

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-189			Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)		
Property	77, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW				
SAP Rating	88 B	DER	12.99	TER	16.54
Environmental	89 B	% DER<TER	21.49		
CO ₂ Emissions (t/year)	1.10	DFEE	46.64	TFEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	9.14		
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk			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

End-Terrace House, total floor area 110 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.54 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.30 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:
Average
Windows facing North East: 13.85 m², No overhang
Windows facing South East: 1.80 m², No overhang
Windows facing South West: 7.08 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.3000
Infiltration rate					0.3629 (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) = 0.3084 (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	0.3932	0.3855	0.3778	0.3393	0.3316	0.2930	0.2930	0.2853	0.3084	0.3316	0.3470	0.3624 (22b)
Effective ac	0.5773	0.5743	0.5714	0.5576	0.5550	0.5429	0.5429	0.5407	0.5476	0.5550	0.5602	0.5657 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	16076.8200	(34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K						146.7801	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						9.4056	(36)
Total fabric heat loss					(33) + (36) =	77.8551	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.5419	51.2738	51.0111	49.7770	49.5461	48.4713	48.4713	48.2722	48.8853	49.5461	50.0132	50.5015 (38)
Average = Sum(39)m / 12 =	129.3970	129.1289	128.8662	127.6321	127.4012	126.3263	126.3263	126.1273	126.7404	127.4012	127.8683	128.3566 (39)
	127.6310											(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1814	1.1789	1.1765	1.1653	1.1632	1.1533	1.1533	1.1515	1.1571	1.1632	1.1674	1.1719 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)										Total =	Sum(45)m =	1588.8780	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) =										Sum(63)m =		0.0000	(63)
Output from w/h	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)
Total per year (kWh/year) =										Sum(64)m =		1835.3310	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	443.9965	441.7572	425.7940	399.8526	373.1745	347.6957	331.2853	337.7666	351.2135	377.3861	407.4894	430.3877	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				2.8800	11.2829		0.6200	0.7000	0.7700		9.7732 (75)		
Southeast				1.8000	36.7938		0.6200	0.7000	0.7700		19.9191 (77)		
Southwest				7.0800	36.7938		0.6200	0.7000	0.7700		78.3486 (79)		
Northeast				10.9700	11.2829		0.6200	0.7000	0.7700		37.2265 (75)		
Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790	(83)
Total gains	589.2639	704.8128	827.1848	966.6998	1071.5310	1068.9074	1014.9974	919.1006	809.2296	679.2991	584.3292	552.8667	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	34.5123	34.5839	34.6544	34.9895	35.0529	35.3512	35.3512	35.4070	35.2357	35.0529	34.9249	34.7920		
alpha	3.3008	3.3056	3.3103	3.3326	3.3369	3.3567	3.3567	3.3605	3.3490	3.3369	3.3283	3.3195		
util living area	0.9900	0.9813	0.9613	0.9096	0.8065	0.6538	0.5122	0.5739	0.7990	0.9445	0.9833	0.9919		(86)
MIT	19.0088	19.2477	19.6434	20.1570	20.5933	20.8606	20.9543	20.9330	20.7104	20.1332	19.4761	18.9651		(87)
Th 2	19.9349	19.9369	19.9388	19.9479	19.9496	19.9575	19.9575	19.9590	19.9544	19.9496	19.9461	19.9426		(88)
util rest of house	0.9879	0.9774	0.9528	0.8890	0.7619	0.5752	0.4046	0.4649	0.7356	0.9277	0.9791	0.9901		(89)
MIT 2	17.2709	17.6192	18.1920	18.9255	19.5138	19.8420	19.9324	19.9187	19.6814	18.9075	17.9597	17.2120		(90)
Living area fraction									fLA = Living area / (4) =			0.2371		(91)
MIT	17.6830	18.0054	18.5361	19.2175	19.7697	20.0835	20.1747	20.1592	19.9254	19.1981	18.3192	17.6277		(92)
Temperature adjustment												-0.1500		
adjusted MIT	17.5330	17.8554	18.3861	19.0675	19.6197	19.9335	20.0247	20.0092	19.7754	19.0481	18.1692	17.4777		(93)

8. Space heating requirement

Utilisation	0.9804	0.9659	0.9356	0.8674	0.7458	0.5732	0.4119	0.4706	0.7228	0.9081	0.9684	0.9838		(94)
Useful gains	577.7190	680.8113	773.9489	838.4802	799.1072	612.6758	418.0924	432.4858	584.9146	616.8671	565.8733	543.8981		(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	1712.3087	1672.9124	1531.7175	1297.6951	1008.9830	673.7631	432.6260	455.2164	719.3027	1076.2959	1415.4052	1704.2787		(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	844.1347	666.6920	563.7798	330.6347	156.1476	0.0000	0.0000	0.0000	0.0000	341.8150	611.6630	863.3232		(98)
Space heating												4378.1900		(98)

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Space heating per m2 (98) / (4) = 39.9725 (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													4864.6556 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	844.1347	666.6920	563.7798	330.6347	156.1476	0.0000	0.0000	0.0000	0.0000	341.8150	611.6630	863.3232	(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)	937.9275	740.7688	626.4220	367.3719	173.4974	0.0000	0.0000	0.0000	0.0000	379.7945	679.6255	959.2480	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Efficiency of water heater	89.3862	89.3317	89.2144	88.9441	88.3789	86.7000	86.7000	86.7000	86.7000	88.9414	89.2704	86.7000	(216)
Fuel for water heating, kWh/month	207.8672	182.5653	190.1897	168.5056	164.3404	146.9998	138.6419	155.6517	156.4956	174.8650	187.3504	201.9704	(219)
Water heating fuel used												2075.4428	(219)
Annual totals kWh/year													
Space heating fuel - main system												4864.6556	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												428.0285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1004 * 1.00) =									-650.5895			-650.5895	(233)
Total delivered energy for all uses												6792.5374	(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	4864.6556	0.2160	1050.7656 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2075.4428	0.2160	448.2957 (264)
Space and water heating			1499.0613 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Energy saving/generation technologies			
PV Unit	-650.5895	0.5190	-337.6560 (269)
Total CO2, kg/year			1422.4771 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9900 (273)

