

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-187				Issued on Date	17/12/2018
Assessment Reference	As Built		Prop Type Ref	P307 - Semi (As)		
Property	73, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating		87 B	DER	14.56	TER	19.26
Environmental		89 B	% DER<TER	24.41		
CO ₂ Emissions (t/year)		0.91	DFEE	52.51	TFEE	56.61
General Requirements Compliance		Pass	% DFEE<TFEE	7.25		
Assessor	Silvio Junges, Tel: 01884 242050				Assessor ID	P637-0001
Client						

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 82 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.26 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.56 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.18 (max. 0.20)	0.30 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.48 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing East: 6.33 m², No overhang
Windows facing West: 4.75 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3211 (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	0.4094	0.4014	0.3933	0.3532	0.3452	0.3050	0.3050	0.2970	0.3211	0.3452	0.3612	0.3773 (22b)
Effective ac	0.5838	0.5805	0.5774	0.5624	0.5596	0.5465	0.5465	0.5441	0.5515	0.5596	0.5652	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.5285			(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss	(33) + (36) =						66.9929 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.5925	37.3830	37.1776	36.2130	36.0325	35.1923	35.1923	35.0367	35.5159	36.0325	36.3976	36.7793 (38)
Heat transfer coeff	104.5855	104.3759	104.1706	103.2059	103.0254	102.1852	102.1852	102.0296	102.5088	103.0254	103.3905	103.7722 (39)
Average = Sum(39)m / 12 =												103.2050 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2778	1.2752	1.2727	1.2609	1.2587	1.2484	1.2484	1.2465	1.2524	1.2587	1.2632	1.2678 (40)
HLP (average)												1.2609 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (65)
Total per year (kWh/year) = Sum (64)m =												1716.8894 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	383.2468	381.0135	367.1356	344.8462	322.2396	300.5423	286.5323	292.6897	304.2295	326.7324	352.5183	371.8299 (73)

6. Solar gains

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

Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398 (83)
Total gains	453.1220	517.9013	593.0735	675.1742	727.8034	716.0376	681.9656	631.8667	567.2666	489.2923	439.6796	429.2697 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6648	39.7444	39.8228	40.1950	40.2654	40.5965	40.5965	40.6584	40.4683	40.2654	40.1232	39.9756
alpha	3.6443	3.6496	3.6549	3.6797	3.6844	3.7064	3.7064	3.7106	3.6979	3.6844	3.6749	3.6650
util living area	0.9946	0.9905	0.9798	0.9494	0.8795	0.7505	0.6035	0.6587	0.8643	0.9689	0.9910	0.9956 (86)
MIT	19.1635	19.3446	19.6815	20.1354	20.5473	20.8336	20.9457	20.9242	20.6907	20.1498	19.5762	19.1309 (87)
Th 2	19.8583	19.8603	19.8623	19.8716	19.8733	19.8814	19.8814	19.8829	19.8783	19.8733	19.8698	19.8661 (88)
util rest of house	0.9931	0.9880	0.9741	0.9339	0.8398	0.6652	0.4730	0.5312	0.8038	0.9567	0.9882	0.9944 (89)
MIT 2	17.4150	17.6801	18.1704	18.8261	19.3921	19.7491	19.8549	19.8418	19.5937	18.8575	18.0252	17.3723 (90)
Living area fraction	17.7579	18.0065	18.4667	19.0829	19.6186	19.9618	20.0688	20.0540	19.8088	19.1109	18.3294	17.7171 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6079	17.8565	18.3167	18.9329	19.4686	19.8118	19.9188	19.9040	19.6588	18.9609	18.1794	17.5671 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	447.9767	508.1676	571.0296	618.8577	598.4106	471.9695	325.8337	337.3782	447.5201	460.9868	431.5593	425.2256 (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	1391.8130	1352.3496	1230.9502	1035.4494	800.3674	532.5640	339.1287	357.5156	569.8256	861.3898	1145.5028	1387.1364 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	702.2142	567.2903	490.9809	299.9460	150.2559	0.0000	0.0000	0.0000	0.0000	297.8999	514.0393	715.6616 (98)
Space heating												3738.2881 (98)
Space heating per m2											(98) / (4) =	45.6724 (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												4153.6535 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	702.2142	567.2903	490.9809	299.9460	150.2559	0.0000	0.0000	0.0000	0.0000	297.8999	514.0393	715.6616 (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)	780.2380	630.3225	545.5344	333.2734	166.9510	0.0000	0.0000	0.0000	0.0000	330.9999	571.1548	795.1796 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Efficiency of water heater	89.3262	89.2805	89.1714	88.9219	88.4017	86.7000	86.7000	86.7000	86.7000	88.8898	89.2082	86.7000 (216)
(217)m	89.3262	89.2805	89.1714	88.9219	88.4017	86.7000	86.7000	86.7000	86.7000	88.8898	89.2082	89.3512 (217)
Fuel for water heating, kWh/month	194.2880	170.6596	177.8480	157.6620	153.7952	137.7618	130.0815	145.8253	146.5486	163.6754	175.2245	188.8241 (219)
Water heating fuel used												1942.1940 (219)
Annual totals kWh/year												
Space heating fuel - main system												4153.6535 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097 (233)
Total delivered energy for all uses												5854.8602 (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	4153.6535	0.2160	897.1891 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.1940	0.2160	419.5139 (264)
Space and water heating			1316.7031 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total CO2, kg/year			1191.6307 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5600 (273)

