

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-183				Issued on Date	29/11/2018
Assessment Reference	As Built	Prop Type Ref	P404-A - Det (Op)			
Property	65, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating		88 B	DER	13.05	TER	16.43
Environmental		88 B	% DER<TER	20.59		
CO ₂ Emissions (t/year)		1.27	DFEE	49.75	TFEE	54.69
General Requirements Compliance		Pass	% DFEE<TFEE	9.04		
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

Detached House, total floor area 124 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.43 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.05 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.07 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Potterton Promax Ultra Combi 40 ErP

Combi boiler

Efficiency: 89.1% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 12.76 m², No overhang
Windows facing East: 2.84 m², No overhang
Windows facing South: 12.29 m², No overhang
Windows facing West: 4.76 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Door U-value 0.90 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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.0700
Infiltration rate					0.3383 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3383 (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	0.4313	0.4228	0.4144	0.3721	0.3636	0.3213	0.3213	0.3129	0.3383	0.3636	0.3805	0.3975 (22b)
Effective ac	0.5930	0.5894	0.5859	0.5692	0.5661	0.5516	0.5516	0.5490	0.5572	0.5661	0.5724	0.5790 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	58.0854	57.7316	57.3849	55.7563	55.4516	54.0331	54.0331	53.7704	54.5795	55.4516	56.0680	56.7124 (38)
Heat transfer coeff	162.4706	162.1169	161.7701	160.1415	159.8368	158.4183	158.4183	158.1557	158.9647	159.8368	160.4532	161.0977 (39)
Average = Sum(39)m / 12 =												160.1401 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3106	1.3077	1.3049	1.2918	1.2893	1.2779	1.2779	1.2758	1.2823	1.2893	1.2943	1.2995 (40)
HLP (average)												1.2918 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (64)
	Total per year (kWh/year) = Sum(64)m = 1859.9338 (64)											
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	467.1750	464.9175	448.0992	420.6888	392.3539	365.3946	348.0940	354.6592	368.9219	396.5673	428.3807	452.7194	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					6.9600	10.6334	0.6200	0.7000			0.7700			22.2589 (74)
East					2.8400	19.6403	0.6200	0.7000			0.7700			16.7760 (76)
South					12.2900	46.7521	0.6200	0.7000			0.7700			172.8127 (78)
West					4.7600	19.6403	0.6200	0.7000			0.7700			28.1175 (80)
North					5.8000	10.6334	0.6200	0.7000			0.7700			18.5491 (74)
Solar gains	258.5143	448.8302	637.6675	831.2569	969.8500	980.2140	937.7754	831.5087	704.1452	502.3063	311.1609	220.2639	(83)	
Total gains	725.6893	913.7477	1085.7667	1251.9458	1362.2038	1345.6086	1285.8694	1186.1680	1073.0671	898.8735	739.5416	672.9833	(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	30.9412	31.0088	31.0752	31.3912	31.4511	31.7327	31.7327	31.7854	31.6236	31.4511	31.3303	31.2049
alpha	3.0627	3.0673	3.0717	3.0927	3.0967	3.1155	3.1155	3.1190	3.1082	3.0967	3.0887	3.0803
util living area	0.9870	0.9736	0.9473	0.8899	0.7878	0.6417	0.5020	0.5538	0.7648	0.9256	0.9777	0.9896 (86)
MIT	18.8398	19.1376	19.5731	20.1047	20.5504	20.8359	20.9438	20.9229	20.6991	20.0968	19.3626	18.7864 (87)
Th 2	19.8326	19.8348	19.8370	19.8473	19.8492	19.8582	19.8582	19.8599	19.8547	19.8492	19.8453	19.8412 (88)
util rest of house	0.9842	0.9680	0.9358	0.8651	0.7387	0.5576	0.3871	0.4381	0.6933	0.9035	0.9720	0.9874 (89)
MIT 2	16.9659	17.3984	18.0258	18.7804	19.3772	19.7260	19.8288	19.8159	19.5820	18.7877	17.7352	16.8933 (90)
Living area fraction	17.2292	17.6428	18.2433	18.9665	19.5421	19.8820	19.9855	19.9714	19.7390	18.9717	17.9638	17.1593 (91)
MIT	17.2292	17.6428	18.2433	18.9665	19.5421	19.8820	19.9855	19.9714	19.7390	18.9717	17.9638	17.1593 (92)
Temperature adjustment	17.0792	17.4928	18.0933	18.8165	19.3921	19.7320	19.8355	19.8214	19.5890	18.8217	17.8138	-0.1500
adjusted MIT	17.0792	17.4928	18.0933	18.8165	19.3921	19.7320	19.8355	19.8214	19.5890	18.8217	17.8138	17.0093 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9736	0.9512	0.9119	0.8370	0.7159	0.5473	0.3846	0.4339	0.6736	0.8765	0.9565	0.9784	(94)
Useful gains	706.5527	869.1742	990.1329	1047.8279	975.1757	736.4112	494.5937	514.6256	722.8238	787.8213	707.3878	658.4564	(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	2076.2468	2041.5021	1875.4425	1588.0427	1229.4777	813.0007	512.5560	541.1153	872.5520	1314.1264	1719.0715	2063.5503	(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	1019.0524	787.8044	658.6704	388.9546	189.2007	0.0000	0.0000	0.0000	0.0000	391.5710	728.4122	1045.3899	(98)
Space heating												5209.0556	(98)
Space heating per m2											(98) / (4) =	42.0187	(99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5787.8396	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1019.0524	787.8044	658.6704	388.9546	189.2007	0.0000	0.0000	0.0000	0.0000	391.5710	728.4122	1045.3899	(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)	1132.2804	875.3382	731.8560	432.1718	210.2230	0.0000	0.0000	0.0000	0.0000	435.0789	809.3469	1161.5443	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)	
Efficiency of water heater (217)m	89.4688	89.4097	89.2963	89.0482	88.5258	86.7000	86.7000	86.7000	86.7000	89.0275	89.3579	89.4924	(216)	
Fuel for water heating, kWh/month	210.5221	184.8974	192.5895	170.5656	166.2484	148.9205	140.4217	157.6948	158.5610	177.0331	189.7089	204.5435	(219)	
Water heating fuel used												2101.7066	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5787.8396	(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	(219)
Electricity for lighting (calculated in Appendix L)													457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =													-699.5320	(233)
Total delivered energy for all uses													7722.0638	(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	5787.8396	0.2160	1250.1733	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2101.7066	0.2160	453.9686	(264)
Space and water heating			1704.1420	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	457.0496	0.5190	237.2088	(268)
Energy saving/generation technologies				
PV Unit	-699.5320	0.5190	-363.0571	(269)
Total CO2, kg/year			1617.2186	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0500	(273)

