

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-191			Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)		
Property	81, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW				
SAP Rating	88 B	DER	13.07	TER	16.54
Environmental	89 B	% DER<TER	21.00		
CO ₂ Emissions (t/year)	1.11	DFEE	47.05	TFEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	8.35		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 110 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.07 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.40 (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: 4.81 (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
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing North East: 13.85 m², No overhang
Windows facing South East: 1.80 m², No overhang
Windows facing South West: 7.08 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array 0.81 kW

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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	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) = 0.3301 (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	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3053	0.3301	0.3549	0.3714	0.3879 (22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m2)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	16076.8200 (34)		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					146.7801 (35)		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)					9.4056 (36)		
Total fabric heat loss				(33) + (36) =	77.8551 (37)		

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5462	52.2392	51.9382	50.5245	50.2601	49.0288	49.0288	48.8008	49.5031	50.2601	50.7951	51.3545 (38)
Average = Sum(39)m / 12 =	130.4013	130.0942	129.7933	128.3796	128.1151	126.8839	126.8839	126.6559	127.3582	128.1151	128.6502	129.2096 (39)
	128.3784 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1906	1.1877	1.1850	1.1721	1.1697	1.1584	1.1584	1.1564	1.1628	1.1697	1.1746	1.1797 (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	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)										Total =	Sum(45)m =	1588.8780	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)
Total per year (kWh/year) =										Sum(64)m =		1835.3310	(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	(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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	443.9965	441.7572	425.7940	399.8526	373.1745	347.6957	331.2853	337.7666	351.2135	377.3861	407.4894	430.3877	(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			
Northeast				2.8800	11.2829	0.6200	0.7000	0.7700	9.7732 (75)			
Southeast				1.8000	36.7938	0.6200	0.7000	0.7700	19.9191 (77)			
Southwest				7.0800	36.7938	0.6200	0.7000	0.7700	78.3486 (79)			
Northeast				10.9700	11.2829	0.6200	0.7000	0.7700	37.2265 (75)			

Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790 (83)
Total gains	589.2639	704.8128	827.1848	966.6998	1071.5310	1068.9074	1014.9974	919.1006	809.2296	679.2991	584.3292	552.8667 (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	34.2465	34.3273	34.4069	34.7858	34.8576	35.1958	35.1958	35.2592	35.0648	34.8576	34.7126	34.5623		
alpha	3.2831	3.2885	3.2938	3.3191	3.3238	3.3464	3.3464	3.3506	3.3377	3.3238	3.3142	3.3042		
util living area	0.9900	0.9814	0.9615	0.9102	0.8077	0.6553	0.5139	0.5755	0.8001	0.9448	0.9833	0.9919	(86)	
MIT	18.9925	19.2323	19.6297	20.1477	20.5872	20.8583	20.9534	20.9318	20.7066	20.1256	19.4653	18.9513	(87)	
Th 2	19.9276	19.9298	19.9320	19.9424	19.9443	19.9534	19.9534	19.9551	19.9499	19.9443	19.9404	19.9363	(88)	
util rest of house	0.9878	0.9774	0.9530	0.8896	0.7632	0.5764	0.4056	0.4660	0.7367	0.9280	0.9791	0.9901	(89)	
MIT	17.2429	17.5926	18.1681	18.9089	19.5021	19.8360	19.9277	19.9141	19.6733	18.8933	17.9405	17.1881	(90)	
Living area fraction									fLA =	Living area / (4) =		0.2371	(91)	
MIT	17.6578	17.9814	18.5146	19.2026	19.7594	20.0784	20.1709	20.1554	19.9183	19.1855	18.3021	17.6062	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	17.5078	17.8314	18.3646	19.0526	19.6094	19.9284	20.0209	20.0054	19.7683	19.0355	18.1521	17.4562	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9804	0.9659	0.9358	0.8678	0.7468	0.5744	0.4130	0.4716	0.7237	0.9083	0.9684	0.9837	(94)
Useful gains	577.6871	680.8061	774.0657	838.9380	800.2261	613.9573	419.2134	433.4894	585.6748	617.0213	565.8643	543.8705	(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	1722.3088	1682.2986	1539.9495	1303.3933	1013.3114	676.0883	434.0605	456.6440	721.9035	1080.7092	1421.8517	1712.8225	(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	851.5986	673.0030	569.8176	334.4078	158.5355	0.0000	0.0000	0.0000	0.0000	344.9838	616.3109	869.7003	(98)
Space heating												4418.3575	(98)

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Space heating per m2 (98) / (4) = 40.3392 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4909.2861 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	851.5986	673.0030	569.8176	334.4078	158.5355	0.0000	0.0000	0.0000	0.0000	344.9838	616.3109	869.7003	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	946.2207	747.7811	633.1307	371.5642	176.1505	0.0000	0.0000	0.0000	0.0000	383.3153	684.7899	966.3337	(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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Efficiency of water heater (217)m	89.3906	89.3367	89.2208	88.9522	88.3914	86.7000	86.7000	86.7000	86.7000	88.9480	89.2747	86.7000	(216)
Fuel for water heating, kWh/month	207.8570	182.5550	190.1761	168.4902	164.3171	146.9998	138.6419	155.6517	156.4956	174.8520	187.3414	201.9624	(219)
Water heating fuel used												2075.3401	(219)
Annual totals kWh/year													
Space heating fuel - main system												4909.2861	(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)												428.0285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =									-650.5895			-650.5895	(233)
Total delivered energy for all uses												6837.0652	(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	4909.2861	0.2160	1060.4058 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2075.3401	0.2160	448.2735 (264)
Space and water heating			1508.6793 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Energy saving/generation technologies			
PV Unit	-650.5895	0.5190	-337.6560 (269)
Total CO2, kg/year			1432.0951 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0700 (273)

