



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 20 Fieldfare Crescent
BOTLEY, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 07/06/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 46	Issued on Date	07/06/2024
Assessment Reference	As Built	Prop Type Ref	Bh
Property	20 Fieldfare Crescent, BOTLEY, SO32 2TW		
SAP Rating	88 B	DER	13.48
Environmental	89 B	TER	17.66
CO ₂ Emissions (t/year)	1.18	% DER<TER	23.66
General Requirements Compliance	Pass	DLEE	48.35
		TLEE	59.77
		% DLEE<TLEE	19.11
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 TLEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.66	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.48	kgCO ₂ /m ²	Pass
	-4.18 (-23.7%)	kgCO ₂ /m ²	

1b TLEE and DLEE

Target Fabric Energy Efficiency (TLEE)	59.77	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DLEE)	48.35	kWh/m ² /yr	
	-11.4 (-19.1%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.59 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

3.54 m², No overhang

Windows facing East

14.72 m², No overhang

Windows facing West

9.17 m², Overhang twice as wide as window, ratio 1.12

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

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.10 W/m²K

Floor U-value

0.11 W/m²K

Door U-value

1.10 W/m²K

Thermal bridging y-value

0.023 W/m²K

Photovoltaic array

1.15 kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	88 B	DER	13.48
Environmental	89 B	TER	17.66
CO ₂ Emissions (t/year)	1.18	% DER<TER	23.66
General Requirements Compliance	Pass	DFEE	48.35
		TFEE	59.77
		% DFEE<TFEE	19.11
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			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	0.077	1.26	0.10	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	8.24	0.58	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	2.40	0.16	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	1.77	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	5.54	0.31	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	13.67	0.29	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	44.70	0.72	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	33.42	2.07	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	33.42	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	19.91	1.19	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	13.51	0.59	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	25.30	0.99	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	5.06	-0.46	Knauf P24

Total: **6.72** W/mK:
Y-Value: **0.023** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.18	DFEE	48.35	TFEE	59.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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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 117 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.66 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.48 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.59 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.54 m², No overhang
Windows facing East: 14.72 m², No overhang
Windows facing West: 9.17 m², Overhang twice as wide as window, ratio 1.12
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.023 W/m²K
Photovoltaic array 1.15 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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3946	0.3868	0.3791	0.3404	0.3327	0.2940	0.2940	0.2862	0.3095	0.3327	0.3481	0.3636 (22b)
Effective ac	0.5778	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			18.0000	1055.5200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22281.7272 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.0198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7194 (36)
Total fabric heat loss						(33) + (36) =	86.3166 (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	56.6818	56.3853	56.0947	54.7296	54.4742	53.2854	53.2854	53.0652	53.7433	54.4742	54.9909	55.5310 (38)
Heat transfer coeff	142.9984	142.7019	142.4113	141.0463	140.7909	139.6020	139.6020	139.3818	140.0599	140.7909	141.3075	141.8477 (39)
Average = Sum(39)m / 12 =												141.0450 (39)
HLP	1.2195	1.2170	1.2145	1.2029	1.2007	1.1905	1.1905	1.1887	1.1944	1.2007	1.2051	1.2097 (40)
HLP (average)												1.2028 (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												2.8521 (42)
Average daily hot water use (litres/day)												101.9368 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1603.8628 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (64)
	Total per year (kWh/year) = Sum(64)m = 1927.9397 (64)											
Heat gains from water heating, kWh/month	62.1816	54.5813	56.7883	50.1653	48.6202	42.6691	40.2439	45.1756	45.4155	52.0537	55.9739	60.4350 (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	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1050	22.2981	18.1340	13.7286	10.2623	8.6639	9.3616	12.1686	16.3326	20.7380	24.2043	25.8028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6020	284.5241	277.1604	261.4839	241.6952	223.0965	210.6715	207.7494	215.1131	230.7896	250.5783	269.1769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	83.5775	81.2221	76.3284	69.6741	65.3498	59.2627	54.0913	60.7199	63.0770	69.9647	77.7416	81.2298	(72)
Total internal gains	459.0656	456.8254	440.4039	413.6677	386.0883	359.8042	342.9056	349.4190	363.3039	390.2734	421.3053	444.9906	(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					3.5400	10.6334	0.6300	0.7000	0.7700		11.5039 (74)	
East					14.7200	19.6403	0.6300	0.7000	0.7700		88.3541 (76)	
West					9.1700	19.6403	0.6300	0.7000	0.7700		55.0413 (80)	
Solar gains	154.8994	302.4965	499.3204	733.7510	906.5333	931.7852	885.5042	755.3341	582.1977	359.0208	192.9888	127.5117 (83)
Total gains	613.9649	759.3219	939.7243	1147.4187	1292.6216	1291.5895	1228.4098	1104.7531	945.5016	749.2942	614.2942	572.5023 (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	43.2828	43.3727	43.4612	43.8818	43.9614	44.3358	44.3358	44.4059	44.1909	43.9614	43.8007	43.6339
alpha	3.8855	3.8915	3.8974	3.9255	3.9308	3.9557	3.9557	3.9604	3.9461	3.9308	3.9200	3.9089
util living area	0.9962	0.9910	0.9741	0.9197	0.8023	0.6326	0.4834	0.5501	0.8065	0.9636	0.9928	0.9971 (86)
MIT	19.2712	19.4955	19.8800	20.3637	20.7339	20.9252	20.9800	20.9672	20.8004	20.2747	19.6778	19.2326 (87)
Th 2	19.9044	19.9064	19.9084	19.9177	19.9195	19.9276	19.9276	19.9291	19.9245	19.9195	19.9159	19.9123 (88)
util rest of house	0.9952	0.9885	0.9669	0.8974	0.7509	0.5464	0.3731	0.4350	0.7352	0.9494	0.9904	0.9963 (89)
MIT 2	18.3275	18.5521	18.9333	19.4056	19.7371	19.8904	19.9215	19.9180	19.8063	19.3324	18.7419	18.2949 (90)
Living area fraction	18.4617	18.6863	19.0680	19.5419	19.8789	20.0376	20.0721	20.0673	19.9478	19.4664	18.8750	18.4283 (91)
MIT	18.4617	18.6863	19.0680	19.5419	19.8789	20.0376	20.0721	20.0673	19.9478	19.4664	18.8750	18.4283 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4617	18.6863	19.0680	19.5419	19.8789	20.0376	20.0721	20.0673	19.9478	19.4664	18.8750	18.4283 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	609.8090	747.7393	901.8763	1019.0723	967.8316	717.9076	477.2189	497.8853	696.7744	705.4752	606.4398	569.5180	(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	2025.1039	1967.3365	1789.8241	1501.0011	1151.5142	759.0931	484.7059	511.1524	819.0366	1248.3129	1663.8951	2018.2457	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1052.9794	819.5693	660.6331	346.9888	136.6598	0.0000	0.0000	0.0000	0.0000	403.8713	761.3678	1077.8534	(98)
Space heating												5259.9228	(98)
Space heating per m2												44.8569	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5799.2534	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1052.9794	819.5693	660.6331	346.9888	136.6598	0.0000	0.0000	0.0000	0.0000	403.8713	761.3678	1077.8534	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	1160.9475	903.6045	728.3717	382.5675	150.6724	0.0000	0.0000	0.0000	0.0000	445.2825	839.4353	1188.3720	(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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969	(64)	
Efficiency of water heater (217)m	90.2530	90.2056	90.0919	89.8069	89.1989	87.9000	87.9000	87.9000	87.9000	89.8754	90.1633	90.2718	(217)	
Fuel for water heating, kWh/month	214.7873	188.8260	197.1635	175.3586	171.5843	153.4995	145.4467	162.3293	162.9043	181.7884	194.0459	208.9212	(219)	
Water heating fuel used												2156.6551	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5799.2534	(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)													443.3625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.15 * 853 * 1.00) =										-784.7875			-784.7875	(233)
Total delivered energy for all uses													7689.4834	(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	5799.2534	0.2160	1252.6387	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2156.6551	0.2160	465.8375	(264)
Space and water heating			1718.4762	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.3625	0.5190	230.1051	(268)
Energy saving/generation technologies				
PV Unit	-784.7875	0.5190	-407.3047	(269)
Total CO2, kg/year			1580.2016	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4800	(273)

