

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-186				Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)			
Property	71, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	87 B	DER	14.54	TER	19.26	
Environmental	89 B	% DER<TER	24.51			
CO ₂ Emissions (t/year)	0.90	DFEE	52.40	TFEE	56.61	
General Requirements Compliance	Pass	% DFEE<TFEE	7.44			
Assessor	Silvio Junges, Tel: 01884 242050				Assessor ID	P637-0001
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 82 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) 19.26 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.54 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.30 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.60 (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: 4.34 (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 East: 6.33 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.12 W/m²K
Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Thermal bridging y-value 0.035 W/m²K
Photovoltaic array

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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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.3400
Infiltration rate					0.3707 (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) =		0.3151 (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	0.4018	0.3939	0.3860	0.3466	0.3388	0.2994	0.2994	0.2915	0.3151	0.3388	0.3545	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5628	0.5686 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.5285			(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss						(33) + (36) =	66.9929 (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	37.3944	37.1926	36.9947	36.0655	35.8916	35.0823	35.0823	34.9324	35.3941	35.8916	36.2434	36.6111 (38)
Heat transfer coeff	104.3873	104.1855	103.9877	103.0584	102.8846	102.0752	102.0752	101.9253	102.3870	102.8846	103.2363	103.6040 (39)
Average = Sum(39)m / 12 =												103.0576 (39)
HLP	1.2753	1.2729	1.2705	1.2591	1.2570	1.2471	1.2471	1.2453	1.2509	1.2570	1.2613	1.2658 (40)
HLP (average)												1.2591 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (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	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (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	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (65)
Total per year (kWh/year) = Sum (64)m =												1716.8894 (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	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851 (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)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	383.2468	381.0135	367.1356	344.8462	322.2396	300.5423	286.5323	292.6897	304.2295	326.7324	352.5183	371.8299 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East				3.1800	19.6403		0.6200	0.7000	0.7700		18.7844 (76)	
West				4.7500	19.6403		0.6200	0.7000	0.7700		28.0585 (80)	
East				3.1500	19.6403		0.6200	0.7000	0.7700		18.6072 (76)	
East				0.4300	25.9287		0.6300	0.7000	1.0000		4.4252 (82)	

Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398 (83)
Total gains	453.1220	517.9013	593.0735	675.1742	727.8034	716.0376	681.9656	631.8667	567.2666	489.2923	439.6796	429.2697 (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	39.7401	39.8170	39.8928	40.2525	40.3205	40.6402	40.6402	40.7000	40.5165	40.3205	40.1831	40.0405
alpha	3.6493	3.6545	3.6595	3.6835	3.6880	3.7093	3.7093	3.7133	3.7011	3.6880	3.6789	3.6694
util living area	0.9946	0.9905	0.9798	0.9493	0.8792	0.7501	0.6031	0.6583	0.8641	0.9689	0.9910	0.9956 (86)
MIT	19.1672	19.3481	19.6846	20.1375	20.5488	20.8343	20.9460	20.9245	20.6916	20.1516	19.5787	19.1341 (87)
Th 2	19.8602	19.8621	19.8640	19.8730	19.8747	19.8825	19.8825	19.8840	19.8795	19.8747	19.8713	19.8677 (88)
util rest of house	0.9931	0.9880	0.9741	0.9338	0.8396	0.6649	0.4728	0.5310	0.8036	0.9566	0.9882	0.9944 (89)
MIT 2	17.4216	17.6863	18.1760	18.8301	19.3950	19.7506	19.8561	19.8430	19.5957	18.8609	18.0297	17.3779 (90)
Living area fraction	17.7639	18.0122	18.4718	19.0864	19.6213	19.9631	20.0698	20.0550	19.8106	19.1140	18.3335	17.7222 (92)
Temperature adjustment	17.6139	17.8622	18.3218	18.9364	19.4713	19.8131	19.9198	19.9050	19.6606	18.9640	18.1835	-0.1500
adjusted MIT	17.6139	17.8622	18.3218	18.9364	19.4713	19.8131	19.9198	19.9050	19.6606	18.9640	18.1835	17.5722 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	447.9821	508.1717	571.0228	618.8111	598.2692	471.7712	325.6398	337.2054	447.4109	460.9725	431.5624	425.2300 (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	1389.8029	1350.4736	1229.3186	1034.3394	799.5454	532.1309	338.8667	357.2534	569.3342	860.5247	1144.2156	1385.4181 (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)

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Space heating kWh	700.7147	566.0269	489.7720	299.1804	149.7495	0.0000	0.0000	0.0000	0.0000	297.2669	513.1103	714.3799 (98)
Space heating												3730.2007 (98)
Space heating per m2												(98) / (4) = 45.5736 (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												4144.6674 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	700.7147	566.0269	489.7720	299.1804	149.7495	0.0000	0.0000	0.0000	0.0000	297.2669	513.1103	714.3799 (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)	778.5719	628.9188	544.1911	332.4227	166.3883	0.0000	0.0000	0.0000	0.0000	330.2965	570.1226	793.7555 (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	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Efficiency of water heater	89.3251	89.2793	89.1698	88.9201	88.3989	86.7000	86.7000	86.7000	86.7000	88.8882	89.2071	86.7000 (216)
(217)m	89.3251	89.2793	89.1698	88.9201	88.3989	86.7000	86.7000	86.7000	86.7000	88.8882	89.2071	89.3503 (217)
Fuel for water heating, kWh/month	194.2905	170.6620	177.8511	157.6653	153.8000	137.7618	130.0815	145.8253	146.5486	163.6783	175.2266	188.8261 (219)
Water heating fuel used												1942.2171 (219)
Annual totals kWh/year												
Space heating fuel - main system												4144.6674 (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)												376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097 (233)
Total delivered energy for all uses												5845.8973 (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	4144.6674	0.2160	895.2482 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.2171	0.2160	419.5189 (264)
Space and water heating			1314.7671 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total CO2, kg/year			1189.6947 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5400 (273)