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

DER		14.5600 ZC1
Total Floor Area		81.8500
Assumed number of occupants	TFA	2.4970
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190
CO2 emissions from appliances, equation (L14)	EF	16.1639 ZC2
CO2 emissions from cooking, equation (L16)		2.1861 ZC3
Total CO2 emissions		32.9099 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		32.9099 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4037 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Opening Type (Uw = 1.40)			11.0800	1.3258	14.6894		(27)
TER Room Window (Uw = 1.70)			0.4300	1.5918	0.6845		(27a)
Jet Floor Lo			31.5600	0.1300	4.1028		(28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.1800	21.3120		(29a)
Dormer Cheek	2.7200		2.7200	0.1800	0.4896		(29a)
Wall to void	9.1300		9.1300	0.1800	1.6434		(29a)
Plane	8.0700		8.0700	0.1300	1.0491		(30)
Plane GF	2.0000		2.0000	0.1300	0.2600		(30)
Plane 2 void	8.8300		8.8300	0.1300	1.1479		(30)
Slope	15.1900	0.4300	14.7600	0.1300	1.9188		(30)
Dorm Roof	1.6400		1.6400	0.1300	0.2132		(30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.4707			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6035 (36)
Total fabric heat loss						(33) + (36) =	60.0742 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.3609	38.1215	37.8869	36.7849	36.5787	35.6189	35.6189	35.4411	35.9886	36.5787	36.9958	37.4319 (38)
Heat transfer coeff	98.4351	98.1957	97.9611	96.8590	96.6529	95.6930	95.6930	95.5153	96.0627	96.6529	97.0700	97.5060 (39)
Average = Sum(39)m / 12 =												96.8581 (39)
HLP	1.2026	1.1997	1.1968	1.1834	1.1809	1.1691	1.1691	1.1670	1.1736	1.1809	1.1859	1.1913 (40)
HLP (average)												1.1834 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)										Total =	Sum (45)m =	1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	45.6199	48.6018	45.1895	44.7899	41.5006	42.8839	44.7899	45.1895	48.6018	48.8785	50.9589 (61)
Total heat required for water heating calculated for each month	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (64)
								Total per year (kWh/year) =	Sum (64)m =			2029.1509 (64)
Heat gains from water heating, kWh/month	63.4562	55.7619	57.9228	51.2029	49.4877	43.4167	41.3389	46.3319	46.8515	53.5853	57.4490	61.8559 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	85.2906	82.9790	77.8533	71.1151	66.5158	60.3010	55.5630	62.2741	65.0715	72.0233	79.7903	83.1397 (72)
Total internal gains	393.3071	390.9311	376.4346	353.5302	330.3011	307.9847	293.9877	300.7633	312.9314	336.0493	362.4461	381.8971 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				6.3300	19.6403	0.6300	0.7000	0.7700	37.9947 (76)			
West				4.7500	19.6403	0.6300	0.7000	0.7700	28.5110 (80)			
East				0.4300	25.9287	0.6300	0.7000	1.0000	4.4252 (82)			
Solar gains	70.9309	138.9528	229.3388	335.2880	411.6424	421.7178	401.3574	344.2657	266.9925	165.0103	88.4775	58.3079 (83)
Total gains	464.2380	529.8839	605.7734	688.8182	741.9436	729.7026	695.3450	645.0290	579.9239	501.0596	450.9236	440.2050 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.7439	57.8847	58.0233	58.6835	58.8087	59.3986	59.3986	59.5091	59.1700	58.8087	58.5560	58.2941
alpha	4.8496	4.8590	4.8682	4.9122	4.9206	4.9599	4.9599	4.9673	4.9447	4.9206	4.9037	4.8863
util living area	0.9984	0.9967	0.9909	0.9683	0.9000	0.7520	0.5846	0.6453	0.8821	0.9834	0.9969	0.9988 (86)
MIT	19.6585	19.8028	20.0669	20.4241	20.7363	20.9272	20.9834	20.9735	20.8272	20.4153	19.9743	19.6352 (87)
Th 2	19.9179	19.9202	19.9225	19.9333	19.9353	19.9448	19.9448	19.9465	19.9411	19.9353	19.9313	19.9270 (88)
util rest of house	0.9979	0.9956	0.9875	0.9556	0.8589	0.6600	0.4550	0.5148	0.8178	0.9746	0.9956	0.9984 (89)
MIT 2	18.1300	18.3424	18.7283	19.2477	19.6701	19.8948	19.9385	19.9353	19.7958	19.2436	18.6013	18.1022 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.4297	18.6288	18.9907	19.4784	19.8792	20.0972	20.1434	20.1389	19.9980	19.4733	18.8705	18.4028 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4297	18.6288	18.9907	19.4784	19.8792	20.0972	20.1434	20.1389	19.9980	19.4733	18.8705	18.4028 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9967	0.9935	0.9833	0.9485	0.8563	0.6746	0.4805	0.5401	0.8220	0.9692	0.9936	0.9975 (94)
Useful gains	462.7243	526.4274	595.6298	653.3276	635.3479	492.2806	334.0820	348.4103	476.6717	485.6205	448.0536	439.0936 (95)
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	1390.8581	1348.1046	1223.6070	1024.6123	790.5411	526.0478	339.0818	357.1202	566.5813	857.6333	1142.5627	1384.8598 (97)
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	690.5315	552.1670	467.2150	267.3250	115.4638	0.0000	0.0000	0.0000	0.0000	276.7775	500.0466	703.6501 (98)
Space heating												3573.1765 (98)
Space heating per m ²										(98) / (4) =		43.6552 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3825.6708 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	690.5315	552.1670	467.2150	267.3250	115.4638	0.0000	0.0000	0.0000	0.0000	276.7775	500.0466	703.6501 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	739.3271	591.1853	500.2302	286.2152	123.6229	0.0000	0.0000	0.0000	0.0000	296.3357	535.3818	753.3727 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (64)
Efficiency of water heater (217)m	87.8840	87.6993	87.2712	86.2561	84.2461	80.3000	80.3000	80.3000	80.3000	86.2253	87.4313	80.3000 (216)
Fuel for water heating, kWh/month	231.5434	204.1342	213.4301	191.5295	189.8588	175.4343	168.0794	187.3692	189.4385	200.8899	211.4879	225.8617 (219)
Water heating fuel used												2389.0569 (219)
Annual totals kWh/year												
Space heating fuel - main system												3825.6708 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												376.1224 (232)
Total delivered energy for all uses												6665.8501 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3825.6708	0.2160	826.3449 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2389.0569	0.2160	516.0363 (264)
Space and water heating			1342.3812 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Total CO2, kg/m2/year			1576.5137 (272)
Emissions per m2 for space and water heating			16.4005 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3849 (272b)
Emissions per m2 for pumps and fans			0.4756 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4005 * 1.00) + 2.3849 + 0.4756, rounded to 2 d.p.			19.2600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-187	Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (As)
Property	73, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	87 B	DER	14.56
Environmental	89 B	% DER<TER	24.41
CO ₂ Emissions (t/year)	0.91	DFEE	52.51
General Requirements Compliance	Pass	% DFEE<TFEE	7.25
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3211 (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	0.4094	0.4014	0.3933	0.3532	0.3452	0.3050	0.3050	0.2970	0.3211	0.3452	0.3612	0.3773 (22b)
Effective ac	0.5838	0.5805	0.5774	0.5624	0.5596	0.5465	0.5465	0.5441	0.5515	0.5596	0.5652	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			9.0000	470.6100 (32e)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 14463.4800 (34)
 176.7071 (35)
 7.4644 (36)
