



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 23 Fieldfare Crescent, Botley
SOUTHAMPTON, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 04/01/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 27			Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A		
Property	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW				
SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.72	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.29	kgCO ₂ /m ²	Pass
	-4.43 (-23.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	62.89	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	53.15	kWh/m ² /yr	
	-9.8 (-15.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Floor	0.14 (max. 0.25)	0.17 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	Pass
Openings	1.25 (max. 2.00)	1.80 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.66 (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

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Main heating system

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

Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.94 kWh/day
Permitted by DBSCG 2.24

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

8.75 m², No overhang

Windows facing South

1.14 m², No overhang

Windows facing West

4.89 m², Overhang twice as wide as window, ratio 0.63

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

4.66 (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

0.12 W/m²K

Door U-value

1.10 W/m²K

Photovoltaic array

1.28 kW

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THERMAL BRIDGING

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SAP Rating	88 B	DER	14.29
Environmental	88 B	TER	18.72
CO ₂ Emissions (t/year)	1.15	% DER<TER	23.66
General Requirements Compliance	Pass	DFEE	53.15
		TFEE	62.89
		% DFEE<TFEE	15.49
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.26	0.10	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.84	0.06	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	5.57	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.31	0.42	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	10.62	0.22	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	36.45	0.58	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	27.75	1.72	BE-E5-23902
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	12.19	3.90	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	6.01	1.92	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	22.09	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	23.73	1.42	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	1.98	0.08	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	10.59	0.47	Knauf P21
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	3.40	0.14	
External wall	E16 Corner (normal)	Independently assessed	0.039	23.20	0.90	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	1.54	-0.14	Knauf P24
External roof	R6 Flat ceiling	Table K1 - Default	0.060	3.02	0.18	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.040	0.92	0.04	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	2.70	0.16	
External roof	R9 Roof to wall (flat ceiling)	Table K1 - Default	0.040	0.92	0.04	

Total: **12.61** W/mK:
Y-Value: **0.043** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	15.49		
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS BUILT

Detached House, total floor area 109 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.72 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 53.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.66 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Worcester Greenstar 4000 GR4700iW 12 S NG

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.94 kWh/day

Permitted by DBSCG 2.24 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average

Windows facing East: 8.75 m², No overhang

Windows facing South: 1.14 m², No overhang

Windows facing West: 4.89 m², Overhang twice as wide as window, ratio 0.63

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Photovoltaic array 1.28 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1853 (8)
Pressure test										Yes							
Measured/design AP50										4.6600							
Infiltration rate										0.4183 (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) =					0.3555 (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	0.4533	0.4444	0.4355	0.3911	0.3822	0.3378	0.3378	0.3289	0.3555	0.3822	0.4000	0.4178	(22b)				
Effective ac	0.6027	0.5988	0.5948	0.5765	0.5730	0.5570	0.5570	0.5541	0.5632	0.5730	0.5800	0.5873	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000	(28b)					
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812	(29a)					
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046	(29a)					
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500	(30)					
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900	(30)					
Total net area of external elements Aum(A, m2)			292.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.2000			18.0000	795.6000	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20376.3858	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.5760	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112	(36)					
Total fabric heat loss						(33) + (36) =	84.5052	(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	53.6779	53.3226	52.9744	51.3385	51.0325	49.6078	49.6078	49.3439	50.1565	51.0325	51.6516	52.2989	(38)
Heat transfer coeff	138.1831	137.8278	137.4796	135.8438	135.5377	134.1130	134.1130	133.8491	134.6618	135.5377	136.1568	136.8041	(39)
Average = Sum(39)m / 12 =												135.8423	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2721	1.2688	1.2656	1.2505	1.2477	1.2346	1.2346	1.2322	1.2396	1.2477	1.2534	1.2594	(40)
HLP (average)												1.2505	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy content (annual)	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1586.7751 (45)
	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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												
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
								Total per year (kWh/year) = Sum(64)m =				2243.0451 (64)
Heat gains from water heating, kWh/month												
	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)

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

Metabolic gains (Table 5), Watts												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
(66)m	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.9441	23.0433	18.7401	14.1874	10.6053	8.9534	9.6745	12.5753	16.8785	21.4311	25.0133	26.6651 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	269.5728	272.3701	265.3210	250.3141	231.3707	213.5666	201.6723	198.8750	205.9241	220.9310	239.8744	257.6785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	(71)
Water heating gains (Table 5)												
	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	(72)
Total internal gains												
	497.0684	494.6353	478.4452	452.3089	425.5134	400.0451	383.7617	390.4128	404.0915	430.4582	460.6703	(73)

6. Solar gains												

[Jan]			Area		Solar flux		g		FF		Access	
			m2		Table 6a		Specific data		Specific data		factor	
					W/m2		or Table 6b		or Table 6c		Table 6d	
East			8.7500		19.6403		0.6300		0.7000		0.7700	52.5203 (76)
South			1.1400		46.7521		0.6300		0.7000		0.7700	16.2884 (78)
West			4.8900		19.6403		0.6300		0.7000		0.7700	29.3513 (80)

Solar gains	98.1600	186.8344	297.7386	423.0807	511.4548	521.1112	497.0827	431.2072	342.2582	218.8140	121.3916	81.4019 (83)
Total gains	595.2284	681.4698	776.1838	875.3897	936.9683	921.1563	880.8444	821.6200	746.3497	649.2722	582.0619	564.9772 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												21.0000 (85)
tau	40.9609	41.0665	41.1705	41.6663	41.7604	42.2040	42.2040	42.2872	42.0320	41.7604	41.5705	41.3738
alpha	3.7307	3.7378	3.7447	3.7778	3.7840	3.8136	3.8136	3.8191	3.8021	3.7840	3.7714	3.7583
util living area	0.9953	0.9916	0.9819	0.9545	0.8898	0.7634	0.6138	0.6663	0.8686	0.9706	0.9919	0.9961 (86)
MIT	19.2022	19.3812	19.7076	20.1489	20.5502	20.8361	20.9477	20.9278	20.7034	20.1786	19.6157	19.1758 (87)
Th 2	19.8628	19.8654	19.8679	19.8798	19.8820	19.8924	19.8924	19.8944	19.8884	19.8820	19.8775	19.8728 (88)
util rest of house	0.9940	0.9893	0.9767	0.9401	0.8519	0.6790	0.4827	0.5387	0.8086	0.9587	0.9892	0.9951 (89)
MIT 2	18.2289	18.4090	18.7346	19.1757	19.5545	19.8033	19.8751	19.8678	19.7026	19.2122	18.6525	18.2101 (90)
Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.3852	18.5652	18.8909	19.3320	19.7145	19.9692	20.0474	20.0381	19.8634	19.3674	18.8072	18.3652 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3852	18.5652	18.8909	19.3320	19.7145	19.9692	20.0474	20.0381	19.8634	19.3674	18.8072	18.3652 (93)

8. Space heating requirement												

Utilisation	0.9916	0.9856	0.9706	0.9312	0.8451	0.6856	0.5025	0.5571	0.8069	0.9512	0.9857	0.9931 (94)
Useful gains	590.2377	671.6596	753.3778	815.1259	791.8163	631.5831	442.6545	457.7030	602.2655	617.6071	573.7224	561.0705 (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	1946.3395	1883.4395	1703.4931	1417.1268	1086.2654	720.0816	462.3405	486.9571	776.1096	1188.3176	1594.0169	1937.8596 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1008.9398	814.3161	706.8858	433.4407	219.0701	0.0000	0.0000	0.0000	0.0000	424.6086	734.6121	1024.3311 (98)
Space heating											5366.2042 (98)
Space heating per m2											(98) / (4) = 49.3989 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Efficiency of main space heating system 1 (in %)		90.8000 (206)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		5909.9165 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1008.9398	814.3161	706.8858	433.4407	219.0701	0.0000	0.0000	0.0000	0.0000	424.6086	734.6121	1024.3311	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	1111.1672	896.8239	778.5086	477.3576	241.2666	0.0000	0.0000	0.0000	0.0000	467.6307	809.0441	1128.1180	(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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616	(64)
Efficiency of water heater	88.6774	88.5227	88.1604	87.3316	85.6408	80.1000	80.1000	80.1000	80.1000	87.1972	88.2702	88.7430	(217)
Fuel for water heating, kWh/month	248.3751	219.4122	231.6404	209.9879	210.1152	201.1494	193.5788	211.8696	211.3243	218.0630	227.3197	242.3422	(219)
Water heating fuel used												2625.1777	(219)
Annual totals kWh/year													
Space heating fuel - main system												5909.9165	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1068 * 1.00) =										-1093.7042		-1093.7042	(233)
Total delivered energy for all uses												7974.5702	(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	5909.9165	0.2160	1276.5420 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2625.1777	0.2160	567.0384 (264)
Space and water heating			1843.5804 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Energy saving/generation technologies			
PV Unit	-1093.7042	0.5190	-567.6325 (269)
Total CO2, kg/year			1552.6684 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2900 (273)

