratio Veff/V													1.1143 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input	-26.9825	-45.0261	-76.6845	-102.7724	-126.9666	-124.8284	-123.1788	-107.6219	-84.2895	-57.5598	-32.0052	-930.4956	(H17)
Solar input													-22.5798 (63)
Solar input (sum of months) = Sum(63)m =													-930.4956 (63)
Output from w/h	179.0698	136.3723	111.9173	60.0859	25.9401	9.8878	4.5811	35.7350	65.7893	116.9569	154.8949	178.2760	(64)
Heat gains from water heating, kWh/month	87.8494	77.7806	81.3946	69.7063	64.1971	57.6127	55.7271	61.3481	66.0886	76.7113	80.8575	86.1215	(65)
Total per year (kWh/year) = Sum(64)m =													1079.5064 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.0008	55.9568	45.5071	34.4518	25.7531	21.7419	23.4929	30.5369	40.9866	52.0419	60.7406	64.7518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.9087	408.1000	397.5380	375.0529	346.6694	319.9929	302.1714	297.9801	308.5420	331.0272	359.4107	386.0872	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	118.0771	115.7450	109.4013	96.8143	86.2865	80.0177	74.9020	82.4571	91.7897	103.1066	112.3020	115.7547	(72)
Total internal gains	698.8800	693.6952	666.3399	620.2124	572.6024	535.6459	514.4597	524.8675	555.2118	600.0691	646.3467	680.4871	(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					0.8000	10.6334		0.6300	0.7000	0.7700		2.5998 (74)	
Northeast					2.1500	11.2829		0.6300	0.7000	0.7700		7.4137 (75)	
East					0.8000	19.6403		0.6300	0.7000	0.7700		4.8019 (76)	
Southeast					4.8900	36.7938		0.6300	0.7000	0.7700		54.9865 (77)	
Northwest					8.7500	11.2829		0.6300	0.7000	0.7700		30.1719 (81)	
Solar gains	99.9736	184.5304	289.9051	421.2830	528.0628	548.8350	518.9112	435.5721	334.8652	214.0739	122.3479	83.8673 (83)	
Total gains	798.8536	878.2256	956.2449	1041.4953	1100.6652	1084.4809	1033.3708	960.4396	890.0769	814.1430	768.6946	764.3544 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	32.9058	32.9793	33.0516	33.3955	33.4606	33.7673	33.7673	33.8247	33.6485	33.4606	33.3291	33.1927	
alpha	3.1937	3.1986	3.2034	3.2264	3.2307	3.2512	3.2512	3.2550	3.2432	3.2307	3.2219	3.2128	
util living area	0.9792	0.9703	0.9515	0.9077	0.8221	0.6818	0.5402	0.5905	0.7912	0.9256	0.9691	0.9818	(86)
MIT	19.1133	19.3026	19.6451	20.1090	20.5310	20.8260	20.9402	20.9190	20.6973	20.1666	19.5651	19.0777	(87)
Th 2	19.8433	19.8455	19.8478	19.8582	19.8602	19.8693	19.8693	19.8710	19.8658	19.8602	19.8562	19.8521	(88)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

