

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-184				Issued on Date	15/03/2018
Assessment Reference	As Built		Prop Type Ref	P307 - Semi (Op)		
Property	67, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating		87 B	DER	14.51	TER	19.26
Environmental		89 B	% DER<TER	24.67		
CO ₂ Emissions (t/year)		0.90	DFEE	52.27	TFEE	56.61
General Requirements Compliance		Pass	% DFEE<TFEE	7.67		
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) 14.51 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.3 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: 4.17 (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) =				30.0000 / (5) = 0.1537 (8)
Pressure test					Yes
Measured/design AP50					4.1700
Infiltration rate					0.3622 (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) =				0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5654 (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	37.1588	36.9661	36.7773	35.8901	35.7242	34.9515	34.9515	34.8084	35.2491	35.7242	36.0599	36.4110 (38)
Heat transfer coeff	104.1517	103.9590	103.7702	102.8831	102.7171	101.9444	101.9444	101.8013	102.2420	102.7171	103.0528	103.4039 (39)
Average = Sum(39)m / 12 =												102.8823 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2725	1.2701	1.2678	1.2570	1.2549	1.2455	1.2455	1.2438	1.2491	1.2549	1.2590	1.2633 (40)
HLP (average)												1.2570 (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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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)	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)
Distribution loss (46)m = 0.15 x (45)m													
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 =													(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 =													(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)														
tau	39.8300	39.9038	39.9764	40.3211	40.3863	40.6924	40.6924	40.7495	40.5739	40.3863	40.2547	40.1180		
alpha	3.6553	3.6603	3.6651	3.6881	3.6924	3.7128	3.7128	3.7166	3.7049	3.6924	3.6836	3.6745		
util living area	0.9946	0.9905	0.9798	0.9492	0.8790	0.7497	0.6026	0.6578	0.8639	0.9689	0.9910	0.9956	(86)	
MIT	19.1716	19.3523	19.6882	20.1400	20.5505	20.8350	20.9463	20.9249	20.6927	20.1536	19.5816	19.1378	(87)	
Th 2	19.8625	19.8643	19.8661	19.8747	19.8763	19.8838	19.8838	19.8852	19.8809	19.8763	19.8731	19.8697	(88)	
util rest of house	0.9932	0.9880	0.9741	0.9337	0.8393	0.6646	0.4724	0.5306	0.8033	0.9566	0.9882	0.9944	(89)	
MIT 2	17.4294	17.6937	18.1826	18.8348	19.3985	19.7525	19.8575	19.8444	19.5981	18.8649	18.0351	17.3846	(90)	
Living area fraction	17.7711	18.0190	18.4778	19.0907	19.6244	19.9648	20.0710	20.0563	19.8128	19.1176	18.3383	17.7283	(92)	
Temperature adjustment													-0.1500	
adjusted MIT	17.6211	17.8690	18.3278	18.9407	19.4744	19.8148	19.9210	19.9063	19.6628	18.9676	18.1883	17.5783	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9887	0.9812	0.9628	0.9164	0.8218	0.6585	0.4772	0.5333	0.7885	0.9421	0.9815	0.9906	(94)
Useful gains	447.9885	508.1764	571.0147	618.7552	598.1001	471.5347	325.4087	336.9994	447.2803	460.9553	431.5660	425.2352	(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	1387.4105	1348.2409	1227.3766	1033.0184	798.5670	531.6155	338.5550	356.9413	568.7493	859.4952	1142.6838	1383.3731	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

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Space heating kWh	698.9300	564.5233	488.3333	298.2695	149.1474	0.0000	0.0000	0.0000	0.0000	296.5137	512.0048	712.8546 (98)
Space heating												3720.5767 (98)
Space heating per m2												(98) / (4) = 45.4560 (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												4133.9741 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	698.9300	564.5233	488.3333	298.2695	149.1474	0.0000	0.0000	0.0000	0.0000	296.5137	512.0048	712.8546 (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)	776.5889	627.2481	542.5925	331.4106	165.7193	0.0000	0.0000	0.0000	0.0000	329.4597	568.8943	792.0607 (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	89.3237	89.2778	89.1680	88.9179	88.3956	86.7000	86.7000	86.7000	86.7000	88.8864	89.2058	86.7000 (216)
(217)m	89.3237	89.2778	89.1680	88.9179	88.3956	86.7000	86.7000	86.7000	86.7000	88.8864	89.2058	89.3491 (217)
Fuel for water heating, kWh/month	194.2935	170.6649	177.8547	157.6692	153.8058	137.7618	130.0815	145.8253	146.5486	163.6817	175.2292	188.8285 (219)
Water heating fuel used												1942.2447 (219)
Annual totals kWh/year												
Space heating fuel - main system												4133.9741 (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												5835.2314 (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	4133.9741	0.2160	892.9384 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.2447	0.2160	419.5248 (264)
Space and water heating			1312.4632 (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			1187.3908 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5100 (273)

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

DER			14.5100 ZC1
Total Floor Area		TFA	81.8500
Assumed number of occupants		N	2.4970
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1639 ZC2
CO2 emissions from cooking, equation (L16)			2.1861 ZC3
Total CO2 emissions			32.8599 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			32.8599 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