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

DER		14.2900	ZC1
Total Floor Area	TFA	108.6300	
Assumed number of occupants	N	2.8063	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.7053	ZC2
CO2 emissions from cooking, equation (L16)		1.7155	ZC3
Total CO2 emissions		30.7107	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		30.7107	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 269.8665 (5)
Dwelling volume			

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) = 0.1482 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3982 (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) =	0.3385 (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	0.4316	0.4231	0.4146	0.3723	0.3639	0.3216	0.3216	0.3131	0.3385	0.3639	0.3808	0.3977 (22b)
Effective ac	0.5931	0.5895	0.5860	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.7700	1.0000	1.7700		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			14.7800	1.3258	19.5947		(27)
Ground Floor			44.2000	0.1300	5.7460		(28a)
Exposed over Garage			20.2300	0.1300	2.6299		(28b)
Brick and Block	145.3600	16.9000	128.4600	0.1800	23.1228		(29a)
Wall to Garage	17.1800	1.7700	15.4100	0.1800	2.7738		(29a)
Pitched Roof	62.0500		62.0500	0.1300	8.0665		(30)
Sloping Ceiling	3.5100		3.5100	0.1300	0.4563		(30)
Total net area of external elements Aum(A, m ²)			292.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7040		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0931 (36)
Total fabric heat loss						(33) + (36) =	84.7971 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.8215	52.4995	52.1838	50.7011	50.4237	49.1323	49.1323	48.8932	49.6297	50.4237	50.9849	51.5716 (38)
Heat transfer coeff	137.6186	137.2966	136.9809	135.4982	135.2208	133.9294	133.9294	133.6903	134.4268	135.2208	135.7820	136.3687 (39)
Average = Sum(39)m / 12 =												135.4969 (39)
HLP	1.2669	1.2639	1.2610	1.2473	1.2448	1.2329	1.2329	1.2307	1.2375	1.2448	1.2499	1.2554 (40)
HLP (average)												1.2473 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum(45)m =		1586.7751 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9942	0.9856	0.9575	0.8813	0.7159	0.5165	0.5759	0.8443	0.9728	0.9943	0.9977 (94)
Useful gains	588.3412	672.3849	759.9373	833.2478	821.1977	655.7831	452.3022	470.2296	625.8063	626.5962	573.5972	558.5343 (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	1912.8984	1853.9724	1681.2227	1406.0811	1084.1278	721.8549	463.1330	488.0958	776.2430	1177.1228	1570.9527	1905.6493 (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	985.4706	794.0268	685.4363	412.4400	195.6200	0.0000	0.0000	0.0000	0.0000	409.5918	718.0959	1002.2535 (98)
Space heating												5202.9350 (98)
Space heating per m2												47.8959 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5564.6364 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	985.4706	794.0268	685.4363	412.4400	195.6200	0.0000	0.0000	0.0000	0.0000	409.5918	718.0959	1002.2535	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1053.9792	849.2266	733.0870	441.1122	209.2192	0.0000	0.0000	0.0000	0.0000	438.0661	768.0171	1071.9289	(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	215.4407	189.8833	199.4031	178.7291	175.1324	156.4640	150.2447	164.8957	164.6140	185.3329	195.9989	210.2497	(64)
Efficiency of water heater (217)m	88.3742	88.2172	87.8456	86.9742	85.1094	79.8000	79.8000	79.8000	79.8000	86.8713	87.9708	79.8000	(216)
Fuel for water heating, kWh/month	243.7824	215.2452	226.9927	205.4967	205.7734	196.0701	188.2766	206.6362	206.2833	213.3419	222.7999	237.7217	(219)
Water heating fuel used												2568.4200	(219)
Annual totals kWh/year													
Space heating fuel - main system												5564.6364	(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)												458.1801	(232)
Total delivered energy for all uses												8666.2364	(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	5564.6364	0.2160	1201.9615	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2568.4200	0.2160	554.7787	(264)
Space and water heating			1756.7402	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.1801	0.5190	237.7955	(268)
Total CO2, kg/m2/year			2033.4606	(272)
Emissions per m2 for space and water heating			16.1718	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1890	(272b)
Emissions per m2 for pumps and fans			0.3583	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1718 * 1.00) + 2.1890 + 0.3583, rounded to 2 d.p.			18.7200	(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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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) = 0.1482 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3812 (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) =		0.3240 (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	0.4131	0.4050	0.3969	0.3564	0.3483	0.3078	0.3078	0.2997	0.3240	0.3483	0.3645	0.3807 (22b)
Effective ac	0.5853	0.5820	0.5788	0.5635	0.5607	0.5474	0.5474	0.5449	0.5525	0.5607	0.5664	0.5725 (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)			14.7800	1.1450	16.9237		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000 (28a)
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000 (28b)
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812 (29a)
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046 (29a)
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500 (30)
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900 (30)
Total net area of external elements Aum(A, m ²)			292.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940		(33)
Ground Floor Block			48.7500			75.0000	3656.2500 (32c)
Ground Floor Stud			26.2800			9.0000	236.5200 (32c)
First Floor Stud			154.6100			9.0000	1391.4900 (32c)
Internal Floor 1			44.2000			18.0000	795.6000 (32d)
Internal Ceiling 1			44.2000			9.0000	397.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19978.5858 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							183.9141 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112 (36)
Total fabric heat loss						(33) + (36) =	84.5052 (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	52.1285	51.8334	51.5441	50.1853	49.9311	48.7476	48.7476	48.5284	49.2034	49.9311	50.4454	50.9830 (38)
Heat transfer coeff	136.6337	136.3386	136.0493	134.6905	134.4363	133.2528	133.2528	133.0336	133.7087	134.4363	134.9506	135.4883 (39)
Average = Sum(39)m / 12 =												134.6893 (39)
HLP	1.2578	1.2551	1.2524	1.2399	1.2376	1.2267	1.2267	1.2246	1.2309	1.2376	1.2423	1.2472 (40)
HLP (average)												1.2399 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum	(45)m =	1586.7751 (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	34.9594	30.5757	31.5514	27.5072	26.3939	22.7759	21.1052	24.2185	24.5078	28.5615	31.1771	33.8563 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9441	23.0433	18.7401	14.1874	10.6053	8.9534	9.6745	12.5753	16.8785	21.4311	25.0133	26.6651 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.5728	272.3701	265.3210	250.3141	231.3707	213.5666	201.6723	198.8750	205.9241	220.9310	239.8744	257.6785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	46.9884	45.4995	42.4077	38.2045	35.4756	31.6332	28.3672	32.5518	34.0386	38.3891	43.3015	45.5057 (72)
Total internal gains	407.6005	406.0081	391.5640	367.8013	342.5468	319.2484	304.8092	309.0972	321.9364	345.8463	373.2843	394.9446 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
East	8.7500	19.6403	0.6300	0.7000	0.7700	52.5203 (76)
South	1.1400	46.7521	0.6300	0.7000	0.7700	16.2884 (78)
West	4.8900	19.6403	0.6300	0.7000	0.7700	29.3513 (80)