util rest of house	0.9747	0.9639	0.9405	0.8853	0.7762	0.5974	0.4200	0.4712	0.7219	0.9030	0.9612	0.9779 (89)
MIT 2	18.1475	18.3359	18.6742	19.1300	19.5209	19.7730	19.8480	19.8395	19.6776	19.1948	18.6054	18.1188 (90)
Living area fraction									fLA = Living area / (4) =			0.1592 (91)
MIT	18.3013	18.4898	18.8288	19.2859	19.6817	19.9406	20.0219	20.0113	19.8399	19.3496	18.7582	18.2714 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3013	18.4898	18.8288	19.2859	19.6817	19.9406	20.0219	20.0113	19.8399	19.3496	18.7582	18.2714 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9666	0.9540	0.9281	0.8716	0.7679	0.6033	0.4373	0.4873	0.7200	0.8901	0.9512	0.9706	(94)
Useful gains	772.2021	837.8192	887.4514	907.7658	845.2218	654.2662	451.9329	468.0637	640.8769	724.6962	731.1964	741.8483	(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	1985.5644	1922.9182	1740.6698	1451.2586	1113.1433	738.0515	472.8854	498.2240	796.0276	1220.2291	1632.2912	1978.2680	(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	902.7416	729.1865	634.7945	391.3148	199.3336	0.0000	0.0000	0.0000	0.0000	368.6765	648.7882	919.8962	(98)
Space heating												4794.7320	(98)
Space heating per m2												43.8476	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5280.5418 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	902.7416	729.1865	634.7945	391.3148	199.3336	0.0000	0.0000	0.0000	0.0000	368.6765	648.7882	919.8962	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	994.2088	803.0689	699.1128	430.9635	219.5304	0.0000	0.0000	0.0000	0.0000	406.0313	714.5245	1013.1016	(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	179.0698	136.3723	111.9173	60.0859	25.9401	9.8878	4.5811	35.7350	65.7893	116.9569	154.8949	178.2760	(64)
Efficiency of water heater	88.8357	88.9284	89.0177	89.2137	89.4245	80.1000	80.1000	80.1000	80.1000	87.9699	88.5210	88.8727	(216)
Fuel for water heating, kWh/month	201.5741	153.3508	125.7247	67.3505	29.0079	12.3444	5.7193	44.6130	82.1340	132.9510	174.9810	200.5970	(219)
Annual totals kWh/year												1230.3476	(219)
Space heating fuel - main system												5280.5418	(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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													445.0457 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1004 * 1.00) =										-1028.0921		-1028.0921	(233)
Total delivered energy for all uses												6052.8430	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5280.5418	3.4800	183.7629	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1230.3476	3.4800	42.8161	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	445.0457	13.1900	58.7015	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1028.0921	13.1900	-135.6053	(252)
Total energy cost			286.1626	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7787 (257)
 SAP value 89.1375
 SAP rating (Section 12) 89 (258)
 SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5280.5418	0.2160	1140.5970 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1230.3476	0.2160	265.7551 (264)
Space and water heating			1406.3521 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	445.0457	0.5190	230.9787 (268)
Energy saving/generation technologies			
PV Unit	-1028.0921	0.5190	-533.5798 (269)
Total kg/year			1168.6260 (272)
CO2 emissions per m2			10.6900 (273)
EI value			89.8545
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.0000 (1b)	x 2.6600 (2b)	= 119.7000 (1b) - (3b)
First floor	64.3500 (1c)	x 2.3600 (2c)	= 151.8660 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.3500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.5660 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																5 * 10 =	50.0000 (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) =					50.0000	/ (5) =	0.1841 (8)
Pressure test										Yes							
Measured/design AP50										4.1800							
Infiltration rate										0.3931 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3341 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)				
Adj infilt rate	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)				
	0.3509	0.3258	0.3341	0.3174	0.3174	0.3091	0.3007	0.2924	0.2840	0.3091	0.2924	0.3091	(22b)				
Effective ac	0.5616	0.5531	0.5558	0.5504	0.5504	0.5478	0.5452	0.5427	0.5403	0.5478	0.5427	0.5478	(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						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			17.3900	1.1450	19.9122			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			45.0000	0.1200	5.4000	140.0000	6300.0000	(28a)					
Exposed over Garage			18.1900	0.1723	3.1345	20.0000	363.8000	(28b)					
Brick and Block	141.3800	19.5100	121.8700	0.2400	29.2488	42.2200	5145.3514	(29a)					
Wall to Garage	14.3800	1.7700	12.6100	0.1966	2.4796	58.0600	732.1366	(29a)					
Dormer	1.3700		1.3700	0.2300	0.3151	9.1000	12.4670	(29a)					
Pitched Roof	62.7600		62.7600	0.1000	6.2760	9.0000	564.8400	(30)					
Sloping Ceiling	3.1100		3.1100	0.1700	0.5287	9.0000	27.9900	(30)					
Total net area of external elements Aum(A, m2)			286.1900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	72.8129			(33)					
Ground Floor Block			48.7500			9.0000	438.7500	(32c)					