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

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

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

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

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)
Output from w/h	203.4896	179.0242	186.2631	165.2060	159.9485	140.8737	134.9678	150.4574	152.1191	173.2179	184.9067	198.6768 (64)
Heat gains from water heating, kWh/month	63.4562	55.7619	57.9228	51.2029	49.4877	43.4167	41.3389	46.3319	46.8515	53.5853	57.4490	61.8559 (65)
										Total per year (kWh/year) =	Sum (64)m =	2029.1509 (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)	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 m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East				6.3300	19.6403	0.6300	0.7000	0.7700		37.9947 (76)		
West				4.7500	19.6403	0.6300	0.7000	0.7700		28.5110 (80)		
East				0.4300	25.9287	0.6300	0.7000	1.0000		4.4252 (82)		

Solar gains	70.9309	138.9528	229.3388	335.2880	411.6424	421.7178	401.3574	344.2657	266.9925	165.0103	88.4775	58.3079 (83)
Total gains	464.2380	529.8839	605.7734	688.8182	741.9436	729.7026	695.3450	645.0290	579.9239	501.0596	450.9236	440.2050 (84)

7. Mean internal temperature (heating season)

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

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9935	0.9833	0.9485	0.8563	0.6746	0.4805	0.5401	0.8220	0.9692	0.9936	0.9975 (94)
Ext temp.	462.7243	526.4274	595.6298	653.3276	635.3479	492.2806	334.0820	348.4103	476.6717	485.6205	448.0536	439.0936 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1390.8581	1348.1046	1223.6070	1024.6123	790.5411	526.0478	339.0818	357.1202	566.5813	857.6333	1142.5627	1384.8598 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	690.5315	552.1670	467.2150	267.3250	115.4638	0.0000	0.0000	0.0000	0.0000	276.7775	500.0466	703.6501 (98)
Space heating per m2												3573.1765 (98)
										(98) / (4) =		43.6552 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

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

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-184				Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)			
Property	67, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	87 B	DER	14.51	TER	19.26	
Environmental	89 B	% DER<TER	24.67			
CO ₂ Emissions (t/year)	0.90	DFEE	52.27	TFEE	56.61	
General Requirements Compliance	Pass	% DFEE<TFEE	7.67			
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) =					Air changes per hour
Pressure test					30.0000 / (5) = 0.1537 (8)
Measured/design AP50					Yes
Infiltration rate					4.1700
Number of sides sheltered					0.3622 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5654 (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		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	37.1588	36.9661	36.7773	35.8901	35.7242	34.9515	34.9515	34.8084	35.2491	35.7242	36.0599	36.4110	(38)
Heat transfer coeff	104.1517	103.9590	103.7702	102.8831	102.7171	101.9444	101.9444	101.8013	102.2420	102.7171	103.0528	103.4039	(39)
Average = Sum(39)m / 12 =												102.8823	(39)
HLP	1.2725	1.2701	1.2678	1.2570	1.2549	1.2455	1.2455	1.2438	1.2491	1.2549	1.2590	1.2633	(40)
HLP (average)												1.2570	(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													
(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, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	38.5748	38.6463	38.7167	39.0505	39.1136	39.4100	39.4100	39.4654	39.2953	39.1136	38.9861	38.8538
util living area	3.5717	3.5764	3.5811	3.6034	3.6076	3.6273	3.6273	3.6310	3.6197	3.6076	3.5991	3.5903
	0.9953	0.9916	0.9815	0.9526	0.8859	0.7617	0.6172	0.6748	0.8746	0.9723	0.9923	0.9962 (86)
MIT	19.0800	19.2663	19.6135	20.0819	20.5107	20.8142	20.9372	20.9121	20.6590	20.0939	19.5024	19.0462 (87)
Th 2	19.8625	19.8643	19.8661	19.8747	19.8763	19.8838	19.8838	19.8852	19.8809	19.8763	19.8731	19.8697 (88)
util rest of house	0.9941	0.9894	0.9764	0.9383	0.8484	0.6787	0.4868	0.5484	0.8178	0.9615	0.9898	0.9952 (89)
MIT 2	18.1137	18.3006	18.6465	19.1117	19.5169	19.7806	19.8620	19.8514	19.6622	19.1311	18.5431	18.0853 (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	18.4900	18.8361	19.3020	19.7118	19.9832	20.0729	20.0594	19.8576	19.3199	18.7312	18.2737 (92)
Temperature adjustment											0.0000
adjusted MIT	18.4900	18.8361	19.3020	19.7118	19.9832	20.0729	20.0594	19.8576	19.3199	18.7312	18.2737 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9856	0.9701	0.9290	0.8418	0.6871	0.5108	0.5704	0.8164	0.9541	0.9864	0.9932	(94)
Useful gains	414.9936	477.0724	544.0502	599.3388	588.6082	473.7637	335.6673	344.9911	440.3923	438.1184	401.4178	392.7051	(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	1458.4540	1412.7983	1280.1187	1070.1874	822.9438	548.7917	354.0406	372.5327	588.6735	895.6809	1198.6300	1455.2762	(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	776.3345	628.8078	547.6350	339.0110	174.3456	0.0000	0.0000	0.0000	0.0000	340.4265	573.9927	790.5529	(98)
Space heating per m2												4171.1061	(98)
										(98) / (4) =		50.9604	(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	958.2776	754.3887	773.6902	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7562	0.8302	0.7954	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	724.6891	626.2862	615.3919	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	122.4447	170.3968	134.8846	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												427.7261	(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	30.6112	42.5992	33.7212	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling													
Space cooling per m2												0.0000	(107)
Energy for space heating												106.9315	(107)
Energy for space cooling												1.3064	(108)
Total												50.9604	(99)
Dwelling Fabric Energy Efficiency (DFEE)												1.3064	(108)
												52.2668	(109)
												52.3	(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) =				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 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 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	1471.1879 (45)
Water storage loss:												
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.4128	28.3484	29.2530	25.5035	24.4712	21.1168	19.5678	22.4544	22.7225	26.4809	28.9060	31.3900 (65)