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

DER		13.0700	ZC1
Total Floor Area	TFA	109.5300	
Assumed number of occupants	N	2.8120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.6551	ZC2
CO2 emissions from cooking, equation (L16)		1.7026	ZC3
Total CO2 emissions		29.4277	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.4277	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) =					Air changes per hour 40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3979 (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) =		0.3382 (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	0.4312	0.4227	0.4143	0.3720	0.3635	0.3213	0.3213	0.3128	0.3382	0.3635	0.3804	0.3974 (22b)
Effective ac	0.5930	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (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			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			22.7300	1.3258	30.1345		(27)
Heat Loss Floor 1			36.5100	0.1300	4.7463		(28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.1800	18.3204		(29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463		(30)
Total net area of external elements Aum, m ²			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.0775		(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)							10.6533 (36)
Total fabric heat loss						(33) + (36) =	70.7308 (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	52.9378	52.6155	52.2997	50.8160	50.5384	49.2462	49.2462	49.0069	49.7440	50.5384	51.1000	51.6871 (38)
Heat transfer coeff	123.6686	123.3463	123.0304	121.5468	121.2692	119.9770	119.9770	119.7377	120.4747	121.2692	121.8308	122.4178 (39)
Average = Sum(39)m / 12 =												121.5455 (39)
HLP	1.1291	1.1261	1.1233	1.1097	1.1072	1.0954	1.0954	1.0932	1.0999	1.1072	1.1123	1.1177 (40)
HLP (average)												1.1097 (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												2.8120 (42)
Average daily hot water use (litres/day)												100.9844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829 (44)
Energy content (annual)	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302 (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)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.8045	48.3729	44.8205	46.3145	48.3729	48.8045	50.9589	49.3151	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	162.4935	164.2881	185.5439	196.2251	210.4937	210.4937	(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	0.0000	(63)
Output from w/h	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	162.4935	164.2881	185.5439	196.2251	210.4937	210.4937	(64)
Heat gains from water heating, kWh/month	67.5133	59.4122	62.1738	55.2989	53.4466	46.8899	44.6458	50.0383	50.5994	57.4892	61.1764	65.7850	65.7850	(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	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104	24.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271	258.9271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	(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	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	90.7437	88.4110	83.5669	76.8040	71.8368	65.1249	60.0078	67.2558	70.2770	77.2705	84.9672	88.4208	88.4208	(72)
Total internal gains	454.0391	451.8074	435.8599	409.7645	382.4156	356.2701	339.8748	347.0218	361.1463	387.4724	417.5507	440.4379	440.4379	(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
Northeast	13.8500	11.2829	0.6300	0.7000	0.7700	47.7578 (75)
Southeast	1.8000	36.7938	0.6300	0.7000	0.7700	20.2404 (77)
Southwest	7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)

Solar gains	147.6105	267.2984	407.8648	575.9898	709.6203	732.8441	694.7397	590.7103	465.4034	306.7825	179.6921	124.4545	124.4545	(83)
Total gains	601.6496	719.1058	843.7248	985.7543	1092.0359	1089.1143	1034.6145	937.7321	826.5497	694.2549	597.2428	564.8924	564.8924	(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	61.5051	61.6658	61.8241	62.5788	62.7220	63.3976	63.3976	63.5243	63.1356	62.7220	62.4329	62.1335	62.1335		
alpha	5.1003	5.1111	5.1216	5.1719	5.1815	5.2265	5.2265	5.2350	5.2090	5.1815	5.1622	5.1422	5.1422		
util living area	0.9987	0.9964	0.9885	0.9545	0.8514	0.6673	0.5027	0.5719	0.8413	0.9791	0.9970	0.9991	0.9991	(86)	
MIT	19.7395	19.9069	20.1815	20.5424	20.8289	20.9644	20.9932	20.9874	20.8824	20.4975	20.0520	19.7129	19.7129	(87)	
Th 2	19.9772	19.9795	19.9819	19.9929	19.9950	20.0046	20.0046	20.0064	20.0009	19.9950	19.9908	19.9864	19.9864	(88)	
util rest of house	0.9982	0.9952	0.9843	0.9378	0.8019	0.5787	0.3929	0.4562	0.7698	0.9685	0.9958	0.9987	0.9987	(89)	
MIT 2	18.2902	18.5361	18.9367	19.4566	19.8302	19.9816	20.0022	20.0013	19.9063	19.4040	18.7569	18.2578	18.2578	(90)	
Living area fraction	18.6338	18.8612	19.2319	19.7141	20.0670	20.2146	20.2372	20.2351	20.1377	19.6633	19.0640	18.6028	18.6028	(92)	
Temperature adjustment	18.6338	18.8612	19.2319	19.7141	20.0670	20.2146	20.2372	20.2351	20.1377	19.6633	19.0640	18.6028	18.6028	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	600.0412	714.2559	826.9754	918.7576	880.1009	651.6569	433.5921	453.5569	645.5181	669.1284	593.7052	563.7891	563.7891	(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	4.2000	(96)
Heat loss rate W	1772.6424	1722.0563	1566.4077	1314.4140	1014.6591	673.6218	436.3748	459.2024	727.3946	1099.0951	1457.5800	1763.1590	1763.1590	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	872.4153	677.2419	550.1376	284.8726	100.1114	0.0000	0.0000	0.0000	0.0000	319.8952	621.9898	892.3312	892.3312	(98)
Space heating												4318.9950	4318.9950	(98)
Space heating per m2												39.4321	39.4321	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4624.1917 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	872.4153	677.2419	550.1376	284.8726	100.1114	0.0000	0.0000	0.0000	0.0000	319.8952	621.9898	892.3312	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	934.0635	725.0984	589.0124	305.0028	107.1856	0.0000	0.0000	0.0000	0.0000	342.5002	665.9420	955.3867	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	162.4935	164.2881	185.5439	196.2251	210.4937	(64)
Efficiency of water heater (217)m	88.2009	87.9747	87.4706	86.2234	83.7324	80.3000	80.3000	80.3000	80.3000	86.4102	87.7530	88.2806	(216)
Fuel for water heating, kWh/month	244.5457	216.0889	228.2282	206.9298	206.3047	189.4685	181.5252	202.3581	204.5929	214.7245	223.6107	238.4370	(219)
Water heating fuel used												2556.8141	(219)
Annual totals kWh/year													
Space heating fuel - main system												4624.1917	(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)												428.0285	(232)
Total delivered energy for all uses												7684.0343	(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	4624.1917	0.2160	998.8254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2556.8141	0.2160	552.2719 (264)
Space and water heating			1551.0973 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Total CO2, kg/m2/year			1812.1690 (272)
Emissions per m2 for space and water heating			14.1614 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0282 (272b)
Emissions per m2 for pumps and fans			0.3554 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1614 * 1.00) + 2.0282 + 0.3554, rounded to 2 d.p.			16.5400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-191	Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)
Property	81, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.07	TER	16.54
Environmental	89 B	% DER<TER	21.00		
CO ₂ Emissions (t/year)	1.11	DFEE	47.05	TFEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	8.35		

Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk	Assessor ID	T511-0001
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Client	
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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	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) =				0.3301 (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	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3053	0.3301	0.3549	0.3714	0.3879 (22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			9.0000	328.5900 (32e)
Internal Floor 2			36.5100			9.0000	328.5900 (32e)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 15419.6400 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 140.7801 (35)
 Thermal bridges ($\text{Sum}(L \times \text{Psi})$) calculated using Appendix K) 9.4056 (36)
 Total fabric heat loss (33) + (36) = 77.8551 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	52.5462	52.2392	51.9382	50.5245	50.2601	49.0288	49.0288	48.8008	49.5031	50.2601	50.7951	51.3545 (38)
Heat transfer coeff	130.4013	130.0942	129.7933	128.3796	128.1151	126.8839	126.8839	126.6559	127.3582	128.1151	128.6502	129.2096 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												128.3784 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1906	1.1877	1.1850	1.1721	1.1697	1.1584	1.1584	1.1564	1.1628	1.1697	1.1746	1.1797 (40)
Days in month												1.1721 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.8120 (42)
												100.9844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829 (44)
Energy content (annual)	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$												Total = $\text{Sum}(45)\text{m} =$ 1588.8780 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.0057	30.6162	31.5932	27.5437	26.4288	22.8061	21.1332	24.2506	24.5403	28.5993	31.2184	33.9011 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599 (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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790 (71)
Water heating gains (Table 5)	47.0507	45.5598	42.4639	38.2551	35.5226	31.6751	28.4048	32.5949	34.0837	38.4399	43.3589	45.5661 (72)
Total internal gains	407.3461	405.9562	391.7570	368.2156	343.1014	319.8203	305.2718	309.3609	321.9530	345.6418	372.9424	394.5832 (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			
Northeast				2.8800	11.2829	0.6200	0.7000	0.7700	9.7732 (75)			
Southeast				1.8000	36.7938	0.6200	0.7000	0.7700	19.9191 (77)			
Southwest				7.0800	36.7938	0.6200	0.7000	0.7700	78.3486 (79)			
Northeast				10.9700	11.2829	0.6200	0.7000	0.7700	37.2265 (75)			
Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790 (83)
Total gains	552.6135	669.0118	793.1478	935.0627	1041.4579	1041.0320	988.9839	890.6949	779.9690	647.5548	549.7823	517.0622 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hl} (C)												
Utilisation factor for gains for living area, $n_{il,m}$ (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	32.8466	32.9241	33.0004	33.3638	33.4327	33.7571	33.7571	33.8179	33.6314	33.4327	33.2936	33.1495
util living area	3.1898	3.1949	3.2000	3.2243	3.2288	3.2505	3.2505	3.2545	3.2421	3.2288	3.2196	3.2100
	0.9906	0.9821	0.9626	0.9122	0.8121	0.6627	0.5225	0.5861	0.8077	0.9475	0.9844	0.9924 (86)
MIT	18.8884	19.1367	19.5490	20.0882	20.5497	20.8404	20.9457	20.9208	20.6752	20.0636	19.3777	18.8466 (87)
Th 2	19.9276	19.9298	19.9320	19.9424	19.9443	19.9534	19.9534	19.9551	19.9499	19.9443	19.9404	19.9363 (88)
util rest of house	0.9886	0.9784	0.9545	0.8925	0.7689	0.5849	0.4140	0.4768	0.7465	0.9318	0.9805	0.9908 (89)
MIT 2	17.9957	18.2438	18.6526	19.1833	19.6115	19.8614	19.9324	19.9216	19.7374	19.1709	18.4927	17.9604 (90)
Living area fraction	$f_{LA} = \text{Living area} / (4) =$											
	0.2371 (91)											

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MIT	18.2074	18.4555	18.8651	19.3979	19.8340	20.0935	20.1726	20.1585	19.9598	19.3825	18.7025	18.1705 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2074	18.4555	18.8651	19.3979	19.8340	20.0935	20.1726	20.1585	19.9598	19.3825	18.7025	18.1705 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9715	0.9441	0.8802	0.7638	0.5962	0.4380	0.4997	0.7471	0.9211	0.9743	0.9870 (94)	
Useful gains	543.8773	649.9175	748.7953	823.0549	795.4222	620.6183	433.1308	445.0366	582.7385	596.4389	535.6376	510.3583 (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													
1813.5410	1763.4931	1604.9096	1347.7120	1042.0844	697.0402	453.3112	476.0399	746.2889	1125.1739	1492.6631	1805.1247 (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													
944.6298	748.3228	636.9491	377.7532	183.5167	0.0000	0.0000	0.0000	0.0000	393.3788	689.0584	963.3062 (98)		
Space heating												4936.9149 (98)	
Space heating per m2												45.0736 (99)	

(98) / (4) =

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	0.0000	1192.7088	938.9410	962.5849	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8037	0.8635	0.8281	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	958.6066	810.7733	797.1326	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1326.7843	1263.5287	1150.6354	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	0.0000	265.0879	336.8500	263.0061	0.0000	0.0000	0.0000	0.0000 (104)	
Space cooling												864.9440 (104)	
Cooled fraction													
Intermittency factor (Table 10b)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (105)	
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	66.2720	84.2125	65.7515	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												216.2360 (107)	
Space cooling per m2												1.9742 (108)	
Energy for space heating												45.0736 (99)	
Energy for space cooling												1.9742 (108)	
Total												47.0478 (109)	
Dwelling Fabric Energy Efficiency (DFEE)												47.0 (109)	

FC = cooled area / (4) =

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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	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3979 (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) =		0.3382 (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	0.4312	0.4227	0.4143	0.3720	0.3635	0.3213	0.3213	0.3128	0.3382	0.3635	0.3804	0.3974 (22b)
Effective ac	0.5930	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1300	1.0000	2.1300			(26)				
TER Opening Type (Uw = 1.40)			22.7300	1.3258	30.1345			(27)				
Heat Loss Floor 1			36.5100	0.1300	4.7463			(28a)				
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.1800	18.3204			(29a)				
External Roof 1	36.5100		36.5100	0.1300	4.7463			(30)				
Total net area of external elements Aum(A, m2)			199.6600					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	60.0775			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.6533 (36)				
Total fabric heat loss						(33) + (36) =		70.7308 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.9378	Feb 52.6155	Mar 52.2997	Apr 50.8160	May 50.5384	Jun 49.2462	Jul 49.2462	Aug 49.0069	Sep 49.7440	Oct 50.5384	Nov 51.1000	Dec 51.6871 (38)
Heat transfer coeff	123.6686	123.3463	123.0304	121.5468	121.2692	119.9770	119.9770	119.7377	120.4747	121.2692	121.8308	122.4178 (39)
Average = Sum(39)m / 12 =												121.5455 (39)
HLP	Jan 1.1291	Feb 1.1261	Mar 1.1233	Apr 1.1097	May 1.1072	Jun 1.0954	Jul 1.0954	Aug 1.0932	Sep 1.0999	Oct 1.1072	Nov 1.1123	Dec 1.1177 (40)
HLP (average)												1.1097 (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												2.8120 (42)
Average daily hot water use (litres/day)												100.9844 (43)
Daily hot water use	Jan 111.0829	Feb 107.0435	Mar 103.0041	Apr 98.9647	May 94.9253	Jun 90.8860	Jul 90.8860	Aug 94.9253	Sep 98.9647	Oct 103.0041	Nov 107.0435	Dec 111.0829 (44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Energy content (annual)										Total = Sum(45)m =		1588.8780 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.0057	30.6162	31.5932	27.5437	26.4288	22.8061	21.1332	24.2506	24.5403	28.5993	31.2184	33.9011 (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	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	(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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	47.0507	45.5598	42.4639	38.2551	35.5226	31.6751	28.4048	32.5949	34.0837	38.4399	43.3589	45.5661	(72)
Total internal gains	407.3461	405.9562	391.7570	368.2156	343.1014	319.8203	305.2718	309.3609	321.9530	345.6418	372.9424	394.5832	(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			
Northeast				13.8500	11.2829	0.6300	0.7000	0.7700	47.7578 (75)			
Southeast				1.8000	36.7938	0.6300	0.7000	0.7700	20.2404 (77)			
Southwest				7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)			