Solar gains	98.1600	186.8344	297.7386	423.0807	511.4548	521.1112	497.0827	431.2072	342.2582	218.8140	121.3916	81.4019 (83)
Total gains	505.7605	592.8426	689.3026	790.8820	854.0016	840.3596	801.8919	740.3044	664.1946	564.6604	494.6759	476.3465 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.6167	40.7046	40.7911	41.2027	41.2806	41.6472	41.6472	41.7158	41.5052	41.2806	41.1233	40.9601
alpha	3.7078	3.7136	3.7194	3.7468	3.7520	3.7765	3.7765	3.7811	3.7670	3.7520	3.7416	3.7307
util living area	0.9971	0.9943	0.9869	0.9646	0.9094	0.7964	0.6535	0.7099	0.8973	0.9799	0.9950	0.9977 (86)
MIT	19.1043	19.2867	19.6200	20.0718	20.4925	20.8029	20.9331	20.9071	20.6496	20.0949	19.5192	19.0748 (87)
Th 2	19.8740	19.8762	19.8783	19.8882	19.8901	19.8987	19.8987	19.9003	19.8954	19.8901	19.8863	19.8824 (88)
util rest of house	0.9963	0.9928	0.9830	0.9531	0.8766	0.7170	0.5210	0.5836	0.8464	0.9715	0.9933	0.9971 (89)
MIT 2	18.1420	18.3254	18.6584	19.1106	19.5125	19.7875	19.8754	19.8642	19.6672	19.1397	18.5655	18.1187 (90)
Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.2966	18.4798	18.8128	19.2650	19.6700	19.9506	20.0453	20.0318	19.8250	19.2932	18.7187	18.2723 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2966	18.4798	18.8128	19.2650	19.6700	19.9506	20.0453	20.0318	19.8250	19.2932	18.7187	18.2723 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9947	0.9901	0.9780	0.9447	0.8687	0.7213	0.5405	0.6007	0.8423	0.9652	0.9908	0.9957 (94)
Ext temp.	503.0712	586.9449	674.1524	747.1614	741.8333	606.1861	433.4216	444.7232	559.4656	544.9923	490.1368	474.3209 (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	1912.4094	1851.4498	1675.1543	1396.0664	1071.4507	712.9876	459.0944	483.1468	765.4782	1168.6762	1567.9540	1906.6289 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1048.5476	849.7473	744.7454	467.2117	245.2353	0.0000	0.0000	0.0000	0.0000	464.0208	776.0284	1065.6371 (98)
												5661.1736 (98)
										(98) / (4) =		52.1143 (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
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1252.5763	986.0707	1011.0556	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7336	0.8131	0.7765	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	918.8551	801.7411	785.0817	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1092.6352	1045.3340	975.5980	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	125.1216	181.2331	141.7442	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			448.0989	(104)
Intermittency factor (Table 10b)												1.0000	(105)
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	0.0000	0.0000	0.0000	0.0000	0.0000	31.2804	45.3083	35.4360	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												112.0247	(107)
Energy for space heating												1.0313	(108)
Energy for space cooling												52.1143	(99)
Total												1.0313	(108)
Dwelling Fabric Energy Efficiency (DFEE)												53.1455	(109)
												53.1	(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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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) = 0.1482 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3982 (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) =	0.3385 (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	0.4316	0.4231	0.4146	0.3723	0.3639	0.3216	0.3216	0.3131	0.3385	0.3639	0.3808	0.3977 (22b)
Effective ac	0.5931	0.5895	0.5860	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.7700	1.0000	1.7700		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			14.7800	1.3258	19.5947		(27)
Ground Floor			44.2000	0.1300	5.7460		(28a)
Exposed over Garage			20.2300	0.1300	2.6299		(28b)
Brick and Block	145.3600	16.9000	128.4600	0.1800	23.1228		(29a)
Wall to Garage	17.1800	1.7700	15.4100	0.1800	2.7738		(29a)
Pitched Roof	62.0500		62.0500	0.1300	8.0665		(30)
Sloping Ceiling	3.5100		3.5100	0.1300	0.4563		(30)
Total net area of external elements Aum(A, m ²)			292.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.7040		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0931 (36)
Total fabric heat loss						(33) + (36) =	84.7971 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.8215	52.4995	52.1838	50.7011	50.4237	49.1323	49.1323	48.8932	49.6297	50.4237	50.9849	51.5716 (38)
Heat transfer coeff	137.6186	137.2966	136.9809	135.4982	135.2208	133.9294	133.9294	133.6903	134.4268	135.2208	135.7820	136.3687 (39)
Average = Sum(39)m / 12 =												135.4969 (39)
HLP	1.2669	1.2639	1.2610	1.2473	1.2448	1.2329	1.2329	1.2307	1.2375	1.2448	1.2499	1.2554 (40)
HLP (average)												1.2473 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum(45)m =		1586.7751 (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)

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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	34.9594	30.5757	31.5514	27.5072	26.3939	22.7759	21.1052	24.2185	24.5078	28.5615	31.1771	33.8563	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9441	23.0433	18.7401	14.1874	10.6053	8.9534	9.6745	12.5753	16.8785	21.4311	25.0133	26.6651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.5728	272.3701	265.3210	250.3141	231.3707	213.5666	201.6723	198.8750	205.9241	220.9310	239.8744	257.6785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	(71)
Water heating gains (Table 5)	46.9884	45.4995	42.4077	38.2045	35.4756	31.6332	28.3672	32.5518	34.0386	38.3891	43.3015	45.5057	(72)
Total internal gains	407.6005	406.0081	391.5640	367.8013	342.5468	319.2484	304.8092	309.0972	321.9364	345.8463	373.2843	394.9446	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	8.7500	19.6403	0.6300		0.7000	0.7700	52.5203 (76)
South	1.1400	46.7521	0.6300		0.7000	0.7700	16.2884 (78)
West	4.8900	19.6403	0.6300		0.7000	0.7700	29.3513 (80)

Solar gains	98.1600	186.8344	297.7386	423.0807	511.4548	521.1112	497.0827	431.2072	342.2582	218.8140	121.3916	81.4019	(83)
Total gains	505.7605	592.8426	689.3026	790.8820	854.0016	840.3596	801.8919	740.3044	664.1946	564.6604	494.6759	476.3465	(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	54.8163	54.9449	55.0715	55.6742	55.7884	56.3263	56.3263	56.4271	56.1179	55.7884	55.5578	55.3188	
alpha	4.6544	4.6630	4.6714	4.7116	4.7192	4.7551	4.7551	4.7618	4.7412	4.7192	4.7039	4.6879	
util living area	0.9993	0.9984	0.9953	0.9831	0.9420	0.8343	0.6806	0.7421	0.9317	0.9919	0.9986	0.9995	(86)
MIT	19.4823	19.6291	19.8982	20.2677	20.6149	20.8671	20.9630	20.9441	20.7373	20.2808	19.8169	19.4605	(87)
Th 2	19.8669	19.8692	19.8715	19.8823	19.8843	19.8938	19.8938	19.8955	19.8901	19.8843	19.8802	19.8760	(88)
util rest of house	0.9991	0.9978	0.9935	0.9755	0.9131	0.7495	0.5352	0.6032	0.8843	0.9872	0.9980	0.9993	(89)
MIT 2	18.4811	18.6295	18.8997	19.2736	19.6065	19.8264	19.8836	19.8779	19.7276	19.2911	18.8260	18.4664	(90)
Living area fraction									fLA = Living area / (4) =				0.1606 (91)
MIT	18.6419	18.7901	19.0601	19.4333	19.7685	19.9936	20.0570	20.0491	19.8898	19.4501	18.9852	18.6261	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6419	18.7901	19.0601	19.4333	19.7685	19.9936	20.0570	20.0491	19.8898	19.4501	18.9852	18.6261	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9987	0.9970	0.9916	0.9714	0.9093	0.7585	0.5587	0.6251	0.8843	0.9845	0.9973	0.9990	(94)
Ext temp.	505.0949	591.0818	683.5105	768.2618	776.5107	637.3906	447.9924	462.7488	587.3465	555.9291	493.3568	475.8786	(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	1973.7189	1907.0634	1720.4912	1427.2405	1091.0261	722.3551	462.9907	487.8545	778.3039	1196.7178	1613.7929	1967.2675	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1092.6563	884.3396	771.5136	474.4647	233.9995	0.0000	0.0000	0.0000	0.0000	476.7468	806.7140	1109.5933	(98)
												5850.0278	(98)
												53.8528	(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	1258.9364	991.0776	1016.0460	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7631	0.8475	0.8092	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	960.6469	839.9402	822.2259	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1092.6352	1045.3340	975.5980	0.0000	0.0000	0.0000	0.0000	(103)

