

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-188				Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)			
Property	75, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW					
SAP Rating	88 B	DER	13.16	TER	16.71	
Environmental	89 B	% DER<TER	21.23			
CO ₂ Emissions (t/year)	1.12	DFEE	47.37	TFEE	52.13	
General Requirements Compliance	Pass	% DFEE<TFEE	9.13			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

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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) 16.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.16 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.4 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: 4.50 (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 West: 7.08 m², No overhang
Windows facing North West: 1.80 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					4.5000
Infiltration rate					0.3729 (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) = 0.3169 (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	0.4041	0.3962	0.3882	0.3486	0.3407	0.3011	0.3011	0.2932	0.3169	0.3407	0.3565	0.3724 (22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid 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, m2)			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/m2K							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	51.9276	51.6446	51.3672	50.0641	49.8203	48.6854	48.6854	48.4752	49.1226	49.8203	50.3135	50.8291 (38)
Average = Sum(39)m / 12 =	129.7827	129.4997	129.2222	127.9192	127.6754	126.5405	126.5405	126.3303	126.9776	127.6754	128.1686	128.6842 (39)
	127.9180											(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1849	1.1823	1.1798	1.1679	1.1657	1.1553	1.1553	1.1534	1.1593	1.1657	1.1702	1.1749 (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 Type: New Build (As Built)

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(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)		
Southwest				7.0800	36.7938	0.6200		0.7000		0.7700	78.3486 (79)		
Northwest				1.8000	11.2829	0.6200		0.7000		0.7700	6.1083 (81)		
Northeast				10.9700	11.2829	0.6200		0.7000		0.7700	37.2265 (75)		

Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207	(83)
Total gains	575.4530	683.3166	803.1621	945.9675	1056.5541	1057.6655	1002.6498	901.9047	786.2585	656.9944	568.1565	540.8084	(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	34.4097	34.4849	34.5589	34.9110	34.9776	35.2913	35.2913	35.3501	35.1698	34.9776	34.8430	34.7034	
alpha	3.2940	3.2990	3.3039	3.3274	3.3318	3.3528	3.3528	3.3567	3.3447	3.3318	3.3229	3.3136	
util living area	0.9907	0.9829	0.9643	0.9143	0.8119	0.6590	0.5181	0.5829	0.8096	0.9491	0.9846	0.9924	(86)
MIT	18.9858	19.2165	19.6119	20.1348	20.5822	20.8566	20.9525	20.9295	20.6958	20.1073	19.4528	18.9451	(87)
Th 2	19.9321	19.9342	19.9362	19.9458	19.9476	19.9559	19.9559	19.9575	19.9527	19.9476	19.9439	19.9402	(88)
util rest of house	0.9887	0.9793	0.9563	0.8944	0.7679	0.5803	0.4095	0.4730	0.7477	0.9335	0.9807	0.9907	(89)
MIT	17.2358	17.5725	18.1456	18.8940	19.4988	19.8368	19.9297	19.9149	19.6639	18.8705	17.9246	17.1813	(90)
Living area fraction									fLA =	Living area / (4) =		0.2371	(91)
MIT	17.6507	17.9623	18.4933	19.1882	19.7557	20.0786	20.1722	20.1555	19.9086	19.1637	18.2870	17.5995	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5007	17.8123	18.3433	19.0382	19.6057	19.9286	20.0222	20.0055	19.7586	19.0137	18.1370	17.4495	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9684	0.9398	0.8728	0.7513	0.5781	0.4168	0.4784	0.7340	0.9143	0.9706	0.9847	(94)
Useful gains	564.8464	661.7552	754.7981	825.6677	793.7637	611.3906	417.9198	431.4971	577.1226	600.7173	551.4251	532.5288	(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	1713.2284	1672.1433	1530.4134	1296.8727	1009.3598	674.2864	433.0519	455.4790	718.5110	1074.2272	1414.5930	1705.0031	(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	854.3962	678.9808	577.0578	339.2676	160.4035	0.0000	0.0000	0.0000	0.0000	352.2913	621.4809	872.3209	(98)
Space heating												4456.1990	(98)

$$(98) / (4) = 40.6847 \quad (99)$$

Not applicable

Total Floor Area	TFA	109.5300	2C1
Assumed number of occupants	N	2.8120	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.6551	2C2
CO2 emissions from cooking, equation (L16)		1.7026	2C3
Total CO2 emissions		29.5177	2C4
Residual CO2 emissions offset from biofuel CHP		0.0000	2C5
Additional allowable electricity generation, kWh/m ² /year		0.0000	2C6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	2C7
Net CO2 emissions		29.5177	2C8

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	(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	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Output from w/h	215.6916	190.1036	199.6327	178.4219	172.7439	152.1432	145.7647	Solar input (sum of months) = Sum (63)m =					0.0000	(63)
	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)	
	Total per year (kWh/year) = Sum (64)m =												2173.5459	(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)	