Ground Floor Stud			26.4700			9.0000	238.2300	(32c)					
First Floor Stud			154.0400			9.0000	1386.3600	(32c)					
Internal Floor 1			44.1500			18.0000	794.7000	(32d)					
Internal Ceiling 1			44.1500			18.0000	794.7000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		16799.3250	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								153.6289 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.0587 (36)					
Total fabric heat loss						(33) + (36) =		88.8716 (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	50.3243	49.5645	49.8115	49.3237	49.3237	49.0892	48.8609	48.6389	48.4231	49.0892	48.6389	49.0892	(38)
Heat transfer coeff	139.1960	138.4361	138.6831	138.1953	138.1953	137.9608	137.7325	137.5105	137.2948	137.9608	137.5105	137.9608	(39)
Average = Sum(39)m / 12 =												138.0531	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2729	1.2660	1.2682	1.2638	1.2638	1.2616	1.2596	1.2575	1.2556	1.2616	1.2575	1.2616	(40)
HLP (average)												1.2625	(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	2.8109 (42)
Average daily hot water use (litres/day)	100.9581 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0539	107.0156	102.9773	98.9389	94.9006	90.8623	90.8623	94.9006	98.9389	102.9773	107.0156	111.0539	(44)
Energy conte	164.6897	144.0387	148.6350	129.5836	124.3386	107.2947	99.4243	114.0909	115.4535	134.5499	146.8718	159.4932	(45)
Energy content (annual)	Total = Sum (45)m =											1588.4641	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7035	21.6058	22.2953	19.4375	18.6508	16.0942	14.9137	17.1136	17.3180	20.1825	22.0308	23.9240	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7300 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9342 (55)
Total storage loss	28.9602	26.1576	28.9602	28.0260	28.9602	28.0260	28.9602	28.9602	28.0260	28.9602	28.0260	28.9602	(56)
If cylinder contains dedicated solar storage	18.1001	16.3485	18.1001	17.5163	18.1001	17.5163	18.1001	18.1001	17.5163	18.1001	17.5163	18.1001	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	206.0523	181.3984	188.6018	162.8583	152.9068	134.7163	127.7599	143.3570	150.0789	174.5167	186.9000	200.8558	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1208.1510 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													2029.6937 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.2778 (H8)
Utilisation factor													0.5428 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													112.5000 (H13)
Daily hot water demand													100.9581 (H14)
Volume ratio Veff/V													1.1143 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-968.7155 (H17)
Solar input	-31.6018	-44.9358	-77.2339	-104.2064	-122.3966	-130.7389	-127.9895	-114.5545	-89.6882	-62.0074	-37.3767	-25.9859	(63)
Solar input (sum of months) = Sum(63)m =													-968.7155 (63)
Output from w/h	174.4504	136.4626	111.3680	58.6519	30.5101	3.9773	0.0000	28.8025	60.3906	112.5093	149.5234	174.8698	(64)
Heat gains from water heating, kWh/month	87.8494	77.7806	81.3946	69.7063	64.1971	57.6127	55.7271	61.3481	66.0886	76.7113	80.8575	86.1215	(65)
Total per year (kWh/year) = Sum(64)m =													1041.5161 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	168.6521	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.0008	55.9568	45.5071	34.4518	25.7531	21.7419	23.4929	30.5369	40.9866	52.0419	60.7406	64.7518	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.9087	408.1000	397.5380	375.0529	346.6694	319.9929	302.1714	297.9801	308.5420	331.0272	359.4107	386.0872	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	54.6761	(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)	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	-112.4347	(71)
Water heating gains (Table 5)	118.0771	115.7450	109.4013	96.8143	86.2865	80.0177	74.9020	82.4571	91.7897	103.1066	112.3020	115.7547	(72)
Total internal gains	698.8800	693.6952	666.3399	620.2124	572.6024	535.6459	514.4597	524.8675	555.2118	600.0691	646.3467	680.4871	(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					0.8000	13.4839		0.6300	0.7000	0.7700		3.2967 (74)	
Northeast					2.1500	14.6176		0.6300	0.7000	0.7700		9.6048 (75)	
East					0.8000	25.1925		0.6300	0.7000	0.7700		6.1593 (76)	
Southeast					4.8900	45.1778		0.6300	0.7000	0.7700		67.5159 (77)	
Northwest					8.7500	14.6176		0.6300	0.7000	0.7700		39.0893 (81)	
Solar gains	125.6660	198.4524	316.5341	465.0729	554.5788	625.8637	587.2420	505.0728	387.1025	249.0813	153.5170	103.4839 (83)	
Total gains	824.5460	892.1476	982.8740	1085.2853	1127.1812	1161.5096	1101.7016	1029.9404	942.3142	849.1504	799.8638	783.9711 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	33.5245	33.7085	33.6485	33.7673	33.7673	33.8247	33.8807	33.9354	33.9888	33.8247	33.9354	33.8247	
alpha	3.2350	3.2472	3.2432	3.2512	3.2512	3.2550	3.2587	3.2624	3.2659	3.2550	3.2624	3.2550	
util living area	0.9747	0.9665	0.9425	0.8856	0.7803	0.6012	0.4623	0.4891	0.7318	0.9006	0.9594	0.9775	(86)
MIT	19.2799	19.4281	19.7836	20.2466	20.6460	20.8942	20.9666	20.9608	20.7892	20.3282	19.7577	19.2705	(87)
Th 2	19.8621	19.8676	19.8658	19.8693	19.8693	19.8710	19.8727	19.8743	19.8758	19.8710	19.8743	19.8710	(88)