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

DER			13.0500	ZC1
Total Floor Area		TFA	123.9700	
Assumed number of occupants		N	2.8774	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.8762	ZC2
CO2 emissions from cooking, equation (L16)			1.5170	ZC3
Total CO2 emissions			28.4431	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			28.4431	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3848 (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	0.4906	0.4810	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			31.0000	1.3258	41.0985		(27)					
Heat Loss Floor 1			62.4900	0.1300	8.1237		(28a)					
100mm Knauf Supafil	158.8600	31.0000	127.8600	0.1800	23.0148		(29a)					
External Roof	60.0500		60.0500	0.1300	7.8065		(30)					
Bay Roof	2.4400		2.4400	0.1300	0.3172		(30)					
Total net area of external elements Aum(A, m2)			283.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.3607		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2327 (36)					
Total fabric heat loss						(33) + (36) =	93.5934 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7621	60.3044	59.8558	57.7487	57.3544	55.5192	55.5192	55.1793	56.2261	57.3544	58.1520	58.9858 (38)
Heat transfer coeff	154.3555	153.8978	153.4492	151.3420	150.9478	149.1126	149.1126	148.7727	149.8195	150.9478	151.7454	152.5791 (39)
Average = Sum(39)m / 12 =												151.3402 (39)
HLP	Jan 1.2451	Feb 1.2414	Mar 1.2378	Apr 1.2208	May 1.2176	Jun 1.2028	Jul 1.2028	Aug 1.2001	Sep 1.2085	Oct 1.2176	Nov 1.2240	Dec 1.2308 (40)
HLP (average)												1.2208 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)	Total = Sum(45)m =											1613.3389 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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												

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Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.1176	45.5105	47.0275	49.1176	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497 (64)
	68.3566	60.1497	62.9348	56.0900	54.2694	47.6118	45.3332	50.8087	51.3182	58.1782	61.9284	66.6017 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	91.8771	89.5085	84.5898	77.9028	72.9427	66.1275	60.9317	68.2912	71.2753	78.1964	86.0116	89.5184	(72)
Total internal gains	477.2140	474.9641	458.1618	430.7730	401.8399	374.2041	356.9190	364.1598	379.0275	406.6505	438.4387	462.7660	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					12.1200	10.6334	0.6300	0.7000	0.7700		39.3864 (74)	
East					2.7000	19.6403	0.6300	0.7000	0.7700		16.2063 (76)	
South					11.6600	46.7521	0.6300	0.7000	0.7700		166.5985 (78)	
West					4.5200	19.6403	0.6300	0.7000	0.7700		27.1305 (80)	

Solar gains	249.3217	432.8908	615.0717	801.8750	935.6283	945.6501	904.6985	802.1411	679.2193	484.4816	300.1001	212.4289 (83)
Total gains	726.5357	907.8549	1073.2335	1232.6480	1337.4682	1319.8542	1261.6175	1166.3009	1058.2468	891.1321	738.5388	675.1949 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234	
alpha	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616	
util living area	0.9982	0.9945	0.9834	0.9455	0.8471	0.6742	0.5093	0.5677	0.8187	0.9704	0.9957	0.9987	(86)
MIT	19.6205	19.8264	20.1279	20.5020	20.7973	20.9516	20.9899	20.9833	20.8745	20.4723	19.9730	19.5897	(87)
Th 2	19.8841	19.8870	19.8899	19.9034	19.9059	19.9178	19.9178	19.9199	19.9132	19.9059	19.9008	19.8955	(88)
util rest of house	0.9975	0.9926	0.9775	0.9255	0.7944	0.5794	0.3896	0.4439	0.7393	0.9557	0.9939	0.9983	(89)
MIT 2	18.0509	18.3532	18.7916	19.3289	19.7129	19.8868	19.9142	19.9134	19.8159	19.2998	18.5778	18.0138	(90)
Living area fraction	18.2715	18.5602	18.9794	19.4937	19.8652	20.0364	20.0654	20.0637	19.9647	19.4645	18.7739	18.2353	(92)
Temperature adjustment	18.2715	18.5602	18.9794	19.4937	19.8652	20.0364	20.0654	20.0637	19.9647	19.4645	18.7739	18.2353	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9961	0.9892	0.9707	0.9161	0.7922	0.5905	0.4064	0.4611	0.7436	0.9476	0.9911	0.9972	(94)
Ext temp.	723.6894	898.0516	1041.7823	1129.2542	1059.5227	779.4090	512.6824	537.7679	786.9089	844.4588	731.9343	673.2956	(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	2156.5754	2102.2806	1914.9563	1603.2772	1232.5261	810.6348	516.7280	545.0647	878.6409	1338.0837	1771.4544	2141.4876	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1066.0672	809.2418	649.6414	341.2966	128.7146	0.0000	0.0000	0.0000	0.0000	367.2569	748.4545	1092.3348	(98)
												5203.0078	(98)
												41.9699	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5570.6721 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1066.0672	809.2418	649.6414	341.2966	128.7146	0.0000	0.0000	0.0000	0.0000	367.2569	748.4545	1092.3348	(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)	1141.3995	866.4260	695.5475	365.4139	137.8100	0.0000	0.0000	0.0000	0.0000	393.2086	801.3432	1169.5234	(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	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497	(64)
Efficiency of water heater (217)m	88.5084	88.2681	87.7820	86.6252	84.2856	80.3000	80.3000	80.3000	80.3000	86.7122	88.0779	88.5823	(216)
Fuel for water heating, kWh/month	246.5616	217.8835	230.0262	208.8630	208.1059	192.3853	184.3198	205.4734	207.4428	216.3660	225.3537	240.3976	(219)
Water heating fuel used												2583.1789	(219)
Annual totals kWh/year													
Space heating fuel - main system												5570.6721	(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)												457.0496	(232)
Total delivered energy for all uses												8685.9007	(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	5570.6721	0.2160	1203.2652 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.1789	0.2160	557.9666 (264)
Space and water heating			1761.2318 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Total CO2, kg/m2/year			2037.3656 (272)
Emissions per m2 for space and water heating			14.2069 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9134 (272b)
Emissions per m2 for pumps and fans			0.3140 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2069 * 1.00) + 1.9134 + 0.3140, rounded to 2 d.p.			16.4300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-183	Issued on Date	29/11/2018
Assessment Reference	As Built	Prop Type Ref	P404-A - Det (Op)
Property	65, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	88 B	DER	13.05
Environmental	88 B	% DER<TER	20.59
CO ₂ Emissions (t/year)	1.27	DFEE	49.75
General Requirements Compliance	Pass	% DFEE<TFEE	9.04
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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (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							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1348 (8)				
Pressure test							Yes					
Measured/design AP50							4.0700					
Infiltration rate							0.3383	(18)				
Number of sides sheltered							0	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3383 (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	0.4313	0.4228	0.4144	0.3721	0.3636	0.3213	0.3213	0.3129	0.3383	0.3636	0.3805	0.3975 (22b)
Effective ac	0.5930	0.5894	0.5859	0.5692	0.5661	0.5516	0.5516	0.5490	0.5572	0.5661	0.5724	0.5790 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			9.0000	553.3200 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 17544.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							141.5184 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss							(33) + (36) = 104.3852 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