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)	90.7437	88.4110	83.5669	76.8040	71.8368	65.1249	60.0078	67.2558	70.2770	77.2705	84.9672	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	(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)					
Southwest			7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)					
Northwest			1.8000	11.2829	0.6300	0.7000	0.7700	6.2068 (81)					
Solar gains	133.5768	245.4556	383.4546	554.9232	694.4019	721.4209	682.1929	573.2371	442.0618	284.1180	163.2585	112.2017	(83)
Total gains	587.6160	697.2630	819.3146	964.6877	1076.8175	1077.6910	1022.0677	920.2589	803.2081	671.5904	580.8092	552.6396	(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													
	0.9988	0.9969	0.9899	0.9580	0.8570	0.6729	0.5085	0.5815	0.8530	0.9818	0.9974	0.9991	(86)
MIT	19.7276	19.8884	20.1617	20.5279	20.8228	20.9630	20.9929	20.9864	20.8735	20.4799	20.0381	19.7024	(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													
	0.9984	0.9958	0.9862	0.9423	0.8084	0.5841	0.3977	0.4645	0.7837	0.9724	0.9963	0.9989	(89)
MIT 2	18.2726	18.5093	18.9083	19.4372	19.8236	19.9806	20.0020	20.0008	19.8977	19.3795	18.7366	18.2424	(90)
Living area fraction													
	18.6176	18.8363	19.2055	19.6958	20.0605	20.2135	20.2370	20.2345	20.1291	19.6404	19.0452	18.5886	(92)
Temperature adjustment													
adjusted MIT	18.6176	18.8363	19.2055	19.6958	20.0605	20.2135	20.2370	20.2345	20.1291	19.6404	19.0452	18.5886	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9941	0.9823	0.9366	0.8120	0.6037	0.4241	0.4923	0.7940	0.9679	0.9947	0.9982	(94)
Ext temp.	586.1994	693.1295	804.7783	903.4845	874.3367	650.6206	433.4121	453.0133	637.7386	650.0124	577.7538	551.6610	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1770.6374	1718.9876	1563.1598	1312.1968	1013.8697	673.4915	436.3516	459.1335	726.3535	1096.3227	1455.2879	1761.4182	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	881.2219	689.3766	564.2359	294.2729	103.8125	0.0000	0.0000	0.0000	0.0000	332.0549	631.8245	900.0593	(98)
												4396.8585	(98)
												40.1430	(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													4707.5572 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	881.2219	689.3766	564.2359	294.2729	103.8125	0.0000	0.0000	0.0000	0.0000	332.0549	631.8245	900.0593	(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)	943.4924	738.0906	604.1069	315.0673	111.1483	0.0000	0.0000	0.0000	0.0000	355.5191	676.4716	963.6609	(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	88.2182	88.0073	87.5230	86.3027	83.8151	80.3000	80.3000	80.3000	80.3000	86.4999	87.7835	88.2950	(216)
Fuel for water heating, kWh/month	244.4979	216.0089	228.0917	206.7397	206.1011	189.4685	181.5252	202.3581	204.5929	214.5018	223.5330	238.3981	(219)
Water heating fuel used												2555.8168	(219)
Annual totals kWh/year													
Space heating fuel - main system												4707.5572	(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												7766.4026	(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	4707.5572	0.2160	1016.8324 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2555.8168	0.2160	552.0564 (264)
Space and water heating			1568.8888 (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			1829.9606 (272)
Emissions per m2 for space and water heating			14.3238 (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) = (14.3238 * 1.00) + 2.0282 + 0.3554, rounded to 2 d.p.			16.7100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-188	Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)
Property	75, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.16	TER	16.71
Environmental	89 B	% DER<TER	21.23		
CO ₂ Emissions (t/year)	1.12	DFEE	47.37	TTEE	52.13
General Requirements Compliance	Pass	% DFEE<TFEE	9.13		

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					4.5000
Infiltration rate					0.3729 (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) =	0.3169 (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	0.4041	0.3962	0.3882	0.3486	0.3407	0.3011	0.3011	0.2932	0.3169	0.3407	0.3565	0.3724 (22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693 (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	
	51.9276	51.6446	51.3672	50.0641	49.8203	48.6854	48.6854	48.4752	49.1226	49.8203	50.3135	50.8291	(38)
Heat transfer coeff	129.7827	129.4997	129.2222	127.9192	127.6754	126.5405	126.5405	126.3303	126.9776	127.6754	128.1686	128.6842	(39)
Average = Sum(39)m / 12 =												127.9180	(39)
HLP	1.1849	1.1823	1.1798	1.1679	1.1657	1.1553	1.1553	1.1534	1.1593	1.1657	1.1702	1.1749	(40)
HLP (average)												1.1679	(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)													(45)
Distribution loss (46)m = 0.15 x (45)m													(46)
	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	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				2.8800	11.2829	0.6200	0.7000	0.7700	9.7732 (75)				
Southwest				7.0800	36.7938	0.6200	0.7000	0.7700	78.3486 (79)				
Northwest				1.8000	11.2829	0.6200	0.7000	0.7700	6.1083 (81)				
Northeast				10.9700	11.2829	0.6200	0.7000	0.7700	37.2265 (75)				
Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207	(83)
Total gains	538.8026	647.5157	769.1250	914.3305	1026.4810	1029.7901	976.6362	873.4990	756.9980	625.2500	533.6095	505.0039	(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	33.0031	33.0752	33.1463	33.4839	33.5478	33.8487	33.8487	33.9050	33.7322	33.5478	33.4187	33.2848			
alpha	3.2002	3.2050	3.2098	3.2323	3.2365	3.2566	3.2566	3.2603	3.2488	3.2365	3.2279	3.2190			
util living area	0.9912	0.9836	0.9654	0.9163	0.8163	0.6665	0.5268	0.5937	0.8172	0.9518	0.9856	0.9929	(86)		
MIT	18.8813	19.1203	19.5305	20.0746	20.5442	20.8385	20.9447	20.9182	20.6635	20.0444	19.3646	18.8400	(87)		
Th 2	19.9321	19.9342	19.9362	19.9458	19.9476	19.9559	19.9559	19.9575	19.9527	19.9476	19.9439	19.9402	(88)		
util rest of house															
	0.9894	0.9802	0.9578	0.8973	0.7736	0.5888	0.4180	0.4841	0.7575	0.9372	0.9820	0.9914	(89)		
MIT 2	17.9919	18.2307	18.6377	19.1735	19.6099	19.8626	19.9345	19.9227	19.7310	19.1553	18.4823	17.9566	(90)		
Living area fraction													fLA = Living area / (4) =	0.2371	(91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