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

DER			14.5400 ZC1
Total Floor Area		TFA	81.8500
Assumed number of occupants		N	2.4970
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1639 ZC2
CO2 emissions from cooking, equation (L16)			2.1861 ZC3
Total CO2 emissions			32.8899 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			32.8899 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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (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					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4037 (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) =				0.3432 (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	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Opening Type (Uw = 1.40)			11.0800	1.3258	14.6894		(27)
TER Room Window (Uw = 1.70)			0.4300	1.5918	0.6845		(27a)
Jet Floor Lo			31.5600	0.1300	4.1028		(28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.1800	21.3120		(29a)
Dormer Cheek	2.7200		2.7200	0.1800	0.4896		(29a)
Wall to void	9.1300		9.1300	0.1800	1.6434		(29a)
Plane	8.0700		8.0700	0.1300	1.0491		(30)
Plane GF	2.0000		2.0000	0.1300	0.2600		(30)
Plane 2 void	8.8300		8.8300	0.1300	1.1479		(30)
Slope	15.1900	0.4300	14.7600	0.1300	1.9188		(30)
Dorm Roof	1.6400		1.6400	0.1300	0.2132		(30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4707		(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)							10.6035 (36)
Total fabric heat loss						(33) + (36) =	60.0742 (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	38.3609	38.1215	37.8869	36.7849	36.5787	35.6189	35.6189	35.4411	35.9886	36.5787	36.9958	37.4319 (38)
Heat transfer coeff	98.4351	98.1957	97.9611	96.8590	96.6529	95.6930	95.6930	95.5153	96.0627	96.6529	97.0700	97.5060 (39)
Average = Sum(39)m / 12 =												96.8581 (39)
HLP	1.2026	1.1997	1.1968	1.1834	1.1809	1.1691	1.1691	1.1670	1.1736	1.1809	1.1859	1.1913 (40)
HLP (average)												1.1834 (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												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)										Total =	Sum (45)m =	1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (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	50.9589	45.6199	48.6018	45.1895	44.7899	41.5006	42.8839	44.7899	45.1895	48.6018	48.8785	50.9589 (61)
Total heat required for water heating calculated for each month	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (64)
Heat gains from water heating, kWh/month	63.4562	55.7619	57.9228	51.2029	49.4877	43.4167	41.3389	46.3319	46.8515	53.5853	57.4490	61.8559 (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	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851 (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)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	85.2906	82.9790	77.8533	71.1151	66.5158	60.3010	55.5630	62.2741	65.0715	72.0233	79.7903	83.1397 (72)
Total internal gains	393.3071	390.9311	376.4346	353.5302	330.3011	307.9847	293.9877	300.7633	312.9314	336.0493	362.4461	381.8971 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East				6.3300	19.6403	0.6300	0.7000	0.7700		37.9947 (76)		
West				4.7500	19.6403	0.6300	0.7000	0.7700		28.5110 (80)		
East				0.4300	25.9287	0.6300	0.7000	1.0000		4.4252 (82)		

Solar gains	70.9309	138.9528	229.3388	335.2880	411.6424	421.7178	401.3574	344.2657	266.9925	165.0103	88.4775	58.3079 (83)
Total gains	464.2380	529.8839	605.7734	688.8182	741.9436	729.7026	695.3450	645.0290	579.9239	501.0596	450.9236	440.2050 (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	57.7439	57.8847	58.0233	58.6835	58.8087	59.3986	59.3986	59.5091	59.1700	58.8087	58.5560	58.2941
alpha	4.8496	4.8590	4.8682	4.9122	4.9206	4.9599	4.9599	4.9673	4.9447	4.9206	4.9037	4.8863
util living area	0.9984	0.9967	0.9909	0.9683	0.9000	0.7520	0.5846	0.6453	0.8821	0.9834	0.9969	0.9988 (86)
MIT	19.6585	19.8028	20.0669	20.4241	20.7363	20.9272	20.9834	20.9735	20.8272	20.4153	19.9743	19.6352 (87)
Th 2	19.9179	19.9202	19.9225	19.9333	19.9353	19.9448	19.9448	19.9465	19.9411	19.9353	19.9313	19.9270 (88)
util rest of house	0.9979	0.9956	0.9875	0.9556	0.8589	0.6600	0.4550	0.5148	0.8178	0.9746	0.9956	0.9984 (89)
MIT 2	18.1300	18.3424	18.7283	19.2477	19.6701	19.8948	19.9385	19.9353	19.7958	19.2436	18.6013	18.1022 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.4297	18.6288	18.9907	19.4784	19.8792	20.0972	20.1434	20.1389	19.9980	19.4733	18.8705	18.4028 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4297	18.6288	18.9907	19.4784	19.8792	20.0972	20.1434	20.1389	19.9980	19.4733	18.8705	18.4028 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9935	0.9833	0.9485	0.8563	0.6746	0.4805	0.5401	0.8220	0.9692	0.9936	0.9975 (94)
Ext temp.	462.7243	526.4274	595.6298	653.3276	635.3479	492.2806	334.0820	348.4103	476.6717	485.6205	448.0536	439.0936 (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	1390.8581	1348.1046	1223.6070	1024.6123	790.5411	526.0478	339.0818	357.1202	566.5813	857.6333	1142.5627	1384.8598 (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	690.5315	552.1670	467.2150	267.3250	115.4638	0.0000	0.0000	0.0000	0.0000	276.7775	500.0466	703.6501 (98)
Space heating per m2												3573.1765 (98)
										(98) / (4) =		43.6552 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3825.6708 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	690.5315	552.1670	467.2150	267.3250	115.4638	0.0000	0.0000	0.0000	0.0000	276.7775	500.0466	703.6501 (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)	739.3271	591.1853	500.2302	286.2152	123.6229	0.0000	0.0000	0.0000	0.0000	296.3357	535.3818	753.3727 (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	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (64)
Efficiency of water heater (217)m	87.8840	87.6993	87.2712	86.2561	84.2461	80.3000	80.3000	80.3000	80.3000	86.2253	87.4313	80.3000 (216)
Fuel for water heating, kWh/month	231.5434	204.1342	213.4301	191.5295	189.8588	175.4343	168.0794	187.3692	189.4385	200.8899	211.4879	225.8617 (219)
Water heating fuel used												2389.0569 (219)
Annual totals kWh/year												
Space heating fuel - main system												3825.6708 (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)												376.1224 (232)
Total delivered energy for all uses												6665.8501 (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	3825.6708	0.2160	826.3449 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2389.0569	0.2160	516.0363 (264)
Space and water heating			1342.3812 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Total CO2, kg/m2/year			1576.5137 (272)
Emissions per m2 for space and water heating			16.4005 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3849 (272b)
Emissions per m2 for pumps and fans			0.4756 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4005 * 1.00) + 2.3849 + 0.4756, rounded to 2 d.p.			19.2600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-186	Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)
Property	71, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	87 B	DER	14.54
Environmental	89 B	% DER<TER	24.51
CO ₂ Emissions (t/year)	0.90	DFEE	52.40
General Requirements Compliance	Pass	% DFEE<TFEE	7.44
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (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					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.3400
Infiltration rate					0.3707 (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) =				0.3151 (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	0.4018	0.3939	0.3860	0.3466	0.3388	0.2994	0.2994	0.2915	0.3151	0.3388	0.3545	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5628	0.5686 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek			2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void			9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane			8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF			2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void			8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope		0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof			1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			9.0000	470.6100 (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) = 14463.4800 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 176.7071 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4644 (36)
 Total fabric heat loss (33) + (36) = 66.9929 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.3944	37.1926	36.9947	36.0655	35.8916	35.0823	35.0823	34.9324	35.3941	35.8916	36.2434	36.6111
Average = Sum(39)m / 12 =	104.3873	104.1855	103.9877	103.0584	102.8846	102.0752	102.0752	101.9253	102.3870	102.8846	103.2363	103.6040
HLP	1.2753	1.2729	1.2705	1.2591	1.2570	1.2471	1.2471	1.2453	1.2509	1.2570	1.2613	1.2658
HLP (average)												1.2591
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548
Energy content (annual)	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179
Distribution loss (46)m = $0.15 \times (45)\text{m}$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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
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
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
Heat gains from water heating, kWh/month	32.4128	28.3484	29.2530	25.5035	24.4712	21.1168	19.5678	22.4544	22.7225	26.4809	28.9060	31.3900