Solar gains	147.6105	267.2984	407.8648	575.9898	709.6203	732.8441	694.7397	590.7103	465.4034	306.7825	179.6921	124.4545 (83)
Total gains	554.9565	673.2546	799.6218	944.2054	1052.7218	1052.6645	1000.0115	900.0712	787.3564	652.4243	552.6345	519.0377 (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	61.5051	61.6658	61.8241	62.5788	62.7220	63.3976	63.3976	63.5243	63.1356	62.7220	62.4329	62.1335		
alpha	5.1003	5.1111	5.1216	5.1719	5.1815	5.2265	5.2265	5.2350	5.2090	5.1815	5.1622	5.1422		
util living area	0.9991	0.9974	0.9909	0.9613	0.8657	0.6853	0.5189	0.5929	0.8608	0.9839	0.9979	0.9994	(86)	
MIT	19.6996	19.8681	20.1456	20.5137	20.8129	20.9598	20.9922	20.9851	20.8672	20.4648	20.0141	19.6735	(87)	
Th 2	19.9772	19.9795	19.9819	19.9929	19.9950	20.0046	20.0046	20.0064	20.0009	19.9950	19.9908	19.9864	(88)	
util rest of house	0.9988	0.9965	0.9875	0.9466	0.8186	0.5962	0.4062	0.4744	0.7933	0.9754	0.9970	0.9992	(89)	
MIT 2	18.7855	18.9555	19.2331	19.6003	19.8704	19.9866	20.0027	20.0022	19.9262	19.5604	19.1106	18.7669	(90)	
Living area fraction														
MIT	19.0022	19.1718	19.4494	19.8169	20.0938	20.2173	20.2373	20.2353	20.1493	19.7748	19.3248	18.9818	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0022	19.1718	19.4494	19.8169	20.0938	20.2173	20.2373	20.2353	20.1493	19.7748	19.3248	18.9818	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	554.0491	670.1885	787.7825	890.8061	867.2445	648.8092	433.1458	452.4835	633.7074	634.7923	550.5482	518.4357	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1818.2039	1760.3797	1593.1750	1326.9091	1017.9155	673.9506	436.3901	459.2241	728.7873	1112.6212	1489.3576	1809.5608	(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	940.5311	732.6085	599.2121	313.9941	112.0992	0.0000	0.0000	0.0000	0.0000	355.5047	675.9427	960.5971	(98)
Space heating												4690.4895	(98)
Space heating per m2												42.8238	(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	1127.7838	887.8298	910.0065	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9024	0.9490	0.9228	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1017.6818	842.5776	839.7517	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1340.3806	1276.4181	1161.5948	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	232.3432	322.7773	239.4513	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												794.5718 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	58.0858	80.6943	59.8628	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												198.6429 (107)
Space cooling per m2												1.8136 (108)
Energy for space heating												42.8238 (99)
Energy for space cooling												1.8136 (108)
Total												44.6374 (109)
Target Fabric Energy Efficiency (TFEE)												51.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-191	Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)
Property	81, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.07	TER	16.54
Environmental	89 B	% DER<TER	21.00		
CO ₂ Emissions (t/year)	1.11	DFEE	47.05	TFEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	8.35		

Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk	Assessor ID	T511-0001
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Client	
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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	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) =		0.3301 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3466	0.3218	0.3301	0.3136	0.3136	0.3053	0.2971	0.2888	0.2806	0.3053	0.2888	0.3053 (22b)
Effective ac	0.5601	0.5518	0.5545	0.5492	0.5492	0.5466	0.5441	0.5417	0.5394	0.5466	0.5417	0.5466 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 16076.8200 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 146.7801 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4056 (36)
 Total fabric heat loss (33) + (36) = 77.8551 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	50.0017	49.2629	49.5031	49.0288	49.0288	48.8008	48.5789	48.3630	48.1533	48.8008	48.3630	48.8008 (38)
Heat transfer coeff	127.8567	127.1180	127.3582	126.8839	126.8839	126.6559	126.4340	126.2181	126.0084	126.6559	126.2181	126.6559 (39)
Average = Sum(39)m / 12 =												126.7456 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1673	1.1606	1.1628	1.1584	1.1584	1.1564	1.1543	1.1524	1.1504	1.1564	1.1524	1.1564 (40)
Days in month												1.1572 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.8120 (42)
												100.9844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829 (44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Energy content (annual)										Total = Sum(45)m =		1588.8780 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496 (61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844 (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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844 (64)
Total per year (kWh/year) = Sum(64)m =												1835.3310 (64)
												1835 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838 (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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790 (71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706 (72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282 (73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast	2.8800				14.6176		0.6200		0.7000		0.7700		12.6617 (75)	
Southeast	1.8000				45.1778		0.6200		0.7000		0.7700		24.4580 (77)	
Southwest	7.0800				45.1778		0.6200		0.7000		0.7700		96.2014 (79)	
Northeast	10.9700				14.6176		0.6200		0.7000		0.7700		48.2289 (75)	
Solar gains	181.5500	281.0685	435.3924	622.4521	730.6005	819.8375	771.0684	670.9322	526.1936	348.9470	220.5588	150.3005	(83)	
Total gains	841.0633	935.6622	1064.5040	1211.8155	1278.8906	1331.5224	1261.4666	1170.4920	1048.7192	911.4520	827.5622	791.3287	(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)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	34.9280	35.1310	35.0648	35.1958	35.1958	35.2592	35.3211	35.3815	35.4404	35.2592	35.3815	35.2592
util living area	3.3285	3.3421	3.3377	3.3464	3.3464	3.3506	3.3547	3.3588	3.3627	3.3506	3.3588	3.3506