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

DER		12.9900	ZC1
Total Floor Area		109.5300	
Assumed number of occupants		2.8120	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		14.6551	ZC2
CO2 emissions from cooking, equation (L16)		1.7026	ZC3
Total CO2 emissions		29.3477	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.3477	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3979 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3382 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4312	0.4227	0.4143	0.3720	0.3635	0.3213	0.3213	0.3128	0.3382	0.3635	0.3804	0.3974 (22b)
Effective ac	0.5930	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			22.7300	1.3258	30.1345		(27)
Heat Loss Floor 1			36.5100	0.1300	4.7463		(28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.1800	18.3204		(29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463		(30)
Total net area of external elements Aum, m ²			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.0775		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6533 (36)
Total fabric heat loss						(33) + (36) =	70.7308 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.9378	52.6155	52.2997	50.8160	50.5384	49.2462	49.2462	49.0069	49.7440	50.5384	51.1000	51.6871 (38)
Heat transfer coeff	123.6686	123.3463	123.0304	121.5468	121.2692	119.9770	119.9770	119.7377	120.4747	121.2692	121.8308	122.4178 (39)
Average = Sum(39)m / 12 =												121.5455 (39)
HLP	1.1291	1.1261	1.1233	1.1097	1.1072	1.0954	1.0954	1.0932	1.0999	1.1072	1.1123	1.1177 (40)
HLP (average)												1.1097 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8120 (42)
Average daily hot water use (litres/day)												100.9844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829 (44)
Energy content (annual)	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.8045	48.3729	44.8205	46.3145	48.3729	48.8045	50.9589	49.3151	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	162.4935	164.2881	185.5439	196.2251	210.4937	210.4937	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	162.4935	164.2881	185.5439	196.2251	210.4937	210.4937	(64)
Heat gains from water heating, kWh/month	67.5133	59.4122	62.1738	55.2989	53.4466	46.8899	44.6458	50.0383	50.5994	57.4892	61.1764	65.7850	65.7850	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104	24.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271	258.9271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	90.7437	88.4110	83.5669	76.8040	71.8368	65.1249	60.0078	67.2558	70.2770	77.2705	84.9672	88.4208	88.4208	(72)
Total internal gains	454.0391	451.8074	435.8599	409.7645	382.4156	356.2701	339.8748	347.0218	361.1463	387.4724	417.5507	440.4379	440.4379	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	13.8500	11.2829	0.6300	0.7000	0.7700	47.7578 (75)
Southeast	1.8000	36.7938	0.6300	0.7000	0.7700	20.2404 (77)
Southwest	7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)

Solar gains	147.6105	267.2984	407.8648	575.9898	709.6203	732.8441	694.7397	590.7103	465.4034	306.7825	179.6921	124.4545	124.4545	(83)
Total gains	601.6496	719.1058	843.7248	985.7543	1092.0359	1089.1143	1034.6145	937.7321	826.5497	694.2549	597.2428	564.8924	564.8924	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)														21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	61.5051	61.6658	61.8241	62.5788	62.7220	63.3976	63.3976	63.5243	63.1356	62.7220	62.4329	62.1335	62.1335		
alpha	5.1003	5.1111	5.1216	5.1719	5.1815	5.2265	5.2265	5.2350	5.2090	5.1815	5.1622	5.1422	5.1422		
util living area	0.9987	0.9964	0.9885	0.9545	0.8514	0.6673	0.5027	0.5719	0.8413	0.9791	0.9970	0.9991	0.9991	(86)	
MIT	19.7395	19.9069	20.1815	20.5424	20.8289	20.9644	20.9932	20.9874	20.8824	20.4975	20.0520	19.7129	19.7129	(87)	
Th 2	19.9772	19.9795	19.9819	19.9929	19.9950	20.0046	20.0046	20.0064	20.0009	19.9950	19.9908	19.9864	19.9864	(88)	
util rest of house	0.9982	0.9952	0.9843	0.9378	0.8019	0.5787	0.3929	0.4562	0.7698	0.9685	0.9958	0.9987	0.9987	(89)	
MIT 2	18.2902	18.5361	18.9367	19.4566	19.8302	19.9816	20.0022	20.0013	19.9063	19.4040	18.7569	18.2578	18.2578	(90)	
Living area fraction	18.6338	18.8612	19.2319	19.7141	20.0670	20.2146	20.2372	20.2351	20.1377	19.6633	19.0640	18.6028	18.6028	(92)	
Temperature adjustment	18.6338	18.8612	19.2319	19.7141	20.0670	20.2146	20.2372	20.2351	20.1377	19.6633	19.0640	18.6028	18.6028	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	600.0412	714.2559	826.9754	918.7576	880.1009	651.6569	433.5921	453.5569	645.5181	669.1284	593.7052	563.7891	563.7891	(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	4.2000	(96)
Heat loss rate W	1772.6424	1722.0563	1566.4077	1314.4140	1014.6591	673.6218	436.3748	459.2024	727.3946	1099.0951	1457.5800	1763.1590	1763.1590	(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	1.0000	(97a)
Space heating kWh	872.4153	677.2419	550.1376	284.8726	100.1114	0.0000	0.0000	0.0000	0.0000	319.8952	621.9898	892.3312	892.3312	(98)
Space heating												4318.9950	4318.9950	(98)
Space heating per m2												39.4321	39.4321	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4624.1917 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	872.4153	677.2419	550.1376	284.8726	100.1114	0.0000	0.0000	0.0000	0.0000	319.8952	621.9898	892.3312	(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)	934.0635	725.0984	589.0124	305.0028	107.1856	0.0000	0.0000	0.0000	0.0000	342.5002	665.9420	955.3867	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	162.4935	164.2881	185.5439	196.2251	210.4937	(64)
Efficiency of water heater (217)m	88.2009	87.9747	87.4706	86.2234	83.7324	80.3000	80.3000	80.3000	80.3000	86.4102	87.7530	88.2806	(216)
Fuel for water heating, kWh/month	244.5457	216.0889	228.2282	206.9298	206.3047	189.4685	181.5252	202.3581	204.5929	214.7245	223.6107	238.4370	(219)
Water heating fuel used												2556.8141	(219)
Annual totals kWh/year													
Space heating fuel - main system												4624.1917	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												428.0285	(232)
Total delivered energy for all uses												7684.0343	(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	4624.1917	0.2160	998.8254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2556.8141	0.2160	552.2719 (264)
Space and water heating			1551.0973 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Total CO2, kg/m2/year			1812.1690 (272)
Emissions per m2 for space and water heating			14.1614 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0282 (272b)
Emissions per m2 for pumps and fans			0.3554 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1614 * 1.00) + 2.0282 + 0.3554, rounded to 2 d.p.			16.5400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-189	Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)
Property	77, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	12.99	TER	16.54
Environmental	89 B	% DER<TER	21.49		
CO ₂ Emissions (t/year)	1.10	DFEE	46.64	TTEE	51.33
General Requirements Compliance	Pass	% DFEE<TTEE	9.14		

Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk	Assessor ID	P637-0001
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Client	
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.3000
Infiltration rate					0.3629 (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) =	0.3084 (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	0.3932	0.3855	0.3778	0.3393	0.3316	0.2930	0.2930	0.2853	0.3084	0.3316	0.3470	0.3624 (22b)
Effective ac	0.5773	0.5743	0.5714	0.5576	0.5550	0.5429	0.5429	0.5407	0.5476	0.5550	0.5602	0.5657 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			9.0000	328.5900 (32e)
Internal Floor 2			36.5100			9.0000	328.5900 (32e)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 15419.6400 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 140.7801 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4056 (36)
 Total fabric heat loss (33) + (36) = 77.8551 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	51.5419	51.2738	51.0111	49.7770	49.5461	48.4713	48.4713	48.2722	48.8853	49.5461	50.0132	50.5015 (38)
Heat transfer coeff	129.3970	129.1289	128.8662	127.6321	127.4012	126.3263	126.3263	126.1273	126.7404	127.4012	127.8683	128.3566 (39)
Average = Sum(39)m / 12 =												127.6310 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1814	1.1789	1.1765	1.1653	1.1632	1.1533	1.1533	1.1515	1.1571	1.1632	1.1674	1.1719 (40)
Days in month												1.1653 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.8120 (42)
												100.9844 (43)
Daily hot water use												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829 (44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Energy content (annual)												Total = Sum(45)m = 1588.8780 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month												
	35.0057	30.6162	31.5932	27.5437	26.4288	22.8061	21.1332	24.2506	24.5403	28.5993	31.2184	33.9011 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790 (71)
Water heating gains (Table 5)												
	47.0507	45.5598	42.4639	38.2551	35.5226	31.6751	28.4048	32.5949	34.0837	38.4399	43.3589	45.5661 (72)
Total internal gains												
	407.3461	405.9562	391.7570	368.2156	343.1014	319.8203	305.2718	309.3609	321.9530	345.6418	372.9424	394.5832 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				2.8800	11.2829	0.6200	0.7000	0.7700		9.7732 (75)		
Southeast				1.8000	36.7938	0.6200	0.7000	0.7700		19.9191 (77)		
Southwest				7.0800	36.7938	0.6200	0.7000	0.7700		78.3486 (79)		
Northeast				10.9700	11.2829	0.6200	0.7000	0.7700		37.2265 (75)		
Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790 (83)
Total gains	552.6135	669.0118	793.1478	935.0627	1041.4579	1041.0320	988.9839	890.6949	779.9690	647.5548	549.7823	517.0622 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	33.1015	33.1702	33.2378	33.5592	33.6200	33.9061	33.9061	33.9596	33.7953	33.6200	33.4972	33.3698
util living area	3.2068	3.2113	3.2159	3.2373	3.2413	3.2604	3.2604	3.2640	3.2530	3.2413	3.2331	3.2247
	0.9906	0.9821	0.9624	0.9117	0.8109	0.6612	0.5209	0.5846	0.8066	0.9473	0.9843	0.9924 (86)
MIT	18.9049	19.1524	19.5630	20.0977	20.5559	20.8428	20.9468	20.9221	20.6792	20.0714	19.3886	18.8606 (87)
Th 2	19.9349	19.9369	19.9388	19.9479	19.9496	19.9575	19.9575	19.9590	19.9544	19.9496	19.9461	19.9426 (88)
util rest of house												
	0.9886	0.9784	0.9543	0.8919	0.7677	0.5836	0.4129	0.4757	0.7454	0.9315	0.9805	0.9908 (89)
MIT 2	18.0173	18.2644	18.6712	19.1966	19.6214	19.8669	19.9369	19.9261	19.7445	19.1823	18.5077	17.9788 (90)
Living area fraction												fLA = Living area / (4) = 0.2371 (91)

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MIT	18.2278	18.4749	18.8827	19.4102	19.8430	20.0983	20.1763	20.1622	19.9662	19.3931	18.7165	18.1879 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2278	18.4749	18.8827	19.4102	19.8430	20.0983	20.1763	20.1622	19.9662	19.3931	18.7165	18.1879 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9715	0.9439	0.8798	0.7627	0.5950	0.4368	0.4985	0.7462	0.9209	0.9743	0.9871	(94)
Useful gains	543.9019	649.9198	748.6884	822.6286	794.3621	619.3801	432.0057	444.0496	582.0374	596.3064	535.6448	510.3794	(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													
	1802.2131	1752.9171	1595.7068	1341.4401	1037.4247	694.5816	451.7845	474.5197	743.4794	1120.2539	1485.3867	1795.4418	(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													
	936.1835	741.2142	630.1817	373.5443	180.8386	0.0000	0.0000	0.0000	0.0000	389.8170	683.8142	956.0864	(98)
Space heating													4891.6799 (98)
Space heating per m2													44.6606 (99)
										(98) / (4) =			

(98) / (4) =

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1187.4677	934.8150	958.5675	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8058	0.8653	0.8300	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	956.8896	808.8739	795.6184	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1326.7843	1263.5287	1150.6354	0.0000	0.0000	0.0000	0.0000 (103)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)	
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	266.3242	338.2631	264.1327	0.0000	0.0000	0.0000	0.0000 (104)	
Space cooling												868.7200 (104)	
Cooled fraction													
Intermittency factor (Table 10b)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	66.5810	84.5658	66.0332	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												217.1800 (107)	
Space cooling per m2												1.9828 (108)	
Energy for space heating												44.6606 (99)	
Energy for space cooling												1.9828 (108)	
Total												46.6435 (109)	
Dwelling Fabric Energy Efficiency (DFEE)												46.6 (109)	

FC = cooled area / (4) =

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SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3979 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3382 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4312	0.4227	0.4143	0.3720	0.3635	0.3213	0.3213	0.3128	0.3382	0.3635	0.3804	0.3974 (22b)
Effective ac	0.5930	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			22.7300	1.3258	30.1345		(27)
Heat Loss Floor 1			36.5100	0.1300	4.7463		(28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.1800	18.3204		(29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463		(30)
Total net area of external elements Aum, m ²			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.0775		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6533 (36)
Total fabric heat loss						(33) + (36) =	70.7308 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.9378	52.6155	52.2997	50.8160	50.5384	49.2462	49.2462	49.0069	49.7440	50.5384	51.1000	51.6871 (38)
Heat transfer coeff	123.6686	123.3463	123.0304	121.5468	121.2692	119.9770	119.9770	119.7377	120.4747	121.2692	121.8308	122.4178 (39)
Average = Sum(39)m / 12 =												121.5455 (39)
HLP	1.1291	1.1261	1.1233	1.1097	1.1072	1.0954	1.0954	1.0932	1.0999	1.1072	1.1123	1.1177 (40)
HLP (average)												1.1097 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8120 (42)
Average daily hot water use (litres/day)												100.9844 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829 (44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348 (45)
Energy content (annual)										Total = Sum(45)m =		1588.8780 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)
Heat gains from water heating, kWh/month	35.0057	30.6162	31.5932	27.5437	26.4288	22.8061	21.1332	24.2506	24.5403	28.5993	31.2184	33.9011 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	140.5988	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.2367	21.5269	17.5068	13.2538	9.9074	8.3642	9.0378	11.7477	15.7678	20.0208	23.3672	24.9104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	270.8790	273.6899	266.6066	251.5270	232.4918	214.6014	202.6495	199.8386	206.9219	222.0015	241.0367	258.9271	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	37.0599	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	47.0507	45.5598	42.4639	38.2551	35.5226	31.6751	28.4048	32.5949	34.0837	38.4399	43.3589	45.5661	(72)
Total internal gains	407.3461	405.9562	391.7570	368.2156	343.1014	319.8203	305.2718	309.3609	321.9530	345.6418	372.9424	394.5832	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				13.8500	11.2829	0.6300	0.7000	0.7700		47.7578 (75)		
Southeast				1.8000	36.7938	0.6300	0.7000	0.7700		20.2404 (77)		
Southwest				7.0800	36.7938	0.6300	0.7000	0.7700		79.6123 (79)		