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125
Pumps, fans	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water heating gains (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811
Total internal gains	43.5656	42.1852	39.3186	35.4215	32.8914	29.3289	26.3008	30.1806	31.5591	35.5926	40.1472	42.1909

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.1800	19.6403	0.6200	0.7000	0.7700	18.7844
West	4.7500	19.6403	0.6200	0.7000	0.7700	28.0585
East	3.1500	19.6403	0.6200	0.7000	0.7700	18.6072
East	0.4300	25.9287	0.6300	0.7000	1.0000	4.4252
Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953
Total gains	418.4573	484.0249	560.8378	645.1647	699.2406	689.5079

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.4877	38.5623	38.6357	38.9840	39.0499	39.3595	39.3595	39.4174	39.2397	39.0499	38.9169	38.7788
util living area	3.5658	3.5708	3.5757	3.5989	3.6033	3.6240	3.6240	3.6278	3.6160	3.6033	3.5945	3.5853
MIT	0.9953	0.9916	0.9815	0.9527	0.8862	0.7621	0.6177	0.6752	0.8748	0.9724	0.9923	0.9962
Th 2	19.0756	19.2622	19.6098	20.0793	20.5089	20.8134	20.9369	20.9117	20.6579	20.0918	19.4995	19.0424
util rest of house	19.8602	19.8621	19.8640	19.8730	19.8747	19.8825	19.8825	19.8840	19.8795	19.8747	19.8713	19.8677
MIT 2	0.9941	0.9994	0.9764	0.9383	0.8486	0.6791	0.4871	0.5487	0.8180	0.9615	0.9898	0.9952

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.2974	18.4845	18.8312	19.2984	19.7090	19.9817	20.0717	20.0582	19.8557	19.3169	18.7272	18.2688 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2974	18.4845	18.8312	19.2984	19.7090	19.9817	20.0717	20.0582	19.8557	19.3169	18.7272	18.2688 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9856	0.9701	0.9290	0.8420	0.6874	0.5111	0.5707	0.8166	0.9542	0.9864	0.9932	(94)
Useful gains	414.9888	477.0685	544.0562	599.3860	588.7591	473.9841	335.8954	345.1888	440.5047	438.1306	401.4148	392.7012	(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													
Month fracti	1461.1516	1415.3067	1282.2880	1071.6465	824.0057	549.3406	354.3743	372.8667	589.3093	896.8294	1200.3533	1457.5828	(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	778.3451	630.4961	549.2445	340.0276	175.0235	0.0000	0.0000	0.0000	0.0000	341.2719	575.2357	792.2719	(98)
Space heating per m2												4181.9163	(98)
										(98) / (4) =		51.0924	(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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	959.5071	755.3567	774.6326	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7556	0.8296	0.7948	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	724.9651	626.6331	615.6642	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	894.7511	855.3141	796.6884	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	122.2459	170.1386	134.6820	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												427.0666	(104)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	30.5615	42.5347	33.6705	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling												0.0000	(107)
Space cooling per m2												106.7666	(107)
Energy for space heating												1.3044	(108)
Energy for space cooling												51.0924	(99)
Total												1.3044	(108)
Dwelling Fabric Energy Efficiency (DFEE)												52.3969	(109)
												52.4	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4037 (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) =				0.3432 (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	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Opening Type (Uw = 1.40)			11.0800	1.3258	14.6894		(27)
TER Room Window (Uw = 1.70)			0.4300	1.5918	0.6845		(27a)
Jet Floor Lo			31.5600	0.1300	4.1028		(28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.1800	21.3120		(29a)
Dormer Cheek	2.7200		2.7200	0.1800	0.4896		(29a)
Wall to void	9.1300		9.1300	0.1800	1.6434		(29a)
Plane	8.0700		8.0700	0.1300	1.0491		(30)
Plane GF	2.0000		2.0000	0.1300	0.2600		(30)
Plane 2 void	8.8300		8.8300	0.1300	1.1479		(30)
Slope	15.1900	0.4300	14.7600	0.1300	1.9188		(30)
Dorm Roof	1.6400		1.6400	0.1300	0.2132		(30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4707		(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)							10.6035 (36)
Total fabric heat loss						(33) + (36) =	60.0742 (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	38.3609	38.1215	37.8869	36.7849	36.5787	35.6189	35.6189	35.4411	35.9886	36.5787	36.9958	37.4319 (38)
Heat transfer coeff	98.4351	98.1957	97.9611	96.8590	96.6529	95.6930	95.6930	95.5153	96.0627	96.6529	97.0700	97.5060 (39)
Average = Sum(39)m / 12 =												96.8581 (39)
HLP	1.2026	1.1997	1.1968	1.1834	1.1809	1.1691	1.1691	1.1670	1.1736	1.1809	1.1859	1.1913 (40)
HLP (average)												1.1834 (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												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)										Total =	Sum(45)m =	1471.1879 (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												
	32.4128	28.3484	29.2530	25.5035	24.4712	21.1168	19.5678	22.4544	22.7225	26.4809	28.9060	31.3900 (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	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851 (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)												
	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)												
	43.5656	42.1852	39.3186	35.4215	32.8914	29.3289	26.3008	30.1806	31.5591	35.5926	40.1472	42.1909 (72)
Total internal gains												
	348.5821	347.1372	334.8999	314.8367	293.6768	274.0126	261.7255	265.6698	276.4190	296.6187	319.8030	337.9484 (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	
East		6.3300	19.6403	0.6300	0.7000	0.7700	37.9947 (76)
West		4.7500	19.6403	0.6300	0.7000	0.7700	28.5110 (80)
East		0.4300	25.9287	0.6300	0.7000	1.0000	4.4252 (82)

