

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-190				Issued on Date	25/03/2019
Assessment Reference	As Built		Prop Type Ref	P308 - Semi (As)		
Property	79, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	88 B	DER	13.18	TER	16.71	
Environmental	89 B	% DER<TER	21.11			
CO ₂ Emissions (t/year)	1.12	DFEE	47.48	TFEE	52.13	
General Requirements Compliance	Pass	% DFEE<TFEE	8.92			
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) 16.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.18 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.5 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: 4.64 (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 West: 7.08 m², No overhang
Windows facing North West: 1.80 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					4.6400
Infiltration rate					0.3799 (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) = 0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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	52.2039	51.9101	51.6222	50.2697	50.0167	48.8388	48.8388	48.6206	49.2925	50.0167	50.5286	51.0637 (38)
Average = Sum(39)m / 12 =	130.0589	129.7652	129.4772	128.1248	127.8718	126.6939	126.6939	126.4757	127.1476	127.8718	128.3837	128.9188 (39)
												128.1236 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1874	1.1847	1.1821	1.1698	1.1675	1.1567	1.1567	1.1547	1.1608	1.1675	1.1721	1.1770 (40)
Days in month												1.1698 (40)
	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)				
Southwest				7.0800	36.7938	0.6200	0.7000	0.7700	78.3486 (79)				
Northwest				1.8000	11.2829	0.6200	0.7000	0.7700	6.1083 (81)				
Northeast				10.9700	11.2829	0.6200	0.7000	0.7700	37.2265 (75)				
Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207	(83)
Total gains	575.4530	683.3166	803.1621	945.9675	1056.5541	1057.6655	1002.6498	901.9047	786.2585	656.9944	568.1565	540.8084	(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	34.3366	34.4143	34.4909	34.8549	34.9239	35.2486	35.2486	35.3094	35.1228	34.9239	34.7847	34.6403	
alpha	3.2891	3.2943	3.2994	3.3237	3.3283	3.3499	3.3499	3.3540	3.3415	3.3283	3.3190	3.3094	
util living area	0.9907	0.9829	0.9643	0.9144	0.8122	0.6594	0.5185	0.5833	0.8099	0.9492	0.9846	0.9924	(86)
MIT	18.9813	19.2123	19.6082	20.1323	20.5805	20.8559	20.9523	20.9292	20.6947	20.1052	19.4498	18.9413	(87)
Th 2	19.9301	19.9322	19.9343	19.9443	19.9461	19.9548	19.9548	19.9564	19.9515	19.9461	19.9424	19.9384	(88)
util rest of house	0.9887	0.9793	0.9564	0.8946	0.7682	0.5807	0.4098	0.4732	0.7480	0.9335	0.9807	0.9907	(89)
MIT	17.2281	17.5652	18.1390	18.8894	19.4956	19.8352	19.9285	19.9136	19.6616	18.8666	17.9194	17.1748	(90)
Living area fraction									fLA =	Living area / (4) =		0.2371	(91)
MIT	17.6438	17.9558	18.4874	19.1841	19.7528	20.0772	20.1712	20.1544	19.9066	19.1603	18.2823	17.5936	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4938	17.8058	18.3374	19.0341	19.6028	19.9272	20.0212	20.0044	19.7566	19.0103	18.1323	17.4436	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9684	0.9398	0.8730	0.7516	0.5784	0.4171	0.4787	0.7343	0.9144	0.9705	0.9847	(94)
Useful gains	564.8375	661.7519	754.8241	825.7831	794.0601	611.7375	418.2253	431.7678	577.3169	600.7528	551.4217	532.5213	(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	1715.9745	1674.7182	1532.6699	1298.4338	1010.5461	674.9244	433.4458	455.8703	719.2211	1075.4352	1416.3620	1707.3498	(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	856.4459	680.7133	578.7173	340.3085	161.0656	0.0000	0.0000	0.0000	0.0000	353.1637	622.7570	874.0724	(98)
Space heating												4467.2438	(98)

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Space heating per m2 (98) / (4) = 40.7856 (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													4963.6043 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	856.4459	680.7133	578.7173	340.3085	161.0656	0.0000	0.0000	0.0000	0.0000	353.1637	622.7570	874.0724	(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)	951.6066	756.3481	643.0192	378.1206	178.9618	0.0000	0.0000	0.0000	0.0000	392.4041	691.9523	971.1916	(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	89.3934	89.3427	89.2300	88.9647	88.4045	86.7000	86.7000	86.7000	86.7000	88.9647	89.2806	86.7000	(216)
Fuel for water heating, kWh/month	207.8504	182.5427	190.1565	168.4665	164.2928	146.9998	138.6419	155.6517	156.4956	174.8191	187.3290	201.9570	(219)
Water heating fuel used												2075.2032	(219)
Annual totals kWh/year													
Space heating fuel - main system												4963.6043	(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												6891.2464	(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	4963.6043	0.2160	1072.1385 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2075.2032	0.2160	448.2439 (264)
Space and water heating			1520.3824 (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			1443.7982 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.1800 (273)