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

DER			13.4800	ZC1
Total Floor Area		TFA	117.2600	
Assumed number of occupants		N	2.8521	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			14.2309	ZC2
CO2 emissions from cooking, equation (L16)			1.5986	ZC3
Total CO2 emissions			29.3095	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			29.3095	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3846 (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) =	0.3269 (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	0.4168	0.4086	0.4004	0.3596	0.3514	0.3105	0.3105	0.3024	0.3269	0.3514	0.3677	0.3841 (22b)
Effective ac	0.5869	0.5835	0.5802	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5738 (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 Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			27.1700	1.3258	36.0208		(27)
Ground Floor			58.6400	0.1300	7.6232		(28a)
Brick and Block	150.1200	27.1100	123.0100	0.1800	22.1418		(29a)
Cladding	19.1900	2.1800	17.0100	0.1800	3.0618		(29a)
Pitched Roof	58.6400		58.6400	0.1300	7.6232		(30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.0148		(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)							13.1035 (36)
Total fabric heat loss						(33) + (36) =	92.1183 (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	57.5658	57.2350	56.9107	55.3877	55.1027	53.7762	53.7762	53.5305	54.2871	55.1027	55.6792	56.2819 (38)
Heat transfer coeff	149.6842	149.3533	149.0291	147.5060	147.2210	145.8945	145.8945	145.6488	146.4055	147.2210	147.7975	148.4002 (39)
Average = Sum(39)m / 12 =												147.5046 (39)
HLP	1.2765	1.2737	1.2709	1.2579	1.2555	1.2442	1.2442	1.2421	1.2486	1.2555	1.2604	1.2656 (40)
HLP (average)												1.2579 (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												2.8521 (42)
Average daily hot water use (litres/day)												101.9368 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy content (annual)	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.2648	48.8291	45.2432	46.7513	48.8291	49.2648	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	217.2452	191.4624	201.0348	180.1046	174.3731	153.5780	147.1395	164.0260	165.8375	186.8132	197.6106	211.9983 (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	217.2452	191.4624	201.0348	180.1046	174.3731	153.5780	147.1395	164.0260	165.8375	186.8132	197.6106	211.9983 (64)
Heat gains from water heating, kWh/month	68.0299	59.8640	62.6400	55.8204	53.9506	47.3321	45.0669	50.5103	51.0766	57.9113	61.6370	66.2853 (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	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1050	22.2981	18.1340	13.7286	10.2623	8.6639	9.3616	12.1686	16.3326	20.7380	24.2043	25.8028 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6020	284.5241	277.1604	261.4839	241.6952	223.0965	210.6715	207.7494	215.1131	230.7896	250.5783	269.1769 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604 (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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830 (71)
Water heating gains (Table 5)	91.4381	89.0833	84.1935	77.5284	72.5143	65.7391	60.5738	67.8901	70.9398	77.8377	85.6070	89.0932 (72)
Total internal gains	466.9262	464.6866	448.2690	421.5220	393.2529	366.2806	349.3880	356.5892	371.1666	398.1464	429.1708	452.8540 (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						3.5100	10.6334	0.6300	0.7000	0.7700	11.4065 (74)	
East						14.5800	19.6403	0.6300	0.7000	0.7700	87.5138 (76)	
West						9.0800	19.6403	0.6300	0.7000	0.7700	54.5011 (80)	
Solar gains	153.4213	299.6096	494.5562	726.7560	897.8988	922.9143	877.0722	748.1361	576.6444	355.5945	191.1472	126.2951 (83)
Total gains	620.3475	764.2962	942.8253	1148.2780	1291.1517	1289.1949	1226.4602	1104.7253	947.8110	753.7410	620.3180	579.1491 (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	54.4016	54.5221	54.6407	55.2049	55.3118	55.8147	55.8147	55.9088	55.6199	55.3118	55.0960	54.8723
alpha	4.6268	4.6348	4.6427	4.6803	4.6875	4.7210	4.7210	4.7273	4.7080	4.6875	4.6731	4.6582
util living area	0.9988	0.9966	0.9879	0.9507	0.8474	0.6726	0.5114	0.5827	0.8500	0.9813	0.9974	0.9991 (86)
MIT	19.5281	19.7132	20.0365	20.4556	20.7839	20.9475	20.9884	20.9793	20.8391	20.3781	19.8728	19.4983 (87)
Th 2	19.8593	19.8615	19.8637	19.8739	19.8758	19.8848	19.8848	19.8865	19.8814	19.8758	19.8720	19.8679 (88)
util rest of house	0.9984	0.9954	0.9834	0.9321	0.7941	0.5757	0.3879	0.4533	0.7752	0.9714	0.9963	0.9988 (89)
MIT 2	17.8989	18.1708	18.6420	19.2430	19.6705	19.8515	19.8808	19.8783	19.7526	19.1468	18.4119	17.8612 (90)
Living area fraction	18.1307	18.3902	18.8403	19.4155	19.8289	20.0074	20.0384	20.0349	19.9072	19.3220	18.6198	18.0941 (92)
Temperature adjustment	18.1307	18.3902	18.8403	19.4155	19.8289	20.0074	20.0384	20.0349	19.9072	19.3220	18.6198	18.0941 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	618.6999	758.9648	921.6794	1059.1247	1021.9490	756.8488	497.2552	520.7803	736.6461	726.8141	616.7850	578.0243 (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	2070.2343	2014.8052	1839.0693	1551.0949	1196.7464	788.9081	501.6365	529.4261	850.1986	1284.0557	1702.5909	2061.8850 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1079.9416	843.9247	682.5381	354.2185	130.0492	0.0000	0.0000	0.0000	0.0000	414.5877	781.7802	1103.9924 (98)
Space heating												5391.0324 (98)
Space heating per m2												45.9750 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5771.9833 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1079.9416	843.9247	682.5381	354.2185	130.0492	0.0000	0.0000	0.0000	0.0000	414.5877	781.7802	1103.9924	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1156.2544	903.5597	730.7688	379.2489	139.2390	0.0000	0.0000	0.0000	0.0000	443.8841	837.0238	1182.0047	(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	217.2452	191.4624	201.0348	180.1046	174.3731	153.5780	147.1395	164.0260	165.8375	186.8132	197.6106	211.9983	(64)
Efficiency of water heater (217)m	88.5350	88.3452	87.8849	86.7233	84.3248	80.3000	80.3000	80.3000	80.3000	87.0008	88.1626	88.6047	(216)
Fuel for water heating, kWh/month	245.3776	216.7208	228.7478	207.6774	206.7875	191.2554	183.2372	204.2665	206.5224	214.7257	224.1434	239.2631	(219)
Water heating fuel used												2568.7248	(219)
Annual totals kWh/year													
Space heating fuel - main system												5771.9833	(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)												443.3625	(232)
Total delivered energy for all uses												8859.0706	(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	5771.9833	0.2160	1246.7484 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2568.7248	0.2160	554.8446 (264)
Space and water heating			1801.5929 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.3625	0.5190	230.1051 (268)
Total CO2, kg/m2/year			2070.6231 (272)
Emissions per m2 for space and water heating			15.3641 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9623 (272b)
Emissions per m2 for pumps and fans			0.3320 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3641 * 1.00) + 1.9623 + 0.3320, rounded to 2 d.p.			17.6600 (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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3946	0.3868	0.3791	0.3404	0.3327	0.2940	0.2940	0.2862	0.3095	0.3327	0.3481	0.3636 (22b)
Effective ac	0.5778	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			9.0000	527.7600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21753.9672 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.5191 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7194 (36)
Total fabric heat loss						(33) + (36) =	86.3166 (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	56.6818	56.3853	56.0947	54.7296	54.4742	53.2854	53.2854	53.0652	53.7433	54.4742	54.9909	55.5310 (38)
Heat transfer coeff	142.9984	142.7019	142.4113	141.0463	140.7909	139.6020	139.6020	139.3818	140.0599	140.7909	141.3075	141.8477 (39)
Average = Sum(39)m / 12 =												141.0450 (39)
HLP	1.2195	1.2170	1.2145	1.2029	1.2007	1.1905	1.1905	1.1887	1.1944	1.2007	1.2051	1.2097 (40)
HLP (average)												1.2028 (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												2.8521 (42)
Average daily hot water use (litres/day)												101.9368 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