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.9693	0.9561	0.9193	0.8356	0.7005	0.5079	0.3805	0.4070	0.6544	0.8666	0.9486	0.9735 (86)
MIT	19.4248	19.6023	19.9796	20.4329	20.7681	20.9419	20.9834	20.9798	20.8631	20.4586	19.8953	19.4037 (87)
Th 2	19.9462	19.9517	19.9499	19.9534	19.9534	19.9551	19.9567	19.9583	19.9598	19.9551	19.9583	19.9551 (88)
util rest of house	0.9631	0.9475	0.9033	0.8034	0.6434	0.4262	0.2832	0.3041	0.5745	0.8318	0.9366	0.9680 (89)
MIT 2	17.8795	18.1373	18.6721	19.2971	19.7249	19.9140	19.9494	19.9493	19.8475	19.3494	18.5667	17.8554 (90)
Living area fraction									fLA = Living area / (4) =			0.2371 (91)
MIT	18.2459	18.4847	18.9821	19.5664	19.9723	20.1577	20.1946	20.1936	20.0883	19.6124	18.8817	18.2225 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0959	18.3347	18.8321	19.4164	19.8223	20.0077	20.0446	20.0436	19.9383	19.4624	18.7317	18.0725 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9480	0.9297	0.8818	0.7842	0.6356	0.4305	0.2916	0.3128	0.5727	0.8118	0.9177	0.9542	(94)
Useful gains	797.3468	869.8385	938.6686	950.2772	812.8800	573.2547	367.8998	366.1308	600.6162	739.9300	759.4183	755.0516	(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	1687.1885	1656.9416	1506.9202	1258.2350	929.0780	596.2607	372.2970	371.5409	660.0689	1021.1458	1367.1600	1655.7134	(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	662.0422	528.9332	422.7792	221.7296	86.4514	0.0000	0.0000	0.0000	0.0000	209.2245	437.5740	670.0924	(98)
Space heating												3238.8266	(98)
RHI space heating demand												3239	(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	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) =				0.3301 (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	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3053	0.3301	0.3549	0.3714	0.3879 (22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			16076.8200 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							146.7801 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4056 (36)
Total fabric heat loss						(33) + (36) =	77.8551 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5462	52.2392	51.9382	50.5245	50.2601	49.0288	49.0288	48.8008	49.5031	50.2601	50.7951	51.3545 (38)
Average = Sum(39)m / 12 =	130.4013	130.0942	129.7933	128.3796	128.1151	126.8839	126.8839	126.6559	127.3582	128.1151	128.6502	129.2096 (39)
												128.3784 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1906	1.1877	1.1850	1.1721	1.1697	1.1584	1.1584	1.1564	1.1628	1.1697	1.1746	1.1797 (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	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)										Total =	Sum (45)m =	1588.8780	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)
Total per year (kWh/year) =										Sum (64)m =		1835.3310	(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(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	
Northeast				2.8800	11.2829	0.6200		0.7000		0.7700	9.7732 (75)	
Southeast				1.8000	36.7938	0.6200		0.7000		0.7700	19.9191 (77)	
Southwest				7.0800	36.7938	0.6200		0.7000		0.7700	78.3486 (79)	
Northeast				10.9700	11.2829	0.6200		0.7000		0.7700	37.2265 (75)	

Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790 (83)
Total gains	804.7807	917.6492	1030.5025	1156.2106	1246.6466	1232.8966	1174.1103	1080.8938	980.5417	864.4180	783.8433	763.5072 (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	34.2465	34.3273	34.4069	34.7858	34.8576	35.1958	35.1958	35.2592	35.0648	34.8576	34.7126	34.5623	
alpha	3.2831	3.2885	3.2938	3.3191	3.3238	3.3464	3.3464	3.3506	3.3377	3.3238	3.3142	3.3042	
util living area	0.9757	0.9616	0.9327	0.8669	0.7510	0.5923	0.4539	0.5054	0.7257	0.9015	0.9624	0.9792	(86)
MIT	19.2467	19.4727	19.8388	20.3026	20.6769	20.8960	20.9678	20.9538	20.7878	20.2996	19.6927	19.2030	(87)
Th 2	19.9276	19.9298	19.9320	19.9424	19.9443	19.9534	19.9534	19.9551	19.9499	19.9443	19.9404	19.9363	(88)
util rest of house	0.9708	0.9541	0.9192	0.8399	0.7015	0.5146	0.3546	0.4034	0.6550	0.8753	0.9537	0.9751	(89)
MIT 2	17.6102	17.9371	18.4616	19.1147	19.6073	19.8700	19.9363	19.9285	19.7590	19.1274	18.2655	17.5526	(90)
Living area fraction									fLA =	Living area / (4) =		0.2371	(91)
MIT	17.9982	18.3012	18.7881	19.3964	19.8609	20.1132	20.1809	20.1716	20.0029	19.4054	18.6039	17.9439	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8482	18.1512	18.6381	19.2464	19.7109	19.9632	20.0309	20.0216	19.8529	19.2554	18.4539	17.7939	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9573	0.9370	0.8981	0.8187	0.6892	0.5153	0.3622	0.4102	0.6477	0.8539	0.9368	0.9629	(94)
Useful gains	770.4447	859.8106	925.4720	946.5408	859.2037	635.3659	425.2867	443.3879	635.0773	738.1089	734.3063	735.2077	(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	1766.7088	1723.9025	1575.4474	1328.2670	1026.3136	680.5086	435.3219	458.6965	732.6822	1108.8832	1460.6772	1756.4642	(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	741.2205	580.6698	483.5817	274.8429	124.3298	0.0000	0.0000	0.0000	0.0000	275.8561	522.9870	759.8148	(98)
Space heating												3763.3025	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 34.3586 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4181.4473 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	741.2205	580.6698	483.5817	274.8429	124.3298	0.0000	0.0000	0.0000	0.0000	275.8561	522.9870	759.8148	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	823.5784	645.1886	537.3130	305.3810	138.1442	0.0000	0.0000	0.0000	0.0000	306.5067	581.0967	844.2387	(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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Efficiency of water heater (217)m	89.3186	89.2551	89.1189	88.8072	88.1914	86.7000	86.7000	86.7000	86.7000	88.7817	89.1775	86.7000	(216)
Fuel for water heating, kWh/month	208.0245	182.7221	190.3935	168.7653	164.6898	146.9998	138.6419	155.6517	156.4956	175.1795	187.5455	202.1159	(219)
Water heating fuel used												2077.2249	(219)
Annual totals kWh/year													
Space heating fuel - main system												4181.4473	(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)												428.0285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												6111.1111	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4181.4473	3.4800	145.5144	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2077.2249	3.4800	72.2874	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	428.0285	13.1900	56.4570	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-650.5895	13.1900	-85.8128	(252)
Total energy cost			318.3385	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.8652	(257)
SAP value		$[(255) \times (256)] / [(4) + 45.0] =$	87.9302	
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	4181.4473	0.2160	903.1926	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2077.2249	0.2160	448.6806	(264)
Space and water heating			1351.8732	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	428.0285	0.5190	222.1468	(268)
Energy saving/generation technologies				
PV Unit	-650.5895	0.5190	-337.6560	(269)
Total kg/year			1275.2890	(272)
CO2 emissions per m2			11.6400	(273)
EI value			88.9414	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8823 = 3.944$, stars = 4
Water heating environmental impact	$0.216 / 0.8823 = 0.2448$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) = 0.3301 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3466	0.3218	0.3301	0.3136	0.3136	0.3053	0.2971	0.2888	0.2806	0.3053	0.2888	0.3053 (22b)
Effective ac	0.5601	0.5518	0.5545	0.5492	0.5492	0.5466	0.5441	0.5417	0.5394	0.5466	0.5417	0.5466 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	16076.8200	(34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K						146.7801	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						9.4056	(36)
Total fabric heat loss					(33) + (36) =	77.8551	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.0017	49.2629	49.5031	49.0288	49.0288	48.8008	48.5789	48.3630	48.1533	48.8008	48.3630	48.8008 (38)
Average = Sum(39)m / 12 =	127.8567	127.1180	127.3582	126.8839	126.8839	126.6559	126.4340	126.2181	126.0084	126.6559	126.2181	126.6559 (39)
												126.7456 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1673	1.1606	1.1628	1.1584	1.1584	1.1564	1.1543	1.1524	1.1504	1.1564	1.1524	1.1564 (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	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)										Total =	Sum (45)m =	1588.8780	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)
Total per year (kWh/year) =										Sum (64)m =		1835.3310	(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(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	
Northeast					2.8800	14.6176		0.6200	0.7000	0.7700	12.6617 (75)	
Southeast					1.8000	45.1778		0.6200	0.7000	0.7700	24.4580 (77)	
Southwest					7.0800	45.1778		0.6200	0.7000	0.7700	96.2014 (79)	
Northeast					10.9700	14.6176		0.6200	0.7000	0.7700	48.2289 (75)	
Solar gains	181.5500	281.0685	435.3924	622.4521	730.6005	819.8375	771.0684	670.9322	526.1936	348.9470	220.5588	150.3005 (83)
Total gains	841.0633	935.6622	1064.5040	1211.8155	1278.8906	1331.5224	1261.4666	1170.4920	1048.7192	911.4520	827.5622	791.3287 (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	34.9280	35.1310	35.0648	35.1958	35.1958	35.2592	35.3211	35.3815	35.4404	35.2592	35.3815	35.2592		
alpha	3.3285	3.3421	3.3377	3.3464	3.3464	3.3506	3.3547	3.3588	3.3627	3.3506	3.3588	3.3506		
util living area	0.9693	0.9561	0.9193	0.8356	0.7005	0.5079	0.3805	0.4070	0.6544	0.8666	0.9486	0.9735	(86)	
MIT	19.4248	19.6023	19.9796	20.4329	20.7681	20.9419	20.9834	20.9798	20.8631	20.4586	19.8953	19.4037	(87)	
Th 2	19.9462	19.9517	19.9499	19.9534	19.9534	19.9551	19.9567	19.9583	19.9598	19.9551	19.9583	19.9551	(88)	
util rest of house	0.9631	0.9475	0.9033	0.8034	0.6434	0.4262	0.2832	0.3041	0.5745	0.8318	0.9366	0.9680	(89)	
MIT	17.8795	18.1373	18.6721	19.2971	19.7249	19.9140	19.9494	19.9493	19.8475	19.3494	18.5667	17.8554	(90)	
Living area fraction									fLA = Living area / (4) =			0.2371	(91)	
MIT	18.2459	18.4847	18.9821	19.5664	19.9723	20.1577	20.1946	20.1936	20.0883	19.6124	18.8817	18.2225	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.0959	18.3347	18.8321	19.4164	19.8223	20.0077	20.0446	20.0436	19.9383	19.4624	18.7317	18.0725	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9480	0.9297	0.8818	0.7842	0.6356	0.4305	0.2916	0.3128	0.5727	0.8118	0.9177	0.9542	(94)
Useful gains	797.3468	869.8385	938.6686	950.2772	812.8800	573.2547	367.8998	366.1308	600.6162	739.9300	759.4183	755.0516	(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	1687.1885	1656.9416	1506.9202	1258.2350	929.0780	596.2607	372.2970	371.5409	660.0689	1021.1458	1367.1600	1655.7134	(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	662.0422	528.9332	422.7792	221.7296	86.4514	0.0000	0.0000	0.0000	0.0000	209.2245	437.5740	670.0924	(98)
Space heating												3238.8266	(98)

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Space heating per m2 (98) / (4) = 29.5702 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3598.6963 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	662.0422	528.9332	422.7792	221.7296	86.4514	0.0000	0.0000	0.0000	0.0000	209.2245	437.5740	670.0924	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	735.6025	587.7036	469.7547	246.3662	96.0571	0.0000	0.0000	0.0000	0.0000	232.4717	486.1934	744.5471	(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	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Efficiency of water heater	89.2555	89.1999	89.0295	88.6393	87.9026	86.7000	86.7000	86.7000	86.7000	88.5627	89.0626	86.7000	(216)
(217)m													89.2786 (217)
Fuel for water heating, kWh/month	208.1716	182.8351	190.5848	169.0850	165.2308	146.9998	138.6419	155.6517	156.4956	175.6127	187.7875	202.2705	(219)
Water heating fuel used												2079.3670	(219)
Annual totals kWh/year													
Space heating fuel - main system												3598.6963	(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)												428.0285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1122 * 1.00) =										-727.0046		-727.0046	(233)
Total delivered energy for all uses												5454.0872	(238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3598.6963	3.9200	141.0689 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2079.3670	3.9200	81.5112 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	428.0285	16.9600	72.5936 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-727.0046	16.9600	-123.3000 (252)
Total energy cost			272.5937 (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	3598.6963	0.2160	777.3184 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2079.3670	0.2160	449.1433 (264)
Space and water heating			1226.4617 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Energy saving/generation technologies			
PV Unit	-727.0046	0.5190	-377.3154 (269)
Total kg/year			1110.2181 (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	3598.6963	1.2200	4390.4095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2079.3670	1.2200	2536.8278 (264)
Space and water heating			6927.2372 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	428.0285	3.0700	1314.0474 (268)

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Energy saving/generation technologies			
PV Unit	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			6239.6306 (272)
Primary energy kWh/m2/year			56.9673 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 32	-199 kg (17.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 1.82 kg/m²	B 89	B 91
Total Savings	£32 1.82 kg/m²		