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

DER		13.1800	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		29.5377	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		29.5377	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	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 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)		
Southwest					7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)		
Northwest					1.8000	11.2829	0.6300	0.7000	0.7700	6.2068 (81)		
Solar gains	133.5768	245.4556	383.4546	554.9232	694.4019	721.4209	682.1929	573.2371	442.0618	284.1180	163.2585	112.2017 (83)
Total gains	587.6160	697.2630	819.3146	964.6877	1076.8175	1077.6910	1022.0677	920.2589	803.2081	671.5904	580.8092	552.6396 (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	0.9988	0.9969	0.9899	0.9580	0.8570	0.6729	0.5085	0.5815	0.8530	0.9818	0.9974	0.9991			(86)
MIT	19.7276	19.8884	20.1617	20.5279	20.8228	20.9630	20.9929	20.9864	20.8735	20.4799	20.0381	19.7024			(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	0.9984	0.9958	0.9862	0.9423	0.8084	0.5841	0.3977	0.4645	0.7837	0.9724	0.9963	0.9989			(89)
MIT 2	18.2726	18.5093	18.9083	19.4372	19.8236	19.9806	20.0020	20.0008	19.8977	19.3795	18.7366	18.2424			(90)
Living area fraction	18.6176	18.8363	19.2055	19.6958	20.0605	20.2135	20.2370	20.2345	20.1291	19.6404	19.0452	18.5886			(92)
Temperature adjustment	18.6176	18.8363	19.2055	19.6958	20.0605	20.2135	20.2370	20.2345	20.1291	19.6404	19.0452	18.5886			(93)
adjusted MIT	18.6176	18.8363	19.2055	19.6958	20.0605	20.2135	20.2370	20.2345	20.1291	19.6404	19.0452	18.5886			(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9976	0.9941	0.9823	0.9366	0.8120	0.6037	0.4241	0.4923	0.7940	0.9679	0.9947	0.9982		(94)
Ext temp.	586.1994	693.1295	804.7783	903.4845	874.3367	650.6206	433.4121	453.0133	637.7386	650.0124	577.7538	551.6610		(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		(96)
Month fracti	1770.6374	1718.9876	1563.1598	1312.1968	1013.8697	673.4915	436.3516	459.1335	726.3535	1096.3227	1455.2879	1761.4182		(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000		(97a)
Space heating	881.2219	689.3766	564.2359	294.2729	103.8125	0.0000	0.0000	0.0000	0.0000	332.0549	631.8245	900.0593		(98)
Space heating per m2												4396.8585		(98)
												40.1430		(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													4707.5572 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	881.2219	689.3766	564.2359	294.2729	103.8125	0.0000	0.0000	0.0000	0.0000	332.0549	631.8245	900.0593	(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)	943.4924	738.0906	604.1069	315.0673	111.1483	0.0000	0.0000	0.0000	0.0000	355.5191	676.4716	963.6609	(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	88.2182	88.0073	87.5230	86.3027	83.8151	80.3000	80.3000	80.3000	80.3000	86.4999	87.7835	88.2950	(216)
Fuel for water heating, kWh/month	244.4979	216.0089	228.0917	206.7397	206.1011	189.4685	181.5252	202.3581	204.5929	214.5018	223.5330	238.3981	(219)
Water heating fuel used												2555.8168	(219)
Annual totals kWh/year													
Space heating fuel - main system												4707.5572	(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												7766.4026	(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	4707.5572	0.2160	1016.8324 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2555.8168	0.2160	552.0564 (264)
Space and water heating			1568.8888 (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			1829.9606 (272)
Emissions per m2 for space and water heating			14.3238 (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) = (14.3238 * 1.00) + 2.0282 + 0.3554, rounded to 2 d.p.			16.7100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-190	Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)
Property	79, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.18	TER	16.71
Environmental	89 B	% DER<TER	21.11		
CO ₂ Emissions (t/year)	1.12	DFEE	47.48	TFEE	52.13
General Requirements Compliance	Pass	% DFEE<TFEE	8.92		

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					4.6400
Infiltration rate					0.3799 (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) =	0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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 kJ/m²K 140.7801 (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
	52.2039	51.9101	51.6222	50.2697	50.0167	48.8388	48.8388	48.6206	49.2925	50.0167	50.5286	51.0637 (38)
Heat transfer coeff	130.0589	129.7652	129.4772	128.1248	127.8718	126.6939	126.6939	126.4757	127.1476	127.8718	128.3837	128.9188 (39)
Average = Sum(39)m / 12 =												128.1236 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1874	1.1847	1.1821	1.1698	1.1675	1.1567	1.1567	1.1547	1.1608	1.1675	1.1721	1.1770 (40)
Days in month												1.1698 (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												
	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 m ²	Solar flux Table 6a W/m ²	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)
Southwest	7.0800	36.7938	0.6200	0.7000	0.7700	78.3486 (79)
Northwest	1.8000	11.2829	0.6200	0.7000	0.7700	6.1083 (81)
Northeast	10.9700	11.2829	0.6200	0.7000	0.7700	37.2265 (75)
Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698
Total gains	538.8026	647.5157	769.1250	914.3305	1026.4810	1029.7901
						671.3645
						976.6362
						564.1381
						873.4990
						435.0450
						756.9980
						279.6082
						625.2500
						160.6671
						533.6095
						110.4207 (83)
						505.0039 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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
	32.9330	33.0076	33.0810	33.4302	33.4963	33.8077	33.8077	33.8661	33.6871	33.4963	33.3628	33.2243
alpha	3.1955	3.2005	3.2054	3.2287	3.2331	3.2538	3.2538	3.2577	3.2458	3.2331	3.2242	3.2150
util living area												
	0.9912	0.9836	0.9654	0.9165	0.8166	0.6669	0.5273	0.5941	0.8174	0.9518	0.9856	0.9929 (86)
MIT	18.8768	19.1160	19.5266	20.0720	20.5425	20.8378	20.9444	20.9178	20.6624	20.0423	19.3616	18.8362 (87)
Th 2	19.9301	19.9322	19.9343	19.9443	19.9461	19.9548	19.9548	19.9564	19.9515	19.9461	19.9424	19.9384 (88)
util rest of house												
	0.9894	0.9802	0.9579	0.8974	0.7739	0.5892	0.4183	0.4844	0.7578	0.9372	0.9820	0.9914 (89)
MIT 2	17.9859	18.2251	18.6326	19.1698	19.6072	19.8611	19.9332	19.9215	19.7290	19.1522	18.4782	17.9515 (90)
Living area fraction												fLA = Living area / (4) = 0.2371 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