(38)m	Jan 58.0854	Feb 57.7316	Mar 57.3849	Apr 55.7563	May 55.4516	Jun 54.0331	Jul 54.0331	Aug 53.7704	Sep 54.5795	Oct 55.4516	Nov 56.0680	Dec 56.7124	(38)
Heat transfer coeff	162.4706	162.1169	161.7701	160.1415	159.8368	158.4183	158.4183	158.1557	158.9647	159.8368	160.4532	161.0977	(39)
Average = Sum(39)m / 12 =												160.1401	(39)
HLP	Jan 1.3106	Feb 1.3077	Mar 1.3049	Apr 1.2918	May 1.2893	Jun 1.2779	Jul 1.2779	Aug 1.2758	Sep 1.2823	Oct 1.2893	Nov 1.2943	Dec 1.2995	(40)
HLP (average)												1.2918	(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													2.8774	(42)
Average daily hot water use (litres/day)													102.5391	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930	(44)	
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908	(45)	
Energy content (annual)											Total = Sum(45)m =	1613.3389	(45)	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Heat gains from water heating, kWh/month	35.5446	31.0875	32.0796	27.9677	26.8357	23.1572	21.4585	24.6240	24.9181	29.0396	31.6990	34.4231	(65)	

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

Metabolic gains (Table 5), Watts	Jan 143.8717	Feb 143.8717	Mar 143.8717	Apr 143.8717	May 143.8717	Jun 143.8717	Jul 143.8717	Aug 143.8717	Sep 143.8717	Oct 143.8717	Nov 143.8717	Dec 143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	47.7750	46.2612	43.1177	38.8441	36.0695	32.1627	28.8421	33.0967	34.6084	39.0317	44.0264	46.2675	(72)
Total internal gains	430.1119	428.7169	413.6897	388.7143	361.9667	337.2394	321.8294	325.9653	339.3607	364.4858	393.4534	416.5151	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North	6.9600				10.6334	0.6200	0.7000	0.7700	22.2589 (74)				
East	2.8400				19.6403	0.6200	0.7000	0.7700	16.7760 (76)				
South	12.2900				46.7521	0.6200	0.7000	0.7700	172.8127 (78)				
West	4.7600				19.6403	0.6200	0.7000	0.7700	28.1175 (80)				
North	5.8000				10.6334	0.6200	0.7000	0.7700	18.5491 (74)				
Solar gains	258.5143	448.8302	637.6675	831.2569	969.8500	980.2140	937.7754	831.5087	704.1452	502.3063	311.1609	220.2639	(83)
Total gains	688.6262	877.5470	1051.3571	1219.9712	1331.8167	1317.4533	1259.6048	1157.4741	1043.5059	866.7920	704.6143	636.7791	(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	29.9952	30.0607	30.1251	30.4315	30.4895	30.7625	30.7625	30.8136	30.6568	30.4895	30.3723	30.2509	
alpha	2.9997	3.0040	3.0083	3.0288	3.0326	3.0508	3.0508	3.0542	3.0438	3.0326	3.0248	3.0167	
util living area	0.9877	0.9746	0.9486	0.8920	0.7917	0.6476	0.5087	0.5619	0.7711	0.9284	0.9788	0.9902	(86)
MIT	18.7555	19.0612	19.5092	20.0575	20.5202	20.8210	20.9373	20.9140	20.6750	20.0479	19.2918	18.7015	(87)
Th 2	19.8326	19.8348	19.8370	19.8473	19.8492	19.8582	19.8582	19.8599	19.8547	19.8492	19.8453	19.8412	(88)
util rest of house	0.9851	0.9692	0.9375	0.8679	0.7436	0.5642	0.3934	0.4462	0.7012	0.9073	0.9735	0.9882	(89)
MIT 2	17.7955	18.0995	18.5413	19.0770	19.5026	19.7584	19.8353	19.8256	19.6510	19.0810	18.3384	17.7480	(90)
Living area fraction									fLA = Living area / (4) =			0.1405	(91)
MIT	17.9304	18.2347	18.6773	19.2148	19.6456	19.9077	19.9901	19.9786	19.7949	19.2169	18.4724	17.8819	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9304	18.2347	18.6773	19.2148	19.6456	19.9077	19.9901	19.9786	19.7949	19.2169	18.4724	17.8819	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9791	0.9593	0.9233	0.8519	0.7339	0.5682	0.4076	0.4592	0.6969	0.8924	0.9647	0.9831	(94)
Useful gains	674.2192	841.8352	970.7107	1039.3044	977.3860	748.5779	513.4448	531.5497	727.2604	773.4908	679.7516	626.0112	(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	2214.5369	2161.7717	1969.9279	1651.8214	1269.9976	840.8374	537.0584	565.9683	905.2933	1377.2907	1824.7337	2204.1295	(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	1145.9964	886.9973	743.4176	441.0122	217.7030	0.0000	0.0000	0.0000	0.0000	449.2271	824.3871	1174.1200	(98)
Space heating												5882.8607	(98)
Space heating per m2												47.4539	(99)
											(98) / (4) =		

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1489.1325	1172.2958	1201.9831	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7916	0.8531	0.8230	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1178.8035	1000.0436	989.2039	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1656.1458	1585.9026	1468.6874	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	343.6864	435.8791	356.7358	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1136.3013	(104)
Cooled fraction												1.0000	(105)
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	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	85.9216	108.9698	89.1839	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												284.0753	(107)
Space cooling per m2												2.2915	(108)
Energy for space heating												47.4539	(99)
Energy for space cooling												2.2915	(108)
Total												49.7454	(109)
Dwelling Fabric Energy Efficiency (DFEE)												49.7	(109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3848 (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	0.4906	0.4810	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			31.0000	1.3258	41.0985		(27)					
Heat Loss Floor 1			62.4900	0.1300	8.1237		(28a)					
100mm Knauf Supafil	158.8600	31.0000	127.8600	0.1800	23.0148		(29a)					
External Roof	60.0500		60.0500	0.1300	7.8065		(30)					
Bay Roof	2.4400		2.4400	0.1300	0.3172		(30)					
Total net area of external elements Aum(A, m2)			283.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.3607		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2327 (36)					
Total fabric heat loss						(33) + (36) =	93.5934 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7621	60.3044	59.8558	57.7487	57.3544	55.5192	55.5192	55.1793	56.2261	57.3544	58.1520	58.9858 (38)
Heat transfer coeff	154.3555	153.8978	153.4492	151.3420	150.9478	149.1126	149.1126	148.7727	149.8195	150.9478	151.7454	152.5791 (39)
Average = Sum(39)m / 12 =												151.3402 (39)
HLP	Jan 1.2451	Feb 1.2414	Mar 1.2378	Apr 1.2208	May 1.2176	Jun 1.2028	Jul 1.2028	Aug 1.2001	Sep 1.2085	Oct 1.2176	Nov 1.2240	Dec 1.2308 (40)
HLP (average)												1.2208 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3389 (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												

FULL SAP CALCULATION PRINTOUT

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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 (57)
Heat gains from water heating, kWh/month	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)
	35.5446	31.0875	32.0796	27.9677	26.8357	23.1572	21.4585	24.6240	24.9181	29.0396	31.6990	34.4231 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	47.7750	46.2612	43.1177	38.8441	36.0695	32.1627	28.8421	33.0967	34.6084	39.0317	44.0264	46.2675	(72)
Total internal gains	430.1119	428.7169	413.6897	388.7143	361.9667	337.2394	321.8294	325.9653	339.3607	364.4858	393.4534	416.5151	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	12.1200	10.6334	0.6300	0.7000	0.7700	39.3864	(74)
East	2.7000	19.6403	0.6300	0.7000	0.7700	16.2063	(76)
South	11.6600	46.7521	0.6300	0.7000	0.7700	166.5985	(78)
West	4.5200	19.6403	0.6300	0.7000	0.7700	27.1305	(80)