MIT	18.2027	18.4416	18.8494	19.3872	19.8314	20.0940	20.1740	20.1587	19.9521	19.3661	18.6915	18.1661 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2027	18.4416	18.8494	19.3872	19.8314	20.0940	20.1740	20.1587	19.9521	19.3661	18.6915	18.1661 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9737	0.9478	0.8851	0.7683	0.6000	0.4420	0.5069	0.7575	0.9267	0.9762	0.9879	(94)
Useful gains	530.8528	630.4953	728.9921	809.2589	788.6138	617.8495	431.6887	442.7463	573.4258	579.4399	520.8956	498.8742	(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													
	1804.3363	1753.6372	1595.8141	1341.5089	1038.1841	695.2112	452.2558	474.8434	743.0858	1119.2206	1485.6656	1797.2118	(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													
	947.4717	754.7513	644.9156	383.2200	185.6803	0.0000	0.0000	0.0000	0.0000	401.5969	694.6344	965.9632	(98)
Space heating													4978.2334 (98)
Space heating per m2											(98) / (4) =		45.4509 (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	1189.4806	936.3996	960.1105	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8015	0.8614	0.8235	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	953.4139	806.6041	790.6984	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1313.6444	1249.0963	1130.5364	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	259.3660	329.2142	252.8394	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												841.4196 (104)
Cooled fraction												1.0000 (105)
FC = cooled area / (4) =												
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	64.8415	82.3035	63.2099	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												210.3549 (107)
Space cooling per m2												1.9205 (108)
Energy for space heating												45.4509 (99)
Energy for space cooling												1.9205 (108)
Total												47.3714 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	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(A, m2)			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/m2K							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)												
(38)m	Jan 52.9378	Feb 52.6155	Mar 52.2997	Apr 50.8160	May 50.5384	Jun 49.2462	Jul 49.2462	Aug 49.0069	Sep 49.7440	Oct 50.5384	Nov 51.1000	Dec 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	Jan 1.1291	Feb 1.1261	Mar 1.1233	Apr 1.1097	May 1.1072	Jun 1.0954	Jul 1.0954	Aug 1.0932	Sep 1.0999	Oct 1.1072	Nov 1.1123	Dec 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 111.0829	Feb 107.0435	Mar 103.0041	Apr 98.9647	May 94.9253	Jun 90.8860	Jul 90.8860	Aug 94.9253	Sep 98.9647	Oct 103.0041	Nov 107.0435	Dec 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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 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 (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	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)
Southwest	7.0800	36.7938	0.6300	0.7000	0.7700	79.6123 (79)
Northwest	1.8000	11.2829	0.6300	0.7000	0.7700	6.2068 (81)

Solar gains	133.5768	245.4556	383.4546	554.9232	694.4019	721.4209	682.1929	573.2371	442.0618	284.1180	163.2585	112.2017	(83)
Total gains	540.9229	651.4118	775.2116	923.1388	1037.5033	1041.2413	987.4647	882.5980	764.0148	629.7599	536.2009	506.7849	(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	0.9992	0.9977	0.9920	0.9645	0.8711	0.6911	0.5250	0.6031	0.8721	0.9861	0.9982	0.9994	(86)
MIT	19.6876	19.8495	20.1255	20.4987	20.8064	20.9582	20.9918	20.9840	20.8573	20.4468	20.0000	19.6630	(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	0.9989	0.9969	0.9891	0.9508	0.8250	0.6019	0.4112	0.4833	0.8073	0.9787	0.9974	0.9992	(89)
MIT 2	18.7735	18.9370	19.2133	19.5864	19.8654	19.9858	20.0025	20.0018	19.9194	19.5430	19.0966	18.7564	(90)
Living area fraction									fLA = Living area / (4) =			0.2371	(91)
MIT	18.9902	19.1534	19.4296	19.8027	20.0885	20.2164	20.2371	20.2347	20.1418	19.7573	19.3108	18.9713	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9902	19.1534	19.4296	19.8027	20.0885	20.2164	20.2371	20.2347	20.1418	19.7573	19.3108	18.9713	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9961	0.9869	0.9476	0.8299	0.6220	0.4384	0.5119	0.8180	0.9764	0.9967	0.9990	(94)
Ext temp.	540.1352	648.8413	765.0779	874.7712	860.9798	647.6359	432.9352	451.8320	624.9293	614.8876	534.4297	506.2584	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1816.7192	1758.0995	1590.7374	1325.1921	1017.2639	673.8333	436.3674	459.1559	727.8838	1110.5008	1487.6541	1808.2726	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	949.7785	745.4215	614.2907	324.3030	116.2754	0.0000	0.0000	0.0000	0.0000	368.7362	686.3215	968.6986	(98)
Space heating per m2												4773.8255	(98)
												(98) / (4) =	43.5846 (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	0.8993	0.9468	0.9181	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1014.1754	840.6268	835.4717	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1327.0288	1261.7530	1141.1716	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	225.2544	313.3179	227.4407	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												766.0131 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	56.3136	78.3295	56.8602	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												191.5033 (107)
Space cooling per m2												1.7484 (108)
Energy for space heating												43.5846 (99)
Energy for space cooling												1.7484 (108)
Total												45.3330 (109)
Target Fabric Energy Efficiency (TFEE)												52.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-188	Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)
Property	75, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.16	TER	16.71
Environmental	89 B	% DER<TER	21.23		
CO ₂ Emissions (t/year)	1.12	DFEE	47.37	TFEE	52.13
General Requirements Compliance	Pass	% DFEE<TFEE	9.13		