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Energy content (annual)	Total = Sum(45)m = 1603.8628 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.3358	30.9049	31.8911	27.8035	26.6781	23.0212	21.3325	24.4793	24.7717	28.8690	31.5128	34.2209 (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	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1050	22.2981	18.1340	13.7286	10.2623	8.6639	9.3616	12.1686	16.3326	20.7380	24.2043	25.8028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6020	284.5241	277.1604	261.4839	241.6952	223.0965	210.6715	207.7494	215.1131	230.7896	250.5783	269.1769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	47.4944	45.9895	42.8644	38.6159	35.8576	31.9738	28.6727	32.9023	34.4051	38.8025	43.7678	45.9958	(72)
Total internal gains	419.9825	418.5928	403.9399	379.6096	353.5962	329.5154	314.4870	318.6014	331.6320	356.1112	384.3316	406.7566	(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				3.5400	10.6334	0.6300	0.7000	0.7700	11.5039 (74)				
East				14.7200	19.6403	0.6300	0.7000	0.7700	88.3541 (76)				
West				9.1700	19.6403	0.6300	0.7000	0.7700	55.0413 (80)				
Solar gains	154.8994	302.4965	499.3204	733.7510	906.5333	931.7852	885.5042	755.3341	582.1977	359.0208	192.9888	127.5117	(83)
Total gains	574.8819	721.0893	903.2603	1113.3605	1260.1295	1261.3006	1199.9912	1073.9355	913.8297	715.1320	577.3204	534.2683	(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	42.2576	42.3454	42.4318	42.8425	42.9202	43.2857	43.2857	43.3541	43.1442	42.9202	42.7632	42.6004	
alpha	3.8172	3.8230	3.8288	3.8562	3.8613	3.8857	3.8857	3.8903	3.8763	3.8613	3.8509	3.8400	
util living area	0.9967	0.9918	0.9758	0.9234	0.8092	0.6419	0.4926	0.5618	0.8165	0.9668	0.9937	0.9975	(86)
MIT	19.2025	19.4321	19.8266	20.3255	20.7120	20.9165	20.9770	20.9623	20.7807	20.2314	19.6185	19.1638	(87)
Th 2	19.9044	19.9064	19.9084	19.9177	19.9195	19.9276	19.9276	19.9291	19.9245	19.9195	19.9159	19.9123	(88)
util rest of house	0.9958	0.9896	0.9692	0.9023	0.7592	0.5560	0.3811	0.4459	0.7476	0.9539	0.9916	0.9968	(89)
MIT 2	18.2616	18.4916	18.8832	19.3715	19.7200	19.8853	19.9204	19.9161	19.7924	19.2930	18.6854	18.2288	(90)
Living area fraction	18.3954	18.6254	19.0174	19.5072	19.8611	20.0320	20.0707	20.0649	19.9329	19.4265	18.8182	18.3618	(91)
MIT	18.3954	18.6254	19.0174	19.5072	19.8611	20.0320	20.0707	20.0649	19.9329	19.4265	18.8182	18.3618	(92)
Temperature adjustment	18.3954	18.6254	19.0174	19.5072	19.8611	20.0320	20.0707	20.0649	19.9329	19.4265	18.8182	18.3618	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9940	0.9860	0.9620	0.8925	0.7561	0.5650	0.3966	0.4614	0.7482	0.9461	0.9887	0.9955	(94)
Ext temp.	571.4536	711.0187	868.9757	993.7266	952.8176	712.6378	475.8978	495.5399	683.7219	676.5565	570.7791	531.8390	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2015.6220	1958.6422	1782.6188	1496.1111	1149.0081	758.3173	484.5169	510.8183	816.9620	1242.6880	1655.8650	2008.8195	(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	1074.4613	838.4030	679.7504	361.7168	145.9657	0.0000	0.0000	0.0000	0.0000	421.2019	781.2618	1098.8735	(98)
Space heating per m2	(98) / (4) =												46.0654 (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	1312.2587	1033.0547	1059.3019	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8634	0.9149	0.8831	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1133.0343	945.0903	935.5116	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1587.7191	1513.5228	1368.2616	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	327.3730	422.9137	321.9659	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1072.2527 (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	81.8433	105.7284	80.4915	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												268.0632 (107)
Space cooling per m2												2.2861 (108)
Energy for space heating												46.0654 (99)
Energy for space cooling												2.2861 (108)
Total												48.3515 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.4 (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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3846 (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) =	0.3269 (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	0.4168	0.4086	0.4004	0.3596	0.3514	0.3105	0.3105	0.3024	0.3269	0.3514	0.3677	0.3841 (22b)
Effective ac	0.5869	0.5835	0.5802	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5738 (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 Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			27.1700	1.3258	36.0208		(27)
Ground Floor			58.6400	0.1300	7.6232		(28a)
Brick and Block	150.1200	27.1100	123.0100	0.1800	22.1418		(29a)
Cladding	19.1900	2.1800	17.0100	0.1800	3.0618		(29a)
Pitched Roof	58.6400		58.6400	0.1300	7.6232		(30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.0148		(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)							13.1035 (36)
Total fabric heat loss						(33) + (36) =	92.1183 (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	57.5658	57.2350	56.9107	55.3877	55.1027	53.7762	53.7762	53.5305	54.2871	55.1027	55.6792	56.2819 (38)
Heat transfer coeff	149.6842	149.3533	149.0291	147.5060	147.2210	145.8945	145.8945	145.6488	146.4055	147.2210	147.7975	148.4002 (39)
Average = Sum(39)m / 12 =												147.5046 (39)
HLP	1.2765	1.2737	1.2709	1.2579	1.2555	1.2442	1.2442	1.2421	1.2486	1.2555	1.2604	1.2656 (40)
HLP (average)												1.2579 (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												2.8521 (42)
Average daily hot water use (litres/day)												101.9368 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy content (annual)	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)
Distribution loss (46)m = 0.15 x (45)m												1603.8628 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.3358	30.9049	31.8911	27.8035	26.6781	23.0212	21.3325	24.4793	24.7717	28.8690	31.5128	34.2209 (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	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	142.6038	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1050	22.2981	18.1340	13.7286	10.2623	8.6639	9.3616	12.1686	16.3326	20.7380	24.2043	25.8028	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6020	284.5241	277.1604	261.4839	241.6952	223.0965	210.6715	207.7494	215.1131	230.7896	250.5783	269.1769	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	37.2604	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	47.4944	45.9895	42.8644	38.6159	35.8576	31.9738	28.6727	32.9023	34.4051	38.8025	43.7678	45.9958	(72)
Total internal gains	419.9825	418.5928	403.9399	379.6096	353.5962	329.5154	314.4870	318.6014	331.6320	356.1112	384.3316	406.7566	(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					3.5100	10.6334	0.6300	0.7000	0.7700	11.4065 (74)		
East					14.5800	19.6403	0.6300	0.7000	0.7700	87.5138 (76)		
West					9.0800	19.6403	0.6300	0.7000	0.7700	54.5011 (80)		
Solar gains	153.4213	299.6096	494.5562	726.7560	897.8988	922.9143	877.0722	748.1361	576.6444	355.5945	191.1472	126.2951 (83)
Total gains	573.4039	718.2024	898.4962	1106.3656	1251.4951	1252.4296	1191.5591	1066.7375	908.2764	711.7057	575.4788	533.0517 (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	54.4016	54.5221	54.6407	55.2049	55.3118	55.8147	55.8147	55.9088	55.6199	55.3118	55.0960	54.8723	
alpha	4.6268	4.6348	4.6427	4.6803	4.6875	4.7210	4.7210	4.7273	4.7080	4.6875	4.6731	4.6582	
util living area	0.9992	0.9974	0.9900	0.9566	0.8591	0.6872	0.5249	0.6002	0.8656	0.9851	0.9981	0.9994	(86)
MIT	19.4915	19.6776	20.0036	20.4294	20.7689	20.9425	20.9870	20.9766	20.8238	20.3477	19.8380	19.4623	(87)
Th 2	19.8593	19.8615	19.8637	19.8739	19.8758	19.8848	19.8848	19.8865	19.8814	19.8758	19.8720	19.8679	(88)
util rest of house	0.9988	0.9965	0.9862	0.9397	0.8077	0.5901	0.3989	0.4685	0.7945	0.9769	0.9973	0.9992	(89)
MIT 2	18.4844	18.6718	18.9974	19.4191	19.7244	19.8596	19.8817	19.8801	19.7832	19.3491	18.8405	18.4619	(90)
Living area fraction													
MIT	18.6276	18.8149	19.1405	19.5628	19.8729	20.0137	20.0390	20.0361	19.9312	19.4911	18.9824	18.6042	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6276	18.8149	19.1405	19.5628	19.8729	20.0137	20.0390	20.0361	19.9312	19.4911	18.9824	18.6042	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	572.4642	714.7788	883.1485	1033.2136	1010.6896	754.1793	496.7961	519.6756	725.0983	692.4348	573.3698	532.4312	(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	2144.6185	2078.2332	1883.8031	1572.8311	1203.2301	789.8219	501.7250	529.5903	853.7191	1308.9608	1756.1893	2137.5797	(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	1169.6828	916.2413	744.4870	388.5246	143.2502	0.0000	0.0000	0.0000	0.0000	458.6954	851.6300	1194.2305	(98)
Space heating												5866.7418	(98)
Space heating per m2												(98) / (4) =	50.0319 (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	1371.4083	1079.6193	1106.9312	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8776	0.9305	0.8984	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1203.4923	1004.6314	994.5088	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1577.3504	1503.6672	1359.8483	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	269.1778	371.2826	271.8126	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												912.2730 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	67.2945	92.8206	67.9531	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												228.0682 (107)
Space cooling per m2												1.9450 (108)
Energy for space heating												50.0319 (99)
Energy for space cooling												1.9450 (108)
Total												51.9769 (109)
Target Fabric Energy Efficiency (TFEE)												59.8 (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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3249	0.3017	0.3095	0.2940	0.2940	0.2862	0.2785	0.2708	0.2630	0.2862	0.2708	0.2862 (22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5367	0.5346	0.5410	0.5367	0.5410 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			18.0000	1055.5200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 22281.7272 (34)
190.0198 (35)
6.7194 (36)
(33) + (36) = 86.3166 (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	54.2247	53.5114	53.7433	53.2854	53.2854	53.0652	52.8509	52.6425	52.4399	53.0652	52.6425	53.0652 (38)
Heat transfer coeff	140.5414	139.8280	140.0599	139.6020	139.6020	139.3818	139.1675	138.9591	138.7566	139.3818	138.9591	139.3818 (39)
Average = Sum(39)m / 12 =												139.4684 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1985	1.1925	1.1944	1.1905	1.1905	1.1887	1.1868	1.1851	1.1833	1.1887	1.1851	1.1887 (40)
HLP (average)												1.1894 (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
Average daily hot water use (litres/day)
2.8521 (42)
101.9368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy conte	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1603.8628 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)	
Total heat required for water heating calculated for each month	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (64)	
	Total per year (kWh/year) = Sum(64)m =											1927.9397 (64)	
RHI water heating demand												1928 (64)	