Solar gains	70.9309	138.9528	229.3388	335.2880	411.6424	421.7178	401.3574	344.2657	266.9925	165.0103	88.4775	58.3079 (83)
Total gains	419.5129	486.0900	564.2387	650.1247	705.3192	695.7305	663.0829	609.9355	543.4115	461.6290	408.2805	396.2563 (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	57.7439	57.8847	58.0233	58.6835	58.8087	59.3986	59.3986	59.5091	59.1700	58.8087	58.5560	58.2941
alpha	4.8496	4.8590	4.8682	4.9122	4.9206	4.9599	4.9599	4.9673	4.9447	4.9206	4.9037	4.8863
util living area												
	0.9990	0.9978	0.9932	0.9746	0.9143	0.7751	0.6089	0.6744	0.9027	0.9881	0.9980	0.9993 (86)
MIT	19.6080	19.7538	20.0216	20.3860	20.7102	20.9163	20.9802	20.9679	20.8031	20.3735	19.9264	19.5854 (87)
Th 2	19.9179	19.9202	19.9225	19.9333	19.9353	19.9448	19.9448	19.9465	19.9411	19.9353	19.9313	19.9270 (88)
util rest of house												
	0.9987	0.9969	0.9906	0.9640	0.8771	0.6848	0.4759	0.5417	0.8448	0.9816	0.9972	0.9990 (89)
MIT 2	18.6468	18.7941	19.0625	19.4293	19.7330	19.9047	19.9396	19.9370	19.8246	19.4229	18.9755	18.6314 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.8353	18.9823	19.2506	19.6169	19.9246	20.1031	20.1437	20.1391	20.0165	19.6093	19.1620	18.8185 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8353	18.9823	19.2506	19.6169	19.9246	20.1031	20.1437	20.1391	20.0165	19.6093	19.1620	18.8185 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9982	0.9960	0.9884	0.9600	0.8767	0.6998	0.5023	0.5678	0.8499	0.9788	0.9963	0.9986 (94)
Useful gains	418.7396	484.1251	557.7156	624.0935	618.3348	486.8935	333.0380	346.3310	461.8341	451.8487	406.7602	395.7065 (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												
	1430.7830	1382.8215	1249.0594	1038.0270	794.9349	526.6058	339.1030	357.1431	568.3515	870.7727	1170.8551	1425.3894 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	752.9603	603.9240	514.3598	298.0321	131.3905	0.0000	0.0000	0.0000	0.0000	311.6795	550.1483	766.0841 (98)
Space heating												3928.5785 (98)
Space heating per m2										(98) / (4) =		47.9973 (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												

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	899.5145	708.1284	725.9162	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8334	0.9026	0.8713	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	749.6278	639.1269	632.4957	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	902.0243	862.2384	802.6363	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	109.7255	165.9950	126.5846	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			402.3050 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	27.4314	41.4987	31.6461	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												100.5763 (107)
Energy for space heating												1.2288 (108)
Energy for space cooling												47.9973 (99)
Total												1.2288 (108)
Target Fabric Energy Efficiency (TFEE)												49.2261 (109)
												56.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-186	Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)
Property	71, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	87 B	DER	14.54
TER			19.26
Environmental	89 B	% DER<TER	24.51
CO ₂ Emissions (t/year)	0.90	DFEE	52.40
TREE			56.61
General Requirements Compliance	Pass	% DFEE<TFEE	7.44
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (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					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.3400
Infiltration rate					0.3707 (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) =				0.3151 (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	0.3309	0.3073	0.3151	0.2994	0.2994	0.2915	0.2836	0.2757	0.2679	0.2915	0.2757	0.2915 (22b)
Effective ac	0.5547	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek			2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void			9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane			8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF			2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void			8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope		0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof			1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (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) = 14934.0900 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 182.4568 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4644 (36)
 Total fabric heat loss (33) + (36) = 66.9929 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.7218	35.2362	35.3941	35.0823	35.0823	34.9324	34.7866	34.6447	34.5068	34.9324	34.6447	34.9324
Average = Sum(39)m / 12 =	102.7147	102.2291	102.3870	102.0752	102.0752	101.9253	101.7795	101.6376	101.4997	101.9253	101.6376	101.9253
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2549	1.2490	1.2509	1.2471	1.2471	1.2453	1.2435	1.2418	1.2401	1.2453	1.2418	1.2453
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179
Energy content (annual)	Total = Sum(45)m =											
Distribution loss (46)m = $0.15 \times (45)\text{m}$	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577
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
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
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166
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
Output from w/h	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166
RHI water heating demand	Total per year (kWh/year) = Sum(64)m =											
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792
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
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421

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
East	3.1800	25.1925	0.6200	0.7000	0.7700	24.0947 (76)
West	4.7500	25.1925	0.6200	0.7000	0.7700	35.9906 (80)
East	3.1500	25.1925	0.6200	0.7000	0.7700	23.8674 (76)
East	0.4300	33.4886	0.6300	0.7000	1.0000	5.7154 (82)
Solar gains	89.6681	149.4298	247.9665	363.2022	422.4704	469.5761
Total gains	656.7912	711.8889	788.3733	869.5921	894.1152	910.2268

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	40.3872	40.5790	40.5165	40.6402	40.6402	40.7000	40.7583	40.8152	40.8706	40.7000	40.8152	40.7000
	3.6925	3.7053	3.7011	3.7093	3.7093	3.7133	3.7172	3.7210	3.7247	3.7133	3.7210	3.7133