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				4.5000	
Infiltration rate				0.3729	(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) =		0.3169 (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	0.3328	0.3090	0.3169	0.3011	0.3011	0.2932	0.2852	0.2773	0.2694	0.2932	0.2773	0.2932 (22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5385	0.5363	0.5430	0.5385	0.5430 (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)

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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 kJ/m²K 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	
	49.5821	48.9012	49.1226	48.6854	48.6854	48.4752	48.2707	48.0717	47.8784	48.4752	48.0717	48.4752	(38)
Heat transfer coeff	127.4372	126.7563	126.9776	126.5405	126.5405	126.3303	126.1258	125.9268	125.7334	126.3303	125.9268	126.3303	(39)
Average = Sum(39)m / 12 =												126.4130	(39)
HLP	1.1635	1.1573	1.1593	1.1553	1.1553	1.1534	1.1515	1.1497	1.1479	1.1534	1.1497	1.1534	(40)
HLP (average)												1.1541	(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	
	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													
Solar input	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)
	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)
													(64)
RHI water heating demand													(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	Specific data or Table 6b	g	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)
Southwest				7.0800	45.1778		0.6200	0.7000	0.7700				96.2014 (79)
Northwest				1.8000	14.6176		0.6200	0.7000	0.7700				7.9136 (81)
Northeast				10.9700	14.6176		0.6200	0.7000	0.7700				48.2289 (75)
Solar gains	165.0056	259.4270	411.5871	602.5209	717.5045	809.4939	759.6216	653.8647	502.4626	324.9115	201.3123	136.0570	(83)
Total gains	824.5189	914.0207	1040.6988	1191.8844	1265.7946	1321.1788	1250.0198	1153.4245	1024.9882	887.4165	808.3157	777.0852	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	35.0430	35.2313	35.1698	35.2913	35.2913	35.3501	35.4074	35.4633	35.5179	35.3501	35.4633	35.3501	
alpha	3.3362	3.3488	3.3447	3.3528	3.3528	3.3567	3.3605	3.3642	3.3679	3.3567	3.3642	3.3567	
util living area													

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	0.9709	0.9587	0.9234	0.8404	0.7041	0.5102	0.3829	0.4116	0.6637	0.8735	0.9516	0.9747 (86)
MIT	19.4131	19.5850	19.9629	20.4235	20.7656	20.9415	20.9832	20.9792	20.8576	20.4435	19.8791	19.3927 (87)
Th 2	19.9493	19.9543	19.9527	19.9559	19.9559	19.9575	19.9590	19.9604	19.9619	19.9575	19.9604	19.9575 (88)
util rest of house												
	0.9650	0.9505	0.9079	0.8087	0.6472	0.4285	0.2853	0.3080	0.5840	0.8399	0.9401	0.9695 (89)
MIT 2	17.8647	18.1145	18.6512	19.2872	19.7246	19.9160	19.9516	19.9512	19.8443	19.3321	18.5456	17.8412 (90)
Living area fraction									fLA = Living area / (4) =			0.2371 (91)
MIT	18.2318	18.4631	18.9622	19.5566	19.9714	20.1592	20.1962	20.1949	20.0846	19.5956	18.8618	18.2090 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0818	18.3131	18.8122	19.4066	19.8214	20.0092	20.0462	20.0449	19.9346	19.4456	18.7118	18.0590 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9503	0.9331	0.8867	0.7893	0.6392	0.4327	0.2937	0.3167	0.5817	0.8197	0.9216	0.9561 (94)	
Useful gains	783.5693	852.8924	922.7702	940.7564	809.0428	571.7305	367.1403	365.2745	596.2334	727.4329	744.9667	742.9584 (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	1679.8576	1649.4979	1499.8915	1253.5887	926.4546	594.9104	371.5925	370.8456	658.1627	1016.4089	1361.4959	1649.7520 (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	666.8385	535.3189	429.3782	225.2392	87.3544	0.0000	0.0000	0.0000	0.0000	214.9981	443.9010	674.6544 (98)	
Space heating												3277.6827 (98)	
RHI space heating demand												3278 (98)	