Heat gains from water heating, kWh/month	62.1816	54.5813	56.7883	50.1653	48.6202	42.6691	40.2439	45.1756	45.4155	52.0537	55.9739	60.4350 (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	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7625	55.7451	45.3350	34.3215	25.6557	21.6596	23.4040	30.4214	40.8316	51.8451	60.5108	64.5069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3014	424.6628	413.6722	390.2745	360.7390	332.9799	314.4351	310.0737	321.0643	344.4620	373.9975	401.7566	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	83.5775	81.2221	76.3284	69.6741	65.3498	59.2627	54.0913	60.7199	63.0770	69.9647	77.7416	81.2298	(72)
Total internal gains	681.6475	676.6362	650.3417	609.2761	566.7506	528.9083	506.9365	516.2211	539.9790	581.2778	627.2559	662.4994	(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					3.5400	13.4839	0.6300	0.7000			0.7700			14.5878 (74)
East					14.7200	25.1925	0.6300	0.7000			0.7700			113.3318 (76)
West					9.1700	25.1925	0.6300	0.7000			0.7700			70.6014 (80)
Solar gains	198.5209	330.0676	548.3930	808.0674	946.1217	1055.0741	995.3280	871.9946	674.5023	422.5235	246.5876			160.5947 (83)
Total gains	880.1684	1006.7038	1198.7347	1417.3435	1512.8723	1583.9824	1502.2645	1388.2157	1214.4813	1003.8013	873.8436			823.0941 (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	44.0395	44.2641	44.1909	44.3358	44.3358	44.4059	44.4742	44.5409	44.6060	44.4059	44.5409	44.4059
alpha	3.9360	3.9509	3.9461	3.9557	3.9557	3.9604	3.9649	3.9694	3.9737	3.9604	3.9694	3.9604
util living area	0.9850	0.9746	0.9389	0.8447	0.6919	0.4848	0.3572	0.3846	0.6520	0.8947	0.9710	0.9877 (86)
MIT	19.6353	19.8113	20.1825	20.6001	20.8630	20.9739	20.9940	20.9922	20.9192	20.5688	20.0469	19.6114 (87)
Th 2	19.9212	19.9260	19.9245	19.9276	19.9276	19.9291	19.9306	19.9320	19.9334	19.9291	19.9320	19.9291 (88)
util rest of house	0.9811	0.9682	0.9236	0.8087	0.6282	0.4004	0.2613	0.2821	0.5642	0.8598	0.9622	0.9845 (89)
MIT 2	18.7014	18.8780	19.2365	19.6245	19.8429	19.9183	19.9291	19.9301	19.8931	19.6099	19.1169	18.6841 (90)
Living area fraction	fLA = Living area / (4) =											0.1422 (91)
MIT	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9759	0.9611	0.9141	0.8025	0.6321	0.4117	0.2749	0.2967	0.5735	0.8526	0.9548	0.9799	(94)
Useful gains	858.9466	967.5764	1095.5791	1137.4334	956.2179	652.0882	412.9747	411.8665	696.5150	855.8739	834.3444	806.5822	(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	1958.3407	1917.1497	1732.6897	1432.7717	1045.3349	664.6330	414.8037	414.2642	740.8342	1163.3205	1577.0718	1925.7061	(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	817.9492	638.1132	473.8764	212.6436	66.3030	0.0000	0.0000	0.0000	0.0000	228.7402	534.7637	832.6282	(98)
Space heating												3805.0176	(98)
RHI space heating demand												3805	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3946	0.3868	0.3791	0.3404	0.3327	0.2940	0.2940	0.2862	0.3095	0.3327	0.3481	0.3636 (22b)
Effective ac	0.5778	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			18.0000	1055.5200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 22281.7272 (34)
190.0198 (35)
6.7194 (36)
(33) + (36) = 86.3166 (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	56.6818	56.3853	56.0947	54.7296	54.4742	53.2854	53.2854	53.0652	53.7433	54.4742	54.9909	55.5310 (38)
Heat transfer coeff	142.9984	142.7019	142.4113	141.0463	140.7909	139.6020	139.6020	139.3818	140.0599	140.7909	141.3075	141.8477 (39)
Average = Sum(39)m / 12 =												141.0450 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2195	1.2170	1.2145	1.2029	1.2007	1.1905	1.1905	1.1887	1.1944	1.2007	1.2051	1.2097 (40)
HLP (average)												1.2028 (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
Average daily hot water use (litres/day)
2.8521 (42)
101.9368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy conte	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1603.8628 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (64)
	Total per year (kWh/year) = Sum(64)m = 1927.9397 (64)											
Heat gains from water heating, kWh/month	62.1816	54.5813	56.7883	50.1653	48.6202	42.6691	40.2439	45.1756	45.4155	52.0537	55.9739	60.4350 (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	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7625	55.7451	45.3350	34.3215	25.6557	21.6596	23.4040	30.4214	40.8316	51.8451	60.5108	64.5069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3014	424.6628	413.6722	390.2745	360.7390	332.9799	314.4351	310.0737	321.0643	344.4620	373.9975	401.7566	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	83.5775	81.2221	76.3284	69.6741	65.3498	59.2627	54.0913	60.7199	63.0770	69.9647	77.7416	81.2298	(72)
Total internal gains	681.6475	676.6362	650.3417	609.2761	566.7506	528.9083	506.9365	516.2211	539.9790	581.2778	627.2559	662.4994	(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					3.5400	10.6334	0.6300	0.7000	0.7700					11.5039 (74)
East					14.7200	19.6403	0.6300	0.7000	0.7700					88.3541 (76)
West					9.1700	19.6403	0.6300	0.7000	0.7700					55.0413 (80)
Solar gains	154.8994	302.4965	499.3204	733.7510	906.5333	931.7852	885.5042	755.3341	582.1977	359.0208	192.9888	127.5117	(83)	
Total gains	836.5468	979.1327	1149.6620	1343.0271	1473.2838	1460.6935	1392.4407	1271.5552	1122.1767	940.2986	820.2448	790.0110	(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	43.2828	43.3727	43.4612	43.8818	43.9614	44.3358	44.3358	44.4059	44.1909	43.9614	43.8007	43.6339
alpha	3.8855	3.8915	3.8974	3.9255	3.9308	3.9557	3.9557	3.9604	3.9461	3.9308	3.9200	3.9089
util living area	0.9889	0.9789	0.9521	0.8799	0.7477	0.5744	0.4313	0.4871	0.7343	0.9293	0.9807	0.9910 (86)
MIT	19.4810	19.6962	20.0546	20.4873	20.7969	20.9467	20.9866	20.9786	20.8607	20.4230	19.8678	19.4394 (87)
Th 2	19.9044	19.9064	19.9084	19.9177	19.9195	19.9276	19.9276	19.9291	19.9245	19.9195	19.9159	19.9123 (88)
util rest of house	0.9861	0.9736	0.9399	0.8506	0.6918	0.4912	0.3307	0.3813	0.6559	0.9052	0.9750	0.9887 (89)
MIT 2	18.5356	18.7495	19.1008	19.5157	19.7845	19.9019	19.9236	19.9222	19.8464	19.4690	18.9286	18.5004 (90)
Living area fraction	18.6701	18.8842	19.2365	19.6539	19.9285	20.0505	20.0748	20.0724	19.9907	19.6047	19.0622	18.6340 (91)
MIT	18.6701	18.8842	19.2365	19.6539	19.9285	20.0505	20.0748	20.0724	19.9907	19.6047	19.0622	18.6340 (92)
Temperature adjustment	18.6701	18.8842	19.2365	19.6539	19.9285	20.0505	20.0748	20.0724	19.9907	19.6047	19.0622	18.6340 (93)
adjusted MIT	18.6701	18.8842	19.2365	19.6539	19.9285	20.0505	20.0748	20.0724	19.9907	19.6047	19.0622	18.6340 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9671	0.9306	0.8424	0.6923	0.5012	0.3449	0.3959	0.6612	0.8965	0.9689	0.9850	(94)
Useful gains	821.2583	946.9180	1069.9156	1131.3323	1019.9124	732.1410	480.1872	503.4521	742.0116	842.9555	794.7135	778.1713	(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	2054.9040	1995.5666	1813.8205	1516.7975	1158.5044	760.9057	485.0921	511.8698	825.0478	1267.7790	1690.3516	2047.4224	(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	917.8324	704.6918	553.4652	277.5349	103.1124	0.0000	0.0000	0.0000	0.0000	316.0687	644.8595	944.3228	(98)
Space heating												4461.8877	(98)
Space heating per m2											(98) / (4) =	38.0512	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4919.3911	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	917.8324	704.6918	553.4652	277.5349	103.1124	0.0000	0.0000	0.0000	0.0000	316.0687	644.8595	944.3228	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	1011.9431	776.9480	610.2153	305.9922	113.6851	0.0000	0.0000	0.0000	0.0000	348.4771	710.9807	1041.1497	(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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969	(64)	
Efficiency of water heater (217)m	90.1990	90.1411	90.0034	89.6660	89.0060	87.9000	87.9000	87.9000	87.9000	89.7260	90.0876	90.2216	(216)	
Fuel for water heating, kWh/month	214.9160	188.9611	197.3573	175.6343	171.9562	153.4995	145.4467	162.3293	162.9043	182.0910	194.2090	209.0374	(219)	
Water heating fuel used												2158.3423	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4919.3911	(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)													443.3625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.15 * 853 * 1.00) =										-784.7875			-784.7875	(233)
Total delivered energy for all uses													6811.3084	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4919.3911	3.4800	171.1948 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2158.3423	3.4800	75.1103 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.3625	13.1900	58.4795 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-784.7875	13.1900	-103.5135 (252)
Total energy cost			331.1637 (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] =	0.8572 (257)
SAP value		88.0421
SAP rating (Section 12)		88 (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	4919.3911	0.2160	1062.5885 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2158.3423	0.2160	466.2019 (264)
Space and water heating			1528.7904 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.3625	0.5190	230.1051 (268)
Energy saving/generation technologies			
PV Unit	-784.7875	0.5190	-407.3047 (269)
Total kg/year			1390.5158 (272)
CO2 emissions per m2			11.8600 (273)
EI value			88.5166
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8922 = 3.900$, stars = 4
Water heating environmental impact	$0.216 / 0.8922 = 0.2421$, 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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3249	0.3017	0.3095	0.2940	0.2940	0.2862	0.2785	0.2708	0.2630	0.2862	0.2708	0.2862 (22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5367	0.5346	0.5410	0.5367	0.5410 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			18.0000	1055.5200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 22281.7272 (34)
190.0198 (35)
6.7194 (36)
(33) + (36) = 86.3166 (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	54.2247	53.5114	53.7433	53.2854	53.2854	53.0652	52.8509	52.6425	52.4399	53.0652	52.6425	53.0652 (38)
Heat transfer coeff	140.5414	139.8280	140.0599	139.6020	139.6020	139.3818	139.1675	138.9591	138.7566	139.3818	138.9591	139.3818 (39)
Average = Sum(39)m / 12 =												139.4684 (40)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1985	1.1925	1.1944	1.1905	1.1905	1.1887	1.1868	1.1851	1.1833	1.1887	1.1851	1.1887 (40)
HLP (average)												1.1894 (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
Average daily hot water use (litres/day)
2.8521 (42)
101.9368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy conte	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m = 1603.8628 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (64)
												Total per year (kWh/year) = Sum(64)m = 1927.9397 (64)
Heat gains from water heating, kWh/month	62.1816	54.5813	56.7883	50.1653	48.6202	42.6691	40.2439	45.1756	45.4155	52.0537	55.9739	60.4350 (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	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7625	55.7451	45.3350	34.3215	25.6557	21.6596	23.4040	30.4214	40.8316	51.8451	60.5108	64.5069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3014	424.6628	413.6722	390.2745	360.7390	332.9799	314.4351	310.0737	321.0643	344.4620	373.9975	401.7566	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	83.5775	81.2221	76.3284	69.6741	65.3498	59.2627	54.0913	60.7199	63.0770	69.9647	77.7416	81.2298	(72)
Total internal gains	681.6475	676.6362	650.3417	609.2761	566.7506	528.9083	506.9365	516.2211	539.9790	581.2778	627.2559	662.4994	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5400	13.4839	0.6300	0.7000	0.7700	14.5878	(74)
East	14.7200	25.1925	0.6300	0.7000	0.7700	113.3318	(76)
West	9.1700	25.1925	0.6300	0.7000	0.7700	70.6014	(80)