 (33) + (36) = 66.9929 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.5925	37.3830	37.1776	36.2130	36.0325	35.1923	35.1923	35.0367	35.5159	36.0325	36.3976	36.7793	(38)
Heat transfer coeff	104.5855	104.3759	104.1706	103.2059	103.0254	102.1852	102.1852	102.0296	102.5088	103.0254	103.3905	103.7722	(39)
Average = Sum(39)m / 12 =												103.2050	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2778	1.2752	1.2727	1.2609	1.2587	1.2484	1.2484	1.2465	1.2524	1.2587	1.2632	1.2678	(40)
HLP (average)												1.2609	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4970 (42)
Average daily hot water use (litres/day)													93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548	(44)
Energy content (annual)	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179	(45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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													
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	32.4128	28.3484	29.2530	25.5035	24.4712	21.1168	19.5678	22.4544	22.7225	26.4809	28.9060	31.3900	(65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	(71)
Water heating gains (Table 5)	43.5656	42.1852	39.3186	35.4215	32.8914	29.3289	26.3008	30.1806	31.5591	35.5926	40.1472	42.1909	(72)
Total internal gains	348.5821	347.1372	334.8999	314.8367	293.6768	274.0126	261.7255	265.6698	276.4190	296.6187	319.8030	337.9484	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East			3.1800		19.6403		0.6200		0.7000		0.7700		18.7844 (76)
West			4.7500		19.6403		0.6200		0.7000		0.7700		28.0585 (80)
East			3.1500		19.6403		0.6200		0.7000		0.7700		18.6072 (76)
East			0.4300		25.9287		0.6300		0.7000		1.0000		4.4252 (82)
Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398	(83)
Total gains	418.4573	484.0249	560.8378	645.1647	699.2406	689.5079	657.1587	604.8468	539.4561	459.1786	406.9643	395.3882	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, $n_{il,m}$ (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.4148	38.4920	38.5678	38.9283	38.9965	39.3172	39.3172	39.3771	39.1930	38.9965	38.8588	38.7159	(86)
alpha	3.5610	3.5661	3.5712	3.5952	3.5998	3.6211	3.6211	3.6251	3.6129	3.5998	3.5906	3.5811	(87)
util living area	0.9953	0.9916	0.9815	0.9527	0.8864	0.7624	0.6181	0.6756	0.8750	0.9724	0.9922	0.9962	(86)
MIT	19.0718	19.2586	19.6067	20.0772	20.5073	20.8128	20.9366	20.9114	20.6569	20.0900	19.4970	19.0392	(87)
Th 2	19.8583	19.8603	19.8623	19.8716	19.8733	19.8814	19.8814	19.8829	19.8783	19.8733	19.8698	19.8661	(88)
util rest of house	0.9941	0.9994	0.9764	0.9384	0.8488	0.6794	0.4874	0.5490	0.8183	0.9615	0.9898	0.9952	(89)
MIT 2	18.1025	18.2899	18.6368	19.1048	19.5115	19.7774	19.8595	19.8489	19.6582	19.1251	18.5353	18.0757	(90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Living area fraction									fLA = Living area / (4) =				0.1961 (91)
MIT	18.2926	18.4799	18.8270	19.2955	19.7067	19.9804	20.0707	20.0572	19.8541	19.3143	18.7239	18.2647 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.2926	18.4799	18.8270	19.2955	19.7067	19.9804	20.0707	20.0572	19.8541	19.3143	18.7239	18.2647 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9856	0.9701	0.9291	0.8422	0.6877	0.5114	0.5710	0.8167	0.9542	0.9864	0.9932	(94)
Useful gains	414.9847	477.0651	544.0611	599.4253	588.8852	474.1688	336.0868	345.3546	440.5989	438.1409	401.4122	392.6980	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Month fracti	1463.4186	1417.4148	1284.1111	1072.8728	824.8980	549.8020	354.6547	373.1474	589.8435	897.7947	1201.8016	1459.5215	(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	780.0348	631.9150	550.5972	340.8822	175.5935	0.0000	0.0000	0.0000	0.0000	341.9825	576.2804	793.7166	(98)
Space heating per m2												4191.0022	(98)
										(98) / (4) =		51.2034	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	960.5411	756.1706	775.4252	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7550	0.8291	0.7943	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	725.1964	626.9241	615.8925	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	894.7511	855.3141	796.6884	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	122.0794	169.9222	134.5122	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												426.5137	(104)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	1.0000	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	30.5198	42.4805	33.6280	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling												0.0000	(107)
Space cooling per m2												106.6284	(107)
Energy for space heating												1.3027	(108)
Energy for space cooling												51.2034	(99)
Total												1.3027	(108)
Dwelling Fabric Energy Efficiency (DFEE)												52.5062	(109)
												52.5	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4037 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3174	0.3432	0.3689	0.3861	0.4032 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5531	0.5531	0.5504	0.5589	0.5681	0.5745	0.5813 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Opening Type (Uw = 1.40)			11.0800	1.3258	14.6894		(27)
TER Room Window (Uw = 1.70)			0.4300	1.5918	0.6845		(27a)
Jet Floor Lo			31.5600	0.1300	4.1028		(28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.1800	21.3120		(29a)
Dormer Cheek	2.7200		2.7200	0.1800	0.4896		(29a)
Wall to void	9.1300		9.1300	0.1800	1.6434		(29a)
Plane	8.0700		8.0700	0.1300	1.0491		(30)
Plane GF	2.0000		2.0000	0.1300	0.2600		(30)
Plane 2 void	8.8300		8.8300	0.1300	1.1479		(30)
Slope	15.1900	0.4300	14.7600	0.1300	1.9188		(30)
Dorm Roof	1.6400		1.6400	0.1300	0.2132		(30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.4707		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6035 (36)
Total fabric heat loss						(33) + (36) =	60.0742 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.3609	38.1215	37.8869	36.7849	36.5787	35.6189	35.6189	35.4411	35.9886	36.5787	36.9958	37.4319 (38)
Heat transfer coeff	98.4351	98.1957	97.9611	96.8590	96.6529	95.6930	95.6930	95.5153	96.0627	96.6529	97.0700	97.5060 (39)
Average = Sum(39)m / 12 =												96.8581 (39)
HLP	1.2026	1.1997	1.1968	1.1834	1.1809	1.1691	1.1691	1.1670	1.1736	1.1809	1.1859	1.1913 (40)
HLP (average)												1.1834 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)										Total =	Sum(45)m =	1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												
	32.4128	28.3484	29.2530	25.5035	24.4712	21.1168	19.5678	22.4544	22.7225	26.4809	28.9060	31.3900 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513	124.8513 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	21.2976	18.9163	15.3838	11.6465	8.7059	7.3499	7.9418	10.3231	13.8556	17.5929	20.5335	21.8895 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	223.2635	225.5803	219.7421	207.3132	191.6241	176.8784	167.0275	164.7107	170.5489	182.9777	198.6669	213.4125 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851	35.4851 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)												
	43.5656	42.1852	39.3186	35.4215	32.8914	29.3289	26.3008	30.1806	31.5591	35.5926	40.1472	42.1909 (72)
Total internal gains												
	348.5821	347.1372	334.8999	314.8367	293.6768	274.0126	261.7255	265.6698	276.4190	296.6187	319.8030	337.9484 (73)