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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					4.5000
Infiltration rate					0.3729 (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) = 0.3169 (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	0.4041	0.3962	0.3882	0.3486	0.3407	0.3011	0.3011	0.2932	0.3169	0.3407	0.3565	0.3724 (22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693 (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)				(26)...(30) + (32) =	68.4495		(33)
Fabric heat loss, W/K = Sum (A x U)				0.0000	0.0000	45.0000	2790.9000 (32)
Party Wall 1			62.0200			9.0000	352.1700 (32c)
GF			39.1300			9.0000	486.4500 (32c)
FF			54.0500			9.0000	644.9400 (32c)
2F			71.6600			18.0000	657.1800 (32d)
Internal Floor 1			36.5100			18.0000	657.1800 (32d)
Internal Floor 2			36.5100			18.0000	657.1800 (32e)
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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.9276	51.6446	51.3672	50.0641	49.8203	48.6854	48.6854	48.4752	49.1226	49.8203	50.3135	50.8291 (38)
Heat transfer coeff	129.7827	129.4997	129.2222	127.9192	127.6754	126.5405	126.5405	126.3303	126.9776	127.6754	128.1686	128.6842 (39)
Average = Sum(39)m / 12 =												127.9180 (39)
HLP	1.1849	1.1823	1.1798	1.1679	1.1657	1.1553	1.1553	1.1534	1.1593	1.1657	1.1702	1.1749 (40)
HLP (average)												1.1679 (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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	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)		
Southwest				7.0800	36.7938	0.6200		0.7000		0.7700	78.3486 (79)		
Northwest				1.8000	11.2829	0.6200		0.7000		0.7700	6.1083 (81)		
Northeast				10.9700	11.2829	0.6200		0.7000		0.7700	37.2265 (75)		

Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207	(83)
Total gains	790.9699	896.1531	1006.4797	1135.4783	1231.6697	1221.6547	1161.7627	1063.6979	957.5706	842.1133	767.6706	751.4489	(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	34.4097	34.4849	34.5589	34.9110	34.9776	35.2913	35.2913	35.3501	35.1698	34.9776	34.8430	34.7034	
alpha	3.2940	3.2990	3.3039	3.3274	3.3318	3.3528	3.3528	3.3567	3.3447	3.3318	3.3229	3.3136	
util living area	0.9767	0.9639	0.9362	0.8713	0.7549	0.5953	0.4572	0.5112	0.7345	0.9068	0.9644	0.9801	(86)
MIT	19.2411	19.4590	19.8238	20.2925	20.6734	20.8950	20.9674	20.9525	20.7806	20.2849	19.6818	19.1977	(87)
Th 2	19.9321	19.9342	19.9362	19.9458	19.9476	19.9559	19.9559	19.9575	19.9527	19.9476	19.9439	19.9402	(88)
util rest of house	0.9721	0.9567	0.9233	0.8449	0.7057	0.5177	0.3575	0.4086	0.6646	0.8818	0.9561	0.9761	(89)
MIT	17.6052	17.9204	18.4437	19.1042	19.6062	19.8715	19.9385	19.9300	19.7541	19.1105	18.2524	17.5475	(90)
Living area fraction									fLA =	Living area / (4) =		0.2371	(91)
MIT	17.9931	18.2852	18.7709	19.3859	19.8593	20.1142	20.1825	20.1725	19.9975	19.3889	18.5913	17.9388	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.8431	18.1352	18.6209	19.2359	19.7093	19.9642	20.0325	20.0225	19.8475	19.2389	18.4413	17.7888	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9590	0.9401	0.9026	0.8236	0.6932	0.5183	0.3651	0.4154	0.6566	0.8604	0.9396	0.9643	(94)
Useful gains	758.5685	842.5030	908.4189	935.2311	853.7873	633.2018	424.1614	441.8572	628.7880	724.5358	721.3177	724.6533	(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	1757.6548	1713.9582	1566.2937	1322.1644	1022.5845	678.7869	434.3467	457.6260	729.8058	1102.9769	1453.5996	1748.6576	(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	743.3202	585.6179	489.4588	278.5919	125.5851	0.0000	0.0000	0.0000	0.0000	281.5602	527.2430	761.8592	(98)
Space heating												3793.2364	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2

(98) / (4) = 34.6319 (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													4214.7071 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	743.3202	585.6179	489.4588	278.5919	125.5851	0.0000	0.0000	0.0000	0.0000	281.5602	527.2430	761.8592	(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)	825.9114	650.6866	543.8431	309.5466	139.5390	0.0000	0.0000	0.0000	0.0000	312.8446	585.8255	846.5103	(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	89.3201	89.2599	89.1267	88.8175	88.1996	86.7000	86.7000	86.7000	86.7000	88.7974	89.1825	86.7000	(216)
Fuel for water heating, kWh/month	208.0210	182.7121	190.3769	168.7457	164.6744	146.9998	138.6419	155.6517	156.4956	175.1485	187.5350	202.1127	(219)
Water heating fuel used												2077.1152	(219)
Annual totals kWh/year													
Space heating fuel - main system												4214.7071	(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												6144.2613	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4214.7071	3.4800	146.6718 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2077.1152	3.4800	72.2836 (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			319.4921 (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] =	0.8684 (257)
SAP value		87.8865
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	4214.7071	0.2160	910.3767 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2077.1152	0.2160	448.6569 (264)
Space and water heating			1359.0336 (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			1282.4494 (272)
CO2 emissions per m2			11.7100 (273)
EI value			88.8793
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	$3.48 / 0.8824 = 3.944$, stars = 4
Water heating environmental impact	$0.216 / 0.8824 = 0.2448$, 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					4.5000
Infiltration rate					0.3729 (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) =				0.3169 (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	0.3328	0.3090	0.3169	0.3011	0.3011	0.2932	0.2852	0.2773	0.2694	0.2932	0.2773	0.2932 (22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5385	0.5363	0.5430	0.5385	0.5430 (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	49.5821	48.9012	49.1226	48.6854	48.6854	48.4752	48.2707	48.0717	47.8784	48.4752	48.0717	48.4752 (38)
Average = Sum(39)m / 12 =	127.4372	126.7563	126.9776	126.5405	126.5405	126.3303	126.1258	125.9268	125.7334	126.3303	125.9268	126.3303 (39)
												126.4130 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1635	1.1573	1.1593	1.1553	1.1553	1.1534	1.1515	1.1497	1.1479	1.1534	1.1497	1.1534 (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)