Solar gains	198.5209	330.0676	548.3930	808.0674	946.1217	1055.0741	995.3280	871.9946	674.5023	422.5235	246.5876	160.5947	(83)
Total gains	880.1684	1006.7038	1198.7347	1417.3435	1512.8723	1583.9824	1502.2645	1388.2157	1214.4813	1003.8013	873.8436	823.0941	(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	44.0395	44.2641	44.1909	44.3358	44.3358	44.4059	44.4742	44.5409	44.6060	44.4059	44.5409	44.4059
alpha	3.9360	3.9509	3.9461	3.9557	3.9557	3.9604	3.9649	3.9694	3.9737	3.9604	3.9694	3.9604
util living area	0.9850	0.9746	0.9389	0.8447	0.6919	0.4848	0.3572	0.3846	0.6520	0.8947	0.9710	0.9877 (86)
MIT	19.6353	19.8113	20.1825	20.6001	20.8630	20.9739	20.9940	20.9922	20.9192	20.5688	20.0469	19.6114 (87)
Th 2	19.9212	19.9260	19.9245	19.9276	19.9276	19.9291	19.9306	19.9320	19.9334	19.9291	19.9320	19.9291 (88)
util rest of house	0.9811	0.9682	0.9236	0.8087	0.6282	0.4004	0.2613	0.2821	0.5642	0.8598	0.9622	0.9845 (89)
MIT 2	18.7014	18.8780	19.2365	19.6245	19.8429	19.9183	19.9291	19.9301	19.8931	19.6099	19.1169	18.6841 (90)
Living area fraction	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (91)
MIT	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	858.9466	967.5764	1095.7591	1137.4334	956.2179	652.0882	412.9747	411.8665	696.5150	855.8739	834.3444	806.5822	(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	(96)
Heat loss rate W	1958.3407	1917.1497	1732.6897	1432.7717	1045.3349	664.6330	414.8037	414.2642	740.8342	1163.3205	1577.0718	1925.7061	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	817.9492	638.1132	473.8764	212.6436	66.3030	0.0000	0.0000	0.0000	0.0000	228.7402	534.7637	832.6282	(98)
Space heating												3805.0176	(98)
Space heating per m2												(98) / (4) = 32.4494	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4195.1682	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	817.9492	638.1132	473.8764	212.6436	66.3030	0.0000	0.0000	0.0000	0.0000	228.7402	534.7637	832.6282	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	901.8183	703.5427	522.4657	234.4472	73.1014	0.0000	0.0000	0.0000	0.0000	252.1943	589.5962	918.0024	(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	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969	(64)	
Efficiency of water heater (217)m	90.1498	90.0953	89.9191	89.4871	88.7279	87.9000	87.9000	87.9000	87.9000	89.5120	89.9933	90.1696	(216)	
Fuel for water heating, kWh/month	215.0332	189.0570	197.5425	175.9853	172.4951	153.4995	145.4467	162.3293	162.9043	182.5265	194.4124	209.1580	(219)	
Water heating fuel used												2160.3900	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4195.1682	(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)													443.3625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.15 * 967 * 1.00) =										-889.4467			-889.4467	(233)
Total delivered energy for all uses													5984.4740	(238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4195.1682	7.3800	309.6034	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2160.3900	7.3800	159.4368	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	443.3625	28.6600	127.0677	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-889.4467	28.6600	-254.9154	(252)
Total energy cost			469.6875	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4195.1682	0.2160	906.1563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2160.3900	0.2160	466.6442	(264)
Space and water heating			1372.8006	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.3625	0.5190	230.1051	(268)
Energy saving/generation technologies				
PV Unit	-889.4467	0.5190	-461.6228	(269)
Total kg/year			1180.2079	(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	4195.1682	1.2200	5118.1052	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2160.3900	1.2200	2635.6758	(264)
Space and water heating			7753.7811	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	443.3625	3.0700	1361.1228	(268)
Energy saving/generation technologies				
PV Unit	-889.4467	3.0700	-2730.6014	(269)
Primary energy kWh/year			6614.5525	(272)
Primary energy kWh/m2/year			56.4093	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	+ 1.0	-£ 62	-197 kg (16.7%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£62	1.68 kg/m²	B 89	B 90
Total Savings	£62	1.68 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 547 TEST (31 May 2024)
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	£149	£163	-£14
Mains gas	£576	£500	£76
Space heating	£438	£438	£0
Water heating	£159	£98	£62
Lighting	£127	£127	£0
Generated (PV)	-£255	-£255	£0
Total cost of fuels	£470	£408	£62
Total cost of uses	£469	£408	£62
Delivered energy	51 kWh/m²	43 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	47 kWh/m²	9 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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3946	0.3868	0.3791	0.3404	0.3327	0.2940	0.2940	0.2862	0.3095	0.3327	0.3481	0.3636 (22b)
Effective ac	0.5778	0.5748	0.5719	0.5579	0.5553	0.5432	0.5432	0.5410	0.5479	0.5553	0.5606	0.5661 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			18.0000	1055.5200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 22281.7272 (34)
190.0198 (35)
6.7194 (36)
(33) + (36) = 86.3166 (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	56.6818	56.3853	56.0947	54.7296	54.4742	53.2854	53.2854	53.0652	53.7433	54.4742	54.9909	55.5310 (38)
Heat transfer coeff	142.9984	142.7019	142.4113	141.0463	140.7909	139.6020	139.6020	139.3818	140.0599	140.7909	141.3075	141.8477 (39)
Average = Sum(39)m / 12 =												141.0450 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2195	1.2170	1.2145	1.2029	1.2007	1.1905	1.1905	1.1887	1.1944	1.2007	1.2051	1.2097 (40)
HLP (average)												1.2028 (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
Average daily hot water use (litres/day)
2.8521 (42)
101.9368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy conte	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1603.8628 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month												
	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (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												1.1308 (H8)
Utilisation factor												0.5870 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9368 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input												-878.6593 (H17)
Solar input	-25.4794	-42.5177	-72.4126	-97.0471	-119.8935	-117.8745	-116.3167	-101.6265	-79.5939	-54.3533	-30.2222	-21.3219 (63)
												Solar input (sum of months) = Sum(63)m = -878.6593 (63)
Output from w/h												
	168.3727	127.8138	105.2157	60.4371	33.1578	17.0516	11.5310	41.0610	63.5990	109.0297	144.7360	167.2750 (64)
												Total per year (kWh/year) = Sum(64)m = 1049.2805 (64)
Heat gains from water heating, kWh/month												
	62.1816	54.5813	56.7883	50.1653	48.6202	42.6691	40.2439	45.1756	45.4155	52.0537	55.9739	60.4350 (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	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7625	55.7451	45.3350	34.3215	25.6557	21.6596	23.4040	30.4214	40.8316	51.8451	60.5108	64.5069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3014	424.6628	413.6722	390.2745	360.7390	332.9799	314.4351	310.0737	321.0643	344.4620	373.9975	401.7566	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	83.5775	81.2221	76.3284	69.6741	65.3498	59.2627	54.0913	60.7199	63.0770	69.9647	77.7416	81.2298	(72)
Total internal gains	681.6475	676.6362	650.3417	609.2761	566.7506	528.9083	506.9365	516.2211	539.9790	581.2778	627.2559	662.4994	(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				3.5400	10.6334		0.6300		0.7000		0.7700		11.5039 (74)
East				14.7200	19.6403		0.6300		0.7000		0.7700		88.3541 (76)
West				9.1700	19.6403		0.6300		0.7000		0.7700		55.0413 (80)
Solar gains	154.8994	302.4965	499.3204	733.7510	906.5333	931.7852	885.5042	755.3341	582.1977	359.0208	192.9888		127.5117 (83)
Total gains	836.5468	979.1327	1149.6620	1343.0271	1473.2838	1460.6935	1392.4407	1271.5552	1122.1767	940.2986	820.2448		790.0110 (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	43.2828	43.3727	43.4612	43.8818	43.9614	44.3358	44.3358	44.4059	44.1909	43.9614	43.8007	43.6339
alpha	3.8855	3.8915	3.8974	3.9255	3.9308	3.9557	3.9557	3.9604	3.9461	3.9308	3.9200	3.9089
util living area	0.9889	0.9789	0.9521	0.8799	0.7477	0.5744	0.4313	0.4871	0.7343	0.9293	0.9807	0.9910 (86)
MIT	19.4810	19.6962	20.0546	20.4873	20.7969	20.9467	20.9866	20.9786	20.8607	20.4230	19.8678	19.4394 (87)
Th 2	19.9044	19.9064	19.9084	19.9177	19.9195	19.9276	19.9276	19.9291	19.9245	19.9195	19.9159	19.9123 (88)