FULL SAP CALCULATION PRINTOUT

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

util rest of house	0.9692	0.9593	0.9294	0.8582	0.7246	0.5062	0.3394	0.3611	0.6487	0.8699	0.9489	0.9726 (89)
MIT 2	18.3261	18.4758	18.8225	19.2676	19.6274	19.8198	19.8631	19.8628	19.7564	19.3549	18.8078	18.3238 (90)
Living area fraction									fLA = Living area / (4) =			0.1592 (91)
MIT	18.4779	18.6274	18.9755	19.4235	19.7896	19.9909	20.0388	20.0376	19.9209	19.5099	18.9590	18.4745 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4779	18.6274	18.9755	19.4235	19.7896	19.9909	20.0388	20.0376	19.9209	19.5099	18.9590	18.4745 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9603	0.9489	0.9165	0.8453	0.7202	0.5171	0.3584	0.3807	0.6525	0.8578	0.9377	0.9643 (94)	
Useful gains	791.8083	846.5359	900.8177	917.3699	811.7401	600.5900	394.8228	392.1464	614.8501	728.4054	750.0294	755.9758 (95)	
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)	
Heat loss rate W	1889.9927	1844.9990	1660.8000	1371.3774	1007.3875	647.1573	404.7628	403.9525	716.7973	1118.8465	1520.7355	1858.9521 (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	817.0492	670.9672	565.4269	326.8854	145.5617	0.0000	0.0000	0.0000	0.0000	290.4882	554.9084	820.6143 (98)	
Space heating												4191.9013 (98)	
Space heating per m2												38.3347 (99)	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4616.6314 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	817.0492	670.9672	565.4269	326.8854	145.5617	0.0000	0.0000	0.0000	0.0000	290.4882	554.9084	820.6143 (98)	
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)	
Space heating fuel (main heating system)	899.8339	738.9506	622.7168	360.0059	160.3102	0.0000	0.0000	0.0000	0.0000	319.9209	611.1326	903.7603 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	174.4504	136.4626	111.3680	58.6519	30.5101	3.9773	0.0000	28.8025	60.3906	112.5093	149.5234	174.8698 (64)	
Efficiency of water heater (217)m	88.7149	88.7953	88.8470	88.9915	88.7457	80.1000	80.1000	80.1000	80.1000	87.5355	88.2964	88.7182 (217)	
Fuel for water heating, kWh/month	196.6416	153.6822	125.3480	65.9073	34.3793	4.9655	0.0000	35.9582	75.3941	128.5300	169.3425	197.1071 (219)	
Water heating fuel used												1187.2558 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4616.6314 (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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													445.0457 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1122 * 1.00) =									-1148.8467			-1148.8467 (233)	
Total delivered energy for all uses												5225.0862 (238)	