6. Solar gains

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

Solar gains	70.9309	138.9528	229.3388	335.2880	411.6424	421.7178	401.3574	344.2657	266.9925	165.0103	88.4775	58.3079 (83)
Total gains	419.5129	486.0900	564.2387	650.1247	705.3192	695.7305	663.0829	609.9355	543.4115	461.6290	408.2805	396.2563 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.7439	57.8847	58.0233	58.6835	58.8087	59.3986	59.3986	59.5091	59.1700	58.8087	58.5560	58.2941
alpha	4.8496	4.8590	4.8682	4.9122	4.9206	4.9599	4.9599	4.9673	4.9447	4.9206	4.9037	4.8863
util living area												
	0.9990	0.9978	0.9932	0.9746	0.9143	0.7751	0.6089	0.6744	0.9027	0.9881	0.9980	0.9993 (86)
MIT	19.6080	19.7538	20.0216	20.3860	20.7102	20.9163	20.9802	20.9679	20.8031	20.3735	19.9264	19.5854 (87)
Th 2	19.9179	19.9202	19.9225	19.9333	19.9353	19.9448	19.9448	19.9465	19.9411	19.9353	19.9313	19.9270 (88)
util rest of house												
	0.9987	0.9969	0.9906	0.9640	0.8771	0.6848	0.4759	0.5417	0.8448	0.9816	0.9972	0.9990 (89)
MIT 2	18.6468	18.7941	19.0625	19.4293	19.7330	19.9047	19.9396	19.9370	19.8246	19.4229	18.9755	18.6314 (90)
Living area fraction									fLA =	Living area / (4) =		0.1961 (91)
MIT	18.8353	18.9823	19.2506	19.6169	19.9246	20.1031	20.1437	20.1391	20.0165	19.6093	19.1620	18.8185 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8353	18.9823	19.2506	19.6169	19.9246	20.1031	20.1437	20.1391	20.0165	19.6093	19.1620	18.8185 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9982	0.9960	0.9884	0.9600	0.8767	0.6998	0.5023	0.5678	0.8499	0.9788	0.9963	0.9986 (94)
Useful gains	418.7396	484.1251	557.7156	624.0935	618.3348	486.8935	333.0380	346.3310	461.8341	451.8487	406.7602	395.7065 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1430.7830	1382.8215	1249.0594	1038.0270	794.9349	526.6058	339.1030	357.1431	568.3515	870.7727	1170.8551	1425.3894 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	752.9603	603.9240	514.3598	298.0321	131.3905	0.0000	0.0000	0.0000	0.0000	311.6795	550.1483	766.0841 (98)
Space heating												3928.5785 (98)
Space heating per m2										(98) / (4) =		47.9973 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-187	Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (As)
Property	73, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	87 B	DER	14.56
TER			19.26
Environmental	89 B	% DER<TER	24.41
CO ₂ Emissions (t/year)	0.91	DFEE	52.51
TREE			56.61
General Requirements Compliance	Pass	% DFEE<TFEE	7.25
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3211 (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	0.3371	0.3131	0.3211	0.3050	0.3050	0.2970	0.2890	0.2809	0.2729	0.2970	0.2809	0.2970 (22b)
Effective ac	0.5568	0.5490	0.5515	0.5465	0.5465	0.5441	0.5418	0.5395	0.5372	0.5441	0.5395	0.5441 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek			2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void			9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane			8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF			2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void			8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope		0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof			1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 14934.0900 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 182.4568 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.4644 (36)
 Total fabric heat loss (33) + (36) = 66.9929 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	35.8562	35.3520	35.5159	35.1923	35.1923	35.0367	34.8853	34.7380	34.5948	35.0367	34.7380	35.0367 (38)
Average = $\text{Sum}(39)\text{m} / 12 =$	102.8491	102.3450	102.5088	102.1852	102.1852	102.0296	101.8782	101.7309	101.5878	102.0296	101.7309	102.0296 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2566	1.2504	1.2524	1.2484	1.2484	1.2465	1.2447	1.2429	1.2411	1.2465	1.2429	1.2465 (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)												2.4970 (42)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)	Total = $\text{Sum}(45)\text{m} =$											
Distribution loss (46)m = $0.15 \times (45)\text{m}$	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
RHI water heating demand	Total per year (kWh/year) = $\text{Sum}(64)\text{m} =$											
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Pumps, fans	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Total internal gains	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East												3.1800	25.1925	0.6200	0.7000	0.7700	24.0947 (76)
West												4.7500	25.1925	0.6200	0.7000	0.7700	35.9906 (80)
East												3.1500	25.1925	0.6200	0.7000	0.7700	23.8674 (76)
East												0.4300	33.4886	0.6300	0.7000	1.0000	5.7154 (82)
Solar gains	89.6681	149.4298	247.9665	363.2022	422.4704	469.5761	443.6261	390.8661	304.3967	191.3119	111.4848	72.4526 (83)					
Total gains	656.7912	711.8889	788.3733	869.5921	894.1152	910.2268	866.3027	822.1310	755.3756	676.5213	634.6186	624.1947 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hi} (C)												
Utilisation factor for gains for living area, $n_{il,m}$ (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	40.3344	40.5331	40.4683	40.5965	40.5965	40.6584	40.7188	40.7778	40.8352	40.6584	40.7778	40.6584
	3.6890	3.7022	3.6979	3.7064	3.7064	3.7106	3.7146	3.7185	3.7223	3.7106	3.7185	3.7106