util rest of house	0.9861	0.9736	0.9399	0.8506	0.6918	0.4912	0.3307	0.3813	0.6559	0.9052	0.9750	0.9887 (89)
MIT 2	18.5356	18.7495	19.1008	19.5157	19.7845	19.9019	19.9236	19.9222	19.8464	19.4690	18.9286	18.5004 (90)
Living area fraction	fLA = Living area / (4) =											0.1422 (91)
MIT	18.6701	18.8842	19.2365	19.6539	19.9285	20.0505	20.0748	20.0724	19.9907	19.6047	19.0622	18.6340 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6701	18.8842	19.2365	19.6539	19.9285	20.0505	20.0748	20.0724	19.9907	19.6047	19.0622	18.6340 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9671	0.9306	0.8424	0.6923	0.5012	0.3449	0.3959	0.6612	0.8965	0.9689	0.9850	(94)
Useful gains	821.2583	946.9180	1069.9156	1131.3323	1019.9124	732.1410	480.1872	503.4521	742.0116	842.9555	794.7135	778.1713	(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	2054.9040	1995.5666	1813.8205	1516.7975	1158.5044	760.9057	485.0921	511.8698	825.0478	1267.7790	1690.3516	2047.4224	(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	917.8324	704.6918	553.4652	277.5349	103.1124	0.0000	0.0000	0.0000	0.0000	316.0687	644.8595	944.3228	(98)
Space heating												4461.8877	(98)
Space heating per m2												(98) / (4) =	38.0512 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4919.3911 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	917.8324	704.6918	553.4652	277.5349	103.1124	0.0000	0.0000	0.0000	0.0000	316.0687	644.8595	944.3228	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1011.9431	776.9480	610.2153	305.9922	113.6851	0.0000	0.0000	0.0000	0.0000	348.4771	710.9807	1041.1497	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	168.3727	127.8138	105.2157	60.4371	33.1578	17.0516	11.5310	41.0610	63.5990	109.0297	144.7360	167.2750	(64)
Efficiency of water heater	90.2543	90.2586	90.2408	90.1863	90.0024	87.9000	87.9000	87.9000	87.9000	89.9650	90.1735	90.2673	(216)
Fuel for water heating, kWh/month	186.5535	141.6085	116.5944	67.0136	36.8410	19.3988	13.1183	46.7133	72.3538	121.1913	160.5084	185.3107	(219)
Water heating fuel used												1167.2058	(219)
Annual totals kWh/year													
Space heating fuel - main system												4919.3911	(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)													443.3625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 853 * 1.00) =										-784.7875		-784.7875	(233)
Total delivered energy for all uses												5870.1719	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4919.3911	3.4800	171.1948	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.2058	3.4800	40.6188	(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	443.3625	13.1900	58.4795	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-784.7875	13.1900	-103.5135	(252)
Total energy cost			303.2671	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.7850 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	89.0494
SAP rating (Section 12)		89 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4919.3911	0.2160	1062.5885 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.2058	0.2160	252.1165 (264)
Space and water heating			1314.7049 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	443.3625	0.5190	230.1051 (268)
Energy saving/generation technologies			
PV Unit	-784.7875	0.5190	-407.3047 (269)
Total kg/year			1202.3803 (272)
CO2 emissions per m2			10.2500 (273)
EI value			90.0703
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	58.6400 (1b)	x 2.3900 (2b)	= 140.1496 (1b) - (3b)
First floor	58.6200 (1c)	x 2.6800 (2c)	= 157.1016 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.2512 (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) = 0.1346 (8)
Pressure test					Yes
Measured/design AP50					4.5900
Infiltration rate					0.3641 (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) =	0.3095 (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	0.3249	0.3017	0.3095	0.2940	0.2940	0.2862	0.2785	0.2708	0.2630	0.2862	0.2708	0.2862 (22b)
Effective ac	0.5528	0.5455	0.5479	0.5432	0.5432	0.5410	0.5388	0.5367	0.5346	0.5410	0.5367	0.5410 (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)			27.4300	1.1450	31.4084		(27)
Ground Floor			58.6400	0.1100	6.4504	140.0000	8209.6000 (28a)
Brick and Block	150.1200	27.3500	122.7700	0.2400	29.4648	42.2200	5183.3494 (29a)
Cladding	19.1900	2.2000	16.9900	0.2400	4.0776	42.2200	717.3178 (29a)
Pitched Roof	58.6400		58.6400	0.1000	5.8640	9.0000	527.7600 (30)
Total net area of external elements Aum(A, m ²)			286.5900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.5972		(33)
Ground Floor Block			50.8500			75.0000	3813.7500 (32c)
Ground Floor Stud			45.5100			9.0000	409.5900 (32c)
First Floor Stud			145.4800			9.0000	1309.3200 (32c)
Internal Floor 1			58.6400			18.0000	1055.5200 (32d)
Internal Ceiling 1			58.6400			18.0000	1055.5200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22281.7272 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.0198 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7194 (36)
Total fabric heat loss						(33) + (36) =	86.3166 (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	54.2247	53.5114	53.7433	53.2854	53.2854	53.0652	52.8509	52.6425	52.4399	53.0652	52.6425	53.0652 (38)
Heat transfer coeff	140.5414	139.8280	140.0599	139.6020	139.6020	139.3818	139.1675	138.9591	138.7566	139.3818	138.9591	139.3818 (39)
Average = Sum(39)m / 12 =												139.4684 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1985	1.1925	1.1944	1.1905	1.1905	1.1887	1.1868	1.1851	1.1833	1.1887	1.1851	1.1887 (40)
HLP (average)												1.1894 (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												2.8521 (42)
Average daily hot water use (litres/day)												101.9368 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1305	108.0530	103.9755	99.8981	95.8206	91.7431	91.7431	95.8206	99.8981	103.9755	108.0530	112.1305 (44)
Energy conte	166.2863	145.4350	150.0759	130.8398	125.5439	108.3349	100.3882	115.1969	116.5727	135.8543	148.2956	161.0394 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m =	1603.8628 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.9429	21.8153	22.5114	19.6260	18.8316	16.2502	15.0582	17.2795	17.4859	20.3781	22.2443	24.1559 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Combi loss	27.5658	24.8965	27.5524	26.6444	27.5074	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)	
Total heat required for water heating calculated for each month	193.8521	170.3316	177.6283	157.4842	153.0514	134.9260	127.8477	142.6875	143.1929	163.3830	174.9582	188.5969 (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												1.2655 (H8)	
Utilisation factor												0.5462 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												101.9368 (H14)	
Volume ratio Veff/V												0.7357 (H15)	
Solar storage volume factor												0.9386 (H16)	
Solar input												-915.0513 (H17)	
Solar input	-29.8512	-42.4465	-72.9553	-98.4336	-115.6162	-123.4963	-120.8992	-108.2084	-84.7197	-58.5723	-35.3061	-24.5464 (63)	
	Solar input (sum of months) = Sum(63)m =											-915.0513 (63)	
Output from w/h	164.0009	127.8851	104.6730	59.0506	37.4352	11.4297	6.9485	34.4790	58.4731	104.8107	139.6521	164.0505 (64)	
	Total per year (kWh/year) = Sum(64)m =											1012.8885 (64)	
Heat gains from water heating, kWh/month	62.1816	54.5813	56.7883	50.1653	48.6202	42.6691	40.2439	45.1756	45.4155	52.0537	55.9739	60.4350 (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	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	171.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7625	55.7451	45.3350	34.3215	25.6557	21.6596	23.4040	30.4214	40.8316	51.8451	60.5108	64.5069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3014	424.6628	413.6722	390.2745	360.7390	332.9799	314.4351	310.0737	321.0643	344.4620	373.9975	401.7566	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	54.9645	(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)	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	-114.0830	(71)
Water heating gains (Table 5)	83.5775	81.2221	76.3284	69.6741	65.3498	59.2627	54.0913	60.7199	63.0770	69.9647	77.7416	81.2298	(72)
Total internal gains	681.6475	676.6362	650.3417	609.2761	566.7506	528.9083	506.9365	516.2211	539.9790	581.2778	627.2559	662.4994	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.5400	13.4839		0.6300	0.7000	0.7700		14.5878 (74)	
East					14.7200	25.1925		0.6300	0.7000	0.7700		113.3318 (76)	
West					9.1700	25.1925		0.6300	0.7000	0.7700		70.6014 (80)	