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

util living area	0.9798	0.9720	0.9476	0.8874	0.7757	0.5887	0.4442	0.4651	0.7183	0.9049	0.9657	0.9824 (86)
MIT	19.5611	19.6977	20.0215	20.4261	20.7516	20.9356	20.9827	20.9799	20.8616	20.4771	19.9734	19.5473 (87)
Th 2	19.8763	19.8810	19.8795	19.8825	19.8825	19.8840	19.8854	19.8867	19.8881	19.8840	19.8867	19.8840 (88)
util rest of house	0.9748	0.9651	0.9342	0.8578	0.7158	0.4914	0.3238	0.3402	0.6298	0.8724	0.9556	0.9779 (89)
MIT 2	18.0027	18.2024	18.6638	19.2266	19.6451	19.8422	19.8791	19.8793	19.7816	19.3099	18.6065	17.9883 (90)
Living area fraction	18.3083	18.4956	18.9300	19.4618	19.8621	20.0566	20.0955	20.0951	fLA = Living area / (4) =			0.1961 (91)
MIT	18.3083	18.4956	18.9300	19.4618	19.8621	20.0566	20.0955	20.0951	19.9934	19.5388	18.8745	18.2940 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1583	18.3456	18.7800	19.3118	19.7121	19.9066	19.9455	19.9451	19.8434	19.3888	18.7245	18.1440 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9638	0.9520	0.9170	0.8394	0.7054	0.4935	0.3305	0.3470	0.6258	0.8541	0.9410	0.9678 (94)	
Useful gains	632.9927	677.6833	722.9034	729.9730	630.7154	449.1716	286.3090	285.3053	472.7144	577.7964	597.1651	604.0904 (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	1361.8229	1333.6378	1206.1221	1001.5421	736.1765	469.5295	289.6105	289.1736	522.0545	814.2617	1100.1775	1339.7068 (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	542.2496	440.8014	359.5147	195.5298	78.4630	0.0000	0.0000	0.0000	0.0000	175.9301	362.1690	547.2986 (98)	
Space heating												2701.9563 (98)	
RHI space heating demand												2702 (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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.3400
Infiltration rate					0.3707 (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) =				0.3151 (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	0.4018	0.3939	0.3860	0.3466	0.3388	0.2994	0.2994	0.2915	0.3151	0.3388	0.3545	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5628	0.5686 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss	(33) + (36) =						66.9929 (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	37.3944	37.1926	36.9947	36.0655	35.8916	35.0823	35.0823	34.9324	35.3941	35.8916	36.2434	36.6111 (38)
Heat transfer coeff	104.3873	104.1855	103.9877	103.0584	102.8846	102.0752	102.0752	101.9253	102.3870	102.8846	103.2363	103.6040 (39)
Average = Sum(39)m / 12 =												103.0576 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2753	1.2729	1.2705	1.2591	1.2570	1.2471	1.2471	1.2453	1.2509	1.2570	1.2613	1.2658 (40)
HLP (average)												1.2591 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (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	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month												
	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (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	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
												Total per year (kWh/year) = Sum (64)m = 1716.8894 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (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	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (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)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
East				3.1800	19.6403	0.6200	0.7000	0.7700				18.7844 (76)
West				4.7500	19.6403	0.6200	0.7000	0.7700				28.0585 (80)
East				3.1500	19.6403	0.6200	0.7000	0.7700				18.6072 (76)
East				0.4300	25.9287	0.6300	0.7000	1.0000				4.4252 (82)
Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398 (83)
Total gains	636.9984	699.3468	766.3447	836.7179	877.2086	856.1460	818.1099	770.4418	714.0161	647.7694	610.2950	609.1819 (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	39.7401	39.8170	39.8928	40.2525	40.3205	40.6402	40.6402	40.7000	40.5165	40.3205	40.1831	40.0405
alpha	3.6493	3.6545	3.6595	3.6835	3.6880	3.7093	3.7093	3.7133	3.7011	3.6880	3.6789	3.6694
util living area	0.9837	0.9758	0.9568	0.9105	0.8195	0.6710	0.5205	0.5669	0.7831	0.9315	0.9748	0.9861 (86)
MIT	19.4168	19.5884	19.9006	20.3096	20.6612	20.8875	20.9668	20.9542	20.7899	20.3357	19.8051	19.3804 (87)
Th 2	19.8602	19.8621	19.8640	19.8730	19.8747	19.8825	19.8825	19.8840	19.8795	19.8747	19.8713	19.8677 (88)
util rest of house	0.9798	0.9698	0.9458	0.8866	0.7698	0.5825	0.4006	0.4465	0.7080	0.9081	0.9675	0.9827 (89)
MIT 2	17.7831	18.0324	18.4818	19.0621	19.5290	19.7978	19.8672	19.8608	19.6994	19.1115	18.3547	17.7354 (90)
Living area fraction	18.1035	18.3375	18.7600	19.3067	19.7510	20.0115	20.0828	20.0752	19.9133	19.3515	18.6391	18.0579 (92)
Temperature adjustment	17.9535	18.1875	18.6100	19.1567	19.6010	19.8615	19.9328	19.9252	19.7633	19.2015	18.4891	-0.1500
adjusted MIT	17.9535	18.1875	18.6100	19.1567	19.6010	19.8615	19.9328	19.9252	19.7633	19.2015	18.4891	17.9079 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9700	0.9574	0.9294	0.8676	0.7558	0.5807	0.4063	0.4513	0.6989	0.8896	0.9548	0.9739 (94)
Ext temp.	617.9024	669.5712	712.2779	725.9128	662.9728	497.1311	332.4041	347.7012	499.0435	576.2758	582.7124	593.2969 (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	1425.2508	1384.3657	1259.2904	1057.0434	812.8953	537.0691	340.1976	359.3068	579.8465	884.9642	1175.7695	1420.1959 (97)
	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	600.6672	480.3419	406.9773	238.4140	111.5424	0.0000	0.0000	0.0000	0.0000	229.6642	427.0011	615.2128 (98)
Space heating												3109.8209 (98)
Space heating per m2											(98) / (4) =	37.9941 (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												3455.3565 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	600.6672	480.3419	406.9773	238.4140	111.5424	0.0000	0.0000	0.0000	0.0000	229.6642	427.0011	615.2128 (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)	667.4080	533.7132	452.1970	264.9045	123.9360	0.0000	0.0000	0.0000	0.0000	255.1824	474.4457	683.5698 (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	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Efficiency of water heater (217)m	89.2386	89.1826	89.0496	88.7492	88.1568	86.7000	86.7000	86.7000	86.7000	88.6908	89.0913	86.7000 (216)
Fuel for water heating, kWh/month	194.4788	170.8471	178.0912	157.9689	154.2224	137.7618	130.0815	145.8253	146.5486	164.0426	175.4545	188.9986 (219)
Water heating fuel used												1944.3213 (219)
Annual totals kWh/year												
Space heating fuel - main system												3455.3565 (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)												376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097 (233)
Total delivered energy for all uses												5158.6905 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3455.3565	3.4800	120.2464 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1944.3213	3.4800	67.6624 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	376.1224	13.1900	49.6105 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-692.1097	13.1900	-91.2893 (252)
Total energy cost			276.1226 (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] =	0.9142 (257)
SAP value		87.2463
SAP rating (Section 12)		87 (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	3455.3565	0.2160	746.3570 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.3213	0.2160	419.9734 (264)
Space and water heating			1166.3304 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			1041.2580 (272)
CO2 emissions per m2			12.7200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value 89.0005
EI rating 89 (274)
EI band B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, 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	$3.48 / 0.8819 = 3.946$, stars = 4
Water heating environmental impact	$0.216 / 0.8819 = 0.2449$, 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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.3400
Infiltration rate					0.3707 (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) =		0.3151 (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	0.3309	0.3073	0.3151	0.2994	0.2994	0.2915	0.2836	0.2757	0.2679	0.2915	0.2757	0.2915 (22b)
Effective ac	0.5547	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss						(33) + (36) =	66.9929 (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	35.7218	35.2362	35.3941	35.0823	35.0823	34.9324	34.7866	34.6447	34.5068	34.9324	34.6447	34.9324 (38)
Heat transfer coeff	102.7147	102.2291	102.3870	102.0752	102.0752	101.9253	101.7795	101.6376	101.4997	101.9253	101.6376	101.9253 (39)
Average = Sum(39)m / 12 =												101.9843 (39)
HLP	1.2549	1.2490	1.2509	1.2471	1.2471	1.2453	1.2435	1.2418	1.2401	1.2453	1.2418	1.2453 (40)
HLP (average)												1.2460 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (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	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month												
Solar input	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
	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	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (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	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (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)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East				3.1800	25.1925	0.6200	0.7000	0.7700		24.0947 (76)		
West				4.7500	25.1925	0.6200	0.7000	0.7700		35.9906 (80)		
East				3.1500	25.1925	0.6200	0.7000	0.7700		23.8674 (76)		
East				0.4300	33.4886	0.6300	0.7000	1.0000		5.7154 (82)		