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

util living area	0.9798	0.9720	0.9477	0.8876	0.7760	0.5891	0.4446	0.4654	0.7186	0.9050	0.9658	0.9824 (86)
MIT	19.5585	19.6956	20.0194	20.4247	20.7507	20.9353	20.9826	20.9798	20.8612	20.4759	19.9719	19.5454 (87)
Th 2	19.8750	19.8799	19.8783	19.8814	19.8814	19.8829	19.8844	19.8858	19.8872	19.8829	19.8858	19.8829 (88)
util rest of house												
MIT 2	0.9748	0.9652	0.9343	0.8580	0.7161	0.4917	0.3239	0.3404	0.6301	0.8725	0.9557	0.9779 (89)
Living area fraction	17.9982	18.1985	18.6601	19.2239	19.6432	19.8410	19.8781	19.8784	19.7804	19.3076	18.6038	17.9848 (90)
MIT	18.3042	18.4921	18.9267	19.4593	19.8604	20.0556	20.0947	20.0944	fLA = Living area / (4) =			0.1961 (91)
Temperature adjustment									19.9924	19.5367	18.8721	18.2908 (92)
adjusted MIT	18.1542	18.3421	18.7767	19.3093	19.7104	19.9056	19.9447	19.9444	19.8424	19.3867	18.7221	-0.1500 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9638	0.9520	0.9170	0.8396	0.7057	0.4938	0.3307	0.3472	0.6260	0.8542	0.9410	0.9678 (94)	
Useful gains	632.9988	677.6972	722.9510	730.0967	630.9514	449.4446	286.4876	285.4711	472.8942	577.8737	597.1804	604.0933 (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													
Month fracti	1363.1814	1334.7909	1207.2144	1002.3694	736.7959	469.9046	289.8083	289.3601	522.4007	814.8841	1100.9395	1340.7531 (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	543.2558	441.5669	360.2920	196.0363	78.7483	0.0000	0.0000	0.0000	0.0000	176.3358	362.7065	548.0749 (98)	
RHI space heating demand												2707.0166 (98)	
												2707 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3211 (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	0.4094	0.4014	0.3933	0.3532	0.3452	0.3050	0.3050	0.2970	0.3211	0.3452	0.3612	0.3773 (22b)
Effective ac	0.5838	0.5805	0.5774	0.5624	0.5596	0.5465	0.5465	0.5441	0.5515	0.5596	0.5652	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.5285			(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss					(33) + (36) =		66.9929 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.5925	Feb 37.3830	Mar 37.1776	Apr 36.2130	May 36.0325	Jun 35.1923	Jul 35.1923	Aug 35.0367	Sep 35.5159	Oct 36.0325	Nov 36.3976	Dec 36.7793 (38)
Heat transfer coeff	104.5855	104.3759	104.1706	103.2059	103.0254	102.1852	102.1852	102.0296	102.5088	103.0254	103.3905	103.7722 (39)
Average = Sum(39)m / 12 =												103.2050 (39)

HLP	Jan 1.2778	Feb 1.2752	Mar 1.2727	Apr 1.2609	May 1.2587	Jun 1.2484	Jul 1.2484	Aug 1.2465	Sep 1.2524	Oct 1.2587	Nov 1.2632	Dec 1.2678 (40)
HLP (average)												1.2609 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Assumed occupancy													2.4970 (42)
Average daily hot water use (litres/day)													93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548	(44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179	(45)
Energy content (annual)													Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988	(61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum (63)m =													0.0000 (63)
Output from w/h	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166	(64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659	(65)
Total per year (kWh/year) = Sum (64)m =													1716.8894 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	(71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724	(72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
East				3.1800	19.6403	0.6200	0.7000	0.7700				18.7844 (76)
West				4.7500	19.6403	0.6200	0.7000	0.7700				28.0585 (80)
East				3.1500	19.6403	0.6200	0.7000	0.7700				18.6072 (76)
East				0.4300	25.9287	0.6300	0.7000	1.0000				4.4252 (82)
Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398 (83)
Total gains	636.9984	699.3468	766.3447	836.7179	877.2086	856.1460	818.1099	770.4418	714.0161	647.7694	610.2950	609.1819 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6648	39.7444	39.8228	40.1950	40.2654	40.5965	40.5965	40.6584	40.4683	40.2654	40.1232	39.9756	
alpha	3.6443	3.6496	3.6549	3.6797	3.6844	3.7064	3.7064	3.7106	3.6979	3.6844	3.6749	3.6650	
util living area	0.9838	0.9758	0.9569	0.9107	0.8198	0.6714	0.5209	0.5673	0.7834	0.9316	0.9748	0.9861	(86)
MIT	19.4129	19.5849	19.8974	20.3075	20.6598	20.8870	20.9666	20.9539	20.7891	20.3339	19.8026	19.3771	(87)
Th 2	19.8583	19.8603	19.8623	19.8716	19.8733	19.8814	19.8814	19.8829	19.8783	19.8733	19.8698	19.8661	(88)
util rest of house	0.9798	0.9698	0.9459	0.8868	0.7702	0.5828	0.4009	0.4468	0.7083	0.9082	0.9676	0.9827	(89)
MIT 2	17.7764	18.0260	18.4762	19.0583	19.5263	19.7964	19.8660	19.8597	19.6976	19.1081	18.3501	17.7296	(90)
Living area fraction	18.0973	18.3317	18.7549	19.3032	19.7486	20.0103	20.0819	20.0742	19.9116	19.3485	18.6349	18.0527	(91)
MIT	18.0973	18.3317	18.7549	19.3032	19.7486	20.0103	20.0819	20.0742	19.9116	19.3485	18.6349	18.0527	(92)
Temperature adjustment	17.9473	18.1817	18.6049	19.1532	19.5986	19.8603	19.9319	19.9242	19.7616	19.1985	18.4849	-0.1500	
adjusted MIT	17.9473	18.1817	18.6049	19.1532	19.5986	19.8603	19.9319	19.9242	19.7616	19.1985	18.4849	17.9027	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9700	0.9574	0.9295	0.8677	0.7561	0.5810	0.4066	0.4516	0.6992	0.8897	0.9548	0.9739	0.9739	(94)
Useful gains	617.9047	669.5856	712.3270	726.0334	663.2199	497.3994	332.6272	347.9121	499.2442	576.3414	582.7243	593.2967	(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	1427.3109	1386.2901	1260.9694	1058.1940	813.7545	537.5201	340.4662	359.5779	580.3669	885.8651	1177.0939	1421.9559	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	602.1982	481.6254	408.1900	239.1556	111.9977	0.0000	0.0000	0.0000	0.0000	230.2857	427.9461	616.5224 (98)
Space heating												3117.9212 (98)
Space heating per m2												(98) / (4) = 38.0931 (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												3464.3568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	602.1982	481.6254	408.1900	239.1556	111.9977	0.0000	0.0000	0.0000	0.0000	230.2857	427.9461	616.5224 (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)	669.1091	535.1394	453.5444	265.7285	124.4419	0.0000	0.0000	0.0000	0.0000	255.8730	475.4957	685.0249 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Efficiency of water heater (217)m	89.2401	89.1842	89.0516	88.7516	88.1601	86.7000	86.7000	86.7000	86.7000	88.6930	89.0927	86.7000 (216)
Fuel for water heating, kWh/month	194.4756	170.8440	178.0872	157.9646	154.2166	137.7618	130.0815	145.8253	146.5486	164.0387	175.4516	188.9960 (219)
Water heating fuel used												1944.2914 (219)
Annual totals kWh/year												
Space heating fuel - main system												3464.3568 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =										-692.1097		-692.1097 (233)
Total delivered energy for all uses												5167.6610 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3464.3568	3.4800	120.5596 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1944.2914	3.4800	67.6613 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	376.1224	13.1900	49.6105 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-692.1097	13.1900	-91.2893 (252)
Total energy cost			276.4347 (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] =	0.9153 (257)
SAP value		87.2319
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3464.3568	0.2160	748.3011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.2914	0.2160	419.9669 (264)
Space and water heating			1168.2680 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-692.1097	0.5190	-359.2049 (269)
Total kg/year			1043.1956 (272)
CO2 emissions per m2			12.7500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value	88.9800
EI rating	89 (274)
EI band	B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8819 = 3.946$, stars = 4
Water heating environmental impact	$0.216 / 0.8819 = 0.2449$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3211 (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	0.3371	0.3131	0.3211	0.3050	0.3050	0.2970	0.2890	0.2809	0.2729	0.2970	0.2809	0.2970 (22b)
Effective ac	0.5568	0.5490	0.5515	0.5465	0.5465	0.5441	0.5418	0.5395	0.5372	0.5441	0.5395	0.5441 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss						(33) + (36) =	66.9929 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.8562	35.3520	35.5159	35.1923	35.1923	35.0367	34.8853	34.7380	34.5948	35.0367	34.7380	35.0367 (38)
Heat transfer coeff	102.8491	102.3450	102.5088	102.1852	102.1852	102.0296	101.8782	101.7309	101.5878	102.0296	101.7309	102.0296 (39)
Average = Sum(39)m / 12 =												102.0908 (39)
HLP	1.2566	1.2504	1.2524	1.2484	1.2484	1.2465	1.2447	1.2429	1.2411	1.2465	1.2429	1.2465 (40)
HLP (average)												1.2473 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
												Solar input (sum of months) = Sum (63)m = 0.0000 (63)
Output from w/h	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (65)
Heat gains from water heating, kWh/month												Total per year (kWh/year) = Sum (64)m = 1716.8894 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