Solar gains	249.3217	432.8908	615.0717	801.8750	935.6283	945.6501	904.6985	802.1411	679.2193	484.4816	300.1001	212.4289	(83)
Total gains	679.4336	861.6076	1028.7614	1190.5892	1297.5950	1282.8895	1226.5279	1128.1064	1018.5799	848.9674	693.5535	628.9441	(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	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234		
alpha	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616		
util living area	0.9986	0.9956	0.9860	0.9516	0.8585	0.6887	0.5226	0.5844	0.8346	0.9753	0.9967	0.9991	(86)	
MIT	19.5857	19.7929	20.0972	20.4777	20.7831	20.9469	20.9887	20.9812	20.8623	20.4448	19.9401	19.5554	(87)	
Th 2	19.8841	19.8870	19.8899	19.9034	19.9059	19.9178	19.9178	19.9199	19.9132	19.9059	19.9008	19.8955	(88)	
util rest of house	0.9982	0.9940	0.9808	0.9334	0.8079	0.5937	0.4004	0.4582	0.7579	0.9628	0.9953	0.9987	(89)	
MIT 2	18.5978	18.8065	19.1102	19.4890	19.7635	19.8943	19.9150	19.9148	19.8390	19.4664	18.9648	18.5765	(90)	
Living area fraction														
MIT	18.7366	18.9451	19.2489	19.6280	19.9067	20.0422	20.0659	20.0647	19.9828	19.6039	19.1019	18.7140	(92)	
Temperature adjustment														
adjusted MIT	18.7366	18.9451	19.2489	19.6280	19.9067	20.0422	20.0659	20.0647	19.9828	19.6039	19.1019	18.7140	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9922	0.9769	0.9277	0.8079	0.6055	0.4176	0.4759	0.7636	0.9581	0.9939	0.9982	(94)
Useful gains	677.6926	854.8844	1004.9876	1104.5034	1048.3439	776.7565	512.2538	536.8472	777.7967	813.3873	689.2934	627.8200	(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	2228.3726	2161.5135	1956.3104	1623.5914	1238.7898	811.5021	516.8084	545.2018	881.3598	1359.1141	1821.2285	2214.5413	(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	1153.7059	878.0548	707.7842	373.7434	141.6917	0.0000	0.0000	0.0000	0.0000	406.0208	814.9933	1180.5206	(98)
Space heating												5656.5148	(98)
Space heating per m2											(98) / (4) =	45.6281	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1401.6580	1103.4329	1130.6724	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8822	0.9354	0.9113	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1236.5296	1032.1130	1030.4246	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1615.7465	1547.2412	1434.3616	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	273.0362	383.2554	300.5291	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling											956.8206 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	68.2590	95.8138	75.1323	0.0000	0.0000	0.0000 (107)
Space cooling											239.2052 (107)
Space cooling per m2											1.9295 (108)
Energy for space heating											45.6281 (99)
Energy for space cooling											1.9295 (108)
Total											47.5576 (109)
Target Fabric Energy Efficiency (TFEE)											54.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-183	Issued on Date	29/11/2018
Assessment Reference	As Built	Prop Type Ref	P404-A - Det (Op)
Property	65, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	88 B	DER	13.05
Environmental	88 B	% DER<TER	20.59
CO ₂ Emissions (t/year)	1.27	DFEE	49.75
General Requirements Compliance	Pass	% DFEE<TFEE	9.04
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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (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							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
							Air changes per hour					
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1348 (8)				
Pressure test							Yes					
Measured/design AP50								4.0700				
Infiltration rate								0.3383 (18)				
Number of sides sheltered								0 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	1.0000 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3383 (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	0.3552	0.3298	0.3383	0.3213	0.3213	0.3129	0.3044	0.2960	0.2875	0.3129	0.2960	0.3129 (22b)
Effective ac	0.5631	0.5544	0.5572	0.5516	0.5516	0.5490	0.5463	0.5438	0.5413	0.5490	0.5438	0.5490 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss						(33) + (36) =	104.3852 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