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4616.6314	9.7400	449.6599 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1187.2558	9.7400	115.6387 (247)	
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)	
Pump for solar water heating	50.0000	36.8500	18.4250 (249)	
Energy for lighting	445.0457	36.8500	163.9994 (250)	
Additional standing charges			104.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1148.8467	36.8500	-423.3500 (252)	
Total energy cost			456.0105 (255)	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4616.6314	0.2160	997.1924 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1187.2558	0.2160	256.4473 (264)
Space and water heating			1253.6396 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	445.0457	0.5190	230.9787 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	0.5190	-596.2515 (269)
Total kg/year			953.2419 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4616.6314	1.2200	5632.2903 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1187.2558	1.2200	1448.4521 (264)
Space and water heating			7080.7424 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	445.0457	3.0700	1366.2904 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	3.0700	-3526.9594 (269)
Primary energy kWh/year			5303.8234 (272)
Primary energy kWh/m2/year			48.5032 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool batt				
	Main construction	350	0.0380	9.2105	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Mineral wool batt				
	Main construction	100	0.0380	2.6316	87.50
	Main construction	100	0.1300	0.7692	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Roof 000004 - Insulation between and below

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Tiling				
	Main construction	30	1.5000	0.0200	100.00
Layer 2	airspace/timber battens				
	Main construction	25	0.2500	0.1000	91.59
	Main construction	25	0.1563	0.1600	8.41
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Standard cavity				
	Main construction	50	0.2948	0.1696	87.50
	Main construction	50	0.1300	0.3846	12.50
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)				
Layer 5	Celotex GA4000				
	Main construction	100	0.0220	4.5455	87.50
	Main construction	100	0.1300	0.7692	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Celotex				
	Main construction	45	0.0220	2.0455	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 6.229 m ² K/W	Lower limit = 5.367 m ² K/W	Average = 5.798 m ² K/W
	Total correction = 0.0036 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space: None

Total thickness: 264 mm

U-value: 0.17 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000006

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None

Total thickness: 330 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
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Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000009

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00		
Layer 2	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	680	1000
	Main construction	100	0.8803	0.1136	5.96	680	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.569 m ² K/W	Lower limit = 4.435 m ² K/W	Average = 4.502 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.22 W/m ² K	

U-VALUE CALCULATOR REPORT

Unheated space: None

Total thickness: 355 mm

U-value: 0.22 W/m² K

Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000010

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Zinc						
	Main construction	1	113.0000	0.0000	100.00		
Layer 2	Breather membrane						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Orientated Strand Board						
	Main construction	9	0.1300	0.0692	100.00		
Layer 4	Celotex GA4000						
	Main construction	100	0.0220	4.5455	87.50	30	1400
	Main construction	100	0.1300	0.7692	12.50	30	1400
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Celotex TB4000						
	Main construction	20	0.0220	0.9091	100.00	30	1400
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.644 m ² K/W	Lower limit = 4.025 m ² K/W	Average = 4.335 m ² K/W
	Total correction = 0.0047 m ² K/W	U-value (unrounded) = 0.23 W/m ² K	

Unheated space: None

Total thickness: 143 mm

U-value: 0.23 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Floor 000008 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 45.17 m², Perimeter = 28.84 m, Wall thickness = 300.00 mm, Soil: Clay

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

Floor height above ground: h = 0.000 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	Extruded polystyrene						
	Main construction	100	0.0270	3.7037	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Extruded polystyrene						
	Main construction	200	0.0270	7.4074	91.67		
	Main construction	200	2.3000	0.0870	8.33		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Concrete, reinforced (1% steel)						
	Main construction	75	2.3000	0.0326	100.00	2000	1000
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance:	Upper limit = 10.093 m ² K/W	Lower limit = 5.066 m ² K/W	Average = 7.579 m ² K/W
	Total correction = 0.0025 m ² K/W	U-value (unrounded) = 0.12 W/m ² K	

Unheated space: None

Total thickness: 450 mm

U-value: 0.12 W/m² K

Kappa: 140.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Project	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.66	TER	18.87
Environmental	88 B	% DER<TER	22.30		
CO ₂ Emissions (t/year)	1.22	DFEE	53.92	TFEE	64.29
General Requirements Compliance	Pass	% DFEE<TFEE	16.12		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Floor 000005 - New exposed above Garage

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, high density				
	Main construction	12.5	0.2500	0.0500	100.00
Layer 2	Polythene, 500 gauge				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 3	Mineral wool batt				
	Main construction	255	0.0380	6.7105	87.50
	Main construction	255	0.1300	1.9615	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 5.720 m ² K/W	Lower limit = 5.581 m ² K/W	Average = 5.650 m ² K/W
	Total correction = 0.0083 m ² K/W	U-value (unrounded) = 0.19 W/m ² K	