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

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3344	40.5331	40.4683	40.5965	40.5965	40.6584	40.7188	40.7778	40.8352	40.6584	40.7778	40.6584
alpha	3.6890	3.7022	3.6979	3.7064	3.7064	3.7106	3.7146	3.7185	3.7223	3.7106	3.7185	3.7106
util living area	0.9798	0.9720	0.9477	0.8876	0.7760	0.5891	0.4446	0.4654	0.7186	0.9050	0.9658	0.9824 (86)
MIT	19.5585	19.6956	20.0194	20.4247	20.7507	20.9353	20.9826	20.9798	20.8612	20.4759	19.9719	19.5454 (87)
Th 2	19.8750	19.8799	19.8783	19.8814	19.8814	19.8829	19.8844	19.8858	19.8872	19.8829	19.8858	19.8829 (88)
util rest of house	0.9748	0.9652	0.9343	0.8580	0.7161	0.4917	0.3239	0.3404	0.6301	0.8725	0.9557	0.9779 (89)
MIT 2	17.9982	18.1985	18.6601	19.2239	19.6432	19.8410	19.8781	19.8784	19.7804	19.3076	18.6038	17.9848 (90)
Living area fraction	18.3042	18.4921	18.9267	19.4593	19.8604	20.0556	20.0947	20.0944	19.9924	19.5367	18.8721	18.2908 (91)
Temperature adjustment	18.1542	18.3421	18.7767	19.3093	19.7104	19.9056	19.9447	19.9444	19.8424	19.3867	18.7221	-0.1500
adjusted MIT	18.1542	18.3421	18.7767	19.3093	19.7104	19.9056	19.9447	19.9444	19.8424	19.3867	18.7221	18.1408 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	632.9988	677.6972	722.9510	730.0967	630.9514	449.4446	286.4876	285.4711	472.8942	577.8737	597.1804	604.0933 (94)
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	1363.1814	1334.7909	1207.2144	1002.3694	736.7959	469.9046	289.8083	289.3601	522.4007	814.8841	1100.9395	1340.7531 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating kWh	543.2558	441.5669	360.2920	196.0363	78.7483	0.0000	0.0000	0.0000	0.0000	176.3358	362.7065	548.0749 (98)
Space heating												2707.0166 (98)
Space heating per m2												(98) / (4) = 33.0729 (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												3007.7962 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	543.2558	441.5669	360.2920	196.0363	78.7483	0.0000	0.0000	0.0000	0.0000	176.3358	362.7065	548.0749 (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)	603.6176	490.6299	400.3245	217.8182	87.4981	0.0000	0.0000	0.0000	0.0000	195.9286	403.0072	608.9721 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (64)
Efficiency of water heater	89.1782	89.1297	88.9650	88.5940	87.8819	86.7000	86.7000	86.7000	86.7000	88.4776	88.9800	86.7000 (216)
(217)m	89.1782	89.1297	88.9650	88.5940	87.8819	86.7000	86.7000	86.7000	86.7000	88.4776	88.9800	89.2008 (217)
Fuel for water heating, kWh/month	194.6106	170.9484	178.2604	158.2456	154.7048	137.7618	130.0815	145.8253	146.5486	164.4380	175.6739	189.1424 (219)
Water heating fuel used												1946.2414 (219)
Annual totals kWh/year												
Space heating fuel - main system												3007.7962 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =									-768.8767			-768.8767 (233)
Total delivered energy for all uses												4636.2833 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3007.7962	3.9400	118.5072 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.2414	3.9400	76.6819 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Energy for lighting	376.1224	16.5500	62.2483 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	-768.8767	16.5500	-127.2491 (252)
Total energy cost			229.6007 (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	3007.7962	0.2160	649.6840 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.2414	0.2160	420.3882 (264)
Space and water heating			1070.0721 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	0.5190	-399.0470 (269)
Total kg/year			905.1577 (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	3007.7962	1.2200	3669.5113 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.2414	1.2200	2374.4146 (264)
Space and water heating			6043.9259 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy For lighting	376.1224	3.0700	1154.6957 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	3.0700	-2360.4514 (269)
Primary energy kWh/year			5068.4203 (272)
Primary energy kWh/m2/year			61.9233 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 31	-190 kg (21.0%)