(38)m	Jan 55.1539	Feb 54.3028	Mar 54.5795	Apr 54.0331	May 54.0331	Jun 53.7704	Jul 53.5148	Aug 53.2661	Sep 53.0244	Oct 53.7704	Nov 53.2661	Dec 53.7704 (38)
Heat transfer coeff	159.5391	158.6880	158.9647	158.4183	158.4183	158.1557	157.9000	157.6513	157.4097	158.1557	157.6513	158.1557 (39)
Average = Sum(39)m / 12 =												158.2590 (39)
HLP	Jan 1.2869	Feb 1.2801	Mar 1.2823	Apr 1.2779	May 1.2779	Jun 1.2758	Jul 1.2737	Aug 1.2717	Sep 1.2697	Oct 1.2758	Nov 1.2717	Dec 1.2758 (40)
HLP (average)												1.2766 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan 112.7930	Feb 108.6914	Mar 104.5899	Apr 100.4883	May 96.3867	Jun 92.2852	Jul 92.2852	Aug 96.3867	Sep 100.4883	Oct 104.5899	Nov 108.6914	Dec 112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (64)
RHI water heating demand										Total per year (kWh/year) = Sum(64)m =		1859.9338 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420 (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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974 (71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718 (72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					6.9600	13.4839	0.6200	0.7000			0.7700	28.2259 (74)
East					2.8400	25.1925	0.6200	0.7000			0.7700	21.5186 (76)
South					12.2900	56.7559	0.6200	0.7000			0.7700	209.7904 (78)
West					4.7600	25.1925	0.6200	0.7000			0.7700	36.0663 (80)
North					5.8000	13.4839	0.6200	0.7000			0.7700	23.5216 (74)
Solar gains	319.1227	472.3636	679.7465	898.1423	1001.5896	1102.0296	1045.0960	945.4200	795.0056	571.1781	383.0029	267.2165 (83)
Total gains	1014.6283	1162.7549	1343.1418	1519.3555	1579.0602	1640.6261	1561.1620	1470.9080	1344.9341	1163.5236	1022.5694	943.0366 (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	31.5098	31.6788	31.6236	31.7327	31.7327	31.7854	31.8369	31.8871	31.9360	31.7854	31.8871	31.7854
alpha	3.1007	3.1119	3.1082	3.1155	3.1155	3.1190	3.1225	3.1258	3.1291	3.1190	3.1258	3.1190
util living area	0.9653	0.9480	0.9056	0.8208	0.6938	0.5077	0.3811	0.4016	0.6331	0.8470	0.9406	0.9706 (86)
MIT	19.2703	19.4853	19.9003	20.3730	20.7261	20.9252	20.9772	20.9737	20.8467	20.4184	19.7942	19.2369 (87)
Th 2	19.8511	19.8565	19.8547	19.8582	19.8582	19.8599	19.8615	19.8631	19.8646	19.8599	19.8631	19.8599 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.9582	0.9376	0.8868	0.7853	0.6330	0.4199	0.2755	0.2915	0.5479	0.8073	0.9266	0.9645 (89)
MIT 2	17.5984	17.9086	18.4943	19.1427	19.5926	19.8084	19.8521	19.8521	19.7428	19.2224	18.3609	17.5565 (90)
Living area fraction									fLA = Living area / (4) =			0.1405 (91)
MIT	17.8333	18.1301	18.6919	19.3156	19.7519	19.9653	20.0102	20.0097	19.8979	19.3905	18.5623	17.7926 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6833	17.9801	18.5419	19.1656	19.6019	19.8153	19.8602	19.8597	19.7479	19.2405	18.4123	17.6426 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9388	0.9144	0.8593	0.7600	0.6178	0.4163	0.2754	0.2911	0.5382	0.7808	0.9020	0.9469 (94)	
Useful gains	952.5630	1063.2457	1154.1704	1154.6342	975.5052	682.9835	429.9549	428.2198	723.8958	908.4369	922.3237	892.9710 (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	2039.4343	2012.1837	1834.7523	1531.2075	1125.0739	714.1185	435.8320	435.0665	794.5908	1240.0132	1657.2830	1999.5038 (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	808.6323	637.6864	506.3529	271.1328	111.2791	0.0000	0.0000	0.0000	0.0000	246.6928	529.1707	823.2604 (98)	
Space heating												3934.2074 (98)	
RHI space heating demand												3934 (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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.0700
Infiltration rate					0.3383 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3383 (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												
Effective ac	0.4313	0.4228	0.4144	0.3721	0.3636	0.3213	0.3213	0.3129	0.3383	0.3636	0.3805	0.3975 (22b)
	0.5930	0.5894	0.5859	0.5692	0.5661	0.5516	0.5516	0.5490	0.5572	0.5661	0.5724	0.5790 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss							(33) + (36) = 104.3852 (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	58.0854	57.7316	57.3849	55.7563	55.4516	54.0331	54.0331	53.7704	54.5795	55.4516	56.0680	56.7124 (38)
Heat transfer coeff	162.4706	162.1169	161.7701	160.1415	159.8368	158.4183	158.4183	158.1557	158.9647	159.8368	160.4532	161.0977 (39)
Average = Sum(39)m / 12 =												160.1401 (39)
HLP	1.3106	1.3077	1.3049	1.2918	1.2893	1.2779	1.2779	1.2758	1.2823	1.2893	1.2943	1.2995 (40)
HLP (average)												1.2918 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.3389 (45)											
Distribution loss (46)m = 0.15 x (45)m												
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(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	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month												
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)											
Output from w/h												
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Heat gains from water heating, kWh/month												
60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					6.9600	10.6334	0.6200	0.7000			0.7700			22.2589 (74)
East					2.8400	19.6403	0.6200	0.7000			0.7700			16.7760 (76)
South					12.2900	46.7521	0.6200	0.7000			0.7700			172.8127 (78)
West					4.7600	19.6403	0.6200	0.7000			0.7700			28.1175 (80)
North					5.8000	10.6334	0.6200	0.7000			0.7700			18.5491 (74)
Solar gains	258.5143	448.8302	637.6675	831.2569	969.8500	980.2140	937.7754	831.5087	704.1452	502.3063	311.1609	220.2639	83	
Total gains	954.0199	1139.2215	1301.0627	1452.4701	1547.3206	1518.8104	1453.8414	1356.9967	1254.0737	1094.6518	950.7274	896.0841	(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)													
tau	30.9412	31.0088	31.0752	31.3912	31.4511	31.7327	31.7327	31.7854	31.6236	31.4511	31.3303	31.2049	
alpha	3.0627	3.0673	3.0717	3.0927	3.0967	3.1155	3.1155	3.1190	3.1082	3.0967	3.0887	3.0803	
util living area	0.9732	0.9541	0.9199	0.8517	0.7405	0.5898	0.4529	0.4976	0.7038	0.8857	0.9575	0.9775	(86)
MIT	19.0693	19.3511	19.7554	20.2384	20.6295	20.8712	20.9579	20.9429	20.7665	20.2464	19.5660	19.0142	(87)
Th 2	19.8326	19.8348	19.8370	19.8473	19.8492	19.8582	19.8582	19.8599	19.8547	19.8492	19.8453	19.8412	(88)
util rest of house	0.9678	0.9450	0.9038	0.8215	0.6874	0.5068	0.3458	0.3887	0.6275	0.8554	0.9475	0.9729	(89)
MIT 2	17.2971	17.7029	18.2794	18.9558	19.4687	19.7572	19.8368	19.8284	19.6507	18.9858	18.0247	17.2227	(90)
Living area fraction	17.5461	17.9345	18.4868	19.1361	19.6318	19.9137	19.9943	19.9850	fLA = Living area / (4) =	19.8075	19.1629	18.2413	0.1405 (91)
MIT	17.5461	17.9345	18.4868	19.1361	19.6318	19.9137	19.9943	19.9850	19.8075	19.1629	18.2413	17.4745	(92)
Temperature adjustment	17.3961	17.7845	18.3368	18.9861	19.4818	19.7637	19.8443	19.8350	19.6575	19.0129	18.0913	-0.1500	
adjusted MIT	17.3961	17.7845	18.3368	18.9861	19.4818	19.7637	19.8443	19.8350	19.6575	19.0129	18.0913	17.3245	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9508	0.9226	0.8766	0.7942	0.6682	0.4994	0.3444	0.3862	0.6126	0.8273	0.9257	0.9578	0.9578	(94)
Useful gains	907.1078	1051.0704	1140.5376	1153.5424	1033.9351	758.4554	500.7578	524.0787	768.2515	905.6438	880.0884	858.2595	(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	2127.7316	2088.7894	1914.8398	1615.1993	1243.8173	818.0252	513.9589	543.2661	883.4489	1344.6961	1763.5879	2114.3213	(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	908.1441	697.3472	576.0808	332.3930	156.1523	0.0000	0.0000	0.0000	0.0000	326.6549	636.1196	934.5100	(98)
Space heating													4567.4019 (98)
Space heating per m2	(98) / (4) = 36.8428 (99)												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5074.8910 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	908.1441	697.3472	576.0808	332.3930	156.1523	0.0000	0.0000	0.0000	0.0000	326.6549	636.1196	934.5100	(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)	1009.0490	774.8302	640.0898	369.3255	173.5026	0.0000	0.0000	0.0000	0.0000	362.9499	706.7996	1038.3444	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater	89.4154	89.3483	89.2193	88.9383	88.3680	86.7000	86.7000	86.7000	86.7000	88.8987	89.2849	89.4424	(216)
(217)m													(217)
Fuel for water heating, kWh/month	210.6478	185.0246	192.7558	170.7763	166.5451	148.9205	140.4217	157.6948	158.5610	177.2895	189.8639	204.6580	(219)
Water heating fuel used												2103.1590	(219)
Annual totals kWh/year													
Space heating fuel - main system												5074.8910	(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)												457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												7010.5677	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5074.8910	3.4800	176.6062 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2103.1590	3.4800	73.1899 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	457.0496	13.1900	60.2848 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-699.5320	13.1900	-92.2683 (252)
Total energy cost			347.7052 (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] =	0.8643 (257)
SAP value		87.9434
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5074.8910	0.2160	1096.1765 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2103.1590	0.2160	454.2823 (264)
Space and water heating			1550.4588 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			1463.5355 (272)
CO2 emissions per m2			11.8100 (273)
EI value			88.3936
EI rating			88 (274)
EI band			B