Unheated space: None

Total thickness: 290 mm

U-value: 0.19 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 18	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	Av
Property	5, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
SAP Rating	88 B	DER	14.66
Environmental	88 B	TER	18.87
CO ₂ Emissions (t/year)	1.22	% DER<TER	22.30
General Requirements Compliance	Pass	DfEE	53.92
		TFEE	64.29
		% DfEE<TFEE	16.12
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	South East					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Suburban					
1.0 Property Type	House, Detached					
2.0 Number of Storeys	2					
3.0 Date Built	2019					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
	Ground Floor:		28.63 m	45.00 m²	2.66 m	
	1st Storey:		34.50 m	64.35 m²	2.36 m	
7.0 Living Area	17.41			m²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	153.63			kJ/m²K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Brick and Block	Cavity Wall	Other		0.24	42.22	141.38
Wall to Garage	Cavity Wall	Other		0.22	58.06	14.38
Dormer	Timber Frame	Other		0.23	9.10	1.37
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Ground Floor Block	Plasterboard on timber frame				9.00	48.75
Ground Floor Stud	Plasterboard on timber frame				9.00	26.47
First Floor Stud	Plasterboard on timber frame				9.00	154.04
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	62.76
Sloping Ceiling	External Slope Roof	Plasterboard, insulated slope		0.17	9.00	3.11
10.2 Internal Ceilings						

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	44.15

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	140.00	45.00
Exposed over Garage	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.19	20.00	18.19

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	44.15

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.1			0.63		0.70	1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20
Personnel Door	Manufacturer	Solid Door							1.80

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Half Glazed Door	[1] Brick and Block	South East							2.12	
Front Elevation	Window	[1] Brick and Block	South East	None	0.66	Yes				0.66	
Front Elevation	Window	[1] Brick and Block	South East	None	0.00					4.23	
East Bay	Window	[1] Brick and Block	East	None	0.00					0.80	
North Bay	Window	[1] Brick and Block	North	None	0.00					0.80	
Side Elevation	Window	[1] Brick and Block	North East	None	0.00					2.15	
Rear Elevation	Window	[1] Brick and Block	North West	None	0.00					8.75	
South West Elevation	Solid Door	[2] Wall to Garage	South West							1.77	

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 Built)

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	12.44	0.274	No	Knauf P3
Table K1 - Approved	E2 Other lintels (including other steel lintels)	1.76	0.300	No	
Independently assessed	E3 Sill	11.46	0.021	No	Knauf P5
Independently assessed	E4 Jamb	35.70	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	28.63	0.062	No	BE-E5-23902
Table K1 - Default	E20 Exposed floor (normal)	12.76	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	6.03	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	22.00	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	24.32	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	1.54	0.240	No	
Independently assessed	E11 Eaves (insulation at rafter level)	2.10	0.010	No	Knauf P20
Independently assessed	E12 Gable (insulation at ceiling level)	9.98	0.044	No	Knauf P21
Table K1 - Approved	E13 Gable (insulation at rafter level)	2.58	0.040	No	
Independently assessed	E16 Corner (normal)	26.31	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	6.11	-0.091	No	Knauf P24
Table K1 - Default	R1 Head of roof window	0.91	0.080	No	
Table K1 - Default	R3 Jamb of roof window	2.40	0.080	No	
Table K1 - Default	R6 Flat ceiling	2.10	0.060	No	
Table K1 - Default	R7 Flat ceiling (inverted)	0.93	0.040	No	
Table K1 - Default	R8 Roof to wall (rafter)	3.25	0.060	No	
Table K1 - Default	R9 Roof to wall (flat ceiling)	0.93	0.040	No	

Y-value W/m²K

18.0 Pressure Testing

Yes
 Designed AP₅₀ m³/(h.m²) @ 50 Pa
 Property Tested ?
 As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present

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				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Light and motion sensor	Yes	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Description	Combi Boiler	
Percentage of Heat	100	%
Database Ref. No.	18913	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.8	
In Summer	80.1	
Controls	CBV Programmer and at least two room thermostats	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2105	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
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	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.73	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

32.0 Photovoltaic Unit

PV Cells kWp
1.28

One Dwelling

Orientation
South West

Elevation
45°

Overshading
None Or Little

Connected to Dwelling
Yes

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	£113	B 89	