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

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

6. Solar gains

[Jan]	Area 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	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	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	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
Useful gains	418.7396	484.1251	557.7156	624.0935	618.3348	486.8935	333.0380	346.3310	461.8341	451.8487	406.7602	395.7065 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1430.7830	1382.8215	1249.0594	1038.0270	794.9349	526.6058	339.1030	357.1431	568.3515	870.7727	1170.8551	1425.3894 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	752.9603	603.9240	514.3598	298.0321	131.3905	0.0000	0.0000	0.0000	0.0000	311.6795	550.1483	766.0841 (98)
Space heating												3928.5785 (98)
Space heating per m2										(98) / (4) =		47.9973 (99)

8c. Space cooling requirement

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

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Calculation 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	4907-0015-3817-184				Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)			
Property	67, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	87 B	DER	14.51	TER	19.26	
Environmental	89 B	% DER<TER	24.67			
CO ₂ Emissions (t/year)	0.90	DFEE	52.27	TFEE	56.61	
General Requirements Compliance	Pass	% DFEE<TFEE	7.67			
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					4.1700
Infiltration rate					0.3622 (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) =				0.3079 (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
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
Adj infilt rate	0.3233	0.3002	0.3079	0.2925	0.2925	0.2848	0.2771	0.2694	0.2617	0.2848	0.2694	0.2848
Effective ac	0.5523	0.5451	0.5474	0.5428	0.5428	0.5406	0.5384	0.5363	0.5342	0.5406	0.5363	0.5406

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	35.5620	35.0984	35.2491	34.9515	34.9515	34.8084	34.6692	34.5337	34.4021	34.8084	34.5337	34.8084
Average = Sum(39)m / 12 =	102.5549	102.0913	102.2420	101.9444	101.9444	101.8013	101.6621	101.5266	101.3950	101.8013	101.5266	101.8013
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2530	1.2473	1.2491	1.2455	1.2455	1.2438	1.2421	1.2404	1.2388	1.2438	1.2404	1.2438
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												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
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179
Energy content (annual)	Total = Sum(45)m =											
Distribution loss (46)m = $0.15 \times (45)\text{m}$	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988
Total heat required for water heating calculated for each month	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Output from w/h	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166
RHI water heating demand	Total per year (kWh/year) = Sum(64)m =											
Heat gains from water heating, kWh/month	55.9713	49.0973	51.0044	44.9504	43.4900	38.0582	35.7921	40.3252	40.5861	46.6535	50.3010	54.3659

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

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

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.1800	25.1925	0.6200	0.7000	0.7700	24.0947 (76)
West	4.7500	25.1925	0.6200	0.7000	0.7700	35.9906 (80)
East	3.1500	25.1925	0.6200	0.7000	0.7700	23.8674 (76)
East	0.4300	33.4886	0.6300	0.7000	1.0000	5.7154 (82)
Solar gains	89.6681	149.4298	247.9665	363.2022	422.4704	469.5761
Total gains	656.7912	711.8889	788.3733	869.5921	894.1152	910.2268

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	40.4501	40.6338	40.5739	40.6924	40.6924	40.7495	40.8054	40.8598	40.9129	40.7495	40.8598	40.7495