MIT	18.1972	18.4363	18.8446	19.3838	19.8289	20.0927	20.1730	20.1577	19.9503	19.3632	18.6876	18.1613 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1972	18.4363	18.8446	19.3838	19.8289	20.0927	20.1730	20.1577	19.9503	19.3632	18.6876	18.1613 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9737	0.9479	0.8852	0.7685	0.6003	0.4423	0.5072	0.7577	0.9268	0.9762	0.9879	(94)
Useful gains	530.8460	630.4931	729.0159	809.3660	788.8942	618.1843	431.9949	443.0119	573.6041	579.4700	520.8929	498.8684	(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													
	1807.4488	1756.5411	1598.3397	1343.2295	1039.4626	695.8862	452.6751	475.2604	743.8545	1120.5696	1487.6640	1799.8726	(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													
	949.7925	756.7042	646.7769	384.3817	186.4229	0.0000	0.0000	0.0000	0.0000	402.5781	696.0752	967.9472	(98)
Space heating													4990.6786 (98)
Space heating per m2													45.5645 (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	1190.9222	937.5345	961.2155	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8010	0.8609	0.8230	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	953.8764	807.1172	791.1013	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1313.6444	1249.0963	1130.5364	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	259.0329	328.8325	252.5397	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												840.4050 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			
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 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	64.7582	82.2081	63.1349	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												210.1013 (107)
Space cooling per m2												1.9182 (108)
Energy for space heating												45.5645 (99)
Energy for space cooling												1.9182 (108)
Total												47.4827 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.5 (109)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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)
	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												
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)
Southwest	7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)
Northwest	1.8000	11.2829	0.6300	0.7000	0.7700	6.2068 (81)

Solar gains	133.5768	245.4556	383.4546	554.9232	694.4019	721.4209	682.1929	573.2371	442.0618	284.1180	163.2585	112.2017	(83)
Total gains	540.9229	651.4118	775.2116	923.1388	1037.5033	1041.2413	987.4647	882.5980	764.0148	629.7599	536.2009	506.7849	(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	0.9992	0.9977	0.9920	0.9645	0.8711	0.6911	0.5250	0.6031	0.8721	0.9861	0.9982	0.9994	(86)
MIT	19.6876	19.8495	20.1255	20.4987	20.8064	20.9582	20.9918	20.9840	20.8573	20.4468	20.0000	19.6630	(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	0.9989	0.9969	0.9891	0.9508	0.8250	0.6019	0.4112	0.4833	0.8073	0.9787	0.9974	0.9992	(89)
MIT 2	18.7735	18.9370	19.2133	19.5864	19.8654	19.9858	20.0025	20.0018	19.9194	19.5430	19.0966	18.7564	(90)
Living area fraction									fLA = Living area / (4) =			0.2371	(91)
MIT	18.9902	19.1534	19.4296	19.8027	20.0885	20.2164	20.2371	20.2347	20.1418	19.7573	19.3108	18.9713	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9902	19.1534	19.4296	19.8027	20.0885	20.2164	20.2371	20.2347	20.1418	19.7573	19.3108	18.9713	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9961	0.9869	0.9476	0.8299	0.6220	0.4384	0.5119	0.8180	0.9764	0.9967	0.9990	(94)
Ext temp.	540.1352	648.8413	765.0779	874.7712	860.9798	647.6359	432.9352	451.8320	624.9293	614.8876	534.4297	506.2584	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1816.7192	1758.0995	1590.7374	1325.1921	1017.2639	673.8333	436.3674	459.1559	727.8838	1110.5008	1487.6541	1808.2726	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	949.7785	745.4215	614.2907	324.3030	116.2754	0.0000	0.0000	0.0000	0.0000	368.7362	686.3215	968.6986	(98)
Space heating per m2												4773.8255	(98)
												(98) / (4) =	43.5846 (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	0.8993	0.9468	0.9181	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1014.1754	840.6268	835.4717	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1327.0288	1261.7530	1141.1716	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	225.2544	313.3179	227.4407	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												766.0131 (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	56.3136	78.3295	56.8602	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												191.5033 (107)
Space cooling per m2												1.7484 (108)
Energy for space heating												43.5846 (99)
Energy for space cooling												1.7484 (108)
Total												45.3330 (109)
Target Fabric Energy Efficiency (TFEE)												52.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-190	Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)
Property	79, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.18	TER	16.71
Environmental	89 B	% DER<TER	21.11		
CO ₂ Emissions (t/year)	1.12	DFEE	47.48	TTEE	52.13
General Requirements Compliance	Pass	% DFEE<TFEE	8.92		