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

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

Fuel prices for cost data on this page from database revision number 436 TEST (29 Nov 2018)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£75	£83	-£8
Mains gas	£282	£243	£39
Space heating	£218	£218	£0
Water heating	£77	£45	£31
Lighting	£62	£62	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£230	£199	£31
Total cost of uses	£230	£198	£31
Delivered energy	57 kWh/m²	45 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	49 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3211 (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	0.4094	0.4014	0.3933	0.3532	0.3452	0.3050	0.3050	0.2970	0.3211	0.3452	0.3612	0.3773 (22b)
Effective ac	0.5838	0.5805	0.5774	0.5624	0.5596	0.5465	0.5465	0.5441	0.5515	0.5596	0.5652	0.5712 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.5285			(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss						(33) + (36) =	66.9929 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.5925	37.3830	37.1776	36.2130	36.0325	35.1923	35.1923	35.0367	35.5159	36.0325	36.3976	36.7793 (38)
Heat transfer coeff	104.5855	104.3759	104.1706	103.2059	103.0254	102.1852	102.1852	102.0296	102.5088	103.0254	103.3905	103.7722 (39)
Average = Sum(39)m / 12 =												103.2050 (39)
HLP	1.2778	1.2752	1.2727	1.2609	1.2587	1.2484	1.2484	1.2465	1.2524	1.2587	1.2632	1.2678 (40)
HLP (average)												1.2609 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2327 (H8)
Utilisation factor												0.5557 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5044 (H14)
Volume ratio Veff/V												0.8021 (H15)
Solar storage volume factor												0.9559 (H16)
Solar input												-847.0449 (H17)
Solar input	-24.5626	-40.9879	-69.8072	-93.5554	-115.5798	-113.6333	-112.1316	-97.9699	-76.7301	-52.3976	-29.1348	-20.5547 (63)
Solar input (sum of months) = Sum (63)m =												-847.0449 (63)
Output from w/h	148.9876	111.3779	88.7823	46.6407	20.3777	5.8062	0.6491	28.4606	50.3275	93.0931	127.1799	148.1619 (64)
Total per year (kWh/year) = Sum (64)m =												869.8445 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

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

Solar gains	69.8752	136.8878	225.9379	330.3280	405.5638	415.4953	395.4332	339.1770	263.0371	162.5600	87.1612	57.4398 (83)
Total gains	636.9984	699.3468	766.3447	836.7179	877.2086	856.1460	818.1099	770.4418	714.0161	647.7694	610.2950	609.1819 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6648	39.7444	39.8228	40.1950	40.2654	40.5965	40.5965	40.6584	40.4683	40.2654	40.1232	39.9756
alpha	3.6443	3.6496	3.6549	3.6797	3.6844	3.7064	3.7064	3.7106	3.6979	3.6844	3.6749	3.6650
util living area	0.9838	0.9758	0.9569	0.9107	0.8198	0.6714	0.5209	0.5673	0.7834	0.9316	0.9748	0.9861 (86)
MIT	19.4129	19.5849	19.8974	20.3075	20.6598	20.8870	20.9666	20.9539	20.7891	20.3339	19.8026	19.3771 (87)
Th 2	19.8583	19.8603	19.8623	19.8716	19.8733	19.8814	19.8814	19.8829	19.8783	19.8733	19.8698	19.8661 (88)
util rest of house	0.9798	0.9698	0.9459	0.8868	0.7702	0.5828	0.4009	0.4468	0.7083	0.9082	0.9676	0.9827 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.7764	18.0260	18.4762	19.0583	19.5263	19.7964	19.8660	19.8597	19.6976	19.1081	18.3501	17.7296 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.0973	18.3317	18.7549	19.3032	19.7486	20.0103	20.0819	20.0742	19.9116	19.3485	18.6349	18.0527 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9473	18.1817	18.6049	19.1532	19.5986	19.8603	19.9319	19.9242	19.7616	19.1985	18.4849	17.9027 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9700	0.9574	0.9295	0.8677	0.7561	0.5810	0.4066	0.4516	0.6992	0.8897	0.9548	0.9739 (94)	
Useful gains	617.9047	669.5856	712.3270	726.0334	663.2199	497.3994	332.6272	347.9121	499.2442	576.3414	582.7243	593.2967 (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	1427.3109	1386.2901	1260.9694	1058.1940	813.7545	537.5201	340.4662	359.5779	580.3669	885.8651	1177.0939	1421.9559 (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	602.1982	481.6254	408.1900	239.1556	111.9977	0.0000	0.0000	0.0000	0.0000	230.2857	427.9461	616.5224 (98)	
Space heating												3117.9212 (98)	
Space heating per m2										(98) / (4) =		38.0931 (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													3464.3568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.1982	481.6254	408.1900	239.1556	111.9977	0.0000	0.0000	0.0000	0.0000	230.2857	427.9461	616.5224 (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)	669.1091	535.1394	453.5444	265.7285	124.4419	0.0000	0.0000	0.0000	0.0000	255.8730	475.4957	685.0249 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	148.9876	111.3779	88.7823	46.6407	20.3777	5.8062	0.6491	28.4606	50.3275	93.0931	127.1799	148.1619 (64)	
Efficiency of water heater (217)m	89.3257	89.3612	89.3922	89.4444	89.4757	86.7000	86.7000	86.7000	86.7000	89.0245	89.2220	86.7000 (216)	
Fuel for water heating, kWh/month	166.7914	124.6379	99.3178	52.1449	22.7746	6.6968	0.7486	32.8265	58.0479	104.5702	142.5432	165.8384 (219)	
Water heating fuel used												976.9383 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3464.3568 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1068 * 1.00) =									-692.1097				-692.1097 (233)
Total delivered energy for all uses													4250.3079 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3464.3568	3.4800	120.5596 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	976.9383	3.4800	33.9975 (247)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	376.1224	13.1900	49.6105 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-692.1097	13.1900	-91.2893 (252)	
Total energy cost			249.3658 (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] =	0.8256 (257)
SAP value		88.4822