Solar gains	147.6105	267.2984	407.8648	575.9898	709.6203	732.8441	694.7397	590.7103	465.4034	306.7825	179.6921	124.4545 (83)
Total gains	554.9565	673.2546	799.6218	944.2054	1052.7218	1052.6645	1000.0115	900.0712	787.3564	652.4243	552.6345	519.0377 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.5051	61.6658	61.8241	62.5788	62.7220	63.3976	63.3976	63.5243	63.1356	62.7220	62.4329	62.1335	
alpha	5.1003	5.1111	5.1216	5.1719	5.1815	5.2265	5.2265	5.2350	5.2090	5.1815	5.1622	5.1422	
util living area	0.9991	0.9974	0.9909	0.9613	0.8657	0.6853	0.5189	0.5929	0.8608	0.9839	0.9979	0.9994	(86)
MIT	19.6996	19.8681	20.1456	20.5137	20.8129	20.9598	20.9922	20.9851	20.8672	20.4648	20.0141	19.6735	(87)
Th 2	19.9772	19.9795	19.9819	19.9929	19.9950	20.0046	20.0046	20.0064	20.0009	19.9950	19.9908	19.9864	(88)
util rest of house	0.9988	0.9965	0.9875	0.9466	0.8186	0.5962	0.4062	0.4744	0.7933	0.9754	0.9970	0.9992	(89)
MIT 2	18.7855	18.9555	19.2331	19.6003	19.8704	19.9866	20.0027	20.0022	19.9262	19.5604	19.1106	18.7669	(90)
Living area fraction									fLA = Living area / (4) =			0.2371	(91)
MIT	19.0022	19.1718	19.4494	19.8169	20.0938	20.2173	20.2373	20.2353	20.1493	19.7748	19.3248	18.9818	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0022	19.1718	19.4494	19.8169	20.0938	20.2173	20.2373	20.2353	20.1493	19.7748	19.3248	18.9818	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	554.0491	670.1885	787.7825	890.8061	867.2445	648.8092	433.1458	452.4835	633.7074	634.7923	550.5482	518.4357	(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	1818.2039	1760.3797	1593.1750	1326.9091	1017.9155	673.9506	436.3901	459.2241	728.7873	1112.6212	1489.3576	1809.5608	(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	940.5311	732.6085	599.2121	313.9941	112.0992	0.0000	0.0000	0.0000	0.0000	355.5047	675.9427	960.5971	(98)
Space heating												4690.4895	(98)
Space heating per m2												42.8238	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1127.7838	887.8298	910.0065	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9024	0.9490	0.9228	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1017.6818	842.5776	839.7517	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1340.3806	1276.4181	1161.5948	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	232.3432	322.7773	239.4513	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												794.5718 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	58.0858	80.6943	59.8628	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												198.6429 (107)
Space cooling per m2												1.8136 (108)
Energy for space heating												42.8238 (99)
Energy for space cooling												1.8136 (108)
Total												44.6374 (109)
Target Fabric Energy Efficiency (TFEE)												51.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-189	Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)
Property	77, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	12.99	TER	16.54
Environmental	89 B	% DER<TER	21.49		
CO ₂ Emissions (t/year)	1.10	DFEE	46.64	TTEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	9.14		

Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk	Assessor ID	P637-0001
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Client	
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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1479 (8)
Pressure test				Yes	
Measured/design AP50				4.3000	
Infiltration rate				0.3629	(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) =		0.3084 (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	0.3238	0.3007	0.3084	0.2930	0.2930	0.2853	0.2776	0.2699	0.2622	0.2853	0.2699	0.2853 (22b)
Effective ac	0.5524	0.5452	0.5476	0.5429	0.5429	0.5407	0.5385	0.5364	0.5344	0.5407	0.5364	0.5407 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 16076.8200 (34)
 Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 146.7801 (35)
 Thermal bridges ($\text{Sum}(L \times \text{Psi})$) calculated using Appendix K) 9.4056 (36)
 Total fabric heat loss (33) + (36) = 77.8551 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	49.3205	48.6756	48.8853	48.4713	48.4713	48.2722	48.0785	47.8900	47.7069	48.2722	47.8900	48.2722	(38)
Heat transfer coeff	127.1756	126.5307	126.7404	126.3263	126.3263	126.1273	125.9336	125.7451	125.5620	126.1273	125.7451	126.1273	(39)
Average = $\text{Sum}(39)\text{m} / 12 =$												126.2056	(39)
HLP	1.1611	1.1552	1.1571	1.1533	1.1533	1.1515	1.1498	1.1480	1.1464	1.1515	1.1480	1.1515	(40)
HLP (average)												1.1522	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8120	(42)	
Average daily hot water use (litres/day)												100.9844	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)	
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)	
Energy content (annual)												Total = Sum(45)m =	1588.8780	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)	
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
	Solar input (sum of months) = Sum(63)m =											0.0000	(63)	
Output from w/h	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)	
	Total per year (kWh/year) = Sum(64)m =											1835.3310	(64)	
RHI water heating demand												1835	(64)	
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W			

Northeast					2.8800	14.6176	0.6200		0.7000		0.7700		12.6617 (75)			
Southeast					1.8000	45.1778	0.6200		0.7000		0.7700		24.4580 (77)			
Southwest					7.0800	45.1778	0.6200		0.7000		0.7700		96.2014 (79)			
Northeast					10.9700	14.6176	0.6200		0.7000		0.7700		48.2289 (75)			

Solar gains					181.5500	281.0685	435.3924	622.4521	730.6005	819.8375	771.0684	670.9322	526.1936	348.9470	220.5588	150.3005 (83)
Total gains					841.0633	935.6622	1064.5040	1211.8155	1278.8906	1331.5224	1261.4666	1170.4920	1048.7192	911.4520	827.5622	791.3287 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hl} (C)													21.0000	(85)
Utilisation factor for gains for living area, $n_{il,m}$ (see Table 9a)														
tau	35.1151	35.2941	35.2357	35.3512	35.3512	35.4070	35.4614	35.5146	35.5664	35.4070	35.5146	35.4070		
alpha	3.3410	3.3529	3.3490	3.3567	3.3567	3.3605	3.3641	3.3676	3.3711	3.3605	3.3676	3.3605		
util living area														