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Month fraction	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	95.0316	152.8130	114.1088	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												361.9534 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	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												0.0000 (107)
Space cooling per m2												90.4883 (107)
Energy for space heating												0.8330 (108)
Energy for space cooling												53.8528 (99)
Total												0.8330 (108)
Target Fabric Energy Efficiency (TFEE)												54.6858 (109)
												62.9 (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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										50.0000 / (5) =							0.1853 (8)
Pressure test										Yes							
Measured/design AP50																	4.6600
Infiltration rate																	0.4183 (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) =							0.3555 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)				
Adj infilt rate	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)				
	0.3733	0.3466	0.3555	0.3378	0.3378	0.3289	0.3200	0.3111	0.3022	0.3289	0.3111	0.3289	(22b)				
Effective ac	0.5697	0.5601	0.5632	0.5570	0.5570	0.5541	0.5512	0.5484	0.5457	0.5541	0.5484	0.5541	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000	(28b)					
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812	(29a)					
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046	(29a)					
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500	(30)					
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900	(30)					
Total net area of external elements Aum(A, m2)			292.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.2000			18.0000	795.6000	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20376.3858	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.5760	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112	(36)					
Total fabric heat loss						(33) + (36) =	84.5052	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7335	49.8786	50.1565	49.6078	49.6078	49.3439	49.0871	48.8373	48.5946	49.3439	48.8373	49.3439	(38)
Heat transfer coeff	135.2387	134.3838	134.6618	134.1130	134.1130	133.8491	133.5923	133.3426	133.0998	133.8491	133.3426	133.8491	(39)
Average = Sum(39)m / 12 =												133.9529	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2371	1.2396	1.2346	1.2346	1.2322	1.2298	1.2275	1.2253	1.2322	1.2275	1.2322	(40)
HLP (average)												1.2331	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)												1586.7751 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
Total per year (kWh/year) = Sum(64)m =												2243.0451 (64)
RHI water heating demand												2243 (64)
Heat gains from water heating, kWh/month	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	131.1364 (72)
Total internal gains	714.4353	709.0289	682.9119	642.5553	601.0562	564.3409	543.2807	552.9052	576.5107	617.0978	662.0134	696.1655 (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	
East						8.7500	25.1925	0.6300	0.7000	0.7700	67.3677 (76)	
South						1.1400	56.7559	0.6300	0.7000	0.7700	19.7737 (78)	
West						4.8900	25.1925	0.6300	0.7000	0.7700	37.6489 (80)	
Solar gains	124.7903	202.2124	324.5089	462.9234	531.0033	587.3651	556.0169	494.8459	393.6586	255.4582	153.8499	101.7036 (83)
Total gains	839.2257	911.2413	1007.4208	1105.4787	1132.0595	1151.7060	1099.2976	1047.7510	970.1694	872.5560	815.8633	797.8691 (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	41.8527	42.1190	42.0320	42.2040	42.2040	42.2872	42.3695	42.4479	42.5253	42.2872	42.4479	42.2872
alpha	3.7902	3.8079	3.8021	3.8136	3.8136	3.8191	3.8246	3.8299	3.8350	3.8191	3.8299	3.8191
util living area	0.9833	0.9764	0.9548	0.9004	0.7950	0.6087	0.4592	0.4786	0.7318	0.9134	0.9704	0.9854 (86)
MIT	19.5742	19.7112	20.0252	20.4220	20.7464	20.9345	20.9829	20.9804	20.8638	20.4840	19.9890	19.5668 (87)
Th 2	19.8842	19.8905	19.8884	19.8924	19.8924	19.8944	19.8962	19.8981	19.8998	19.8944	19.8981	19.8944 (88)
util rest of house	0.9790	0.9703	0.9428	0.8728	0.7368	0.5101	0.3362	0.3517	0.6438	0.8826	0.9613	0.9816 (89)
MIT 2	18.6137	18.7533	19.0588	19.4392	19.7261	19.8654	19.8920	19.8932	19.8284	19.5064	19.0348	18.6144 (90)
Living area fraction	18.7680	18.9072	19.2141	19.5971	19.8900	20.0371	20.0672	20.0678	19.9947	19.6635	19.1881	18.7674 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7680	18.9072	19.2141	19.5971	19.8900	20.0371	20.0672	20.0678	19.9947	19.6635	19.1881	18.7674 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9732	0.9633	0.9336	0.8641	0.7366	0.5237	0.3559	0.3720	0.6523	0.8747	0.9537	0.9764 (94)
Ext temp.	816.7409	877.8409	940.5284	955.2747	833.8964	603.1516	391.2380	389.7662	632.8002	763.2093	778.1081	779.0372 (95)
Heat loss rate W	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)
Month fracti	1875.4907	1828.5857	1644.7667	1354.1467	991.0960	634.0568	396.4008	395.7351	704.7222	1106.0564	1505.1784	1842.7542 (97)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	787.7098	638.9006	523.9533	287.1878	116.9565	0.0000	0.0000	0.0000	0.0000	255.0782	523.4906	791.4054 (98)
Space heating												3924.6823 (98)
RHI space heating demand												3925 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1853 (8)
Pressure test										Yes							
Measured/design AP50										4.6600							
Infiltration rate										0.4183 (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) =					0.3555 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	(22)				
Adj infilt rate	0.4533	0.4444	0.4355	0.3911	0.3822	0.3378	0.3378	0.3289	0.3555	0.3822	0.4000	0.4178	(22a)				
Effective ac	0.6027	0.5988	0.5948	0.5765	0.5730	0.5570	0.5570	0.5541	0.5632	0.5730	0.5800	0.5873	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000	(28b)					
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812	(29a)					
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046	(29a)					
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500	(30)					
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900	(30)					
Total net area of external elements Aum(A, m2)			292.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.2000			18.0000	795.6000	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20376.3858	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.5760	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112	(36)					
Total fabric heat loss						(33) + (36) =	84.5052	(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	53.6779	53.3226	52.9744	51.3385	51.0325	49.6078	49.6078	49.3439	50.1565	51.0325	51.6516	52.2989	(38)
Heat transfer coeff	138.1831	137.8278	137.4796	135.8438	135.5377	134.1130	134.1130	133.8491	134.6618	135.5377	136.1568	136.8041	(39)
Average = Sum(39)m / 12 =												135.8423	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2721	1.2688	1.2656	1.2505	1.2477	1.2346	1.2346	1.2322	1.2396	1.2477	1.2534	1.2594	(40)
HLP (average)												1.2505	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum(45)m =		1586.7751 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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												
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
								Total per year (kWh/year) = Sum(64)m =				2243.0451 (64)
Heat gains from water heating, kWh/month												
	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	131.1364 (72)
Total internal gains	714.4353	709.0289	682.9119	642.5553	601.0562	564.3409	543.2807	552.9052	576.5107	617.0978	662.0134	696.1655 (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
East					8.7500	19.6403		0.6300	0.7000	0.7700		52.5203 (76)
South					1.1400	46.7521		0.6300	0.7000	0.7700		16.2884 (78)
West					4.8900	19.6403		0.6300	0.7000	0.7700		29.3513 (80)

Solar gains	98.1600	186.8344	297.7386	423.0807	511.4548	521.1112	497.0827	431.2072	342.2582	218.8140	121.3916	81.4019 (83)
Total gains	812.5953	895.8633	980.6505	1065.6360	1112.5110	1085.4521	1040.3634	984.1123	918.7689	835.9118	783.4050	777.5674 (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	40.9609	41.0665	41.1705	41.6663	41.7604	42.2040	42.2040	42.2872	42.0320	41.7604	41.5705	41.3738
alpha	3.7307	3.7378	3.7447	3.7778	3.7840	3.8136	3.8136	3.8191	3.8021	3.7840	3.7714	3.7583
util living area	0.9867	0.9796	0.9631	0.9217	0.8373	0.6909	0.5370	0.5820	0.7962	0.9386	0.9786	0.9887 (86)
MIT	19.4216	19.5930	19.8989	20.3033	20.6533	20.8855	20.9668	20.9546	20.7913	20.3414	19.8150	19.3923 (87)
Th 2	19.8628	19.8654	19.8679	19.8798	19.8820	19.8924	19.8924	19.8944	19.8884	19.8820	19.8775	19.8728 (88)
util rest of house	0.9834	0.9745	0.9532	0.8997	0.7897	0.6025	0.4150	0.4603	0.7223	0.9168	0.9723	0.9858 (89)
MIT 2	18.4463	18.6175	18.9200	19.3187	19.6392	19.8334	19.8820	19.8788	19.7661	19.3639	18.8481	18.4248 (90)
Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.6030	18.7742	19.0773	19.4769	19.8021	20.0024	20.0563	20.0516	19.9308	19.5209	19.0034	18.5803 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6030	18.7742	19.0773	19.4769	19.8021	20.0024	20.0563	20.0516	19.9308	19.5209	19.0034	18.5803 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9783	0.9679	0.9445	0.8901	0.7858	0.6121	0.4340	0.4788	0.7255	0.9079	0.9656	0.9813 (94)
Useful gains	794.9622	867.0880	926.2002	948.5345	874.2100	664.3708	451.5123	471.1717	666.6052	758.9111	756.4772	763.0284 (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												
	1976.4268	1912.2538	1729.1195	1436.8022	1098.1419	724.5336	463.5330	488.7634	785.1866	1209.1161	1620.7335	1967.2778 (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												