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8831 = 3.941$, stars = 4
Water heating environmental impact	$0.216 / 0.8831 = 0.2446$, 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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.0700
Infiltration rate					0.3383 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3383 (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	0.3552	0.3298	0.3383	0.3213	0.3213	0.3129	0.3044	0.2960	0.2875	0.3129	0.2960	0.3129 (22b)
Effective ac	0.5631	0.5544	0.5572	0.5516	0.5516	0.5490	0.5463	0.5438	0.5413	0.5490	0.5438	0.5490 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3514 (36)
Total fabric heat loss (33) + (36) = 104.3852 (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	55.1539	54.3028	54.5795	54.0331	54.0331	53.7704	53.5148	53.2661	53.0244	53.7704	53.2661	53.7704 (38)
Heat transfer coeff	159.5391	158.6880	158.9647	158.4183	158.4183	158.1557	157.9000	157.6513	157.4097	158.1557	157.6513	158.1557 (39)
Average = Sum(39)m / 12 =												158.2590 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2869	1.2801	1.2823	1.2779	1.2779	1.2758	1.2737	1.2717	1.2697	1.2758	1.2717	1.2758 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum(45)m = 1613.3389 (45)											
Distribution loss (46)m = 0.15 x (45)m												
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(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	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month												
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)											
Output from w/h												
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Heat gains from water heating, kWh/month												
60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					6.9600	13.4839	0.6200	0.7000			0.7700			28.2259 (74)
East					2.8400	25.1925	0.6200	0.7000			0.7700			21.5186 (76)
South					12.2900	56.7559	0.6200	0.7000			0.7700			209.7904 (78)
West					4.7600	25.1925	0.6200	0.7000			0.7700			36.0663 (80)
North					5.8000	13.4839	0.6200	0.7000			0.7700			23.5216 (74)
Solar gains	319.1227	472.3636	679.7465	898.1423	1001.5896	1102.0296	1045.0960	945.4200	795.0056	571.1781	383.0029			267.2165 (83)
Total gains	1014.6283	1162.7549	1343.1418	1519.3555	1579.0602	1640.6261	1561.1620	1470.9080	1344.9341	1163.5236	1022.5694			943.0366 (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)													
tau	31.5098	31.6788	31.6236	31.7327	31.7327	31.7854	31.8369	31.8871	31.9360	31.7854	31.8871	31.7854	
alpha	3.1007	3.1119	3.1082	3.1155	3.1155	3.1190	3.1225	3.1258	3.1291	3.1190	3.1258	3.1190	
util living area	0.9653	0.9480	0.9056	0.8208	0.6938	0.5077	0.3811	0.4016	0.6331	0.8470	0.9406	0.9706	(86)
MIT	19.2703	19.4853	19.9003	20.3730	20.7261	20.9252	20.9772	20.9737	20.8467	20.4184	19.7942	19.2369	(87)
Th 2	19.8511	19.8565	19.8547	19.8582	19.8582	19.8599	19.8615	19.8631	19.8646	19.8599	19.8631	19.8599	(88)
util rest of house	0.9582	0.9376	0.8868	0.7853	0.6330	0.4199	0.2755	0.2915	0.5479	0.8073	0.9266	0.9645	(89)
MIT 2	17.5984	17.9086	18.4943	19.1427	19.5926	19.8084	19.8521	19.8521	19.7428	19.2224	18.3609	17.5565	(90)
Living area fraction	17.8333	18.1301	18.6919	19.3156	19.7519	19.9653	20.0102	20.0097	fLA = Living area / (4) =	19.8979	19.3905	18.5623	0.1405 (91)
MIT	17.8333	18.1301	18.6919	19.3156	19.7519	19.9653	20.0102	20.0097	19.8979	19.3905	18.5623	17.7926	(92)
Temperature adjustment	17.6833	17.9801	18.5419	19.1656	19.6019	19.8153	19.8602	19.8597	19.7479	19.2405	18.4123	-0.1500	
adjusted MIT	17.6833	17.9801	18.5419	19.1656	19.6019	19.8153	19.8602	19.8597	19.7479	19.2405	18.4123	17.6426	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9388	0.9144	0.8593	0.7600	0.6178	0.4163	0.2754	0.2911	0.5382	0.7808	0.9020	0.9469 (94)
Useful gains	952.5630	1063.2457	1154.1704	1154.6342	975.5052	682.9835	429.9549	428.2198	723.8958	908.4369	922.3237	892.9710 (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	2039.4343	2012.1837	1834.7523	1531.2075	1125.0739	714.1185	435.8320	435.0665	794.5908	1240.0132	1657.2830	1999.5038 (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	808.6323	637.6864	506.3529	271.1328	111.2791	0.0000	0.0000	0.0000	0.0000	246.6928	529.1707	823.2604 (98)
Space heating												3934.2074 (98)
Space heating per m2	(98) / (4) =											31.7352 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4371.3416 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	808.6323	637.6864	506.3529	271.1328	111.2791	0.0000	0.0000	0.0000	0.0000	246.6928	529.1707	823.2604	(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)	898.4803	708.5404	562.6144	301.2586	123.6435	0.0000	0.0000	0.0000	0.0000	274.1031	587.9675	914.7338	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater	89.3575	89.3002	89.1398	88.7866	88.0907	86.7000	86.7000	86.7000	86.7000	88.6841	89.1765	89.3812	(216)
(217)m	89.3575	89.3002	89.1398	88.7866	88.0907	86.7000	86.7000	86.7000	86.7000	88.6841	89.1765	89.3812	(217)
Fuel for water heating, kWh/month	210.7844	185.1241	192.9276	171.0680	167.0695	148.9205	140.4217	157.6948	158.5610	177.7186	190.0948	204.7982	(219)
Water heating fuel used												2105.1832	(219)
Annual totals kWh/year													
Space heating fuel - main system												4371.3416	(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)												457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												6225.6925	(238)

10a. Fuel costs - using BEDF prices (431)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4371.3416	3.9400	172.2309 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2105.1832	3.9400	82.9442 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Energy for lighting	457.0496	16.5500	75.6417 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	-782.8819	16.5500	-129.5669 (252)
Total energy cost			300.6623 (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	4371.3416	0.2160	944.2098 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.1832	0.2160	454.7196 (264)
Space and water heating			1398.9293 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-782.8819	0.5190	-406.3157 (269)
Total kg/year			1268.7474 (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	4371.3416	1.2200	5333.0367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.1832	1.2200	2568.3235 (264)
Space and water heating			7901.3602 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	457.0496	3.0700	1403.1424 (268)
Energy saving/generation technologies			
PV Unit	-782.8819	3.0700	-2403.4473 (269)
Primary energy kWh/year			7131.3053 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