Solar gains	198.5209	330.0676	548.3930	808.0674	946.1217	1055.0741	995.3280	871.9946	674.5023	422.5235	246.5876	160.5947 (83)	
Total gains	880.1684	1006.7038	1198.7347	1417.3435	1512.8723	1583.9824	1502.2645	1388.2157	1214.4813	1003.8013	873.8436	823.0941 (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	44.0395	44.2641	44.1909	44.3358	44.3358	44.4059	44.4742	44.5409	44.6060	44.4059	44.5409	44.4059
alpha	3.9360	3.9509	3.9461	3.9557	3.9557	3.9604	3.9649	3.9694	3.9737	3.9604	3.9694	3.9604
util living area	0.9850	0.9746	0.9389	0.8447	0.6919	0.4848	0.3572	0.3846	0.6520	0.8947	0.9710	0.9877 (86)
MIT	19.6353	19.8113	20.1825	20.6001	20.8630	20.9739	20.9940	20.9922	20.9192	20.5688	20.0469	19.6114 (87)
Th 2	19.9212	19.9260	19.9245	19.9276	19.9276	19.9291	19.9306	19.9320	19.9334	19.9291	19.9320	19.9291 (88)
util rest of house	0.9811	0.9682	0.9236	0.8087	0.6282	0.4004	0.2613	0.2821	0.5642	0.8598	0.9622	0.9845 (89)
MIT 2	18.7014	18.8780	19.2365	19.6245	19.8429	19.9183	19.9291	19.9301	19.8931	19.6099	19.1169	18.6841 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8343	19.0108	19.3711	19.7633	19.9880	20.0684	20.0806	20.0812	20.0391	19.7463	19.2492	18.8160 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9759	0.9611	0.9141	0.8025	0.6321	0.4117	0.2749	0.2967	0.5735	0.8526	0.9548	0.9799	(94)
Useful gains	858.9466	967.5764	1095.7591	1137.4334	956.2179	652.0882	412.9747	411.8665	696.5150	855.8739	834.3444	806.5822	(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													
1958.3407	1917.1497	1732.6897	1432.7717	1045.3349	664.6330	414.8037	414.2642	740.8342	1163.3205	1577.0718	1925.7061	832.6282	(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													
817.9492	638.1132	473.8764	212.6436	66.3030	0.0000	0.0000	0.0000	0.0000	228.7402	534.7637	832.6282	3805.0176	(98)
Space heating													
Space heating per m2													(98) / (4) = 32.4494 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4195.1682 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	817.9492	638.1132	473.8764	212.6436	66.3030	0.0000	0.0000	0.0000	0.0000	228.7402	534.7637	832.6282	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	901.8183	703.5427	522.4657	234.4472	73.1014	0.0000	0.0000	0.0000	0.0000	252.1943	589.5962	918.0024	(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	164.0009	127.8851	104.6730	59.0506	37.4352	11.4297	6.9485	34.4790	58.4731	104.8107	139.6521	164.0505	(64)
Efficiency of water heater	90.2200	90.2202	90.1803	90.0764	89.6692	87.9000	87.9000	87.9000	87.9000	89.8011	90.1057	90.2269	(216)
(217)m	181.7788	141.7477	116.0709	65.5562	41.7481	13.0031	7.9050	39.2253	66.5224	116.7142	154.9871	181.8199	(219)
Fuel for water heating, kWh/month												1127.0786	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													4195.1682 (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)													443.3625 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 967 * 1.00) =									-889.4467				-889.4467 (233)
Total delivered energy for all uses													5001.1626 (238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4195.1682	7.3800	309.6034	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1127.0786	7.3800	83.1784	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Pump for solar water heating	50.0000	28.6600	14.3300	(249)
Energy for lighting	443.3625	28.6600	127.0677	(250)
Additional standing charges			107.0000	(251)
Energy saving/generation technologies				
PV Unit	-889.4467	28.6600	-254.9154	(252)
Total energy cost			407.7591	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4195.1682	0.2160	906.1563	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1127.0786	0.2160	243.4490	(264)
Space and water heating			1149.6053	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	443.3625	0.5190	230.1051	(268)
Energy saving/generation technologies				
PV Unit	-889.4467	0.5190	-461.6228	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Total kg/year