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879.0097	702.3514	597.3720	351.5527	166.6053	0.0000	0.0000	0.0000	0.0000	334.9525	622.2646	895.9615 (98)
Space heating											4550.0698 (98)
Space heating per m2											(98) / (4) = 41.8859 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	90.8000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	5011.0901 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	879.0097	702.3514	597.3720	351.5527	166.6053	0.0000	0.0000	0.0000	0.0000	334.9525	622.2646	895.9615	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	968.0723	773.5148	657.8987	387.1726	183.4860	0.0000	0.0000	0.0000	0.0000	368.8904	685.3134	986.7418	(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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616	(64)
Efficiency of water heater (217)m	88.4331	88.2463	87.8116	86.8239	84.9104	80.1000	80.1000	80.1000	80.1000	86.6105	87.9358	80.1000	(216)
Fuel for water heating, kWh/month	249.0614	220.0994	232.5604	211.2158	211.9226	201.1494	193.5788	211.8696	211.3243	219.5403	228.1843	242.9765	(219)
Water heating fuel used												2633.4828	(219)
Annual totals kWh/year													
Space heating fuel - main system												5011.0901	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1068 * 1.00) =										-1093.7042		-1093.7042	(233)
Total delivered energy for all uses												7084.0488	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5011.0901	3.4800	174.3859	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2633.4828	3.4800	91.6452	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	458.1801	13.1900	60.4340	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1093.7042	13.1900	-144.2596	(252)
Total energy cost			312.0980	(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] = 0.8532 (257)
SAP value	88.0975
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	5011.0901	0.2160	1082.3955	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2633.4828	0.2160	568.8323	(264)
Space and water heating			1651.2277	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.1801	0.5190	237.7955	(268)
Energy saving/generation technologies				
PV Unit	-1093.7042	0.5190	-567.6325	(269)
Total kg/year			1360.3157	(272)
CO2 emissions per m2			12.5200	(273)
EI value			88.1350	

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EI rating

88 (274)

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9080 = 3.833$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9080 = 0.2379$, stars = 4
Water heating energy efficiency	$3.48 / 0.8497 = 4.095$, stars = 4
Water heating environmental impact	$0.216 / 0.8497 = 0.2542$, stars = 4

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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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										50.0000 / (5) =							0.1853 (8)
Pressure test										Yes							
Measured/design AP50																	4.6600
Infiltration rate																	0.4183 (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) =							0.3555 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)				
Adj infilt rate	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)				
	0.3733	0.3466	0.3555	0.3378	0.3378	0.3289	0.3200	0.3111	0.3022	0.3289	0.3111	0.3289	(22b)				
Effective ac	0.5697	0.5601	0.5632	0.5570	0.5570	0.5541	0.5512	0.5484	0.5457	0.5541	0.5484	0.5541	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000	(28b)					
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812	(29a)					
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046	(29a)					
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500	(30)					
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900	(30)					
Total net area of external elements Aum(A, m2)			292.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.2000			18.0000	795.6000	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20376.3858	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.5760	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112	(36)					
Total fabric heat loss						(33) + (36) =	84.5052	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7335	49.8786	50.1565	49.6078	49.6078	49.3439	49.0871	48.8373	48.5946	49.3439	48.8373	49.3439	(38)
Heat transfer coeff	135.2387	134.3838	134.6618	134.1130	134.1130	133.8491	133.5923	133.3426	133.0998	133.8491	133.3426	133.8491	(39)
Average = Sum(39)m / 12 =												133.9529	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2371	1.2396	1.2346	1.2346	1.2322	1.2298	1.2275	1.2253	1.2322	1.2275	1.2322	(40)
HLP (average)												1.2331	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)												1586.7751 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)	
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss												
32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)	
If cylinder contains dedicated solar storage												
32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120 (59)	
Total heat required for water heating calculated for each month												
220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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 (63)	
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
Heat gains from water heating, kWh/month	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)
99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)	
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
(66)m	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (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 (70)	
Losses e.g. evaporation (negative values) (Table 5)												
-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)	
Water heating gains (Table 5)												
133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	131.1364 (72)	
Total internal gains	714.4353	709.0289	682.9119	642.5553	601.0562	564.3409	543.2807	552.9052	576.5107	617.0978	662.0134	696.1655 (73)
6. Solar gains												
[Jan]												
Area												
m2												
Solar flux												
Table 6a												
W/m2												
Specific data												
or Table 6b												
g												
Specific data												
or Table 6c												
FF												
Access												
factor												
Table 6d												
Gains												
W												
East	8.7500	25.1925	0.6300	0.7000	0.7700	67.3677 (76)						
South	1.1400	56.7559	0.6300	0.7000	0.7700	19.7737 (78)						
West	4.8900	25.1925	0.6300	0.7000	0.7700	37.6489 (80)						
Solar gains	124.7903	202.2124	324.5089	462.9234	531.0033	587.3651	556.0169	494.8459	393.6586	255.4582	153.8499	101.7036 (83)
Total gains	839.2257	911.2413	1007.4208	1105.4787	1132.0595	1151.7060	1099.2976	1047.7510	970.1694	872.5560	815.8633	797.8691 (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	41.8527	42.1190	42.0320	42.2040	42.2040	42.2872	42.3695	42.4479	42.5253	42.2872	42.4479	42.2872
alpha	3.7902	3.8079	3.8021	3.8136	3.8136	3.8191	3.8246	3.8299	3.8350	3.8191	3.8299	3.8191
util living area	0.9833	0.9764	0.9548	0.9004	0.7950	0.6087	0.4592	0.4786	0.7318	0.9134	0.9704	0.9854 (86)
MIT	19.5742	19.7112	20.0252	20.4220	20.7464	20.9345	20.9829	20.9804	20.8638	20.4840	19.9890	19.5668 (87)
Th 2	19.8842	19.8905	19.8884	19.8924	19.8924	19.8944	19.8962	19.8981	19.8998	19.8944	19.8981	19.8944 (88)
util rest of house	0.9790	0.9703	0.9428	0.8728	0.7368	0.5101	0.3362	0.3517	0.6438	0.8826	0.9613	0.9816 (89)
MIT 2	18.6137	18.7533	19.0588	19.4392	19.7261	19.8654	19.8920	19.8932	19.8284	19.5064	19.0348	18.6144 (90)
Living area fraction												
fLA = Living area / (4) =												0.1606 (91)
MIT	18.7680	18.9072	19.2141	19.5971	19.8900	20.0371	20.0672	20.0678	19.9947	19.6635	19.1881	18.7674 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7680	18.9072	19.2141	19.5971	19.8900	20.0371	20.0672	20.0678	19.9947	19.6635	19.1881	18.7674 (93)
8. Space heating requirement												
Utilisation	0.9732	0.9633	0.9336	0.8641	0.7366	0.5237	0.3559	0.3720	0.6523	0.8747	0.9537	0.9764 (94)
Useful gains	816.7409	877.8409	940.5284	955.2747	833.8964	603.1516	391.2380	389.7662	632.8002	763.2093	778.1081	779.0372 (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	1875.4907	1828.5857	1644.7667	1354.1467	991.0960	634.0568	396.4008	395.7351	704.7222	1106.0564	1505.1784	1842.7542 (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												