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)		
Southwest					7.0800	45.1778	0.6200	0.7000	0.7700	96.2014 (79)		
Northwest					1.8000	14.6176	0.6200	0.7000	0.7700	7.9136 (81)		
Northeast					10.9700	14.6176	0.6200	0.7000	0.7700	48.2289 (75)		
Solar gains	165.0056	259.4270	411.5871	602.5209	717.5045	809.4939	759.6216	653.8647	502.4626	324.9115	201.3123	136.0570 (83)
Total gains	824.5189	914.0207	1040.6988	1191.8844	1265.7946	1321.1788	1250.0198	1153.4245	1024.9882	887.4165	808.3157	777.0852 (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	35.0430	35.2313	35.1698	35.2913	35.2913	35.3501	35.4074	35.4633	35.5179	35.3501	35.4633	35.3501		
alpha	3.3362	3.3488	3.3447	3.3528	3.3528	3.3567	3.3605	3.3642	3.3679	3.3567	3.3642	3.3567		
util living area	0.9709	0.9587	0.9234	0.8404	0.7041	0.5102	0.3829	0.4116	0.6637	0.8735	0.9516	0.9747	(86)	
MIT	19.4131	19.5850	19.9629	20.4235	20.7656	20.9415	20.9832	20.9792	20.8576	20.4435	19.8791	19.3927	(87)	
Th 2	19.9493	19.9543	19.9527	19.9559	19.9559	19.9575	19.9590	19.9604	19.9619	19.9575	19.9604	19.9575	(88)	
util rest of house	0.9650	0.9505	0.9079	0.8087	0.6472	0.4285	0.2853	0.3080	0.5840	0.8399	0.9401	0.9695	(89)	
MIT 2	17.8647	18.1145	18.6512	19.2872	19.7246	19.9160	19.9516	19.9512	19.8443	19.3321	18.5456	17.8412	(90)	
Living area fraction	fLA = Living area / (4) =												0.2371	(91)
MIT	18.2318	18.4631	18.9622	19.5566	19.9714	20.1592	20.1962	20.1949	20.0846	19.5956	18.8618	18.2090	(92)	
Temperature adjustment													-0.1500	
adjusted MIT	18.0818	18.3131	18.8122	19.4066	19.8214	20.0092	20.0462	20.0449	19.9346	19.4456	18.7118	18.0590	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9503	0.9503	0.9331	0.8867	0.7893	0.6392	0.4327	0.2937	0.3167	0.5817	0.8197	0.9216	0.9561	(94)
Useful gains	783.5693	852.8924	922.7702	940.7564	809.0428	571.7305	367.1403	365.2745	596.2334	727.4329	744.9667	742.9584	(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	1679.8576	1649.4979	1499.8915	1253.5887	926.4546	594.9104	371.5925	370.8456	658.1627	1016.4089	1361.4959	1649.7520	(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	666.8385	535.3189	429.3782	225.2392	87.3544	0.0000	0.0000	0.0000	0.0000	214.9981	443.9010	674.6544	(98)
Space heating	3277.6827												(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating per m2 (98) / (4) = 29.9250 (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												3641.8697	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	666.8385	535.3189	429.3782	225.2392	87.3544	0.0000	0.0000	0.0000	0.0000	214.9981	443.9010	674.6544	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	740.9317	594.7988	477.0869	250.2658	97.0604	0.0000	0.0000	0.0000	0.0000	238.8868	493.2234	749.6160	(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	89.2596	89.2071	89.0401	88.6518	87.9106	86.7000	86.7000	86.7000	86.7000	88.5847	89.0722	86.7000	(216)
Fuel for water heating, kWh/month	208.1619	182.8203	190.5621	169.0610	165.2159	146.9998	138.6419	155.6517	156.4956	175.5690	187.7673	202.2619	(219)
Water heating fuel used												2079.2084	(219)
Annual totals kWh/year													
Space heating fuel - main system												3641.8697	(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												5497.1020	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3641.8697	3.9400	143.4897	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2079.2084	3.9400	81.9208	(247)
Pumps and fans for heating	75.0000	16.5500	12.4125	(249)
Energy for lighting	428.0285	16.5500	70.8387	(250)
Additional standing charges			87.0000	(251)
Energy saving/generation technologies				
PV Unit	-727.0046	16.5500	-120.3193	(252)
Total energy cost			275.3424	(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	3641.8697	0.2160	786.6439	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2079.2084	0.2160	449.1090	(264)
Space and water heating			1235.7529	(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			1119.5093	(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	3641.8697	1.2200	4443.0810	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2079.2084	1.2200	2536.6342	(264)
Space and water heating			6979.7152	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	428.0285	3.0700	1314.0474	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			6292.1086 (272)
Primary energy kWh/m2/year			57.4464 (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	-£ 33	-199 kg (17.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£33 1.82 kg/m²	B 89	B 91
Total Savings	£33 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 436 TEST (29 Nov 2018)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£83	£92	-£8
Mains gas	£312	£271	£41
Space heating	£243	£243	£0
Water heating	£82	£49	£33
Lighting	£71	£71	£0
Generated (PV)	-£120	-£120	£0
Total cost of fuels	£275	£243	£33
Total cost of uses	£276	£243	£33
Delivered energy	50 kWh/m²	41 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	47 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					4.5000
Infiltration rate					0.3729 (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) =				0.3169 (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	0.4041	0.3962	0.3882	0.3486	0.3407	0.3011	0.3011	0.2932	0.3169	0.3407	0.3565	0.3724 (22b)
Effective ac	0.5816	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.9276	51.6446	51.3672	50.0641	49.8203	48.6854	48.6854	48.4752	49.1226	49.8203	50.3135	50.8291 (38)
Heat transfer coeff	129.7827	129.4997	129.2222	127.9192	127.6754	126.5405	126.5405	126.3303	126.9776	127.6754	128.1686	128.6842 (39)
Average = Sum(39)m / 12 =												127.9180 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1849	1.1823	1.1798	1.1679	1.1657	1.1553	1.1553	1.1534	1.1593	1.1657	1.1702	1.1749 (40)
HLP (average)												1.1679 (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 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 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)
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													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input	-25.3813	-42.3541	-72.1339	-96.6736	-119.4321	-117.4208	-115.8691	-101.2354	-79.2876	-54.1441	-30.1059	-875.2778	(63)
Solar input (sum of months) = Sum(63)m =													
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 =													
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)	
Southwest					7.0800	36.7938	0.6200	0.7000			0.7700	78.3486 (79)	
Northwest					1.8000	11.2829	0.6200	0.7000			0.7700	6.1083 (81)	
Northeast					10.9700	11.2829	0.6200	0.7000			0.7700	37.2265 (75)	