Solar gains	89.6681	149.4298	247.9665	363.2022	422.4704	469.5761	443.6261	390.8661	304.3967	191.3119	111.4848	72.4526 (83)
Total gains	656.7912	711.8889	788.3733	869.5921	894.1152	910.2268	866.3027	822.1310	755.3756	676.5213	634.6186	624.1947 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3872	40.5790	40.5165	40.6402	40.6402	40.7000	40.7593	40.8152	40.8706	40.7000	40.8152	40.7000
alpha	3.6925	3.7053	3.7011	3.7093	3.7093	3.7133	3.7172	3.7210	3.7247	3.7133	3.7210	3.7133
util living area	0.9798	0.9720	0.9476	0.8874	0.7757	0.5887	0.4442	0.4651	0.7183	0.9049	0.9657	0.9824 (86)
MIT	19.5611	19.6977	20.0215	20.4261	20.7516	20.9356	20.9827	20.9799	20.8616	20.4771	19.9734	19.5473 (87)
Th 2	19.8763	19.8810	19.8795	19.8825	19.8825	19.8840	19.8854	19.8867	19.8881	19.8840	19.8867	19.8840 (88)
util rest of house	0.9748	0.9651	0.9342	0.8578	0.7158	0.4914	0.3238	0.3402	0.6298	0.8724	0.9556	0.9779 (89)
MIT 2	18.0027	18.2024	18.6638	19.2266	19.6451	19.8422	19.8791	19.8793	19.7816	19.3099	18.6065	17.9883 (90)
Living area fraction	18.3083	18.4956	18.9300	19.4618	19.8621	20.0566	20.0955	20.0951	19.9934	19.5388	18.8745	18.2940 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1583	18.3456	18.7800	19.3118	19.7121	19.9066	19.9455	19.9451	19.8434	19.3888	18.7245	18.1440 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	632.9927	677.6833	722.9034	729.9730	630.7154	449.1716	286.3090	285.3053	472.7144	577.7964	597.1651	604.0904 (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	1361.8229	1333.6378	1206.1221	1001.5421	736.1765	469.5295	289.6105	289.1736	522.0545	814.2617	1100.1775	1339.7068 (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)

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

Space heating kWh	542.2496	440.8014	359.5147	195.5298	78.4630	0.0000	0.0000	0.0000	0.0000	175.9301	362.1690	547.2986 (98)
Space heating												2701.9563 (98)
Space heating per m2												(98) / (4) = 33.0111 (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												3002.1737 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	542.2496	440.8014	359.5147	195.5298	78.4630	0.0000	0.0000	0.0000	0.0000	175.9301	362.1690	547.2986 (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)	602.4996	489.7794	399.4608	217.2553	87.1811	0.0000	0.0000	0.0000	0.0000	195.4779	402.4100	608.1096 (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	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Efficiency of water heater	89.1770	89.1286	88.9635	88.5919	87.8791	86.7000	86.7000	86.7000	86.7000	88.4757	88.9790	86.7000 (216)
(217)m	89.1770	89.1286	88.9635	88.5919	87.8791	86.7000	86.7000	86.7000	86.7000	88.4757	88.9790	89.2000 (217)
Fuel for water heating, kWh/month	194.6131	170.9505	178.2635	158.2494	154.7097	137.7618	130.0815	145.8253	146.5486	164.4416	175.6760	189.1442 (219)
Water heating fuel used												1946.2651 (219)
Annual totals kWh/year												
Space heating fuel - main system												3002.1737 (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)												376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =									-768.8767			-768.8767 (233)
Total delivered energy for all uses												4630.6845 (238)

10a. Fuel costs - using BEDF prices (436)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3002.1737	3.9400	118.2856 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.2651	3.9400	76.6828 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Energy for lighting	376.1224	16.5500	62.2483 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	-768.8767	16.5500	-127.2491 (252)
Total energy cost			229.3802 (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	3002.1737	0.2160	648.4695 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.2651	0.2160	420.3933 (264)
Space and water heating			1068.8628 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	0.5190	-399.0470 (269)
Total kg/year			903.9483 (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	3002.1737	1.2200	3662.6519 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.2651	1.2200	2374.4435 (264)
Space and water heating			6037.0953 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy For lighting	376.1224	3.0700	1154.6957 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	3.0700	-2360.4514 (269)
Primary energy kWh/year			5061.5897 (272)
Primary energy kWh/m2/year			61.8398 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
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	+ 1.3	-£ 31	-190 kg (21.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£31	2.33 kg/m²	B 88 B 91
Total Savings	£31	2.33 kg/m²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 436 TEST (29 Nov 2018)
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	£75	£83	-£8
Mains gas	£282	£242	£39
Space heating	£218	£218	£0
Water heating	£77	£45	£31
Lighting	£62	£62	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£230	£198	£31
Total cost of uses	£230	£198	£31
Delivered energy	57 kWh/m²	45 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	49 kWh/m²	13 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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (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					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.3400
Infiltration rate					0.3707 (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) =				0.3151 (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	0.4018	0.3939	0.3860	0.3466	0.3388	0.2994	0.2994	0.2915	0.3151	0.3388	0.3545	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5628	0.5686 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.5285			(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss	(33) + (36) =						66.9929 (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	37.3944	37.1926	36.9947	36.0655	35.8916	35.0823	35.0823	34.9324	35.3941	35.8916	36.2434	36.6111 (38)
Heat transfer coeff	104.3873	104.1855	103.9877	103.0584	102.8846	102.0752	102.0752	101.9253	102.3870	102.8846	103.2363	103.6040 (39)
Average = Sum(39)m / 12 =												103.0576 (39)
HLP	1.2753	1.2729	1.2705	1.2591	1.2570	1.2471	1.2471	1.2453	1.2509	1.2570	1.2613	1.2658 (40)
HLP (average)												1.2591 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (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	0.0000 (57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2327 (H8)
Utilisation factor												0.5557 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5044 (H14)
Volume ratio Veff/V												0.8021 (H15)
Solar storage volume factor												0.9559 (H16)
Solar input												-847.0449 (H17)
Solar input	-24.5626	-40.9879	-69.8072	-93.5554	-115.5798	-113.6333	-112.1316	-97.9699	-76.7301	-52.3976	-29.1348	-20.5547 (63)
Solar input (sum of months) = Sum (63)m =												-847.0449 (63)
Output from w/h	148.9876	111.3779	88.7823	46.6407	20.3777	5.8062	0.6491	28.4606	50.3275	93.0931	127.1799	148.1619 (64)
Total per year (kWh/year) = Sum (64)m =												869.8445 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (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	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (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)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.1800	19.6403	0.6200	0.7000	0.7700	18.7844 (76)
West	4.7500	19.6403	0.6200	0.7000	0.7700	28.0585 (80)
East	3.1500	19.6403	0.6200	0.7000	0.7700	18.6072 (76)
East	0.4300	25.9287	0.6300	0.7000	1.0000	4.4252 (82)

Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398 (83)
Total gains	636.9984	699.3468	766.3447	836.7179	877.2086	856.1460	818.1099	770.4418	714.0161	647.7694	610.2950	609.1819 (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	39.7401	39.8170	39.8928	40.2525	40.3205	40.6402	40.6402	40.7000	40.5165	40.3205	40.1831	40.0405
alpha	3.6493	3.6545	3.6595	3.6835	3.6880	3.7093	3.7093	3.7133	3.7011	3.6880	3.6789	3.6694
util living area	0.9837	0.9758	0.9568	0.9105	0.8195	0.6710	0.5205	0.5669	0.7831	0.9315	0.9748	0.9861 (86)
MIT	19.4168	19.5884	19.9006	20.3096	20.6612	20.8875	20.9668	20.9542	20.7899	20.3357	19.8051	19.3804 (87)
Th 2	19.8602	19.8621	19.8640	19.8730	19.8747	19.8825	19.8825	19.8840	19.8795	19.8747	19.8713	19.8677 (88)
util rest of house	0.9798	0.9698	0.9458	0.8866	0.7698	0.5825	0.4006	0.4465	0.7080	0.9081	0.9675	0.9827 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.7831	18.0324	18.4818	19.0621	19.5290	19.7978	19.8672	19.8608	19.6994	19.1115	18.3547	17.7354 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.1035	18.3375	18.7600	19.3067	19.7510	20.0115	20.0828	20.0752	19.9133	19.3515	18.6391	18.0579 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9535	18.1875	18.6100	19.1567	19.6010	19.8615	19.9328	19.9252	19.7633	19.2015	18.4891	17.9079 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9700	0.9574	0.9294	0.8676	0.7558	0.5807	0.4063	0.4513	0.6989	0.8896	0.9548	0.9739 (94)	
Useful gains	617.9024	669.5712	712.2779	725.9128	662.9728	497.1311	332.4041	347.7012	499.0435	576.2758	582.7124	593.2969 (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	1425.2508	1384.3657	1259.2904	1057.0434	812.8953	537.0691	340.1976	359.3068	579.8465	884.9642	1175.7695	1420.1959 (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	600.6672	480.3419	406.9773	238.4140	111.5424	0.0000	0.0000	0.0000	0.0000	229.6642	427.0011	615.2128 (98)	
Space heating												3109.8209 (98)	
Space heating per m2										(98) / (4) =		37.9941 (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													3455.3565 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	600.6672	480.3419	406.9773	238.4140	111.5424	0.0000	0.0000	0.0000	0.0000	229.6642	427.0011	615.2128 (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)	667.4080	533.7132	452.1970	264.9045	123.9360	0.0000	0.0000	0.0000	0.0000	255.1824	474.4457	683.5698 (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	148.9876	111.3779	88.7823	46.6407	20.3777	5.8062	0.6491	28.4606	50.3275	93.0931	127.1799	148.1619 (64)	
Efficiency of water heater (217)m	89.3243	89.3598	89.3907	89.4430	89.4739	86.7000	86.7000	86.7000	86.7000	89.0227	89.2207	86.7000 (216)	
Fuel for water heating, kWh/month	166.7940	124.6398	99.3194	52.1458	22.7751	6.6968	0.7486	32.8265	58.0479	104.5724	142.5453	165.8405 (219)	
Water heating fuel used												976.9521 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3455.3565 (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)													376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =									-692.1097				-692.1097 (233)
Total delivered energy for all uses													4241.3213 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3455.3565	3.4800	120.2464 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	976.9521	3.4800	33.9979 (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	376.1224	13.1900	49.6105 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893 (252)	
Total energy cost			249.0531 (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] =	0.8246 (257)
SAP value		88.4966

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

88 (258)
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	3455.3565	0.2160	746.3570 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	976.9521	0.2160	211.0217 (264)
Space and water heating			957.3787 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			858.2563 (272)
CO2 emissions per m2			10.4900 (273)
EI value			90.9337
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	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (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) =						30.0000 / (5) =	0.1537 (8)				
Pressure test							Yes					
Measured/design AP50								4.3400				
Infiltration rate								0.3707 (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) =	0.3151 (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	0.3309	0.3073	0.3151	0.2994	0.2994	0.2915	0.2836	0.2757	0.2679	0.2915	0.2757	0.2915 (22b)
Effective ac	0.5547	0.5472	0.5497	0.5448	0.5448	0.5425	0.5402	0.5380	0.5359	0.5425	0.5380	0.5425 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid FD			1.9600	0.9000	1.7640		(26)					
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)					
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)					
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)					
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)					
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)					
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)					
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)					
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)					
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)					
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)					
Total net area of external elements Aum(A, m2)			210.5800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5285		(33)					
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)					
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)					
Internal Floor 1			52.2900			18.0000	941.2200 (32d)					
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14934.0900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							182.4568 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)					
Total fabric heat loss						(33) + (36) =	66.9929 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.7218	Feb 35.2362	Mar 35.3941	Apr 35.0823	May 35.0823	Jun 34.9324	Jul 34.7866	Aug 34.6447	Sep 34.5068	Oct 34.9324	Nov 34.6447	Dec 34.9324 (38)
Heat transfer coeff	102.7147	102.2291	102.3870	102.0752	102.0752	101.9253	101.7795	101.6376	101.4997	101.9253	101.6376	101.9253 (39)
Average = Sum(39)m / 12 =												101.9843 (39)
HLP	Jan 1.2549	Feb 1.2490	Mar 1.2509	Apr 1.2471	May 1.2471	Jun 1.2453	Jul 1.2435	Aug 1.2418	Sep 1.2401	Oct 1.2453	Nov 1.2418	Dec 1.2453 (40)
HLP (average)												1.2460 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (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	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (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												1.3796 (H8)
Utilisation factor												0.5156 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5044 (H14)
Volume ratio Veff/V												0.8021 (H15)
Solar storage volume factor												0.9559 (H16)
Solar input												-879.5956 (H17)
Solar input	-28.6945	-40.8018	-70.1285	-94.6196	-111.1364	-118.7112	-116.2147	-104.0157	-81.4371	-56.3028	-33.9381	-23.5953 (63)
Solar input (sum of months) = Sum (63)m =												-879.5956 (63)
Output from w/h	144.8556	111.5640	88.4610	45.5765	24.8211	0.7283	0.0000	22.4148	45.6205	89.1879	122.3766	145.1214 (64)
Total per year (kWh/year) = Sum (64)m =												840.7278 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (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	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (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)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East				3.1800	25.1925	0.6200	0.7000			0.7700			24.0947 (76)
West				4.7500	25.1925	0.6200	0.7000			0.7700			35.9906 (80)
East				3.1500	25.1925	0.6200	0.7000			0.7700			23.8674 (76)
East				0.4300	33.4886	0.6300	0.7000			1.0000			5.7154 (82)