57.5244 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 33	-200 kg (15.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£33	1.62 kg/m ²	B 89 B 90
Total Savings	£33	1.62 kg/m ²	

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 431 TEST (24 Aug 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	£88	£96	-£8
Mains gas	£342	£301	£41
Space heating	£272	£272	£0
Water heating	£83	£50	£33
Lighting	£76	£76	£0
Generated (PV)	-£130	-£130	£0
Total cost of fuels	£300	£267	£33
Total cost of uses	£301	£268	£33
Delivered energy	50 kWh/m ²	42 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	1.1 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	58 kWh/m ²	48 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.0700
Infiltration rate					0.3383 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3383 (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	0.4313	0.4228	0.4144	0.3721	0.3636	0.3213	0.3213	0.3129	0.3383	0.3636	0.3805	0.3975 (22b)
Effective ac	0.5930	0.5894	0.5859	0.5692	0.5661	0.5516	0.5516	0.5490	0.5572	0.5661	0.5724	0.5790 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	58.0854	57.7316	57.3849	55.7563	55.4516	54.0331	54.0331	53.7704	54.5795	55.4516	56.0680	56.7124 (38)
Heat transfer coeff	162.4706	162.1169	161.7701	160.1415	159.8368	158.4183	158.4183	158.1557	158.9647	159.8368	160.4532	161.0977 (39)
Average = Sum(39)m / 12 =												160.1401 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3106	1.3077	1.3049	1.2918	1.2893	1.2779	1.2779	1.2758	1.2823	1.2893	1.2943	1.2995 (40)
HLP (average)												1.2918 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(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	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602	(61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(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												1.1241	(H8)
Utilisation factor												0.5892	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												102.5391	(H14)
Volume ratio Veff/V												0.7314	(H15)
Solar storage volume factor												0.9374	(H16)
Solar input												-880.7738	(H17)
Solar input	-25.5407	-42.6201	-72.5868	-97.2807	-120.1821	-118.1581	-116.5966	-101.8710	-79.7855	-54.4841	-30.2949	-21.3732	(63)
												Solar input (sum of months) = Sum (63)m =	-880.7738 (63)
Output from w/h	162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778	(64)
												Total per year (kWh/year) = Sum (64)m =	979.1600 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					6.9600	10.6334	0.6200		0.7000		0.7700		22.2589 (74)	
East					2.8400	19.6403	0.6200		0.7000		0.7700		16.7760 (76)	
South					12.2900	46.7521	0.6200		0.7000		0.7700		172.8127 (78)	
West					4.7600	19.6403	0.6200		0.7000		0.7700		28.1175 (80)	
North					5.8000	10.6334	0.6200		0.7000		0.7700		18.5491 (74)	
Solar gains	258.5143	448.8302	637.6675	831.2569	969.8500	980.2140	937.7754	831.5087	704.1452	502.3063	311.1609	220.2639	(83)	
Total gains	954.0199	1139.2215	1301.0627	1452.4701	1547.3206	1518.8104	1453.8414	1356.9967	1254.0737	1094.6518	950.7274	896.0841	(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	30.9412	31.0088	31.0752	31.3912	31.4511	31.7327	31.7327	31.7854	31.6236	31.4511	31.3303	31.2049	
alpha	3.0627	3.0673	3.0717	3.0927	3.0967	3.1155	3.1155	3.1190	3.1082	3.0967	3.0887	3.0803	
util living area	0.9732	0.9541	0.9199	0.8517	0.7405	0.5898	0.4529	0.4976	0.7038	0.8857	0.9575	0.9775	(86)
MIT	19.0693	19.3511	19.7554	20.2384	20.6295	20.8712	20.9579	20.9429	20.7665	20.2464	19.5660	19.0142	(87)
Th 2	19.8326	19.8348	19.8370	19.8473	19.8492	19.8582	19.8582	19.8599	19.8547	19.8492	19.8453	19.8412	(88)
util rest of house	0.9678	0.9450	0.9038	0.8215	0.6874	0.5068	0.3458	0.3887	0.6275	0.8554	0.9475	0.9729	(89)
MIT 2	17.2971	17.7029	18.2794	18.9558	19.4687	19.7572	19.8368	19.8284	19.6507	18.9858	18.0247	17.2227	(90)
Living area fraction	17.5461	17.9345	18.4868	19.1361	19.6318	19.9137	19.9943	19.9850	19.8075	19.1629	18.2413	17.4745	(92)
Temperature adjustment	17.3961	17.7845	18.3368	18.9861	19.4818	19.7637	19.8443	19.8350	19.6575	19.0129	18.0913	17.3245	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9508	0.9226	0.8766	0.7942	0.6682	0.4994	0.3444	0.3862	0.6126	0.8273	0.9257	0.9578	(94)
Useful gains	907.1078	1051.0704	1140.5376	1153.5424	1033.9351	758.4554	500.7578	524.0787	768.2515	905.6438	880.0884	858.2595	(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	2127.7316	2088.7894	1914.8398	1615.1993	1243.8173	818.0252	513.9589	543.2661	883.4489	1344.6961	1763.5879	2114.3213	(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	908.1441	697.3472	576.0808	332.3930	156.1523	0.0000	0.0000	0.0000	0.0000	326.6549	636.1196	934.5100	(98)
Space heating												4567.4019	(98)
Space heating per m2											(98) / (4) =	36.8428	(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													5074.8910 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	908.1441	697.3472	576.0808	332.3930	156.1523	0.0000	0.0000	0.0000	0.0000	326.6549	636.1196	934.5100	(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)	1009.0490	774.8302	640.0898	369.3255	173.5026	0.0000	0.0000	0.0000	0.0000	362.9499	706.7996	1038.3444	(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	162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778	(64)
Efficiency of water heater	89.4822	89.4904	89.4988	89.5192	89.4980	86.7000	86.7000	86.7000	86.7000	89.1855	89.3891	89.4976	(216)
Fuel for water heating, kWh/month	181.9477	137.1055	111.0501	60.9979	30.1578	12.6366	5.9389	40.1965	66.5362	115.6288	155.7517	180.6505	(219)
Water heating fuel used												1098.5981	(219)
Annual totals kWh/year													
Space heating fuel - main system												5074.8910	(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)													457.0496 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6056.0069	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5074.8910	3.4800	176.6062	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1098.5981	3.4800	38.2312	(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	457.0496	13.1900	60.2848	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-699.5320	13.1900	-92.2683	(252)
Total energy cost			319.3415	(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] =	0.7938 (257)
SAP value		88.9269
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5074.8910	0.2160	1096.1765 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1098.5981	0.2160	237.2972 (264)
Space and water heating			1333.4737 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-699.5320	0.5190	-363.0571 (269)
Total kg/year			1272.5003 (272)
CO2 emissions per m2			10.2600 (273)
EI value			89.9086
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.0700
Infiltration rate					0.3383 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3383 (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	0.3552	0.3298	0.3383	0.3213	0.3213	0.3129	0.3044	0.2960	0.2875	0.3129	0.2960	0.3129 (22b)
Effective ac	0.5631	0.5544	0.5572	0.5516	0.5516	0.5490	0.5463	0.5438	0.5413	0.5490	0.5438	0.5490 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss							(33) + (36) = 104.3852 (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	55.1539	54.3028	54.5795	54.0331	54.0331	53.7704	53.5148	53.2661	53.0244	53.7704	53.2661	53.7704 (38)
Heat transfer coeff	159.5391	158.6880	158.9647	158.4183	158.4183	158.1557	157.9000	157.6513	157.4097	158.1557	157.6513	158.1557 (39)
Average = Sum(39)m / 12 =												158.2590 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2869	1.2801	1.2823	1.2779	1.2779	1.2758	1.2737	1.2717	1.2697	1.2758	1.2717	1.2758 (40)
HLP (average)												1.2766 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum (45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month											
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1208.1510 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2029.6937 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.2581 (H8)
Collector performance factor											0.5484 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											102.5391 (H14)
Solar storage volume factor											0.7314 (H15)
Solar input											0.9374 (H16)
Solar input	-29.9291	-42.5572	-73.1457	-98.6904	-115.9178	-123.8186	-121.2146	-108.4908	-84.9408	-58.7251	-35.3982
Solar input (sum of months) = Sum (63)m =											-917.4387 (H17)
Output from w/h	158.4225	122.7591	98.8297	53.1951	31.2548	5.2955	0.5310	28.2306	52.5316	98.8830	134.1217
Total per year (kWh/year) = Sum (64)m =											942.4951 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866
											59.1270 (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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.9600	13.4839		0.6200	0.7000	0.7700		28.2259 (74)	
East					2.8400	25.1925		0.6200	0.7000	0.7700		21.5186 (76)	
South					12.2900	56.7559		0.6200	0.7000	0.7700		209.7904 (78)	
West					4.7600	25.1925		0.6200	0.7000	0.7700		36.0663 (80)	
North					5.8000	13.4839		0.6200	0.7000	0.7700		23.5216 (74)	