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

util living area	0.9798	0.9720	0.9475	0.8872	0.7753	0.5882	0.4438	0.4646	0.7180	0.9048	0.9657	0.9824 (86)
MIT	19.5641	19.7003	20.0239	20.4278	20.7526	20.9360	20.9828	20.9801	20.8621	20.4785	19.9751	19.5496 (87)
Th 2	19.8779	19.8823	19.8809	19.8838	19.8838	19.8852	19.8865	19.8878	19.8891	19.8852	19.8878	19.8852 (88)
util rest of house												
MIT 2	0.9748	0.9651	0.9341	0.8576	0.7154	0.4910	0.3235	0.3400	0.6295	0.8722	0.9556	0.9779 (89)
Living area fraction	18.0081	18.2069	18.6682	19.2298	19.6474	19.8436	19.8802	19.8804	19.7831	19.3127	18.6097	17.9924 (90)
MIT	18.3132	18.4997	18.9340	19.4647	19.8641	20.0578	20.0964	20.0961	19.9947	19.5413	18.8774	18.2978 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1632	18.3497	18.7840	19.3147	19.7141	19.9078	19.9464	19.9461	19.8447	19.3913	18.7274	18.1478 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9638	0.9519	0.9169	0.8393	0.7051	0.4931	0.3302	0.3468	0.6255	0.8539	0.9410	0.9678 (94)
Useful gains	632.9854	677.6667	722.8464	729.8252	630.4338	448.8464	286.0962	285.1079	472.5001	577.7042	597.1467	604.0870 (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	1360.2064	1332.2659	1204.8223	1000.5576	735.4394	469.0832	289.3750	288.9517	521.6426	813.5210	1099.2711	1338.4620 (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	541.0524	439.8907	358.5901	194.9274	78.1242	0.0000	0.0000	0.0000	0.0000	175.4477	361.5295	546.3750 (98)
RHI space heating demand												2695.9371 (98)
												2696 (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					4.1700
Infiltration rate					0.3622 (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) =		0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5654 (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	37.1588	36.9661	36.7773	35.8901	35.7242	34.9515	34.9515	34.8084	35.2491	35.7242	36.0599	36.4110 (38)
Heat transfer coeff	104.1517	103.9590	103.7702	102.8831	102.7171	101.9444	101.9444	101.8013	102.2420	102.7171	103.0528	103.4039 (39)
Average = Sum(39)m / 12 =												102.8823 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2725	1.2701	1.2678	1.2570	1.2549	1.2455	1.2455	1.2438	1.2491	1.2549	1.2590	1.2633 (40)
HLP (average)												1.2570 (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)