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CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.9692	0.9560	0.9189	0.8348	0.6991	0.5063	0.3792	0.4057	0.6532	0.8659	0.9485	0.9734 (86)
MIT	19.4360	19.6118	19.9885	20.4390	20.7715	20.9431	20.9838	20.9802	20.8649	20.4636	19.9017	19.4124 (87)
Th 2	19.9512	19.9560	19.9544	19.9575	19.9575	19.9590	19.9604	19.9618	19.9631	19.9590	19.9618	19.9590 (88)
util rest of house	0.9630	0.9473	0.9029	0.8025	0.6422	0.4251	0.2825	0.3034	0.5735	0.8311	0.9364	0.9680 (89)
MIT 2	17.8988	18.1537	18.6877	19.3083	19.7324	19.9187	19.9533	19.9530	19.8523	19.3588	18.5781	17.8703 (90)
Living area fraction									fLA = Living area / (4) =			0.2371 (91)
MIT	18.2633	18.4994	18.9961	19.5764	19.9788	20.1616	20.1976	20.1965	20.0923	19.6208	18.8919	18.2359 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1133	18.3494	18.8461	19.4264	19.8288	20.0116	20.0476	20.0465	19.9423	19.4708	18.7419	18.0859 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9480	0.9295	0.8814	0.7835	0.6345	0.4294	0.2909	0.3120	0.5717	0.8113	0.9175	0.9541 (94)	
Useful gains	797.2937	869.7207	938.3019	949.4095	811.4038	571.7194	366.9073	365.2154	599.5991	739.4263	759.3039	755.0257 (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	1680.4048	1651.1548	1501.3823	1253.9622	925.8204	594.2570	371.2039	370.5123	658.2399	1017.9455	1363.3222	1650.4930 (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	657.0347	525.1237	418.9318	219.2779	85.1260	0.0000	0.0000	0.0000	0.0000	207.2183	434.8932	666.2277 (98)	
Space heating												3213.8333 (98)	
RHI space heating demand												3214 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.3000
Infiltration rate					0.3629 (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) = 0.3084 (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	0.3932	0.3855	0.3778	0.3393	0.3316	0.2930	0.2930	0.2853	0.3084	0.3316	0.3470	0.3624 (22b)
Effective ac	0.5773	0.5743	0.5714	0.5576	0.5550	0.5429	0.5429	0.5407	0.5476	0.5550	0.5602	0.5657 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			16076.8200 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							146.7801 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4056 (36)
Total fabric heat loss						(33) + (36) =	77.8551 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.5419	51.2738	51.0111	49.7770	49.5461	48.4713	48.4713	48.2722	48.8853	49.5461	50.0132	50.5015 (38)
Average = Sum(39)m / 12 =	129.3970	129.1289	128.8662	127.6321	127.4012	126.3263	126.3263	126.1273	126.7404	127.4012	127.8683	128.3566 (39)
												127.6310 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1814	1.1789	1.1765	1.1653	1.1632	1.1533	1.1533	1.1515	1.1571	1.1632	1.1674	1.1719 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)										Total =	Sum(45)m =	1588.8780	(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) =										Sum(63)m =		0.0000	(63)
Output from w/h	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)
Total per year (kWh/year) =										Sum(64)m =		1835.3310	(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				2.8800	11.2829		0.6200		0.7000		0.7700		9.7732 (75)	
Southeast				1.8000	36.7938		0.6200		0.7000		0.7700		19.9191 (77)	
Southwest				7.0800	36.7938		0.6200		0.7000		0.7700		78.3486 (79)	
Northeast				10.9700	11.2829		0.6200		0.7000		0.7700		37.2265 (75)	
Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790	(83)	
Total gains	804.7807	917.6492	1030.5025	1156.2106	1246.6466	1232.8966	1174.1103	1080.8938	980.5417	864.4180	783.8433	763.5072	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	34.5123	34.5839	34.6544	34.9895	35.0529	35.3512	35.3512	35.4070	35.2357	35.0529	34.9249	34.7920		
alpha	3.3008	3.3056	3.3103	3.3326	3.3369	3.3567	3.3567	3.3605	3.3490	3.3369	3.3283	3.3195		
util living area	0.9756	0.9614	0.9322	0.8660	0.7495	0.5906	0.4523	0.5039	0.7242	0.9009	0.9623	0.9792	(86)	
MIT	19.2634	19.4885	19.8526	20.3115	20.6823	20.8979	20.9685	20.9547	20.7911	20.3071	19.7038	19.2173	(87)	
Th 2	19.9349	19.9369	19.9388	19.9479	19.9496	19.9575	19.9575	19.9590	19.9544	19.9496	19.9461	19.9426	(88)	
util rest of house	0.9707	0.9539	0.9187	0.8389	0.7000	0.5133	0.3536	0.4023	0.6537	0.8747	0.9536	0.9750	(89)	
MIT	17.6390	17.9642	18.4855	19.1308	19.6182	19.8755	19.9408	19.9329	19.7665	19.1414	18.2850	17.5772	(90)	
Living area fraction									fLA = Living area / (4) =			0.2371	(91)	
MIT	18.0242	18.3256	18.8097	19.4107	19.8705	20.1180	20.1845	20.1752	20.0094	19.4178	18.6214	17.9661	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	17.8742	18.1756	18.6597	19.2607	19.7205	19.9680	20.0345	20.0252	19.8594	19.2678	18.4714	17.8161	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9573	0.9368	0.8977	0.8179	0.6879	0.5141	0.3612	0.4091	0.6465	0.8534	0.9367	0.9629	(94)
Useful gains	770.4180	859.6783	925.0789	945.6699	857.5948	633.8173	424.0573	442.2359	633.9150	737.6650	734.2147	735.2015	(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	1756.4581	1714.2691	1566.9694	1322.3612	1021.8168	678.1137	433.8617	457.2327	729.9513	1104.2864	1454.0426	1747.7125	(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	733.6139	574.2850	477.5665	271.2177	122.1812	0.0000	0.0000	0.0000	0.0000	272.7663	518.2761	753.3082	(98)
Space heating												3723.2149	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 33.9926 (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													4136.9054 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	733.6139	574.2850	477.5665	271.2177	122.1812	0.0000	0.0000	0.0000	0.0000	272.7663	518.2761	753.3082	(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)	815.1265	638.0944	530.6295	301.3530	135.7569	0.0000	0.0000	0.0000	0.0000	303.0737	575.8623	837.0091	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Efficiency of water heater (217)m	89.3130	89.2487	89.1108	88.7971	88.1772	86.7000	86.7000	86.7000	86.7000	88.7730	89.1719	86.7000	(216)
Fuel for water heating, kWh/month	208.0376	182.7351	190.4108	168.7845	164.7163	146.9998	138.6419	155.6517	156.4956	175.1966	187.5573	202.1261	(219)
Water heating fuel used												2077.3533	(219)
Annual totals kWh/year													
Space heating fuel - main system												4136.9054	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												428.0285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 + 0.81 + 1004 + 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												6066.6977	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4136.9054	3.4800	143.9643 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2077.3533	3.4800	72.2919 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	428.0285	13.1900	56.4570 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-650.5895	13.1900	-85.8128 (252)
Total energy cost			316.7929 (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] =	0.8610 (257)
SAP value		87.9888
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4136.9054	0.2160	893.5716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2077.3533	0.2160	448.7083 (264)
Space and water heating			1342.2799 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Energy saving/generation technologies			
PV Unit	-650.5895	0.5190	-337.6560 (269)
Total kg/year			1265.6957 (272)
CO2 emissions per m2			11.5600 (273)
EI value			89.0246
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8823 = 3.944$, stars = 4
Water heating environmental impact	$0.216 / 0.8823 = 0.2448$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.3000
Infiltration rate					0.3629 (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) =				0.3084 (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	0.3238	0.3007	0.3084	0.2930	0.2930	0.2853	0.2776	0.2699	0.2622	0.2853	0.2699	0.2853 (22b)
Effective ac	0.5524	0.5452	0.5476	0.5429	0.5429	0.5407	0.5385	0.5364	0.5344	0.5407	0.5364	0.5407 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			16076.8200 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							146.7801 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4056 (36)
Total fabric heat loss						(33) + (36) =	77.8551 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.3205	48.6756	48.8853	48.4713	48.4713	48.2722	48.0785	47.8900	47.7069	48.2722	47.8900	48.2722 (38)
Average = Sum(39)m / 12 =	127.1756	126.5307	126.7404	126.3263	126.3263	126.1273	125.9336	125.7451	125.5620	126.1273	125.7451	126.1273 (39)
												126.2056 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1611	1.1552	1.1571	1.1533	1.1533	1.1515	1.1498	1.1480	1.1464	1.1515	1.1480	1.1515 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)	Total = Sum(45)m = 1588.8780												(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =	0.0000												(63)
Output from w/h	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)
Total per year (kWh/year) = Sum(64)m =	1835.3310												(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
Northeast				2.8800	14.6176	0.6200		0.7000		0.7700	12.6617 (75)	
Southeast				1.8000	45.1778	0.6200		0.7000		0.7700	24.4580 (77)	
Southwest				7.0800	45.1778	0.6200		0.7000		0.7700	96.2014 (79)	
Northeast				10.9700	14.6176	0.6200		0.7000		0.7700	48.2289 (75)	
Solar gains	181.5500	281.0685	435.3924	622.4521	730.6005	819.8375	771.0684	670.9322	526.1936	348.9470	220.5588	150.3005 (83)
Total gains	841.0633	935.6622	1064.5040	1211.8155	1278.8906	1331.5224	1261.4666	1170.4920	1048.7192	911.4520	827.5622	791.3287 (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	35.1151	35.2941	35.2357	35.3512	35.3512	35.4070	35.4614	35.5146	35.5664	35.4070	35.5146	35.4070		
alpha	3.3410	3.3529	3.3490	3.3567	3.3567	3.3605	3.3641	3.3676	3.3711	3.3605	3.3676	3.3605		
util living area	0.9692	0.9560	0.9189	0.8348	0.6991	0.5063	0.3792	0.4057	0.6532	0.8659	0.9485	0.9734	(86)	
MIT	19.4360	19.6118	19.9885	20.4390	20.7715	20.9431	20.9838	20.9802	20.8649	20.4636	19.9017	19.4124	(87)	
Th 2	19.9512	19.9560	19.9544	19.9575	19.9575	19.9590	19.9604	19.9618	19.9631	19.9590	19.9618	19.9590	(88)	
util rest of house	0.9630	0.9473	0.9029	0.8025	0.6422	0.4251	0.2825	0.3034	0.5735	0.8311	0.9364	0.9680	(89)	
MIT 2	17.8988	18.1537	18.6877	19.3083	19.7324	19.9187	19.9533	19.9530	19.8523	19.3588	18.5781	17.8703	(90)	
Living area fraction	fLA = Living area / (4) =												0.2371	(91)
MIT	18.2633	18.4994	18.9961	19.5764	19.9788	20.1616	20.1976	20.1965	20.0923	19.6208	18.8919	18.2359	(92)	
Temperature adjustment													-0.1500	
adjusted MIT	18.1133	18.3494	18.8461	19.4264	19.8288	20.0116	20.0476	20.0465	19.9423	19.4708	18.7419	18.0859	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9480	0.9295	0.8814	0.7835	0.6345	0.4294	0.2909	0.3120	0.5717	0.8113	0.9175	0.9541	(94)
Useful gains	797.2937	869.7207	938.3019	949.4095	811.4038	571.7194	366.9073	365.2154	599.5991	739.4263	759.3039	755.0257	(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	1680.4048	1651.1548	1501.3823	1253.9622	925.8204	594.2570	371.2039	370.5123	658.2399	1017.9455	1363.3222	1650.4930	(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	657.0347	525.1237	418.9318	219.2779	85.1260	0.0000	0.0000	0.0000	0.0000	207.2183	434.8932	666.2277	(98)
Space heating	3213.8333												(98)