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					4.6400
Infiltration rate					0.3799 (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) =	0.3229 (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	0.3390	0.3148	0.3229	0.3067	0.3067	0.2987	0.2906	0.2825	0.2744	0.2987	0.2825	0.2987 (22b)
Effective ac	0.5575	0.5496	0.5521	0.5470	0.5470	0.5446	0.5422	0.5399	0.5377	0.5446	0.5399	0.5446 (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 49.7695	Feb 49.0627	Mar 49.2925	Apr 48.8388	May 48.8388	Jun 48.6206	Jul 48.4083	Aug 48.2018	Sep 48.0011	Oct 48.6206	Nov 48.2018	Dec 48.6206 (38)
Heat transfer coeff	127.6246	126.9178	127.1476	126.6939	126.6939	126.4757	126.2634	126.0569	125.8562	126.4757	126.0569	126.4757 (39)
Average = Sum(39)m / 12 =												126.5615 (39)
HLP	Jan 1.1652	Feb 1.1587	Mar 1.1608	Apr 1.1567	May 1.1567	Jun 1.1547	Jul 1.1528	Aug 1.1509	Sep 1.1491	Oct 1.1547	Nov 1.1509	Dec 1.1547 (40)
HLP (average)												1.1555 (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)
	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)
	Total per year (kWh/year) = Sum(64)m =											1835.3310 (64)
RHI water heating demand												1835 (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												
(66)m	Jan 168.7185	Feb 168.7185	Mar 168.7185	Apr 168.7185	May 168.7185	Jun 168.7185	Jul 168.7185	Aug 168.7185	Sep 168.7185	Oct 168.7185	Nov 168.7185	Dec 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)
Southwest				7.0800	45.1778	0.6200		0.7000		0.7700		96.2014 (79)
Northwest				1.8000	14.6176	0.6200		0.7000		0.7700		7.9136 (81)
Northeast				10.9700	14.6176	0.6200		0.7000		0.7700		48.2289 (75)
Solar gains	165.0056	259.4270	411.5871	602.5209	717.5045	809.4939	759.6216	653.8647	502.4626	324.9115	201.3123	136.0570 (83)
Total gains	824.5189	914.0207	1040.6988	1191.8844	1265.7946	1321.1788	1250.0198	1153.4245	1024.9882	887.4165	808.3157	777.0852 (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	34.9916	35.1864	35.1228	35.2486	35.2486	35.3094	35.3688	35.4267	35.4832	35.3094	35.4267	35.3094
alpha	3.3328	3.3458	3.3415	3.3499	3.3499	3.3540	3.3579	3.3618	3.3655	3.3540	3.3618	3.3540
util living area												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.9709	0.9587	0.9235	0.8406	0.7044	0.5106	0.3833	0.4120	0.6640	0.8737	0.9516	0.9748 (86)
MIT	19.4100	19.5823	19.9605	20.4218	20.7647	20.9412	20.9831	20.9791	20.8571	20.4421	19.8774	19.3903 (87)
Th 2	19.9479	19.9531	19.9515	19.9548	19.9548	19.9564	19.9580	19.9595	19.9610	19.9564	19.9595	19.9564 (88)
util rest of house	0.9650	0.9505	0.9080	0.8090	0.6475	0.4288	0.2855	0.3082	0.5843	0.8401	0.9402	0.9696 (89)
MIT 2	17.8594	18.1100	18.6470	19.2841	19.7225	19.9147	19.9506	19.9502	19.8430	19.3295	18.5425	17.8371 (90)
Living area fraction									fLA = Living area / (4) =			0.2371 (91)
MIT	18.2271	18.4591	18.9584	19.5539	19.9696	20.1581	20.1954	20.1941	20.0835	19.5933	18.8590	18.2054 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0771	18.3091	18.8084	19.4039	19.8196	20.0081	20.0454	20.0441	19.9335	19.4433	18.7090	18.0554 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9503	0.9332	0.8868	0.7895	0.6395	0.4331	0.2939	0.3169	0.5820	0.8199	0.9217	0.9561 (94)	
Useful gains	783.5815	852.9205	922.8618	940.9837	809.4411	572.1501	367.4124	365.5248	596.5036	727.5598	744.9944	742.9642 (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	1681.7196	1651.0850	1501.4090	1254.7593	927.3483	595.4609	371.8929	371.1281	658.6632	1017.2839	1362.5482	1651.1853 (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	668.2148	536.3666	430.4390	225.9184	87.7230	0.0000	0.0000	0.0000	0.0000	215.5547	444.6387	675.7165 (98)	
Space heating												3284.5718 (98)	
RHI space heating demand												3285 (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 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.6400
Infiltration rate					0.3799 (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) = 0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.2039	51.9101	51.6222	50.2697	50.0167	48.8388	48.8388	48.6206	49.2925	50.0167	50.5286	51.0637 (38)
Heat transfer coeff	130.0589	129.7652	129.4772	128.1248	127.8718	126.6939	126.6939	126.4757	127.1476	127.8718	128.3837	128.9188 (39)
Average = Sum(39)m / 12 =												128.1236 (39)
HLP	1.1874	1.1847	1.1821	1.1698	1.1675	1.1567	1.1567	1.1547	1.1608	1.1675	1.1721	1.1770 (40)
HLP (average)												1.1698 (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)	
Southwest				7.0800	36.7938	0.6200		0.7000		0.7700	78.3486 (79)	
Northwest				1.8000	11.2829	0.6200		0.7000		0.7700	6.1083 (81)	
Northeast				10.9700	11.2829	0.6200		0.7000		0.7700	37.2265 (75)	
Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207 (83)
Total gains	790.9699	896.1531	1006.4797	1135.4783	1231.6697	1221.6547	1161.7627	1063.6979	957.5706	842.1133	767.6706	751.4489 (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	34.3366	34.4143	34.4909	34.8549	34.9239	35.2486	35.2486	35.3094	35.1228	34.9239	34.7847	34.6403	
alpha	3.2891	3.2943	3.2994	3.3237	3.3283	3.3499	3.3499	3.3540	3.3415	3.3283	3.3190	3.3094	
util living area	0.9768	0.9639	0.9363	0.8715	0.7553	0.5958	0.4576	0.5116	0.7349	0.9070	0.9644	0.9801	(86)
MIT	19.2365	19.4547	19.8200	20.2900	20.6719	20.8945	20.9672	20.9523	20.7797	20.2828	19.6787	19.1938	(87)
Th 2	19.9301	19.9322	19.9343	19.9443	19.9461	19.9548	19.9548	19.9564	19.9515	19.9461	19.9424	19.9384	(88)
util rest of house	0.9721	0.9568	0.9234	0.8452	0.7061	0.5180	0.3578	0.4089	0.6649	0.8819	0.9561	0.9761	(89)
MIT 2	17.5973	17.9130	18.4371	19.0998	19.6032	19.8700	19.9373	19.9288	19.7521	19.1066	18.2470	17.5407	(90)
Living area fraction									fLA =	Living area / (4) =		0.2371	(91)
MIT	17.9859	18.2785	18.7650	19.3820	19.8566	20.1129	20.1815	20.1715	19.9957	19.3855	18.5865	17.9327	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8359	18.1285	18.6150	19.2320	19.7066	19.9629	20.0315	20.0215	19.8457	19.2355	18.4365	17.7827	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9590	0.9402	0.9027	0.8238	0.6935	0.5187	0.3654	0.4157	0.6570	0.8605	0.9396	0.9643	(94)
Useful gains	758.5738	842.5337	908.5157	935.4567	854.2181	633.6231	424.4976	442.1703	629.0930	724.6462	721.3394	724.6538	(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	1760.4696	1716.6006	1568.6171	1323.7824	1023.8175	679.4445	434.7478	458.0277	730.5525	1104.2349	1455.4201	1751.0613	(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	745.4105	587.3730	491.1155	279.5945	126.1820	0.0000	0.0000	0.0000	0.0000	282.4140	528.5381	763.6472	(98)
Space heating												3804.2747	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2