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	39.8300	39.9038	39.9764	40.3211	40.3863	40.6924	40.6924	40.7495	40.5739	40.3863	40.2547	40.1180	
alpha	3.6553	3.6603	3.6651	3.6881	3.6924	3.7128	3.7128	3.7166	3.7049	3.6924	3.6836	3.6745	
util living area	0.9837	0.9757	0.9568	0.9103	0.8191	0.6705	0.5200	0.5664	0.7827	0.9314	0.9748	0.9861	(86)
MIT	19.4213	19.5927	19.9043	20.3121	20.6627	20.8881	20.9670	20.9544	20.7909	20.3377	19.8081	19.3842	(87)
Th 2	19.8625	19.8643	19.8661	19.8747	19.8763	19.8838	19.8838	19.8852	19.8809	19.8763	19.8731	19.8697	(88)
util rest of house	0.9798	0.9698	0.9457	0.8864	0.7694	0.5821	0.4003	0.4462	0.7076	0.9079	0.9675	0.9827	(89)
MIT 2	17.7912	18.0399	18.4885	19.0667	19.5323	19.7995	19.8686	19.8621	19.7017	19.1154	18.3602	17.7422	(90)
Living area fraction	18.1108	18.3444	18.7661	19.3109	19.7540	20.0130	20.0840	20.0763	19.9153	19.3551	18.6441	18.0642	(91)
MIT	18.1108	18.3444	18.7661	19.3109	19.7540	20.0130	20.0840	20.0763	19.9153	19.3551	18.6441	18.0642	(92)
Temperature adjustment	17.9608	18.1944	18.6161	19.1609	19.6040	19.8630	19.9340	19.9263	19.7653	19.2051	18.4941	-0.1500	
adjusted MIT	17.9608	18.1944	18.6161	19.1609	19.6040	19.8630	19.9340	19.9263	19.7653	19.2051	18.4941	17.9142	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	617.8995	669.5539	712.2190	725.7685	662.6774	496.8112	332.1383	347.4499	498.8039	576.1974	582.6981	593.2971	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1422.7988	1382.0751	1257.2920	1055.6740	811.8727	536.5324	339.8779	358.9843	579.2272	883.8921	1174.1934	1418.1013	(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	598.8451	478.8143	405.5343	237.5320	111.0013	0.0000	0.0000	0.0000	0.0000	228.9248	425.8766	613.6544 (98)
Space heating												3100.1827 (98)
Space heating per m2												(98) / (4) = 37.8764 (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												3444.6475 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	598.8451	478.8143	405.5343	237.5320	111.0013	0.0000	0.0000	0.0000	0.0000	228.9248	425.8766	613.6544 (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)	665.3834	532.0159	450.5936	263.9244	123.3348	0.0000	0.0000	0.0000	0.0000	254.3609	473.1963	681.8382 (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	89.2368	89.1806	89.0472	88.7463	88.1528	86.7000	86.7000	86.7000	86.7000	88.6883	89.0896	86.7000 (216)
Fuel for water heating, kWh/month	194.4827	170.8509	178.0960	157.9740	154.2293	137.7618	130.0815	145.8253	146.5486	164.0473	175.4579	189.0016 (219)
Water heating fuel used												1944.3570 (219)
Annual totals kWh/year												
Space heating fuel - main system												3444.6475 (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												5148.0172 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3444.6475	3.4800	119.8737 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1944.3570	3.4800	67.6636 (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			275.7511 (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] =	0.9130 (257)
SAP value		87.2635
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	3444.6475	0.2160	744.0438 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1944.3570	0.2160	419.9811 (264)
Space and water heating			1164.0250 (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			1038.9526 (272)
CO2 emissions per m2			12.6900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value 89.0249
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	$3.48 / 0.8818 = 3.946$, stars = 4
Water heating environmental impact	$0.216 / 0.8818 = 0.2449$, 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	m3 per hour			
Number of chimneys					0	+		0	+	0	=	0 * 40 =	0.0000	(6a)	
Number of open flues					0	+		0	+	0	=	0 * 20 =	0.0000	(6b)	
Number of intermittent fans												3 * 10 =	30.0000	(7a)	
Number of passive vents												0 * 10 =	0.0000	(7b)	
Number of flueless gas fires												0 * 40 =	0.0000	(7c)	
												Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1537	(8)	
Pressure test												Yes			
Measured/design AP50													4.1700		
Infiltration rate													0.3622	(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) =		0.3079	(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	0.3233	0.3002	0.3079	0.2925	0.2925	0.2848	0.2771	0.2694	0.2617	0.2848	0.2694	0.2848	(22b)		
Effective ac	0.5523	0.5451	0.5474	0.5428	0.5428	0.5406	0.5384	0.5363	0.5342	0.5406	0.5363	0.5406	(25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid FD			1.9600	0.9000	1.7640			(26)					
Windows (Uw = 1.40)			7.9300	1.3258	10.5133			(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466			(27a)					
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000	(28a)					
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000	(29a)					
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800	(29a)					
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700	(29a)					
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300	(30)					
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000	(30)					
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700	(30)					
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400	(30)					
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600	(30)					
Total net area of external elements Aum(A, m2)			210.5800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5285			(33)					
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500	(32)					
Internal Partition 1			132.2500			9.0000	1190.2500	(32c)					
Internal Floor 1			52.2900			18.0000	941.2200	(32d)					