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Space heating	787.7098	638.9006	523.9533	287.1878	116.9565	0.0000	0.0000	0.0000	0.0000	255.0782	523.4906	791.4054 (98)
Space heating per m2												3924.6823 (98)
										(98) / (4) =		36.1289 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4322.3373 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	787.7098	638.9006	523.9533	287.1878	116.9565	0.0000	0.0000	0.0000	0.0000	255.0782	523.4906	791.4054 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	867.5219	703.6350	577.0411	316.2862	128.8067	0.0000	0.0000	0.0000	0.0000	280.9231	576.5315	871.5919 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
Efficiency of water heater (217)m	88.2248	88.0577	87.5212	86.3070	83.9993	80.1000	80.1000	80.1000	80.1000	85.8994	87.5590	80.1000 (216)
Fuel for water heating, kWh/month	249.6495	220.5709	233.3321	212.4808	214.2213	201.1494	193.5788	211.8696	211.3243	221.3576	229.1661	243.6127 (219)
Water heating fuel used												2642.3131 (219)
Annual totals kWh/year												4322.3373 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
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)												458.1801 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.28 * 1187 * 1.00) =										-1215.0150		-1215.0150 (233)
Total delivered energy for all uses												6282.8155 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4322.3373	10.2300	442.1751 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2642.3131	10.2300	270.3086 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	458.1801	36.7200	168.2437 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-1215.0150	36.7200	-446.1535 (252)
Total energy cost			565.1140 (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	4322.3373	0.2160	933.6249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.3131	0.2160	570.7396 (264)
Space and water heating			1504.3645 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Energy saving/generation technologies			
PV Unit	-1215.0150	0.5190	-630.5928 (269)
Total kg/year			1150.4922 (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	4322.3373	1.2200	5273.2515 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2642.3131	1.2200	3223.6220 (264)
Space and water heating			8496.8735 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)

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Energy for lighting	458.1801	3.0700	1406.6128 (268)
Energy saving/generation technologies			
PV Unit	-1215.0150	3.0700	-3730.0960 (269)
Primary energy kWh/year			6403.6403 (272)
Primary energy kWh/m ² /year			58.9491 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 121	-269 kg (23.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£121 2.48 kg/m ²	B 90	B 90
Total Savings	£121 2.48 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£196	£214	-£18
Mains gas	£815	£676	£140
Space heating	£573	£579	-£6
Water heating	£270	£143	£127
Lighting	£168	£168	£0
Generated (PV)	-£446	-£446	£0
Total cost of fuels	£565	£444	£122
Total cost of uses	£565	£444	£121
Delivered energy	58 kWh/m ²	46 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m ²	11 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	59 kWh/m ²	45 kWh/m ²	14 kWh/m ²

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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1853 (8)
Pressure test										Yes							
Measured/design AP50										4.6600							
Infiltration rate										0.4183 (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) =					0.3555 (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	0.4533	0.4444	0.4355	0.3911	0.3822	0.3378	0.3378	0.3289	0.3555	0.3822	0.4000	0.4178	(22b)				
Effective ac	0.6027	0.5988	0.5948	0.5765	0.5730	0.5570	0.5570	0.5541	0.5632	0.5730	0.5800	0.5873	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000	(28b)					
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812	(29a)					
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046	(29a)					
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500	(30)					
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900	(30)					
Total net area of external elements Aum(A, m2)			292.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.2000			18.0000	795.6000	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20376.3858	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.5760	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112	(36)					
Total fabric heat loss						(33) + (36) =	84.5052	(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	53.6779	53.3226	52.9744	51.3385	51.0325	49.6078	49.6078	49.3439	50.1565	51.0325	51.6516	52.2989	(38)
Heat transfer coeff	138.1831	137.8278	137.4796	135.8438	135.5377	134.1130	134.1130	133.8491	134.6618	135.5377	136.1568	136.8041	(39)
Average = Sum(39)m / 12 =												135.8423	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2721	1.2688	1.2656	1.2505	1.2477	1.2346	1.2346	1.2322	1.2396	1.2477	1.2534	1.2594	(40)
HLP (average)												1.2505	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use												
Energy content (annual)	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Distribution loss	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
											Total = Sum(45)m =	1586.7751 (45)
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b												
Enter (49) or (54) in (55)												
Total storage loss												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	20.2973	18.3330	20.2973	19.6425	20.2973	19.6425	20.2973	20.2973	19.6425	20.2973	19.6425	20.2973 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	208.0743	183.2297	190.6409	164.8467	154.9717	136.7284	129.8513	145.4328	152.0824	176.5708	188.8701	202.8833 (62)
Aperture area of solar collector												
Zero-loss collector efficiency	3.0000 (H1)											
Collector heat loss coefficient	0.7000 (H2)											
Collector 2nd order heat loss coefficient	1.8000 (H3)											
Collector effective heat loss coefficient	0.0050 (H3a)											
Collector performance ratio	1.8063 (H3b)											
Annual solar radiation per m2	2.5804 (H4)											
Overshading factor	1079.5246 (H5)											
Solar energy available	0.8000 (H6)											
Adjustment factor for showers	1813.6014 (H7)											
Solar-to-load ratio	1.0000 (H7a)											
Utilisation factor	1.1429 (H8)											
Collector performance factor	0.5831 (H9)											
Dedicated solar storage volume	0.8793 (H10)											
Effective solar volume	75.0000 (H11)											
Daily hot water demand	112.5000 (H13)											
Volume ratio Veff/V	100.8508 (H14)											
Solar storage volume factor	1.1155 (H15)											
Solar input	1.0000 (H16)											
Solar input	-26.9646	-44.9961	-76.6335	-102.7041	-126.8822	-124.7454	-123.0969	-107.5503	-84.2335	-57.5216	-31.9839	-929.8768 (H17)
											Solar input (sum of months) = Sum(63)m =	-929.8768 (63)
Output from w/h												
	181.1097	138.2336	114.0074	62.1427	28.0895	11.9830	6.7545	37.8824	67.8489	119.0492	156.8862	180.3185 (64)
											Total per year (kWh/year) = Sum(64)m =	1104.3057 (64)
Heat gains from water heating, kWh/month												
	89.5488	79.3173	83.0997	71.3615	65.9109	59.2758	57.4496	63.0654	67.7488	78.4214	82.5065	87.8228 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)												
	120.3613	118.0317	111.6932	99.1131	88.5899	82.3275	77.2172	84.7654	94.0955	105.4051	114.5924	118.0414 (72)
Total internal gains	701.3403	695.9339	668.3161	621.9563	574.2039	537.2385	516.1782	526.8032	557.4125	602.5020	648.9184	683.0705 (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	
East					8.7500	19.6403		0.6300	0.7000	0.7700	52.5203 (76)	
South					1.1400	46.7521		0.6300	0.7000	0.7700	16.2884 (78)	
West					4.8900	19.6403		0.6300	0.7000	0.7700	29.3513 (80)	
Solar gains	98.1600	186.8344	297.7386	423.0807	511.4548	521.1112	497.0827	431.2072	342.2582	218.8140	121.3916	81.4019 (83)
Total gains	799.5003	882.7683	966.0547	1045.0370	1085.6587	1058.3497	1013.2610	958.0104	899.6707	821.3160	770.3100	764.4724 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	21.0000 (85)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.9609	41.0665	41.1705	41.6663	41.7604	42.2040	42.2040	42.2872	42.0320	41.7604	41.5705	41.3738
alpha	3.7307	3.7378	3.7447	3.7778	3.7840	3.8136	3.8136	3.8191	3.8021	3.7840	3.7714	3.7583
util living area	0.9874	0.9805	0.9647	0.9256	0.8456	0.7025	0.5490	0.5945	0.8043	0.9415	0.9797	0.9893 (86)
MIT	19.4087	19.5804	19.8858	20.2877	20.6391	20.8786	20.9642	20.9512	20.7830	20.3295	19.8024	19.3792 (87)
Th 2	19.8628	19.8654	19.8679	19.8798	19.8820	19.8924	19.8924	19.8944	19.8884	19.8820	19.8775	19.8728 (88)
util rest of house												
	0.9842	0.9756	0.9552	0.9045	0.7993	0.6143	0.4252	0.4715	0.7316	0.9205	0.9737	0.9866 (89)
MIT 2	18.4335	18.6052	18.9074	19.3044	19.6278	19.8294	19.8811	19.8775	19.7604	19.3530	18.8358	18.4119 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =				0.1606 (91)
MIT	18.5901	18.7618	19.0646	19.4624	19.7903	19.9979	20.0551	20.0499	19.9247	19.5098	18.9911	18.5673 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.5901	18.7618	19.0646	19.4624	19.7903	19.9979	20.0551	20.0499	19.9247	19.5098	18.9911	18.5673 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9793	0.9692	0.9466	0.8948	0.7949	0.6235	0.4445	0.4901	0.7343	0.9116	0.9672	0.9822	(94)
Useful gains	782.9602	855.5651	914.4665	935.1510	862.9855	659.8877	450.3496	469.5125	660.6632	748.7471	745.0587	750.8885	(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	1974.6548	1910.5472	1727.3743	1434.8318	1096.5372	723.9301	463.3764	488.5413	784.3585	1207.6201	1619.0563	1965.5016	(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	886.6207	708.9479	604.8034	359.7702	173.7624	0.0000	0.0000	0.0000	0.0000	341.4015	629.2783	903.6721	(98)
Space heating												4608.2566	(98)
Space heating per m2												42.4216	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5075.1725 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	886.6207	708.9479	604.8034	359.7702	173.7624	0.0000	0.0000	0.0000	0.0000	341.4015	629.2783	903.6721	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	976.4546	780.7796	666.0830	396.2227	191.3683	0.0000	0.0000	0.0000	0.0000	375.9928	693.0377	995.2336	(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	181.1097	138.2336	114.0074	62.1427	28.0895	11.9830	6.7545	37.8824	67.8489	119.0492	156.8862	180.3185	(64)
Efficiency of water heater (217)m	88.7882	88.8631	88.9161	89.0480	89.1429	80.1000	80.1000	80.1000	80.1000	87.7687	88.4423	88.8262	(216)
Fuel for water heating, kWh/month	203.9795	155.5580	128.2190	69.7856	31.5106	14.9601	8.4326	47.2939	84.7052	135.6398	177.3882	203.0016	(219)
Water heating fuel used												1260.4740	(219)
Annual totals kWh/year													
Space heating fuel - main system												5075.1725	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1068 * 1.00) =									-1093.7042			-1093.7042	(233)
Total delivered energy for all uses												5825.1224	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5075.1725	3.4800	176.6160	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1260.4740	3.4800	43.8645	(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	458.1801	13.1900	60.4340	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1093.7042	13.1900	-144.2596	(252)
Total energy cost			273.1424	(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] =	0.7467 (257)
SAP value			89.5831
SAP rating (Section 12)			90 (258)