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Space heating per m2 (98) / (4) = 29.3420 (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													3570.9259 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	657.0347	525.1237	418.9318	219.2779	85.1260	0.0000	0.0000	0.0000	0.0000	207.2183	434.8932	666.2277	(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)	730.0385	583.4708	465.4798	243.6422	94.5844	0.0000	0.0000	0.0000	0.0000	230.2426	483.2147	740.2530	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(64)
Efficiency of water heater (217)m	89.2511	89.1955	89.0232	88.6304	87.8908	86.7000	86.7000	86.7000	86.7000	88.5549	89.0585	86.7000	(216)
Fuel for water heating, kWh/month	208.1818	182.8441	190.5982	169.1019	165.2530	146.9998	138.6419	155.6517	156.4956	175.6282	187.7962	89.2754	(217)
Water heating fuel used												202.2779	(219)
Annual totals kWh/year												2079.4704	(219)
Space heating fuel - main system													3570.9259 (211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													428.0285 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1122 * 1.00) =										-727.0046			-727.0046 (233)
Total delivered energy for all uses													5426.4202 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3570.9259	3.9200	139.9803	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2079.4704	3.9200	81.5152	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	428.0285	16.9600	72.5936	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-727.0046	16.9600	-123.3000	(252)
Total energy cost			271.5092	(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	3570.9259	0.2160	771.3200	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2079.4704	0.2160	449.1656	(264)
Space and water heating			1220.4856	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	428.0285	0.5190	222.1468	(268)
Energy saving/generation technologies				
PV Unit	-727.0046	0.5190	-377.3154	(269)
Total kg/year			1104.2420	(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	3570.9259	1.2200	4356.5296	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2079.4704	1.2200	2536.9539	(264)
Space and water heating			6893.4835	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	428.0285	3.0700	1314.0474	(268)

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Energy saving/generation technologies			
PV Unit	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			6205.8769 (272)
Primary energy kWh/m2/year			56.6592 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 32	-199 kg (18.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 1.82 kg/m²	B 89	B 91
Total Savings	£32 1.82 kg/m²		

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

Fuel prices for cost data on this page from database revision number 438 TEST (30 Jan 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£85	£94	-£8
Mains gas	£309	£269	£41
Space heating	£241	£241	£0
Water heating	£82	£49	£32
Lighting	£73	£73	£0
Generated (PV)	-£123	-£123	£0
Total cost of fuels	£271	£240	£33
Total cost of uses	£273	£240	£32
Delivered energy	50 kWh/m²	40 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	46 kWh/m²	10 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2d)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.3000
Infiltration rate					0.3629 (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) = 0.3084 (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	0.3932	0.3855	0.3778	0.3393	0.3316	0.2930	0.2930	0.2853	0.3084	0.3316	0.3470	0.3624 (22b)
Effective ac	0.5773	0.5743	0.5714	0.5576	0.5550	0.5429	0.5429	0.5407	0.5476	0.5550	0.5602	0.5657 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16076.8200 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							146.7801 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4056 (36)
Total fabric heat loss							(33) + (36) = 77.8551 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	51.5419	51.2738	51.0111	49.7770	49.5461	48.4713	48.4713	48.2722	48.8853	49.5461	50.0132	50.5015 (38)
Average = Sum(39)m / 12 =	129.3970	129.1289	128.8662	127.6321	127.4012	126.3263	126.3263	126.1273	126.7404	127.4012	127.8683	128.3566 (39)
												127.6310 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1814	1.1789	1.1765	1.1653	1.1632	1.1533	1.1533	1.1515	1.1571	1.1632	1.1674	1.1719 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m													(45)
	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Aperture area of solar collector													(H1)
Zero-loss collector efficiency													(H2)
Collector heat loss coefficient													(H3)
Collector 2nd order heat loss coefficient													(H3a)
Collector effective heat loss coefficient													(H3b)
Collector performance ratio													(H4)
Annual solar radiation per m2													(H5)
Overshading factor													(H6)
Solar energy available													(H7)
Adjustment factor for showers													(H7a)
Solar-to-load ratio													(H8)
Utilisation factor													(H9)
Collector performance factor													(H10)
Dedicated solar storage volume													(H11)
Effective solar volume													(H13)
Daily hot water demand													(H14)
Volume ratio Veff/V													(H15)
Solar storage volume factor													(H16)
Solar input													(H17)
Solar input	-25.3813	-42.3541	-72.1339	-96.6736	-119.4321	-117.4208	-115.8691	-101.2354	-79.2876	-54.1441	-30.1059	-21.2398	(63)
Solar input (sum of months) = Sum (63)m =													(63)
Output from w/h	160.4233	120.7346	97.5428	53.2020	25.8101	10.0280	4.3335	33.7147	56.3941	101.3832	137.1426	159.3445	(64)
Total per year (kWh/year) = Sum (64)m =													(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				2.8800	11.2829		0.6200	0.7000		0.7700		9.7732 (75)	
Southeast				1.8000	36.7938		0.6200	0.7000		0.7700		19.9191 (77)	
Southwest				7.0800	36.7938		0.6200	0.7000		0.7700		78.3486 (79)	
Northeast				10.9700	11.2829		0.6200	0.7000		0.7700		37.2265 (75)	