Solar gains	89.6681	149.4298	247.9665	363.2022	422.4704	469.5761	443.6261	390.8661	304.3967	191.3119	111.4848	72.4526 (83)	
Total gains	656.7912	711.8889	788.3733	869.5921	894.1152	910.2268	866.3027	822.1310	755.3756	676.5213	634.6186	624.1947 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3872	40.5790	40.5165	40.6402	40.6402	40.7000	40.7583	40.8152	40.8706	40.7000	40.8152	40.7000
alpha	3.6925	3.7053	3.7011	3.7093	3.7093	3.7133	3.7172	3.7210	3.7247	3.7133	3.7210	3.7133
util living area	0.9798	0.9720	0.9476	0.8874	0.7757	0.5887	0.4442	0.4651	0.7183	0.9049	0.9657	0.9824 (86)
MIT	19.5611	19.6977	20.0215	20.4261	20.7516	20.9356	20.9827	20.9799	20.8616	20.4771	19.9734	19.5473 (87)
Th 2	19.8763	19.8810	19.8795	19.8825	19.8825	19.8840	19.8854	19.8867	19.8881	19.8840	19.8867	19.8840 (88)
util rest of house	0.9748	0.9651	0.9342	0.8578	0.7158	0.4914	0.3238	0.3402	0.6298	0.8724	0.9556	0.9779 (89)

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Calculation Type: New Build (As Built)

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

MIT 2	18.0027	18.2024	18.6638	19.2266	19.6451	19.8422	19.8791	19.8793	19.7816	19.3099	18.6065	17.9883 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.3083	18.4956	18.9300	19.4618	19.8621	20.0566	20.0955	20.0951	19.9934	19.5388	18.8745	18.2940 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1583	18.3456	18.7800	19.3118	19.7121	19.9066	19.9455	19.9451	19.8434	19.3888	18.7245	18.1440 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9638	0.9520	0.9170	0.8394	0.7054	0.4935	0.3305	0.3470	0.6258	0.8541	0.9410	0.9678	(94)
Useful gains	632.9927	677.6833	722.9034	729.9730	630.7154	449.1716	286.3090	285.3053	472.7144	577.7964	597.1651	604.0904	(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													
	1361.8229	1333.6378	1206.1221	1001.5421	736.1765	469.5295	289.6105	289.1736	522.0545	814.2617	1100.1775	1339.7068	(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													
	542.2496	440.8014	359.5147	195.5298	78.4630	0.0000	0.0000	0.0000	0.0000	175.9301	362.1690	547.2986	(98)
Space heating													2701.9563 (98)
Space heating per m2													33.0111 (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													3002.1737 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	542.2496	440.8014	359.5147	195.5298	78.4630	0.0000	0.0000	0.0000	0.0000	175.9301	362.1690	547.2986 (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)	602.4996	489.7794	399.4608	217.2553	87.1811	0.0000	0.0000	0.0000	0.0000	195.4779	402.4100	608.1096 (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	144.8556	111.5640	88.4610	45.5765	24.8211	0.7283	0.0000	22.4148	45.6205	89.1879	122.3766	145.1214 (64)	
Efficiency of water heater (217)m	89.2836	89.3134	89.3286	89.3571	89.1842	86.7000	86.7000	86.7000	86.7000	88.8622	89.1431	86.7000 (216)	
Fuel for water heating, kWh/month	162.2422	124.9130	99.0287	51.0049	27.8313	0.8400	0.0000	25.8533	52.6188	100.3666	137.2811	162.5323 (219)	
Water heating fuel used												944.5123 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3002.1737 (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)													376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =									-768.8767			-768.8767 (233)	
Total delivered energy for all uses												3678.9316 (238)	

10a. Fuel costs - using BEDF prices (436)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3002.1737	3.9400	118.2856 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	944.5123	3.9400	37.2138 (247)	
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)	
Pump for solar water heating	50.0000	16.5500	8.2750 (249)	
Energy for lighting	376.1224	16.5500	62.2483 (250)	
Additional standing charges			87.0000 (251)	
Energy saving/generation technologies				
PV Unit	-768.8767	16.5500	-127.2491 (252)	
Total energy cost			198.1861 (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	3002.1737	0.2160	648.4695 (261)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	944.5123	0.2160	204.0146 (264)
Space and water heating			852.4842 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	0.5190	-399.0470 (269)
Total kg/year			713.5197 (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	3002.1737	1.2200	3662.6519 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	944.5123	1.2200	1152.3050 (264)
Space and water heating			4814.9568 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	376.1224	3.0700	1154.6957 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	3.0700	-2360.4514 (269)
Primary energy kWh/year			3992.9512 (272)
Primary energy kWh/m2/year			48.7838 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-186	Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)
Property	71, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	87 B	DER	14.54
Environmental	89 B	TER	19.26
CO ₂ Emissions (t/year)	0.90	% DER<TER	24.51
General Requirements Compliance	Pass	DFEE	52.40
		TFEE	56.61
		% DFEE<TFEE	7.44
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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
Overshading	Average or unknown
Thermal mass parameter	182.5 (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	257.57 (P1)
Transmission heat loss coefficient	66.99 (37)
Summer heat loss coefficient	324.57 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
East	1.000	1.00	1.000	1.000 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.1800	125.2818	0.6200	0.7000	0.9000	140.0522
West	4.7500	125.2818	0.6200	0.7000	0.9000	209.1974
East	3.1500	125.2818	0.6200	0.7000	0.9000	138.7309
East	0.4300	188.6220	0.6300	0.7000	1.0000	32.1916
total:						520.1720

Solar gains	Jun 560	Jul 520	Aug 457	(P3)
Internal gains	438	420	428	
Total summer gains	997	940	885	(P5)
Summer gain/loss ratio	3.07	2.90	2.73	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 182.5)	0.72	0.72	0.72	
Threshold temperature	19.20	20.92	20.75	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			