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£85	£94	-£8
Mains gas	£311	£270	£41
Space heating	£242	£242	£0
Water heating	£82	£49	£32
Lighting	£73	£73	£0
Generated (PV)	-£123	-£123	£0
Total cost of fuels	£273	£241	£33
Total cost of uses	£274	£241	£32
Delivered energy	50 kWh/m²	41 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	47 kWh/m²	10 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) = 0.3301 (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	0.4209	0.4126	0.4044	0.3631	0.3549	0.3136	0.3136	0.3053	0.3301	0.3549	0.3714	0.3879 (22b)
Effective ac	0.5886	0.5851	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752 (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	
Solid Door			2.1300	0.9000	1.9170			(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909			(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436			(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500	(28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000	(29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900	(30)
Total net area of external elements Aum(A, m2)			199.6600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495			(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000	(32)
GF			39.1300			9.0000	352.1700	(32c)
FF			54.0500			9.0000	486.4500	(32c)
2F			71.6600			9.0000	644.9400	(32c)
Internal Floor 1			36.5100			18.0000	657.1800	(32d)
Internal Floor 2			36.5100			18.0000	657.1800	(32d)
Internal Floor 1			36.5100			18.0000	657.1800	(32e)
Internal Floor 2			36.5100			18.0000	657.1800	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			16076.8200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							146.7801	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4056	(36)
Total fabric heat loss						(33) + (36) =	77.8551	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	52.5462	52.2392	51.9382	50.5245	50.2601	49.0288	49.0288	48.8008	49.5031	50.2601	50.7951	51.3545 (38)
Average = Sum(39)m / 12 =	130.4013	130.0942	129.7933	128.3796	128.1151	126.8839	126.8839	126.6559	127.3582	128.1151	128.6502	129.2096 (39)
												128.3784 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1906	1.1877	1.1850	1.1721	1.1697	1.1584	1.1584	1.1564	1.1628	1.1697	1.1746	1.1797 (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	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													(45)
	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Aperture area of solar collector													(H1)
Zero-loss collector efficiency													(H2)
Collector heat loss coefficient													(H3)
Collector 2nd order heat loss coefficient													(H3a)
Collector effective heat loss coefficient													(H3b)
Collector performance ratio													(H4)
Annual solar radiation per m2													(H5)
Overshading factor													(H6)
Solar energy available													(H7)
Adjustment factor for showers													(H7a)
Solar-to-load ratio													(H8)
Utilisation factor													(H9)
Collector performance factor													(H10)
Dedicated solar storage volume													(H11)
Effective solar volume													(H13)
Daily hot water demand													(H14)
Volume ratio Veff/V													(H15)
Solar storage volume factor													(H16)
Solar input													(H17)
Solar input	-25.3813	-42.3541	-72.1339	-96.6736	-119.4321	-117.4208	-115.8691	-101.2354	-79.2876	-54.1441	-30.1059	-21.2398	(63)
Solar input (sum of months) = Sum (63)m =													(63)
Output from w/h	160.4233	120.7346	97.5428	53.2020	25.8101	10.0280	4.3335	33.7147	56.3941	101.3832	137.1426	159.3445	(64)
Total per year (kWh/year) = Sum (64)m =													(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(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	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(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	
Northeast				2.8800	11.2829		0.6200	0.7000	0.7700		9.7732 (75)	
Southeast				1.8000	36.7938		0.6200	0.7000	0.7700		19.9191 (77)	
Southwest				7.0800	36.7938		0.6200	0.7000	0.7700		78.3486 (79)	
Northeast				10.9700	11.2829		0.6200	0.7000	0.7700		37.2265 (75)	

Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790 (83)
Total gains	804.7807	917.6492	1030.5025	1156.2106	1246.6466	1232.8966	1174.1103	1080.8938	980.5417	864.4180	783.8433	763.5072 (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	34.2465	34.3273	34.4069	34.7858	34.8576	35.1958	35.1958	35.2592	35.0648	34.8576	34.7126	34.5623		
alpha	3.2831	3.2885	3.2938	3.3191	3.3238	3.3464	3.3464	3.3506	3.3377	3.3238	3.3142	3.3042		
util living area	0.9757	0.9616	0.9327	0.8669	0.7510	0.5923	0.4539	0.5054	0.7257	0.9015	0.9624	0.9792	(86)	
MIT	19.2467	19.4727	19.8388	20.3026	20.6769	20.8960	20.9678	20.9538	20.7878	20.2996	19.6927	19.2030	(87)	
Th 2	19.9276	19.9298	19.9320	19.9424	19.9443	19.9534	19.9534	19.9551	19.9499	19.9443	19.9404	19.9363	(88)	
util rest of house	0.9708	0.9541	0.9192	0.8399	0.7015	0.5146	0.3546	0.4034	0.6550	0.8753	0.9537	0.9751	(89)	
MIT 2	17.6102	17.9371	18.4616	19.1147	19.6073	19.8700	19.9363	19.9285	19.7590	19.1274	18.2655	17.5526	(90)	
Living area fraction									fLA = Living area / (4) =			0.2371	(91)	
MIT	17.9982	18.3012	18.7881	19.3964	19.8609	20.1132	20.1809	20.1716	20.0029	19.4054	18.6039	17.9439	(92)	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4181.4473	0.2160	903.1926	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1078.0005	0.2160	232.8481	(264)
Space and water heating			1136.0407	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	428.0285	0.5190	222.1468	(268)
Energy saving/generation technologies				
PV Unit	-650.5895	0.5190	-337.6560	(269)
Total kg/year			1085.4065	(272)
CO2 emissions per m2			9.9100	(273)
EI value			90.5879	
EI rating			91	(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	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (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) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3884 (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) = 0.3301 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3466	0.3218	0.3301	0.3136	0.3136	0.3053	0.2971	0.2888	0.2806	0.3053	0.2888	0.3053 (22b)
Effective ac	0.5601	0.5518	0.5545	0.5492	0.5492	0.5466	0.5441	0.5417	0.5394	0.5466	0.5417	0.5466 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	16076.8200	(34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K						146.7801	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						9.4056	(36)
Total fabric heat loss					(33) + (36) =	77.8551	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.0017	49.2629	49.5031	49.0288	49.0288	48.8008	48.5789	48.3630	48.1533	48.8008	48.3630	48.8008 (38)
Average = Sum(39)m / 12 =	127.8567	127.1180	127.3582	126.8839	126.8839	126.6559	126.4340	126.2181	126.0084	126.6559	126.2181	126.6559 (39)
												126.7456 (39)
HLP	1.1673	1.1606	1.1628	1.1584	1.1584	1.1564	1.1543	1.1524	1.1504	1.1564	1.1524	1.1564 (40)
HLP (average)												1.1572 (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	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)	Total = Sum (45)m =												1588.8780 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1208.1510 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													2029.6937 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.2774 (H8)
Utilisation factor													0.5429 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													100.9844 (H14)
Volume ratio Veff/V													0.7427 (H15)
Solar storage volume factor													0.9405 (H16)
Solar input													-911.2377 (H17)
Solar input	-29.7268	-42.2696	-72.6513	-98.0234	-115.1343	-122.9817	-120.3953	-107.7575	-84.3667	-58.3282	-35.1589	-24.4441	(63)
	Solar input (sum of months) = Sum (63)m =												-911.2377 (63)
Output from w/h	156.0778	120.8191	97.0254	51.8523	30.1079	4.4672	0.0000	27.1926	51.3151	97.1991	132.0895	156.1403	(64)
	Total per year (kWh/year) = Sum (64)m =												924.2862 (64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(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	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(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)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(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	
Northeast				2.8800	14.6176	0.6200		0.7000		0.7700	12.6617 (75)	
Southeast				1.8000	45.1778	0.6200		0.7000		0.7700	24.4580 (77)	
Southwest				7.0800	45.1778	0.6200		0.7000		0.7700	96.2014 (79)	
Northeast				10.9700	14.6176	0.6200		0.7000		0.7700	48.2289 (75)	
Solar gains	181.5500	281.0685	435.3924	622.4521	730.6005	819.8375	771.0684	670.9322	526.1936	348.9470	220.5588	150.3005 (83)
Total gains	841.0633	935.6622	1064.5040	1211.8155	1278.8906	1331.5224	1261.4666	1170.4920	1048.7192	911.4520	827.5622	791.3287 (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	34.9280	35.1310	35.0648	35.1958	35.1958	35.2592	35.3211	35.3815	35.4404	35.2592	35.3815	35.2592	
alpha	3.3285	3.3421	3.3377	3.3464	3.3464	3.3506	3.3547	3.3588	3.3627	3.3506	3.3588	3.3506	
util living area	0.9693	0.9561	0.9193	0.8356	0.7005	0.5079	0.3805	0.4070	0.6544	0.8666	0.9486	0.9735	(86)
MIT	19.4248	19.6023	19.9796	20.4329	20.7681	20.9419	20.9834	20.9798	20.8631	20.4586	19.8953	19.4037	(87)
Th 2	19.9462	19.9517	19.9499	19.9534	19.9534	19.9551	19.9567	19.9583	19.9598	19.9551	19.9583	19.9551	(88)
util rest of house	0.9631	0.9475	0.9033	0.8034	0.6434	0.4262	0.2832	0.3041	0.5745	0.8318	0.9366	0.9680	(89)
MIT 2	17.8795	18.1373	18.6721	19.2971	19.7249	19.9140	19.9494	19.9493	19.8475	19.3494	18.5667	17.8554	(90)
Living area fraction	fLA = Living area / (4) =												0.2371 (91)
MIT	18.2459	18.4847	18.9821	19.5664	19.9723	20.1577	20.1946	20.1936	20.0883	19.6124	18.8817	18.2225	(92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													-0.1500
adjusted MIT	18.0959	18.3347	18.8321	19.4164	19.8223	20.0077	20.0446	20.0436	19.9383	19.4624	18.7317		18.0725 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9480	0.9297	0.8818	0.7842	0.6356	0.4305	0.2916	0.3128	0.5727	0.8118	0.9177	0.9542	(94)
Useful gains	797.3468	869.8385	938.6686	950.2772	812.8800	573.2547	367.8998	366.1308	600.6162	739.9300	759.4183	755.0516	(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													
1687.1885	1656.9416	1506.9202	1258.2350	929.0780	596.2607	372.2970	371.5409	660.0689	1021.1458	1367.1600	1655.7134	670.0924	(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													
662.0422	528.9332	422.7792	221.7296	86.4514	0.0000	0.0000	0.0000	0.0000	209.2245	437.5740	670.0924	3238.8266	(98)
Space heating													
Space heating per m2													(98) / (4) = 29.5702 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3598.6963 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	662.0422	528.9332	422.7792	221.7296	86.4514	0.0000	0.0000	0.0000	0.0000	209.2245	437.5740	670.0924	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	735.6025	587.7036	469.7547	246.3662	96.0571	0.0000	0.0000	0.0000	0.0000	232.4717	486.1934	744.5471	(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	156.0778	120.8191	97.0254	51.8523	30.1079	4.4672	0.0000	27.1926	51.3151	97.1991	132.0895	156.1403	(64)
Efficiency of water heater	89.3512	89.3675	89.3651	89.3554	89.1238	86.7000	86.7000	86.7000	86.7000	88.9263	89.2126	86.7000	(216)
(217)m	89.3512	89.3675	89.3651	89.3554	89.1238	86.7000	86.7000	86.7000	86.7000	88.9263	89.2126	89.3573	(217)
Fuel for water heating, kWh/month	174.6791	135.1936	108.5719	58.0293	33.7821	5.1524	0.0000	31.3640	59.1869	109.3029	148.0614	174.7371	(219)
Water heating fuel used													
Annual totals kWh/year													1038.0607 (219)
Space heating fuel - main system													3598.6963 (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)													428.0285 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1122 * 1.00) =										-727.0046			-727.0046 (233)
Total delivered energy for all uses													4462.7809 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3598.6963	3.9200	141.0689	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1038.0607	3.9200	40.6920	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	428.0285	16.9600	72.5936	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-727.0046	16.9600	-123.3000	(252)
Total energy cost			240.2545	(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	3598.6963	0.2160	777.3184	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1038.0607	0.2160	224.2211	(264)
Space and water heating			1001.5395	(265)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Energy saving/generation technologies			
PV Unit	-727.0046	0.5190	-377.3154 (269)
Total kg/year			911.2459 (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	3598.6963	1.2200	4390.4095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1038.0607	1.2200	1266.4341 (264)
Space and water heating			5656.8435 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	428.0285	3.0700	1314.0474 (268)
Energy saving/generation technologies			
PV Unit	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			5122.7369 (272)
Primary energy kWh/m2/year			46.7702 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-191	Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)
Property	81, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.07	TER	16.54
Environmental	89 B	% DER<TER	21.00		
CO ₂ Emissions (t/year)	1.11	DFEE	47.05	TFEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	8.35		

Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk	Assessor ID	T511-0001
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Client	
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SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	146.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	357.11 (P1)
Transmission heat loss coefficient	77.86 (37)
Summer heat loss coefficient	434.97 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.8800	106.0502	0.6200	0.7000	0.9000	107.3690
South East	1.8000	127.3119	0.6200	0.7000	0.9000	80.5594
South West	7.0800	127.3119	0.6200	0.7000	0.9000	316.8669
North East	10.9700	106.0502	0.6200	0.7000	0.9000	408.9714
total:						913.7666

	Jun	Jul	Aug	
Solar gains	988	914	793	(P3)
Internal gains	509	487	497	
Total summer gains	1496	1401	1289	(P5)
Summer gain/loss ratio	3.44	3.22	2.96	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 146.8)	0.97	0.97	0.97	
Threshold temperature	19.81	21.49	21.24	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			