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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	5075.1725	0.2160	1096.2373	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1260.4740	0.2160	272.2624	(264)
Space and water heating			1368.4996	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	458.1801	0.5190	237.7955	(268)
Energy saving/generation technologies				
PV Unit	-1093.7042	0.5190	-567.6325	(269)
Total kg/year			1103.5376	(272)
CO2 emissions per m2			10.1600	(273)
EI value			90.3747	
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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1853 (8)
Pressure test										Yes							
Measured/design AP50										4.6600							
Infiltration rate										0.4183 (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) =					0.3555	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)				
Adj infilt rate	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)				
	0.3733	0.3466	0.3555	0.3378	0.3378	0.3289	0.3200	0.3111	0.3022	0.3289	0.3111	0.3289	(22b)				
Effective ac	0.5697	0.5601	0.5632	0.5570	0.5570	0.5541	0.5512	0.5484	0.5457	0.5541	0.5484	0.5541	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1723	3.4860	20.0000	404.6000	(28b)					
Brick and Block	145.3600	16.9000	128.4600	0.2400	30.8304	42.2200	5423.5812	(29a)					
Wall to Garage	17.1800	1.7700	15.4100	0.1966	3.0302	58.0600	894.7046	(29a)					
Pitched Roof	62.0500		62.0500	0.1000	6.2050	9.0000	558.4500	(30)					
Sloping Ceiling	3.5100		3.5100	0.1700	0.5967	9.0000	31.5900	(30)					
Total net area of external elements Aum(A, m2)			292.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.8940			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.2000			18.0000	795.6000	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20376.3858	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.5760	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6112	(36)					
Total fabric heat loss						(33) + (36) =	84.5052	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7335	49.8786	50.1565	49.6078	49.6078	49.3439	49.0871	48.8373	48.5946	49.3439	48.8373	49.3439	(38)
Heat transfer coeff	135.2387	134.3838	134.6618	134.1130	134.1130	133.8491	133.5923	133.3426	133.0998	133.8491	133.3426	133.8491	(39)
Average = Sum(39)m / 12 =												133.9529	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2371	1.2396	1.2346	1.2346	1.2322	1.2298	1.2275	1.2253	1.2322	1.2275	1.2322	(40)
HLP (average)												1.2331	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Built)

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

Daily hot water use												
	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)	Total = Sum(45)m = 1586.7751 (45)											
Distribution loss (46)m = 0.15 x (45)m	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume	200.0000 (47)											
a) If manufacturer declared loss factor is known (kWh/day):	1.9400 (48)											
Temperature factor from Table 2b	0.5400 (49)											
Enter (49) or (54) in (55)	1.0476 (55)											
Total storage loss	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	20.2973	18.3330	20.2973	19.6425	20.2973	19.6425	20.2973	20.2973	19.6425	20.2973	19.6425	20.2973 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	208.0743	183.2297	190.6409	164.8467	154.9717	136.7284	129.8513	145.4328	152.0824	176.5708	188.8701	202.8833 (62)
Aperture area of solar collector												
Zero-loss collector efficiency	3.0000 (H1)											
Collector heat loss coefficient	0.7000 (H2)											
Collector 2nd order heat loss coefficient	1.8000 (H3)											
Collector effective heat loss coefficient	0.0050 (H3a)											
Collector performance ratio	1.8063 (H3b)											
Annual solar radiation per m2	2.5804 (H4)											
Overshading factor	1208.1510 (H5)											
Solar energy available	0.8000 (H6)											
Adjustment factor for showers	2029.6937 (H7)											
Solar-to-load ratio	1.0000 (H7a)											
Utilisation factor	1.2791 (H8)											
Collector performance factor	0.5424 (H9)											
Dedicated solar storage volume	0.8793 (H10)											
Effective solar volume	75.0000 (H11)											
Daily hot water demand	112.5000 (H13)											
Volume ratio Veff/V	100.8508 (H14)											
Solar storage volume factor	1.1155 (H15)											
Solar input	1.0000 (H16)											
Solar input	-31.5797	-44.9043	-77.1797	-104.1333	-122.3108	-130.6473	-127.8997	-114.4741	-89.6253	-61.9639	-37.3504	-968.0362 (H17)
	Solar input (sum of months) = Sum(63)m = -25.9677 (63)											
Output from w/h	176.4946	138.3255	113.4612	60.7135	32.6609	6.0812	1.9516	30.9587	62.4570	114.6069	151.5197	-968.0362 (63)
	Total per year (kWh/year) = Sum(64)m = 176.9156 (64)											
Heat gains from water heating, kWh/month	89.5488	79.3173	83.0997	71.3615	65.9109	59.2758	57.4496	63.0654	67.7488	78.4214	82.5065	1066.1462 (64)
	89.5488	79.3173	83.0997	71.3615	65.9109	59.2758	57.4496	63.0654	67.7488	78.4214	82.5065	87.8228 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)												
	120.3613	118.0317	111.6932	99.1131	88.5899	82.3275	77.2172	84.7654	94.0955	105.4051	114.5924	118.0414 (72)
Total internal gains												
	701.3403	695.9339	668.3161	621.9563	574.2039	537.2385	516.1782	526.8032	557.4125	602.5020	648.9184	683.0705 (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	

East				8.7500		25.1925	0.6300		0.7000		0.7700		67.3677 (76)
South				1.1400		56.7559	0.6300		0.7000		0.7700		19.7737 (78)
West				4.8900		25.1925	0.6300		0.7000		0.7700		37.6489 (80)