Solar gains	131.4566	241.5594	377.3681	546.1149	683.3796	709.9698	671.3645	564.1381	435.0450	279.6082	160.6671	110.4207	(83)
Total gains	790.9699	896.1531	1006.4797	1135.4783	1231.6697	1221.6547	1161.7627	1063.6979	957.5706	842.1133	767.6706	751.4489	(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	34.4097	34.4849	34.5589	34.9110	34.9776	35.2913	35.2913	35.3501	35.1698	34.9776	34.8430	34.7034		
alpha	3.2940	3.2990	3.3039	3.3274	3.3318	3.3528	3.3528	3.3567	3.3447	3.3318	3.3229	3.3136		
util living area	0.9767	0.9639	0.9362	0.8713	0.7549	0.5953	0.4572	0.5112	0.7345	0.9068	0.9644	0.9801	(86)	
MIT	19.2411	19.4590	19.8238	20.2925	20.6734	20.8950	20.9674	20.9525	20.7806	20.2849	19.6818	19.1977	(87)	
Th 2	19.9321	19.9342	19.9362	19.9458	19.9476	19.9559	19.9559	19.9575	19.9527	19.9476	19.9439	19.9402	(88)	
util rest of house	0.9721	0.9567	0.9233	0.8449	0.7057	0.5177	0.3575	0.4086	0.6646	0.8818	0.9561	0.9761	(89)	
MIT 2	17.6052	17.9204	18.4437	19.1042	19.6062	19.8715	19.9385	19.9300	19.7541	19.1105	18.2524	17.5475	(90)	
Living area fraction									fLA = Living area / (4) =			0.2371	(91)	
MIT	17.9931	18.2852	18.7709	19.3859	19.8593	20.1142	20.1825	20.1725	19.9975	19.3889	18.5913	17.9388	(92)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment													-0.1500
adjusted MIT	17.8431	18.1352	18.6209	19.2359	19.7093	19.9642	20.0325	20.0225	19.8475	19.2389	18.4413		17.7888 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9590	0.9401	0.9026	0.8236	0.6932	0.5183	0.3651	0.4154	0.6566	0.8604	0.9396	0.9643	(94)
Useful gains	758.5685	842.5030	908.4189	935.2311	853.7873	633.2018	424.1614	441.8572	628.7880	724.5358	721.3177	724.6533	(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													
	1757.6548	1713.9582	1566.2937	1322.1644	1022.5845	678.7869	434.3467	457.6260	729.8058	1102.9769	1453.5996	1748.6576	(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													
	743.3202	585.6179	489.4588	278.5919	125.5851	0.0000	0.0000	0.0000	0.0000	281.5602	527.2430	761.8592	(98)
Space heating													3793.2364 (98)
Space heating per m2											(98) / (4) =	34.6319	(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													4214.7071 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	743.3202	585.6179	489.4588	278.5919	125.5851	0.0000	0.0000	0.0000	0.0000	281.5602	527.2430	761.8592	(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)	825.9114	650.6866	543.8431	309.5466	139.5390	0.0000	0.0000	0.0000	0.0000	312.8446	585.8255	846.5103	(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	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)
Efficiency of water heater	89.3960	89.4183	89.4343	89.4540	89.4198	86.7000	86.7000	86.7000	86.7000	89.1021	89.2984	86.7000	(216)
(217)m	89.3960	89.4183	89.4343	89.4540	89.4198	86.7000	86.7000	86.7000	86.7000	89.1021	89.2984	89.4113	(217)
Fuel for water heating, kWh/month	179.4524	135.0223	109.0663	59.4742	28.8640	11.5663	4.9982	38.8866	65.0451	113.7831	153.5778	178.2152	(219)
Water heating fuel used												1077.9515	(219)
Annual totals kWh/year													
Space heating fuel - main system												4214.7071	(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 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												5195.0976	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4214.7071	3.4800	146.6718	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1077.9515	3.4800	37.5127	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	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			291.3162	(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] =	0.7918 (257)