Solar gains	319.1227	472.3636	679.7465	898.1423	1001.5896	1102.0296	1045.0960	945.4200	795.0056	571.1781	383.0029	267.2165	(83)
Total gains	1014.6283	1162.7549	1343.1418	1519.3555	1579.0602	1640.6261	1561.1620	1470.9080	1344.9341	1163.5236	1022.5694	943.0366	(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)												
tau	31.5098	31.6788	31.6236	31.7327	31.7327	31.7854	31.8369	31.8871	31.9360	31.7854	31.8871	31.7854
alpha	3.1007	3.1119	3.1082	3.1155	3.1155	3.1190	3.1225	3.1258	3.1291	3.1190	3.1258	3.1190
util living area	0.9653	0.9480	0.9056	0.8208	0.6938	0.5077	0.3811	0.4016	0.6331	0.8470	0.9406	0.9706 (86)
MIT	19.2703	19.4853	19.9003	20.3730	20.7261	20.9252	20.9772	20.9737	20.8467	20.4184	19.7942	19.2369 (87)
Th 2	19.8511	19.8565	19.8547	19.8582	19.8582	19.8599	19.8615	19.8631	19.8646	19.8599	19.8631	19.8599 (88)
util rest of house	0.9582	0.9376	0.8868	0.7853	0.6330	0.4199	0.2755	0.2915	0.5479	0.8073	0.9266	0.9645 (89)
MIT 2	17.5984	17.9086	18.4943	19.1427	19.5926	19.8084	19.8521	19.8521	19.7428	19.2224	18.3609	17.5565 (90)
Living area fraction	17.8333	18.1301	18.6919	19.3156	19.7519	19.9653	20.0102	20.0097	19.8979	19.3905	18.5623	17.7926 (92)
Temperature adjustment	17.6833	17.9801	18.5419	19.1656	19.6019	19.8153	19.8602	19.8597	19.7479	19.2405	18.4123	17.6426 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9388	0.9144	0.8593	0.7600	0.6178	0.4163	0.2754	0.2911	0.5382	0.7808	0.9020	0.9469 (94)
Useful gains	952.5630	1063.2457	1154.1704	1154.6342	975.5052	682.9835	429.9549	428.2198	723.8958	908.4369	922.3237	892.9710 (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	2039.4343	2012.1837	1834.7523	1531.2075	1125.0739	714.1185	435.8320	435.0665	794.5908	1240.0132	1657.2830	1999.5038 (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	808.6323	637.6864	506.3529	271.1328	111.2791	0.0000	0.0000	0.0000	0.0000	246.6928	529.1707	823.2604 (98)
Space heating												3934.2074 (98)
Space heating per m2												31.7352 (99)
										(98) / (4) =		

Not applicable

Fraction of space heat from secondary/supplementary system (Table 11)

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	4371.3416	(211)

[illegible][illegible]

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)	457.0496 (232)

Energy saving/generation technologies (Appendices M ,N and Q)			
PV Unit 0 (0.80 * 0.81 * 1208 * 1.00) =	-782.8819	-782.8819	(233)
Total delivered energy for all uses		5228.0901	(238)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4371.3416	3.9400	172.2309 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1057.5808	3.9400	41.6687 (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	457.0496	16.5500	75.6417 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	-782.8819	16.5500	-129.5669 (252)
Total energy cost			267.6618 (255)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4371.3416	0.2160	944.2098 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1057.5808	0.2160	228.4375 (264)
Space and water heating			1172.6472 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Energy saving/generation technologies			
PV Unit	-782.8819	0.5190	-406.3157 (269)
Total kg/year			1068.4153 (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	4371.3416	1.2200	5333.0367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1057.5808	1.2200	1290.2486 (264)
Space and water heating			6623.2853 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	457.0496	3.0700	1403.1424 (268)
Energy saving/generation technologies			
PV Unit	-782.8819	3.0700	-2403.4473 (269)
Primary energy kWh/year			6006.7303 (272)
Primary energy kWh/m2/year			48.4531 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-183				Issued on Date	29/11/2018
Assessment Reference	As Built	Prop Type Ref	P404-A - Det (Op)			
Property	65, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	88 B	DER	13.05	TER	16.43	
Environmental	88 B	% DER<TER	20.59			
CO ₂ Emissions (t/year)	1.27	DFEE	49.75	TFEE	54.69	
General Requirements Compliance	Pass	% DFEE<TFEE	9.04			
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	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	146.0 (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	391.81 (P1)
Transmission heat loss coefficient	104.39 (37)
Summer heat loss coefficient	496.19 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.9600	87.1704	0.6200	0.7000	0.9000	213.2815
East	2.8400	125.2818	0.6200	0.7000	0.9000	125.0780
South	12.2900	118.5567	0.6200	0.7000	0.9000	512.2154
West	4.7600	125.2818	0.6200	0.7000	0.9000	209.6378
North	5.8000	87.1704	0.6200	0.7000	0.9000	177.7346
total:						1237.9474

	Jun	Jul	Aug	
Solar gains	1327	1238	1116	(P3)
Internal gains	536	513	522	
Total summer gains	1863	1751	1639	(P5)
Summer gain/loss ratio	3.75	3.53	3.30	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 146.0)	0.98	0.98	0.98	
Threshold temperature	20.13	21.81	21.58	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			