(98) / (4) = 34.7327 (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													4226.9719 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.4105	587.3730	491.1155	279.5945	126.1820	0.0000	0.0000	0.0000	0.0000	282.4140	528.5381	763.6472	(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)	828.2339	652.6367	545.6839	310.6605	140.2022	0.0000	0.0000	0.0000	0.0000	313.7933	587.2645	848.4969	(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	89.3216	89.2617	89.1289	88.8202	88.2035	86.7000	86.7000	86.7000	86.7000	88.7997	89.1840	86.7000	(216)
Fuel for water heating, kWh/month	208.0174	182.7085	190.3722	168.7405	164.6672	146.9998	138.6419	155.6517	156.4956	175.1440	187.5318	202.1099	(219)
Water heating fuel used												2077.0806	(219)
Annual totals kWh/year													
Space heating fuel - main system												4226.9719	(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												6156.4914	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4226.9719	3.4800	147.0986 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2077.0806	3.4800	72.2824 (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			319.9177 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8695 (257)
SAP value		87.8703
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	4226.9719	0.2160	913.0259 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2077.0806	0.2160	448.6494 (264)
Space and water heating			1361.6753 (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			1285.0911 (272)
CO2 emissions per m2			11.7300 (273)
EI value			88.8564
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	$3.48 / 0.8824 = 3.944$, stars = 4
Water heating environmental impact	$0.216 / 0.8824 = 0.2448$, 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					4.6400
Infiltration rate					0.3799 (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) =				0.3229 (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	0.3390	0.3148	0.3229	0.3067	0.3067	0.2987	0.2906	0.2825	0.2744	0.2987	0.2825	0.2987 (22b)
Effective ac	0.5575	0.5496	0.5521	0.5470	0.5470	0.5446	0.5422	0.5399	0.5377	0.5446	0.5399	0.5446 (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	49.7695	49.0627	49.2925	48.8388	48.8388	48.6206	48.4083	48.2018	48.0011	48.6206	48.2018	48.6206 (38)
Average = Sum(39)m / 12 =	127.6246	126.9178	127.1476	126.6939	126.6939	126.4757	126.2634	126.0569	125.8562	126.4757	126.0569	126.4757 (39)
												126.5615 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1652	1.1587	1.1608	1.1567	1.1567	1.1547	1.1528	1.1509	1.1491	1.1547	1.1509	1.1547 (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)