Solar gains	145.2674	263.0556	401.3908	566.8471	698.3565	721.2117	683.7121	581.3340	458.0160	301.9129	176.8399	122.4790 (83)	
Total gains	804.7807	917.6492	1030.5025	1156.2106	1246.6466	1232.8966	1174.1103	1080.8938	980.5417	864.4180	783.8433	763.5072 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	34.5123	34.5839	34.6544	34.9895	35.0529	35.3512	35.3512	35.4070	35.2357	35.0529	34.9249	34.7920		
alpha	3.3008	3.3056	3.3103	3.3326	3.3369	3.3567	3.3567	3.3605	3.3490	3.3369	3.3283	3.3195		
util living area	0.9756	0.9614	0.9322	0.8660	0.7495	0.5906	0.4523	0.5039	0.7242	0.9009	0.9623	0.9792	(86)	
MIT	19.2634	19.4885	19.8526	20.3115	20.6823	20.8979	20.9685	20.9547	20.7911	20.3071	19.7038	19.2173	(87)	
Th 2	19.9349	19.9369	19.9388	19.9479	19.9496	19.9575	19.9575	19.9590	19.9544	19.9496	19.9461	19.9426	(88)	
util rest of house	0.9707	0.9539	0.9187	0.8389	0.7000	0.5133	0.3536	0.4023	0.6537	0.8747	0.9536	0.9750	(89)	
MIT 2	17.6390	17.9642	18.4855	19.1308	19.6182	19.8755	19.9408	19.9329	19.7665	19.1414	18.2850	17.5772	(90)	
Living area fraction									fLA = Living area / (4) =			0.2371	(91)	
MIT	18.0242	18.3256	18.8097	19.4107	19.8705	20.1180	20.1845	20.1752	20.0094	19.4178	18.6214	17.9661	(92)	

AES
Sustainability
Consultants

	1	2	3	4	5	6	7	8	9	10	11	12
Temperature adjustment												-0.1500
adjusted MIT	17.8742	18.1756	18.6597	19.2607	19.7205	19.9680	20.0345	20.0252	19.8594	19.2678	18.4714	17.8161 (93)