Internal Ceiling 1			52.2900			18.0000	941.2200	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14934.0900	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							182.4568	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644	(36)					
Total fabric heat loss					(33) + (36) =		66.9929	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.5620	Feb 35.0984	Mar 35.2491	Apr 34.9515	May 34.9515	Jun 34.8084	Jul 34.6692	Aug 34.5337	Sep 34.4021	Oct 34.8084	Nov 34.5337	Dec 34.8084	(38)
Heat transfer coeff	102.5549	102.0913	102.2420	101.9444	101.9444	101.8013	101.6621	101.5266	101.3950	101.8013	101.5266	101.8013	(39)
Average = Sum(39)m / 12 =												101.8576	(39)
HLP	Jan 1.2530	Feb 1.2473	Mar 1.2491	Apr 1.2455	May 1.2455	Jun 1.2438	Jul 1.2421	Aug 1.2404	Sep 1.2388	Oct 1.2438	Nov 1.2404	Dec 1.2438	(40)
HLP (average)												1.2444	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Assumed occupancy													2.4970 (42)
Average daily hot water use (litres/day)													93.5044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.8548	99.1146	95.3745	91.6343	87.8941	84.1539	84.1539	87.8941	91.6343	95.3745	99.1146	102.8548	(44)
Energy conte	152.5307	133.4043	137.6613	120.0165	115.1587	99.3732	92.0839	105.6676	106.9296	124.6161	136.0282	147.7179	(45)
Energy content (annual)													Total = Sum (45)m = 1471.1879 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8796	20.0107	20.6492	18.0025	17.2738	14.9060	13.8126	15.8501	16.0394	18.6924	20.4042	22.1577	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0195	18.9615	20.9282	20.1796	20.7988	20.0663	20.6968	20.7630	20.1280	20.8747	20.2864	20.9988	(61)
Total heat required for water heating calculated for each month													
Solar input	173.5502	152.3658	158.5895	140.1961	135.9575	119.4395	112.7807	126.4305	127.0576	145.4908	156.3147	168.7166	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
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	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	40.4501	40.6338	40.5739	40.6924	40.6924	40.7495	40.8054	40.8598	40.9129	40.7495	40.8598	40.7495	
alpha	3.6967	3.7089	3.7049	3.7128	3.7128	3.7166	3.7204	3.7240	3.7275	3.7166	3.7240	3.7166	
util living area	0.9798	0.9720	0.9475	0.8872	0.7753	0.5882	0.4438	0.4646	0.7180	0.9048	0.9657	0.9824	(86)
MIT	19.5641	19.7003	20.0239	20.4278	20.7526	20.9360	20.9828	20.9801	20.8621	20.4785	19.9751	19.5496	(87)
Th 2	19.8779	19.8823	19.8809	19.8838	19.8838	19.8852	19.8865	19.8878	19.8891	19.8852	19.8878	19.8852	(88)
util rest of house	0.9748	0.9651	0.9341	0.8576	0.7154	0.4910	0.3235	0.3400	0.6295	0.8722	0.9556	0.9779	(89)
MIT 2	18.0081	18.2069	18.6682	19.2298	19.6474	19.8436	19.8802	19.8804	19.7831	19.3127	18.6097	17.9924	(90)
Living area fraction	18.3132	18.4997	18.9340	19.4647	19.8641	20.0578	20.0964	20.0961	19.9947	19.5413	18.8774	18.2978	(91)
MIT	18.3132	18.4997	18.9340	19.4647	19.8641	20.0578	20.0964	20.0961	19.9947	19.5413	18.8774	18.2978	(92)
Temperature adjustment	18.1632	18.3497	18.7840	19.3147	19.7141	19.9078	19.9464	19.9461	19.8447	19.3913	18.7274	-0.1500	
adjusted MIT	18.1632	18.3497	18.7840	19.3147	19.7141	19.9078	19.9464	19.9461	19.8447	19.3913	18.7274	18.1478	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	632.9854	677.6667	722.8464	729.8252	630.4338	448.8464	286.0962	285.1079	472.5001	577.7042	597.1467	604.0870	(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	1360.2064	1332.2659	1204.8223	1000.5576	735.4394	469.0832	289.3750	288.9517	521.6426	813.5210	1099.2711	1338.4620	(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	541.0524	439.8907	358.5901	194.9274	78.1242	0.0000	0.0000	0.0000	0.0000	175.4477	361.5295	546.3750 (98)
Space heating												2695.9371 (98)
Space heating per m2												(98) / (4) = 32.9375 (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												2995.4856 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	541.0524	439.8907	358.5901	194.9274	78.1242	0.0000	0.0000	0.0000	0.0000	175.4477	361.5295	546.3750 (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)	601.1694	488.7674	398.4334	216.5860	86.8046	0.0000	0.0000	0.0000	0.0000	194.9419	401.6995	607.0834 (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	89.1757	89.1273	88.9617	88.5894	87.8758	86.7000	86.7000	86.7000	86.7000	88.4734	88.9777	86.7000 (216)
(217)m	89.1757	89.1273	88.9617	88.5894	87.8758	86.7000	86.7000	86.7000	86.7000	88.4734	88.9777	89.1990 (217)
Fuel for water heating, kWh/month	194.6161	170.9531	178.2672	158.2538	154.7154	137.7618	130.0815	145.8253	146.5486	164.4457	175.6785	189.1464 (219)
Water heating fuel used												1946.2934 (219)
Annual totals kWh/year												
Space heating fuel - main system												2995.4856 (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												4624.0247 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2995.4856	3.9400	118.0221 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.2934	3.9400	76.6840 (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			229.1178 (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	2995.4856	0.2160	647.0249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.2934	0.2160	420.3994 (264)
Space and water heating			1067.4243 (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			902.5098 (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	2995.4856	1.2200	3654.4925 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.2934	1.2200	2374.4779 (264)
Space and water heating			6028.9704 (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			5053.4647 (272)
Primary energy kWh/m2/year			61.7406 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 31	-190 kg (21.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£31	2.33 kg/m²	B 89 B 91
Total Savings	£31	2.33 kg/m²	