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)		
Southwest					7.0800	45.1778	0.6200		0.7000	0.7700	96.2014 (79)		
Northwest					1.8000	14.6176	0.6200		0.7000	0.7700	7.9136 (81)		
Northeast					10.9700	14.6176	0.6200		0.7000	0.7700	48.2289 (75)		
Solar gains	165.0056	259.4270	411.5871	602.5209	717.5045	809.4939	759.6216	653.8647	502.4626	324.9115	201.3123	136.0570 (83)	
Total gains	824.5189	914.0207	1040.6988	1191.8844	1265.7946	1321.1788	1250.0198	1153.4245	1024.9882	887.4165	808.3157	777.0852 (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	34.9916	35.1864	35.1228	35.2486	35.2486	35.3094	35.3688	35.4267	35.4832	35.3094	35.4267	35.3094		
alpha	3.3328	3.3458	3.3415	3.3499	3.3499	3.3540	3.3579	3.3618	3.3655	3.3540	3.3618	3.3540		
util living area	0.9709	0.9587	0.9235	0.8406	0.7044	0.5106	0.3833	0.4120	0.6640	0.8737	0.9516	0.9748	(86)	
MIT	19.4100	19.5823	19.9605	20.4218	20.7647	20.9412	20.9831	20.9791	20.8571	20.4421	19.8774	19.3903	(87)	
Th 2	19.9479	19.9531	19.9515	19.9548	19.9548	19.9564	19.9580	19.9595	19.9610	19.9564	19.9595	19.9564	(88)	
util rest of house	0.9650	0.9505	0.9080	0.8090	0.6475	0.4288	0.2855	0.3082	0.5843	0.8401	0.9402	0.9696	(89)	
MIT 2	17.8594	18.1100	18.6470	19.2841	19.7225	19.9147	19.9506	19.9502	19.8430	19.3295	18.5425	17.8371	(90)	
Living area fraction	fLA = Living area / (4) =												0.2371	(91)
MIT	18.2271	18.4591	18.9584	19.5539	19.9696	20.1581	20.1954	20.1941	20.0835	19.5933	18.8590	18.2054	(92)	
Temperature adjustment													-0.1500	
adjusted MIT	18.0771	18.3091	18.8084	19.4039	19.8196	20.0081	20.0454	20.0441	19.9335	19.4433	18.7090	18.0554	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9503	0.9332	0.8868	0.8895	0.8395	0.4331	0.2939	0.3169	0.5820	0.8199	0.9217	0.9561	(94)
Useful gains	783.5815	852.9205	922.8618	940.9837	809.4411	572.1501	367.4124	365.5248	596.5036	727.5598	744.9944	742.9642	(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	1681.7196	1651.0850	1501.4090	1254.7593	927.3483	595.4609	371.8929	371.1281	658.6632	1017.2839	1362.5482	1651.1853	(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	668.2148	536.3666	430.4390	225.9184	87.7230	0.0000	0.0000	0.0000	0.0000	215.5547	444.6387	675.7165	(98)
Space heating												3284.5718	(98)

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Space heating per m2 (98) / (4) = 29.9879 (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													3649.5242 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	668.2148	536.3666	430.4390	225.9184	87.7230	0.0000	0.0000	0.0000	0.0000	215.5547	444.6387	675.7165	(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)	742.4609	595.9629	478.2656	251.0205	97.4700	0.0000	0.0000	0.0000	0.0000	239.5053	494.0430	750.7961	(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	89.2608	89.2083	89.0418	88.6542	87.9138	86.7000	86.7000	86.7000	86.7000	88.5868	89.0733	86.7000	(216)
Fuel for water heating, kWh/month	208.1592	182.8178	190.5585	169.0565	165.2098	146.9998	138.6419	155.6517	156.4956	175.5648	187.7649	202.2599	(219)
Water heating fuel used												2079.1805	(219)
Annual totals kWh/year													
Space heating fuel - main system												3649.5242	(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												5504.7286	(238)

10a. Fuel costs - using BEDF prices (438)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3649.5242	3.9200	143.0613	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2079.1805	3.9200	81.5039	(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			274.5789	(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	3649.5242	0.2160	788.2972	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2079.1805	0.2160	449.1030	(264)
Space and water heating			1237.4002	(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			1121.1566	(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	3649.5242	1.2200	4452.4195	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2079.1805	1.2200	2536.6002	(264)
Space and water heating			6989.0197	(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			6301.4131 (272)
Primary energy kWh/m2/year			57.5314 (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 (17.7%)