982.9626 (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	4195.1682	1.2200	5118.1052 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1127.0786	1.2200	1375.0359 (264)
Space and water heating			6493.1411 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	443.3625	3.0700	1361.1228 (268)
Energy saving/generation technologies			
PV Unit	-889.4467	3.0700	-2730.6014 (269)
Primary energy kWh/year			5507.4125 (272)
Primary energy kWh/m2/year			46.9675 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 46	Issued on Date	07/06/2024
Assessment Reference	As Built	Prop Type Ref	Bh
Project	20 Fieldfare Crescent, BOTLEY, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.48	TER	17.66
Environmental	89 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.18	DFEE	48.35	TFEE	59.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		

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 000004 - 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 46	Issued on Date	07/06/2024
Assessment Reference	As Built	Prop Type Ref	Bh
Project	20 Fieldfare Crescent, BOTLEY, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.48	TER	17.66
Environmental	89 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.18	DFEE	48.35	TFEE	59.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		

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 46	Issued on Date	07/06/2024
Assessment Reference	As Built	Prop Type Ref	Bh
Project	20 Fieldfare Crescent, BOTLEY, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.48	TER	17.66
Environmental	89 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.18	DFEE	48.35	TFEE	59.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		

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				0.1300			
Layer 1	Tiling, clay						
	Main construction	30	1.0000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	93.18		
	Main construction	100	0.8800	0.1136	6.82		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
Layer 5	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 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 = 4.349 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 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: 383 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 46	Issued on Date	07/06/2024
Assessment Reference	As Built	Prop Type Ref	Bh
Project	20 Fieldfare Crescent, BOTLEY, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.48	TER	17.66
Environmental	89 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.18	DFEE	48.35	TFEE	59.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		

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 000008 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 58.62 m², Perimeter = 33.37 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) = 0.11 W/m ² K	

Unheated space: None

Total thickness: 450 mm

U-value: 0.11 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 46			Issued on Date	07/06/2024
Assessment Reference	As Built	Prop Type Ref	Bh		
Property	20 Fieldfare Crescent, BOTLEY, SO32 2TW				
SAP Rating	88 B	DER	13.48	TER	17.66
Environmental	89 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.18	DFEE	48.35	TFEE	59.77
General Requirements Compliance	Pass	% DFEE<TFEE	19.11		
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	West
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:	33.42 m	58.64 m ²	2.39 m
	1st Storey:	33.37 m	58.62 m ²	2.68 m

7.0 Living Area	16.68	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	190.02	kJ/m ² K

9.0 External Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Brick and Block	Cavity Wall	Other		0.24	42.22	150.12	122.77
Cladding	Cavity Wall	Other		0.24	42.22	19.19	16.99

9.2 Internal Walls				Kappa (kJ/m ² K)	Area (m ²)
Description	Construction				
Ground Floor Block	Dense block, plasterboard on dabs			75.00	50.85
Ground Floor Stud	Plasterboard on timber frame			9.00	45.51
First Floor Stud	Plasterboard on timber frame			9.00	145.48

10.0 External Roofs				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	58.64	58.64

10.2 Internal Ceilings				Kappa (kJ/m ² K)	Area (m ²)
Description	Construction				
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor			9.00	58.64

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.11	140.00	58.64

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	58.64

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
West Elevation	Half Glazed Door	[1] Brick and Block	West							2.12	
West Elevation	Window	[1] Brick and Block	West	None	1.12	Yes				1.92	
West Elevation	Window	[1] Brick and Block	West	None	0.00					5.05	
West Elevation	Window	[2] Cladding	West	None	0.00					2.20	
East Elevation	Window	[1] Brick and Block	East	None	0.00					14.72	
North Elevation	Window	[1] Brick and Block	North	None	0.00					3.54	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.26	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	8.24	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.40	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.77	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.54	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	13.67	0.021	No	Knauf P5
Independently assessed	E4 Jamb	44.70	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	33.42	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	33.42	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	19.91	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	13.51	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	25.30	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.06	-0.091	No	Knauf P24

Y-value 0.023 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.59	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	23	
Total number of L.E.L. fittings	23	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Database		
Description	System Boiler	
Percentage of Heat	100	%
Database Ref. No.	17515	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.9	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.15	West	45°	None Or Little	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	£62	B 89	