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

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

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

	Current	Potential	Saving
Electricity	£75	£83	-£8
Mains gas	£282	£242	£39
Space heating	£217	£217	£0
Water heating	£77	£45	£31
Lighting	£62	£62	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£230	£198	£31
Total cost of uses	£229	£197	£31
Delivered energy	56 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					4.1700
Infiltration rate					0.3622 (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) =		0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5654 (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	37.1588	36.9661	36.7773	35.8901	35.7242	34.9515	34.9515	34.8084	35.2491	35.7242	36.0599	36.4110 (38)
Heat transfer coeff	104.1517	103.9590	103.7702	102.8831	102.7171	101.9444	101.9444	101.8013	102.2420	102.7171	103.0528	103.4039 (39)
Average = Sum(39)m / 12 =												102.8823 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2725	1.2701	1.2678	1.2570	1.2549	1.2455	1.2455	1.2438	1.2491	1.2549	1.2590	1.2633 (40)
HLP (average)												1.2570 (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	39.8300	39.9038	39.9764	40.3211	40.3863	40.6924	40.6924	40.7495	40.5739	40.3863	40.2547	40.1180
alpha	3.6553	3.6603	3.6651	3.6881	3.6924	3.7128	3.7128	3.7166	3.7049	3.6924	3.6836	3.6745
util living area	0.9837	0.9757	0.9568	0.9103	0.8191	0.6705	0.5200	0.5664	0.7827	0.9314	0.9748	0.9861 (86)
MIT	19.4213	19.5927	19.9043	20.3121	20.6627	20.8881	20.9670	20.9544	20.7909	20.3377	19.8081	19.3842 (87)
Th 2	19.8625	19.8643	19.8661	19.8747	19.8763	19.8838	19.8838	19.8852	19.8809	19.8763	19.8731	19.8697 (88)
util rest of house	0.9798	0.9698	0.9457	0.8864	0.7694	0.5821	0.4003	0.4462	0.7076	0.9079	0.9675	0.9827 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	17.7912	18.0399	18.4885	19.0667	19.5323	19.7995	19.8686	19.8621	19.7017	19.1154	18.3602	17.7422 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.1108	18.3444	18.7661	19.3109	19.7540	20.0130	20.0840	20.0763	19.9153	19.3551	18.6441	18.0642 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9608	18.1944	18.6161	19.1609	19.6040	19.8630	19.9340	19.9263	19.7653	19.2051	18.4941	17.9142 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9700	0.9574	0.9294	0.8674	0.7554	0.5803	0.4060	0.4510	0.6986	0.8895	0.9548	0.9739 (94)	
Useful gains	617.8995	669.5539	712.2190	725.7685	662.6774	496.8112	332.1383	347.4499	498.8039	576.1974	582.6981	593.2971 (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	1422.7988	1382.0751	1257.2920	1055.6740	811.8727	536.5324	339.8779	358.9843	579.2272	883.8921	1174.1934	1418.1013 (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	598.8451	478.8143	405.5343	237.5320	111.0013	0.0000	0.0000	0.0000	0.0000	228.9248	425.8766	613.6544 (98)	
Space heating												3100.1827 (98)	
Space heating per m2										(98) / (4) =		37.8764 (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													3444.6475 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	598.8451	478.8143	405.5343	237.5320	111.0013	0.0000	0.0000	0.0000	0.0000	228.9248	425.8766	613.6544 (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)	665.3834	532.0159	450.5936	263.9244	123.3348	0.0000	0.0000	0.0000	0.0000	254.3609	473.1963	681.8382 (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	89.3227	89.3581	89.3889	89.4413	89.4718	86.7000	86.7000	86.7000	86.7000	89.0205	89.2191	89.3387 (217)	
Fuel for water heating, kWh/month	166.7970	124.6421	99.3214	52.1468	22.7756	6.6968	0.7486	32.8265	58.0479	104.5750	142.5478	165.8430 (219)	
Water heating fuel used												976.9686 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3444.6475 (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													4230.6287 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3444.6475	3.4800	119.8737 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	976.9686	3.4800	33.9985 (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			248.6810 (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] =	0.8234 (257)
SAP value		88.5138

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

89 (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	3444.6475	0.2160	744.0438	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	976.9686	0.2160	211.0252	(264)
Space and water heating			955.0691	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	376.1224	0.5190	195.2075	(268)
Energy saving/generation technologies				
PV Unit	-692.1097	0.5190	-359.2049	(269)
Total kg/year			855.9467	(272)
CO2 emissions per m2			10.4600	(273)
EI value			90.9581	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour		
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												3 * 10 =	30.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans						= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1537 (8)
Pressure test												Yes	
Measured/design AP50													4.1700
Infiltration rate													0.3622 (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) =	0.3079 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
	0.3233	0.3002	0.3079	0.2925	0.2925	0.2848	0.2771	0.2694	0.2617	0.2848	0.2694	0.2848	(22b)
Effective ac	0.5523	0.5451	0.5474	0.5428	0.5428	0.5406	0.5384	0.5363	0.5342	0.5406	0.5363	0.5406	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid FD			1.9600	0.9000	1.7640			(26)					
Windows (Uw = 1.40)			7.9300	1.3258	10.5133			(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Roof Light (Uw = 1.60)			0.4300	1.5038	0.6466			(27a)					
Jet Floor Lo			31.5600	0.1400	4.4184	75.0000	2367.0000	(28a)					
100mm Knauf Supafil	131.4400	13.0400	118.4000	0.2500	29.6000	60.0000	7104.0000	(29a)					
Dormer Cheek	2.7200		2.7200	0.3000	0.8160	9.0000	24.4800	(29a)					
Wall to void	9.1300		9.1300	0.1200	1.0956	9.0000	82.1700	(29a)					
Plane	8.0700		8.0700	0.1300	1.0491	9.0000	72.6300	(30)					
Plane GF	2.0000		2.0000	0.1500	0.3000	9.0000	18.0000	(30)					
Plane 2 void	8.8300		8.8300	0.2600	2.2958	9.0000	79.4700	(30)					
Slope	15.1900	0.4300	14.7600	0.1600	2.3616	9.0000	132.8400	(30)					
Dorm Roof	1.6400		1.6400	0.3000	0.4920	9.0000	14.7600	(30)					
Total net area of external elements Aum(A, m2)			210.5800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	59.5285				(33)					
Party Wall 1			43.6900	0.0000	0.0000	45.0000	1966.0500	(32)					
Internal Partition 1			132.2500			9.0000	1190.2500	(32c)					
Internal Floor 1			52.2900			18.0000	941.2200	(32d)					
Internal Ceiling 1			52.2900			18.0000	941.2200	(32e)					
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	14934.0900				(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							182.4568	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4644	(36)					
Total fabric heat loss			(33) + (36) =	66.9929				(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.5620	Feb 35.0984	Mar 35.2491	Apr 34.9515	May 34.9515	Jun 34.8084	Jul 34.6692	Aug 34.5337	Sep 34.4021	Oct 34.8084	Nov 34.5337	Dec 34.8084	(38)
Heat transfer coeff	102.5549	102.0913	102.2420	101.9444	101.9444	101.8013	101.6621	101.5266	101.3950	101.8013	101.5266	101.8013	(39)
Average = Sum(39)m / 12 =												101.8576	(39)
HLP	Jan 1.2530	Feb 1.2473	Mar 1.2491	Apr 1.2455	May 1.2455	Jun 1.2438	Jul 1.2421	Aug 1.2404	Sep 1.2388	Oct 1.2438	Nov 1.2404	Dec 1.2438	(40)
HLP (average)												1.2444	(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	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	40.4501	40.6338	40.5739	40.6924	40.6924	40.7495	40.8054	40.8598	40.9129	40.7495	40.8598	40.7495
alpha	3.6967	3.7089	3.7049	3.7128	3.7128	3.7166	3.7204	3.7240	3.7275	3.7166	3.7240	3.7166
util living area	0.9798	0.9720	0.9475	0.8872	0.7753	0.5882	0.4438	0.4646	0.7180	0.9048	0.9657	0.9824 (86)
MIT	19.5641	19.7003	20.0239	20.4278	20.7526	20.9360	20.9828	20.9801	20.8621	20.4785	19.9751	19.5496 (87)
Th 2	19.8779	19.8823	19.8809	19.8838	19.8838	19.8852	19.8865	19.8878	19.8891	19.8852	19.8878	19.8852 (88)
util rest of house	0.9748	0.9651	0.9341	0.8576	0.7154	0.4910	0.3235	0.3400	0.6295	0.8722	0.9556	0.9779 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