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7844 (257)
SAP value		89.0573
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4136.9054	0.2160	893.5716	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1078.0594	0.2160	232.8608	(264)
Space and water heating			1126.4324	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	428.0285	0.5190	222.1468	(268)
Energy saving/generation technologies				
PV Unit	-650.5895	0.5190	-337.6560	(269)
Total kg/year			1075.7982	(272)
CO2 emissions per m2			9.8200	(273)
EI value			90.6713	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.5100 (1b)	x 2.3100 (2b)	= 84.3381 (1b) - (3b)
First floor	36.5100 (1c)	x 2.5500 (2c)	= 93.1005 (1c) - (3c)
Second floor	36.5100 (1d)	x 2.5500 (2c)	= 93.1005 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	109.5300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 270.5391 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1479 (8)
Pressure test					Yes
Measured/design AP50					4.3000
Infiltration rate					0.3629 (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) = 0.3084 (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	0.3238	0.3007	0.3084	0.2930	0.2930	0.2853	0.2776	0.2699	0.2622	0.2853	0.2699	0.2853 (22b)
Effective ac	0.5524	0.5452	0.5476	0.5429	0.5429	0.5407	0.5385	0.5364	0.5344	0.5407	0.5364	0.5407 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			11.7600	1.3258	15.5909		(27)
French (Uw = 1.40)			10.9700	1.3258	14.5436		(27)
Heat Loss Floor 1			36.5100	0.1700	6.2067	75.0000	2738.2500 (28a)
100mm Knauf Supafil	126.6400	24.8600	101.7800	0.2500	25.4450	60.0000	6106.8000 (29a)
External Roof 1	36.5100		36.5100	0.1300	4.7463	9.0000	328.5900 (30)
Total net area of external elements Aum(A, m ²)			199.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.4495		(33)
Party Wall 1			62.0200	0.0000	0.0000	45.0000	2790.9000 (32)
GF			39.1300			9.0000	352.1700 (32c)
FF			54.0500			9.0000	486.4500 (32c)
2F			71.6600			9.0000	644.9400 (32c)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32e)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	16076.8200	(34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K						146.7801	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						9.4056	(36)
Total fabric heat loss					(33) + (36) =	77.8551	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.3205	48.6756	48.8853	48.4713	48.4713	48.2722	48.0785	47.8900	47.7069	48.2722	47.8900	48.2722 (38)
Average = Sum(39)m / 12 =	127.1756	126.5307	126.7404	126.3263	126.3263	126.1273	125.9336	125.7451	125.5620	126.1273	125.7451	126.1273 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1611	1.1552	1.1571	1.1533	1.1533	1.1515	1.1498	1.1480	1.1464	1.1515	1.1480	1.1515 (40)
HLP (average)												1.1522 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8120 (42)
Average daily hot water use (litres/day)	100.9844 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.0829	107.0435	103.0041	98.9647	94.9253	90.8860	90.8860	94.9253	98.9647	103.0041	107.0435	111.0829	(44)
Energy conte	164.7327	144.0762	148.6738	129.6174	124.3710	107.3227	99.4503	114.1206	115.4836	134.5850	146.9100	159.5348	(45)
Energy content (annual)	Total = Sum (45)m = 1588.8780												(45)
Distribution loss (46)m = 0.15 x (45)m	24.7099	21.6114	22.3011	19.4426	18.6556	16.0984	14.9175	17.1181	17.3225	20.1877	22.0365	23.9302	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0719	19.0124	21.0029	20.2583	20.8712	20.1261	20.7523	20.8294	20.1981	20.9423	20.3384	21.0496	(61)
Total heat required for water heating calculated for each month	185.8046	163.0887	169.6767	149.8757	145.2422	127.4488	120.2025	134.9500	135.6817	155.5273	167.2484	180.5844	(62)
Aperture area of solar collector	3.0000 (H1)												
Zero-loss collector efficiency	0.7000 (H2)												
Collector heat loss coefficient	1.8000 (H3)												
Collector 2nd order heat loss coefficient	0.0050 (H3a)												
Collector effective heat loss coefficient	1.8063 (H3b)												
Collector performance ratio	2.5804 (H4)												
Annual solar radiation per m2	1208.1510 (H5)												
Overshading factor	0.8000 (H6)												
Solar energy available	2029.6937 (H7)												
Adjustment factor for showers	1.0000 (H7a)												
Solar-to-load ratio	1.2774 (H8)												
Utilisation factor	0.5429 (H9)												
Collector performance factor	0.8793 (H10)												
Dedicated solar storage volume	75.0000 (H11)												
Effective solar volume	75.0000 (H13)												
Daily hot water demand	100.9844 (H14)												
Volume ratio Veff/V	0.7427 (H15)												
Solar storage volume factor	0.9405 (H16)												
Solar input	-911.2377 (H17)												
Solar input	-29.7268	-42.2696	-72.6513	-98.0234	-115.1343	-122.9817	-120.3953	-107.7575	-84.3667	-58.3282	-35.1589	-24.4441	(63)
Solar input (sum of months) = Sum (63)m =	-911.2377												
Output from w/h	156.0778	120.8191	97.0254	51.8523	30.1079	4.4672	0.0000	27.1926	51.3151	97.1991	132.0895	156.1403	(64)
Total per year (kWh/year) = Sum (64)m =	924.2862												(64)
Heat gains from water heating, kWh/month	60.0416	52.6585	54.6848	48.1624	46.5712	40.7163	38.2553	43.1525	43.4478	49.9851	53.9322	58.3077	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	168.7185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.5919	53.8172	43.7671	33.1345	24.7684	20.9105	22.5946	29.3693	39.4194	50.0520	58.4180	62.2759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	404.2971	408.4924	397.9203	375.4135	347.0027	320.3006	302.4619	298.2666	308.8387	331.3455	359.7563	386.4584	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	54.6838	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	-112.4790	(71)
Water heating gains (Table 5)	80.7011	78.3608	73.5010	66.8922	62.5956	56.5505	51.4184	58.0006	60.3442	67.1843	74.9058	78.3706	(72)
Total internal gains	659.5133	654.5937	629.1117	589.3635	548.2901	511.6849	490.3982	499.5598	522.5256	562.5050	607.0034	641.0282	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W	
Northeast					2.8800	14.6176	0.6200	0.7000				0.7700			12.6617 (75)	
Southeast					1.8000	45.1778	0.6200	0.7000				0.7700			24.4580 (77)	
Southwest					7.0800	45.1778	0.6200	0.7000				0.7700			96.2014 (79)	
Northeast					10.9700	14.6176	0.6200	0.7000				0.7700			48.2289 (75)	
Solar gains					181.5500	281.0685	435.3924	622.4521	730.6005	819.8375	771.0684	670.9322	526.1936	348.9470	220.5588	150.3005 (83)
Total gains					841.0633	935.6622	1064.5040	1211.8155	1278.8906	1331.5224	1261.4666	1170.4920	1048.7192	911.4520	827.5622	791.3287 (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	35.1151	35.2941	35.2357	35.3512	35.3512	35.4070	35.4614	35.5146	35.5664	35.4070	35.5146	35.4070
alpha	3.3410	3.3529	3.3490	3.3567	3.3567	3.3605	3.3641	3.3676	3.3711	3.3605	3.3676	3.3605
util living area	0.9692	0.9560	0.9189	0.8348	0.6991	0.5063	0.3792	0.4057	0.6532	0.8659	0.9485	0.9734 (86)
MIT	19.4360	19.6118	19.9885	20.4390	20.7715	20.9431	20.9838	20.9802	20.8649	20.4636	19.9017	19.4124 (87)
Th 2	19.9512	19.9560	19.9544	19.9575	19.9575	19.9590	19.9604	19.9618	19.9631	19.9590	19.9618	19.9590 (88)
util rest of house	0.9630	0.9473	0.9029	0.8025	0.6422	0.4251	0.2825	0.3034	0.5735	0.8311	0.9364	0.9680 (89)
MIT 2	17.8988	18.1537	18.6877	19.3083	19.7324	19.9187	19.9533	19.9530	19.8523	19.3588	18.5781	17.8703 (90)
Living area fraction									fLA = Living area / (4) =			0.2371 (91)
MIT	18.2633	18.4994	18.9961	19.5764	19.9788	20.1616	20.1976	20.1965	20.0923	19.6208	18.8919	18.2359 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													-0.1500
adjusted MIT	18.1133	18.3494	18.8461	19.4264	19.8288	20.0116	20.0476	20.0465	19.9423	19.4708	18.7419		18.0859 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9480	0.9295	0.8814	0.7835	0.6345	0.4294	0.2909	0.3120	0.5717	0.8113	0.9175	0.9541	(94)
Useful gains	797.2937	869.7207	938.3019	949.4095	811.4038	571.7194	366.9073	365.2154	599.5991	739.4263	759.3039	755.0257	(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													
	1680.4048	1651.1548	1501.3823	1253.9622	925.8204	594.2570	371.2039	370.5123	658.2399	1017.9455	1363.3222	1650.4930	(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	657.0347	525.1237	418.9318	219.2779	85.1260	0.0000	0.0000	0.0000	0.0000	207.2183	434.8932	666.2277	(98)
Space heating													3213.8333 (98)
Space heating per m2											(98) / (4) =	29.3420	(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													3570.9259 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	657.0347	525.1237	418.9318	219.2779	85.1260	0.0000	0.0000	0.0000	0.0000	207.2183	434.8932	666.2277	(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)	730.0385	583.4708	465.4798	243.6422	94.5844	0.0000	0.0000	0.0000	0.0000	230.2426	483.2147	740.2530	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	156.0778	120.8191	97.0254	51.8523	30.1079	4.4672	0.0000	27.1926	51.3151	97.1991	132.0895	156.1403	(64)
Efficiency of water heater (217)m	89.3472	89.3638	89.3604	89.3496	89.1138	86.7000	86.7000	86.7000	86.7000	88.9194	89.2090	86.7000	(216)
Fuel for water heating, kWh/month	174.6868	135.1992	108.5776	58.0331	33.7859	5.1524	0.0000	31.3640	59.1869	109.3115	148.0675	174.7430	(219)
Water heating fuel used												1038.1079	(219)
Annual totals kWh/year													
Space heating fuel - main system												3570.9259	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												428.0285	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1122 * 1.00) =										-727.0046		-727.0046	(233)
Total delivered energy for all uses												4435.0577	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3570.9259	3.9200	139.9803	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1038.1079	3.9200	40.6938	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	428.0285	16.9600	72.5936	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-727.0046	16.9600	-123.3000	(252)
Total energy cost			239.1678	(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	3570.9259	0.2160	771.3200	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1038.1079	0.2160	224.2313	(264)
Space and water heating			995.5513	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	428.0285	0.5190	222.1468 (268)
Energy saving/generation technologies			
PV Unit	-727.0046	0.5190	-377.3154 (269)
Total kg/year			905.2577 (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	3570.9259	1.2200	4356.5296 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1038.1079	1.2200	1266.4916 (264)
Space and water heating			5623.0212 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	428.0285	3.0700	1314.0474 (268)
Energy saving/generation technologies			
PV Unit	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			5088.9146 (272)
Primary energy kWh/m2/year			46.4614 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-189	Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (Op)
Property	77, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	12.99	TER	16.54
Environmental	89 B	% DER<TER	21.49		
CO ₂ Emissions (t/year)	1.10	DFEE	46.64	TFEE	51.33
General Requirements Compliance	Pass	% DFEE<TFEE	9.14		

Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk	Assessor ID	P637-0001
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Client	
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SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	146.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	357.11 (P1)
Transmission heat loss coefficient	77.86 (37)
Summer heat loss coefficient	434.97 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.8800	106.0502	0.6200	0.7000	0.9000	107.3690
South East	1.8000	127.3119	0.6200	0.7000	0.9000	80.5594
South West	7.0800	127.3119	0.6200	0.7000	0.9000	316.8669
North East	10.9700	106.0502	0.6200	0.7000	0.9000	408.9714
total:						913.7666

	Jun	Jul	Aug	
Solar gains	988	914	793	(P3)
Internal gains	509	487	497	
Total summer gains	1496	1401	1289	(P5)
Summer gain/loss ratio	3.44	3.22	2.96	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 146.8)	0.97	0.97	0.97	
Threshold temperature	19.81	21.49	21.24	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			