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

88 (258)
B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3464.3568	0.2160	748.3011	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	976.9383	0.2160	211.0187	(264)
Space and water heating			959.3198	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	376.1224	0.5190	195.2075	(268)
Energy saving/generation technologies				
PV Unit				
Total kg/year	-692.1097	0.5190	-359.2049	(269)
CO2 emissions per m2			860.1974	(272)
EI value			10.5100	(273)
EI rating			90.9132	
EI band			91	(274)
			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	31.5600 (1b)	x 2.3100 (2b)	= 72.9036 (1b) - (3b)
First floor	29.5600 (1c)	x 2.5500 (2c)	= 75.3780 (1c) - (3c)
Second floor	20.7300 (1d)	x 2.2600 (2d)	= 46.8498 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	195.1314 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.4800
Infiltration rate					0.3777 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3211 (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	0.3371	0.3131	0.3211	0.3050	0.3050	0.2970	0.2890	0.2809	0.2729	0.2970	0.2809	0.2970 (22b)
Effective ac	0.5568	0.5490	0.5515	0.5465	0.5465	0.5441	0.5418	0.5395	0.5372	0.5441	0.5395	0.5441 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			7.9300	1.3258	10.5133		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466		(27a)
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000 (28a)
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000 (29a)
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800 (29a)
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700 (29a)
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300 (30)
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000 (30)
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700 (30)
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400 (30)
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600 (30)
Total net area of external elements Aum(A, m ²)			210.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5285		(33)
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500 (32)
Internal Partition 1			132.2500			9.0000	1190.2500 (32c)
Internal Floor 1			52.2900			18.0000	941.2200 (32d)
Internal Ceiling 1			52.2900			18.0000	941.2200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14934.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.4568 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644 (36)
Total fabric heat loss					(33) + (36) =		66.9929 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.8562	35.3520	35.5159	35.1923	35.1923	35.0367	34.8853	34.7380	34.5948	35.0367	34.7380	35.0367 (38)
Heat transfer coeff	102.8491	102.3450	102.5088	102.1852	102.1852	102.0296	101.8782	101.7309	101.5878	102.0296	101.7309	102.0296 (39)
Average = Sum(39)m / 12 =												102.0908 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2566	1.2504	1.2524	1.2484	1.2484	1.2465	1.2447	1.2429	1.2411	1.2465	1.2429	1.2465 (40)
HLP (average)												1.2473 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy												2.4970 (42)
Average daily hot water use (litres/day)												93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548 (44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179 (45)
Energy content (annual)												Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988 (61)
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3796 (H8)
Utilisation factor												0.5156 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5044 (H14)
Volume ratio Veff/V												0.8021 (H15)
Solar storage volume factor												0.9559 (H16)
Solar input												-879.5956 (H17)
Solar input	-28.6945	-40.8018	-70.1285	-94.6196	-111.1364	-118.7112	-116.2147	-104.0157	-81.4371	-56.3028	-33.9381	-23.5953 (63)
Solar input (sum of months) = Sum (63)m =												-879.5956 (63)
Output from w/h	144.8556	111.5640	88.4610	45.5765	24.8211	0.7283	0.0000	22.4148	45.6205	89.1879	122.3766	145.1214 (64)
Total per year (kWh/year) = Sum (64)m =												840.7278 (64)
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216	149.8216 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2440	47.2909	38.4595	29.1163	21.7648	18.3748	19.8546	25.8077	34.6391	43.9823	51.3338	54.7238 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.2291	336.6870	327.9732	309.4227	286.0061	263.9977	249.2947	245.8368	254.5506	273.1011	296.5178	318.5262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792	52.4792 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811	-99.8811 (71)
Water heating gains (Table 5)	75.2303	73.0615	68.5543	62.4311	58.4543	52.8585	48.1076	54.2005	56.3696	62.7063	69.8625	73.0724 (72)
Total internal gains	567.1231	562.4590	540.4068	506.3899	471.6448	440.6507	422.6766	431.2648	450.9789	485.2094	523.1338	551.7421 (73)

6. Solar gains

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

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.3344	40.5331	40.4683	40.5965	40.5965	40.6584	40.7188	40.7778	40.8352	40.6584	40.7778	40.6584
alpha	3.6890	3.7022	3.6979	3.7064	3.7064	3.7106	3.7146	3.7185	3.7223	3.7106	3.7185	3.7106
util living area	0.9798	0.9720	0.9477	0.8876	0.7760	0.5891	0.4446	0.4654	0.7186	0.9050	0.9658	0.9824 (86)
MIT	19.5585	19.6956	20.0194	20.4247	20.7507	20.9353	20.9826	20.9798	20.8612	20.4759	19.9719	19.5454 (87)
Th 2	19.8750	19.8799	19.8783	19.8814	19.8814	19.8829	19.8844	19.8858	19.8872	19.8829	19.8858	19.8829 (88)
util rest of house	0.9748	0.9652	0.9343	0.8580	0.7161	0.4917	0.3239	0.3404	0.6301	0.8725	0.9557	0.9779 (89)

AES
Sustainability
Consultants

MIT 2	17.9982	18.1985	18.6601	19.2239	19.6432	19.8410	19.8781	19.8784	19.7804	19.3076	18.6038	17.9848 (90)
Living area fraction									fLA =	Living area / (4) =		0.1961 (91)
MIT	18.3042	18.4921	18.9267	19.4593	19.8604	20.0556	20.0947	20.0944	19.9924	19.5367	18.8721	18.2908 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1542	18.3421	18.7767	19.3093	19.7104	19.9056	19.9447	19.9444	19.8424	19.3867	18.7221	18.1408 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9638	0.9520	0.9170	0.8396	0.7057	0.4938	0.3307	0.3472	0.6260	0.8542	0.9410	0.9678 (94)
Useful gains	632.9988	677.6972	722.9510	730.0967	630.9514	449.4446	286.4876	285.4711	472.8942	577.8737	597.1804	604.0933 (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	1363.1814	1334.7909	1207.2144	1002.3694	736.7959	469.9046	289.8083	289.3601	522.4007	814.8841	1100.9395	1340.7531 (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	543.2558	441.5669	360.2920	196.0363	78.7483	0.0000	0.0000	0.0000	0.0000	176.3358	362.7065	548.0749 (98)
Space heating												2707.0166 (98)
Space heating per m2												33.0729 (99)
										(98) / (4) =		

Not applicable

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3007.7962	3.9400	118.5072 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	944.5015	3.9400	37.2134 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Pump for solar water heating	50.0000	16.5500	8.2750 (249)
Energy for lighting	376.1224	16.5500	62.2483 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	-768.8767	16.5500	-127.2491 (252)
Total energy cost			198.4072 (255)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3007.7962	0.2160	649.6840 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	944.5015	0.2160	204.0123 (264)
Space and water heating			853.6963 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.1224	0.5190	195.2075 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	0.5190	-399.0470 (269)
Total kg/year			714.7318 (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	3007.7962	1.2200	3669.5113 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	944.5015	1.2200	1152.2918 (264)
Space and water heating			4821.8032 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	376.1224	3.0700	1154.6957 (268)
Energy saving/generation technologies			
PV Unit	-768.8767	3.0700	-2360.4514 (269)
Primary energy kWh/year			3999.7975 (272)
Primary energy kWh/m2/year			48.8674 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-187	Issued on Date	17/12/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (As)
Property	73, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		
SAP Rating	87 B	DER	14.56
Environmental	89 B	TER	19.26
CO ₂ Emissions (t/year)	0.91	% DER<TER	24.41
General Requirements Compliance	Pass	DFEE	52.51
		TFEE	56.61
		% DFEE<TFEE	7.25
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	182.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	257.57 (P1)
Transmission heat loss coefficient	66.99 (37)
Summer heat loss coefficient	324.57 (P2)

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

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

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

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