Solar gains	124.7903	202.2124	324.5089	462.9234	531.0033	587.3651	556.0169	494.8459	393.6586	255.4582	153.8499	101.7036	(83)
Total gains	826.1307	898.1463	992.8250	1084.8797	1105.2072	1124.6035	1072.1951	1021.6491	951.0712	857.9602	802.7683	784.7741	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	21.0000 (85)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.8527	42.1190	42.0320	42.2040	42.2040	42.2872	42.3685	42.4479	42.5253	42.2872	42.4479	42.2872
alpha	3.7902	3.8079	3.8021	3.8136	3.8136	3.8191	3.8246	3.8299	3.8350	3.8191	3.8299	3.8191
util living area												
	0.9841	0.9774	0.9567	0.9050	0.8043	0.6198	0.4696	0.4894	0.7405	0.9171	0.9718	0.9862 (86)
MIT	19.5613	19.6987	20.0124	20.4076	20.7347	20.9303	20.9815	20.9788	20.8578	20.4733	19.9768	19.5538 (87)
Th 2	19.8842	19.8905	19.8884	19.8924	19.8924	19.8944	19.8962	19.8981	19.8998	19.8944	19.8981	19.8944 (88)
util rest of house												
	0.9800	0.9716	0.9451	0.8783	0.7472	0.5207	0.3444	0.3603	0.6531	0.8872	0.9632	0.9826 (89)
MIT 2	18.6011	18.7411	19.0467	19.4265	19.7174	19.8633	19.8916	19.8927	19.8247	19.4970	19.0230	18.6016 (90)

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Calculation Type: New Build (As Built)

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

Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.7553	18.8949	19.2018	19.5841	19.8808	20.0347	20.0667	20.0672	19.9907	19.6538	19.1762	18.7546 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7553	18.8949	19.2018	19.5841	19.8808	20.0347	20.0667	20.0672	19.9907	19.6538	19.1762	18.7546 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9744	0.9648	0.9360	0.8695	0.7465	0.5342	0.3644	0.3809	0.6612	0.8792	0.9557	0.9775	(94)
Useful gains	804.9874	866.5383	929.3077	943.2749	825.0595	600.7093	390.7306	389.1798	628.8371	754.3429	767.2248	767.1403	(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	1873.7778	1826.9398	1643.1215	1352.4061	989.8634	633.7332	396.3306	395.6543	704.1862	1104.7703	1503.5989	1841.0363	(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	795.1801	645.3898	531.0775	294.5745	122.6141	0.0000	0.0000	0.0000	0.0000	260.7180	530.1894	798.9786	(98)
Space heating												3978.7220	(98)
Space heating per m2												(98) / (4) =	36.6264 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4381.8524 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	795.1801	645.3898	531.0775	294.5745	122.6141	0.0000	0.0000	0.0000	0.0000	260.7180	530.1894	798.9786	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	875.7490	710.7818	584.8871	324.4212	135.0376	0.0000	0.0000	0.0000	0.0000	287.1344	583.9090	879.9324	(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	176.4946	138.3255	113.4612	60.7135	32.6609	6.0812	1.9516	30.9587	62.4570	114.6069	151.5197	176.9156	(64)
Efficiency of water heater (217)m	88.6490	88.7085	88.7139	88.7735	88.3184	80.1000	80.1000	80.1000	80.1000	87.2414	88.1818	80.1000	(216)
Fuel for water heating, kWh/month	199.0937	155.9326	127.8957	68.3914	36.9808	7.5920	2.4365	38.6500	77.9738	131.3675	171.8264	199.5594	(219)
Water heating fuel used												1217.6998	(219)
Annual totals kWh/year													
Space heating fuel - main system												4381.8524	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1187 * 1.00) =									-1215.0150			-1215.0150	(233)
Total delivered energy for all uses												4967.7173	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4381.8524	10.2300	448.2635	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1217.6998	10.2300	124.5707	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	458.1801	36.7200	168.2437	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1215.0150	36.7200	-446.1535	(252)
Total energy cost			443.8244	(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	4381.8524	0.2160	946.4801	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water heating (other fuel)	1217.6998	0.2160	263.0231 (264)
Space and water heating			1209.5033 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Energy saving/generation technologies			
PV Unit	-1215.0150	0.5190	-630.5928 (269)
Total kg/year			881.5809 (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	4381.8524	1.2200	5345.8600 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1217.6998	1.2200	1485.5937 (264)
Space and water heating			6831.4537 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	458.1801	3.0700	1406.6128 (268)
Energy saving/generation technologies			
PV Unit	-1215.0150	3.0700	-3730.0960 (269)
Primary energy kWh/year			4891.7205 (272)
Primary energy kWh/m2/year			45.0310 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Project	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

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

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Project	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		

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 - Insulation between and below

Roof Type: Pitched Roof, insulated sloping ceiling

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

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

Unheated space: None

Total thickness: 264 mm

U-value: 0.17 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Project	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		

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 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Project	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		

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 000007

Wall Type: Standard Wall

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

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

U-VALUE CALCULATOR REPORT

Unheated space: None

Total thickness: 355 mm

U-value: 0.22 W/m² K

Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Project	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		

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 = 45.17 m², Perimeter = 27.83 m, Wall thickness = 300.00 mm, Soil: Clay

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

Floor height above ground: h = 0.000 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

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

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

Unheated space: None

Total thickness: 450 mm

U-value: 0.12 W/m² K

Kappa: 140.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Project	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.29	TER	18.72
Environmental	88 B	% DER<TER	23.66		
CO ₂ Emissions (t/year)	1.15	DFEE	53.15	TFEE	62.89
General Requirements Compliance	Pass	% DFEE<TFEE	15.49		

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

Floor 000005 - New exposed above Garage

Floor Type: Exposed Floor

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

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

Unheated space: None

Total thickness: 290 mm

U-value: 0.19 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 27	Issued on Date	04/01/2024
Assessment Reference	As Built	Prop Type Ref	A
Property	23 Fieldfare Crescent, Botley, SOUTHAMPTON, SO32 2TW		
SAP Rating	88 B	DER	14.29
Environmental	88 B	TER	18.72
CO ₂ Emissions (t/year)	1.15	% DER<TER	23.66
General Requirements Compliance	Pass	DFEE	53.15
		TFEE	62.89
		% DFEE<TFEE	15.49
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:	27.75 m	44.20 m ²	2.68 m
	1st Storey:	34.54 m	64.43 m ²	2.35 m

7.0 Living Area	17.45	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	187.58	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	145.36	128.46
Wall to Garage	Cavity Wall	Other		0.22	58.06	17.18	15.41

9.2 Internal Walls				Kappa (kJ/m ² K)	Area (m ²)
Description	Construction				
Ground Floor Block	Dense block, plasterboard on dabs			75.00	48.75
Ground Floor Stud	Plasterboard on timber frame			9.00	26.28
First Floor Stud	Plasterboard on timber frame			9.00	154.61

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	62.05	62.05
Sloping Ceiling	External Slope Roof	Plasterboard, insulated slope		0.17	9.00	3.51	3.51

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	44.20

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	140.00	44.20
Exposed over Garage	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.19	20.00	20.23

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	44.20

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Half Glazed Door	[1] Brick and Block	West							2.12	
Front Elevation	Window	[1] Brick and Block	West	None	0.63	Yes				0.66	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					4.23	
Side Elevation	Window	[1] Brick and Block	South	None	0.00					1.14	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					8.75	
North Elevation	Solid Door	[2] Wall to Garage	North							1.77	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.26	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	0.84	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.57	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.31	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	10.62	0.021	No	Knauf P5
Independently assessed	E4 Jamb	36.45	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	27.75	0.062	No	BE-E5-23902
Table K1 - Default	E20 Exposed floor (normal)	12.19	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	6.01	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	22.09	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	23.73	0.060	No	
Table K1 - Approved	E11 Eaves (insulation at rafter level)	1.98	0.040	No	
Independently assessed	E12 Gable (insulation at ceiling level)	10.59	0.044	No	Knauf P21
Table K1 - Approved	E13 Gable (insulation at rafter level)	3.40	0.040	No	
Independently assessed	E16 Corner (normal)	23.20	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	1.54	-0.091	No	Knauf P24
Table K1 - Default	R6 Flat ceiling	3.02	0.060	No	
Table K1 - Default	R7 Flat ceiling (inverted)	0.92	0.040	No	
Table K1 - Default	R8 Roof to wall (rafter)	2.70	0.060	No	
Table K1 - Default	R9 Roof to wall (flat ceiling)	0.92	0.040	No	

Y-value W/m²K

18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted
 Light and motion sensor

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Description	Combi Boiler	
Percentage of Heat	100	%
Database Ref. No.	18913	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.8	
In Summer	80.1	
Controls	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)	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.94	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	One Dwelling	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

PV Cells kWp 1.28	Orientation South	Elevation 45°	Overshading None Or Little	Connected to Dwelling Yes
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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	£121	B 90	