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 438 TEST (30 Jan 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	£313	£272	£41
Space heating	£244	£244	£0
Water heating	£82	£49	£32
Lighting	£73	£73	£0
Generated (PV)	-£123	-£123	£0
Total cost of fuels	£275	£243	£33
Total cost of uses	£276	£243	£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	58 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					4.6400
Infiltration rate					0.3799 (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) =				0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.2039	51.9101	51.6222	50.2697	50.0167	48.8388	48.8388	48.6206	49.2925	50.0167	50.5286	51.0637 (38)
Heat transfer coeff	130.0589	129.7652	129.4772	128.1248	127.8718	126.6939	126.6939	126.4757	127.1476	127.8718	128.3837	128.9188 (39)
Average = Sum(39)m / 12 =												128.1236 (39)
HLP	1.1874	1.1847	1.1821	1.1698	1.1675	1.1567	1.1567	1.1547	1.1608	1.1675	1.1721	1.1770 (40)
HLP (average)												1.1698 (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	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	11.2829	0.6200		0.7000	0.7700	9.7732 (75)		
Southwest				7.0800	36.7938	0.6200		0.7000	0.7700	78.3486 (79)		
Northwest				1.8000	11.2829	0.6200		0.7000	0.7700	6.1083 (81)		
Northeast				10.9700	11.2829	0.6200		0.7000	0.7700	37.2265 (75)		
Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207 (83)
Total gains	790.9699	896.1531	1006.4797	1135.4783	1231.6697	1221.6547	1161.7627	1063.6979	957.5706	842.1133	767.6706	751.4489 (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	34.3366	34.4143	34.4909	34.8549	34.9239	35.2486	35.2486	35.3094	35.1228	34.9239	34.7847	34.6403		
alpha	3.2891	3.2943	3.2994	3.3237	3.3283	3.3499	3.3499	3.3540	3.3415	3.3283	3.3190	3.3094		
util living area	0.9768	0.9639	0.9363	0.8715	0.7553	0.5958	0.4576	0.5116	0.7349	0.9070	0.9644	0.9801	(86)	
MIT	19.2365	19.4547	19.8200	20.2900	20.6719	20.8945	20.9672	20.9523	20.7797	20.2828	19.6787	19.1938	(87)	
Th 2	19.9301	19.9322	19.9343	19.9443	19.9461	19.9548	19.9548	19.9564	19.9515	19.9461	19.9424	19.9384	(88)	
util rest of house	0.9721	0.9568	0.9234	0.8452	0.7061	0.5180	0.3578	0.4089	0.6649	0.8819	0.9561	0.9761	(89)	
MIT 2	17.5973	17.9130	18.4371	19.0998	19.6032	19.8700	19.9373	19.9288	19.7521	19.1066	18.2470	17.5407	(90)	
Living area fraction									fLA = Living area / (4) =			0.2371	(91)	
MIT	17.9859	18.2785	18.7650	19.3820	19.8566	20.1129	20.1815	20.1715	19.9957	19.3855	18.5865	17.9327	(92)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment
adjusted MIT 17.8359 18.1285 18.6150 19.2320 19.7066 19.9629 20.0315 20.0215 19.8457 19.2355 18.4365 -0.1500
17.7827 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9590	0.9402	0.9027	0.8238	0.6935	0.5187	0.3654	0.4157	0.6570	0.8605	0.9396	0.9643	(94)
Useful gains	758.5738	842.5337	908.5157	935.4567	854.2181	633.6231	424.4976	442.1703	629.0930	724.6462	721.3394	724.6538	(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	1760.4696	1716.6006	1568.6171	1323.7824	1023.8175	679.4445	434.7478	458.0277	730.5525	1104.2349	1455.4201	1751.0613	(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	745.4105	587.3730	491.1155	279.5945	126.1820	0.0000	0.0000	0.0000	0.0000	282.4140	528.5381	763.6472	(98)
Space heating												3804.2747	(98)
Space heating per m2												34.7327	(99)
												(98) / (4) =	

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 4226.9719 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	745.4105	587.3730	491.1155	279.5945	126.1820	0.0000	0.0000	0.0000	0.0000	282.4140	528.5381	763.6472	(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)	828.2339	652.6367	545.6839	310.6605	140.2022	0.0000	0.0000	0.0000	0.0000	313.7933	587.2645	848.4969	(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	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)
Efficiency of water heater (217)m	89.3974	89.4197	89.4359	89.4557	89.4220	86.7000	86.7000	86.7000	86.7000	89.1041	89.2998	86.7000	(216)
Fuel for water heating, kWh/month	179.4496	135.0201	109.0644	59.4731	28.8632	11.5663	4.9982	38.8866	65.0451	113.7806	153.5755	178.2129	(219)
Water heating fuel used												1077.9357	(219)
Annual totals kWh/year													
Space heating fuel - main system												4226.9719	(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 * 1004 * 1.00) =									-650.5895			-650.5895	(233)
Total delivered energy for all uses												5207.3465	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4226.9719	3.4800	147.0986	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1077.9357	3.4800	37.5122	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	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			291.7425	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
 Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.7929 (257)
 SAP value 88.9386
 SAP rating (Section 12) 89 (258)
 SAP band B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	4226.9719	0.2160	913.0259	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1077.9357	0.2160	232.8341	(264)
Space and water heating			1145.8600	(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			1095.2258	(272)
CO2 emissions per m2			10.0000	(273)
EI value			90.5028	
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					4.6400
Infiltration rate					0.3799 (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) =				0.3229 (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	0.3390	0.3148	0.3229	0.3067	0.3067	0.2987	0.2906	0.2825	0.2744	0.2987	0.2825	0.2987 (22b)
Effective ac	0.5575	0.5496	0.5521	0.5470	0.5470	0.5446	0.5422	0.5399	0.5377	0.5446	0.5399	0.5446 (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	49.7695	49.0627	49.2925	48.8388	48.8388	48.6206	48.4083	48.2018	48.0011	48.6206	48.2018	48.6206 (38)
Average = Sum(39)m / 12 =	127.6246	126.9178	127.1476	126.6939	126.6939	126.4757	126.2634	126.0569	125.8562	126.4757	126.0569	126.4757 (39)
												126.5615 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1652	1.1587	1.1608	1.1567	1.1567	1.1547	1.1528	1.1509	1.1491	1.1547	1.1509	1.1547 (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												
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)	
Southwest				7.0800	45.1778	0.6200		0.7000		0.7700		96.2014 (79)	
Northwest				1.8000	14.6176	0.6200		0.7000		0.7700		7.9136 (81)	
Northeast				10.9700	14.6176	0.6200		0.7000		0.7700		48.2289 (75)	
Solar gains	165.0056	259.4270	411.5871	602.5209	717.5045	809.4939	759.6216	653.8647	502.4626	324.9115	201.3123	136.0570 (83)	
Total gains	824.5189	914.0207	1040.6988	1191.8844	1265.7946	1321.1788	1250.0198	1153.4245	1024.9882	887.4165	808.3157	777.0852 (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	34.9916	35.1864	35.1228	35.2486	35.2486	35.3094	35.3688	35.4267	35.4832	35.3094	35.4267	35.3094	
alpha	3.3328	3.3458	3.3415	3.3499	3.3499	3.3540	3.3579	3.3618	3.3655	3.3540	3.3618	3.3540	
util living area	0.9709	0.9587	0.9235	0.8406	0.7044	0.5106	0.3833	0.4120	0.6640	0.8737	0.9516	0.9748	(86)
MIT	19.4100	19.5823	19.9605	20.4218	20.7647	20.9412	20.9831	20.9791	20.8571	20.4421	19.8774	19.3903	(87)
Th 2	19.9479	19.9531	19.9515	19.9548	19.9548	19.9564	19.9580	19.9595	19.9610	19.9564	19.9595	19.9564	(88)
util rest of house	0.9650	0.9505	0.9080	0.8090	0.6475	0.4288	0.2855	0.3082	0.5843	0.8401	0.9402	0.9696	(89)
MIT 2	17.8594	18.1100	18.6470	19.2841	19.7225	19.9147	19.9506	19.9502	19.8430	19.3295	18.5425	17.8371	(90)
Living area fraction	fLA = Living area / (4) = 0.2371												(91)
MIT	18.2271	18.4591	18.9584	19.5539	19.9696	20.1581	20.1954	20.1941	20.0835	19.5933	18.8590	18.2054	(92)