MIT 2	18.0081	18.2069	18.6682	19.2298	19.6474	19.8436	19.8802	19.8804	19.7831	19.3127	18.6097	17.9924 (90)
Living area fraction									FLA = Living area / (4) =			0.1961 (91)
MIT	18.3132	18.4997	18.9340	19.4647	19.8641	20.0578	20.0964	20.0961	19.9947	19.5413	18.8774	18.2978 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1632	18.3497	18.7840	19.3147	19.7141	19.9078	19.9464	19.9461	19.8447	19.3913	18.7274	18.1478 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9638	0.9519	0.9169	0.8393	0.7051	0.4931	0.3302	0.3468	0.6255	0.8539	0.9410	0.9678	(94)
Useful gains	632.9854	677.6667	722.8464	729.8252	630.4338	448.8464	286.0962	285.1079	472.5001	577.7042	597.1467	604.0870	(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													
	1360.2064	1332.2659	1204.8223	1000.5576	735.4394	469.0832	289.3750	288.9517	521.6426	813.5210	1099.2711	1338.4620	(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													
	541.0524	439.8907	358.5901	194.9274	78.1242	0.0000	0.0000	0.0000	0.0000	175.4477	361.5295	546.3750	(98)
Space heating												2695.9371	(98)
Space heating per m2												32.9375	(99)
											(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2995.4856 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	541.0524	439.8907	358.5901	194.9274	78.1242	0.0000	0.0000	0.0000	0.0000	175.4477	361.5295	546.3750	(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)	601.1694	488.7674	398.4334	216.5860	86.8046	0.0000	0.0000	0.0000	0.0000	194.9419	401.6995	607.0834	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	144.8556	111.5640	88.4610	45.5765	24.8211	0.7283	0.0000	22.4148	45.6205	89.1879	122.3766	145.1214	(64)
Efficiency of water heater (217)m	89.2823	89.3123	89.3272	89.3555	89.1816	86.7000	86.7000	86.7000	86.7000	88.8601	89.1419	89.2868	(216)
Fuel for water heating, kWh/month	162.2445	124.9145	99.0303	51.0058	27.8321	0.8400	0.0000	25.8533	52.6188	100.3689	137.2828	162.5340	(219)
Water heating fuel used												944.5251	(219)
Annual totals kWh/year													
Space heating fuel - main system												2995.4856	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													376.1224 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1187 * 1.00) =									-768.8767			-768.8767	(233)
Total delivered energy for all uses												3672.2564	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2995.4856	3.9400	118.0221	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	944.5251	3.9400	37.2143	(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			197.9231	(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	2995.4856	0.2160	647.0249	(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)	944.5251	0.2160	204.0174 (264)
Space and water heating			851.0423 (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			712.0778 (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	2995.4856	1.2200	3654.4925 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	944.5251	1.2200	1152.3206 (264)
Space and water heating			4806.8131 (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			3984.8074 (272)
Primary energy kWh/m2/year			48.6843 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-184				Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	P307 - Semi (Op)			
Property	67, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	87 B	DER	14.51	TER	19.26	
Environmental	89 B	% DER<TER	24.67			
CO ₂ Emissions (t/year)	0.90	DFEE	52.27	TFEE	56.61	
General Requirements Compliance	Pass	% DFEE<TFEE	7.67			
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			