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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	18.0771	18.3091	18.8084	19.4039	19.8196	20.0081	20.0454	20.0441	19.9335	19.4433	18.7090	18.0554	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9503	0.9332	0.8868	0.7895	0.6395	0.4331	0.2939	0.3169	0.5820	0.8199	0.9217	0.9561	(94)
Useful gains	783.5815	852.9205	922.8618	940.9837	809.4411	572.1501	367.4124	365.5248	596.5036	727.5598	744.9944	742.9642	(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													
	1681.7196	1651.0850	1501.4090	1254.7593	927.3483	595.4609	371.8929	371.1281	658.6632	1017.2839	1362.5482	1651.1853	(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													
	668.2148	536.3666	430.4390	225.9184	87.7230	0.0000	0.0000	0.0000	0.0000	215.5547	444.6387	675.7165	(98)
Space heating													3284.5718 (98)
Space heating per m2											(98) / (4) =	29.9879	(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													3649.5242 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	668.2148	536.3666	430.4390	225.9184	87.7230	0.0000	0.0000	0.0000	0.0000	215.5547	444.6387	675.7165	(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)	742.4609	595.9629	478.2656	251.0205	97.4700	0.0000	0.0000	0.0000	0.0000	239.5053	494.0430	750.7961	(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 (217)m	89.3560	89.3746	89.3743	89.3650	89.1331	86.7000	86.7000	86.7000	86.7000	88.9478	89.2222	86.7000	(216)
Fuel for water heating, kWh/month	174.6696	135.1828	108.5608	58.0230	33.7785	5.1524	0.0000	31.3640	59.1869	109.2765	148.0455	174.7287	(219)
Water heating fuel used												1037.9689	(219)
Annual totals kWh/year													
Space heating fuel - main system												3649.5242	(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												4513.5170	(238)

10a. Fuel costs - using BEDF prices (438)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3649.5242	3.9200	143.0613	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1037.9689	3.9200	40.6884	(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			242.2434	(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	3649.5242	0.2160	788.2972	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1037.9689	0.2160	224.2013	(264)
Space and water heating			1012.4985	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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			922.2049 (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	3649.5242	1.2200	4452.4195 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1037.9689	1.2200	1266.3220 (264)
Space and water heating			5718.7416 (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			5184.6350 (272)
Primary energy kWh/m2/year			47.3353 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-190	Issued on Date	25/03/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)
Property	79, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.18	TER	16.71
Environmental	89 B	% DER<TER	21.11		
CO ₂ Emissions (t/year)	1.12	DFEE	47.48	TFEE	52.13
General Requirements Compliance	Pass	% DFEE<TFEE	8.92		

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 West	0.000	1.000	None
North 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 West	1.000	0.90	1.000	0.900 (P8)
North 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 West	7.0800	127.3119	0.6200	0.7000	0.9000	316.8669
North West	1.8000	106.0502	0.6200	0.7000	0.9000	67.1056
North East	10.9700	106.0502	0.6200	0.7000	0.9000	408.9714
total:						900.3129

	Jun	Jul	Aug	
Solar gains	975	900	772	(P3)
Internal gains	509	487	497	
Total summer gains	1484	1388	1269	(P5)
Summer gain/loss ratio	3.41	3.19	2.92	(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	19.78	21.46	21.19	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			