SAP value			88.9548
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	4214.7071	0.2160	910.3767 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1077.9515	0.2160	232.8375 (264)
Space and water heating			1143.2143 (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			1092.5801 (272)
CO2 emissions per m2			9.9800 (273)
EI value			90.5257
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 (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					4.5000
Infiltration rate					0.3729 (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) =				0.3169 (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	0.3328	0.3090	0.3169	0.3011	0.3011	0.2932	0.2852	0.2773	0.2694	0.2932	0.2773	0.2932 (22b)
Effective ac	0.5554	0.5477	0.5502	0.5453	0.5453	0.5430	0.5407	0.5385	0.5363	0.5430	0.5385	0.5430 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	49.5821	48.9012	49.1226	48.6854	48.6854	48.4752	48.2707	48.0717	47.8784	48.4752	48.0717	48.4752 (38)
Heat transfer coeff	127.4372	126.7563	126.9776	126.5405	126.5405	126.3303	126.1258	125.9268	125.7334	126.3303	125.9268	126.3303 (39)
Average = Sum(39)m / 12 =												126.4130 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1635	1.1573	1.1593	1.1553	1.1553	1.1534	1.1515	1.1497	1.1479	1.1534	1.1497	1.1534 (40)
HLP (average)												1.1541 (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 (63)
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)	
Southwest				7.0800	45.1778	0.6200		0.7000		0.7700		96.2014 (79)	
Northwest				1.8000	14.6176	0.6200		0.7000		0.7700		7.9136 (81)	
Northeast				10.9700	14.6176	0.6200		0.7000		0.7700		48.2289 (75)	
Solar gains		165.0056	259.4270	411.5871	602.5209	717.5045	809.4939	759.6216	653.8647	502.4626	324.9115	201.3123	136.0570 (83)
Total gains		824.5189	914.0207	1040.6988	1191.8844	1265.7946	1321.1788	1250.0198	1153.4245	1024.9882	887.4165	808.3157	777.0852 (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	35.0430	35.2313	35.1698	35.2913	35.2913	35.3501	35.4074	35.4633	35.5179	35.3501	35.4633	35.3501	
alpha	3.3362	3.3488	3.3447	3.3528	3.3528	3.3567	3.3605	3.3642	3.3679	3.3567	3.3642	3.3567	
util living area	0.9709	0.9587	0.9234	0.8404	0.7041	0.5102	0.3829	0.4116	0.6637	0.8735	0.9516	0.9747	(86)
MIT	19.4131	19.5850	19.9629	20.4235	20.7656	20.9415	20.9832	20.9792	20.8576	20.4435	19.8791	19.3927	(87)
Th 2	19.9493	19.9543	19.9527	19.9559	19.9559	19.9575	19.9590	19.9604	19.9619	19.9575	19.9604	19.9575	(88)
util rest of house	0.9650	0.9505	0.9079	0.8087	0.6472	0.4285	0.2853	0.3080	0.5840	0.8399	0.9401	0.9695	(89)
MIT 2	17.8647	18.1145	18.6512	19.2872	19.7246	19.9160	19.9516	19.9512	19.8443	19.3321	18.5456	17.8412	(90)
Living area fraction	fLA = Living area / (4) =												0.2371 (91)
MIT	18.2318	18.4631	18.9622	19.5566	19.9714	20.1592	20.1962	20.1949	20.0846	19.5956	18.8618	18.2090	(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	18.0818	18.3131	18.8122	19.4066	19.8214	20.0092	20.0462	20.0449	19.9346	19.4456	18.7118		18.0590 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9503	0.9331	0.8867	0.7893	0.6392	0.4327	0.2937	0.3167	0.5817	0.8197	0.9216	0.9561	(94)
Useful gains	783.5693	852.8924	922.7702	940.7564	809.0428	571.7305	367.1403	365.2745	596.2334	727.4329	744.9667	742.9584	(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	1679.8576	1649.4979	1499.8915	1253.5887	926.4546	594.9104	371.5925	370.8456	658.1627	1016.4089	1361.4959	1649.7520	(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	666.8385	535.3189	429.3782	225.2392	87.3544	0.0000	0.0000	0.0000	0.0000	214.9981	443.9010	674.6544	(98)
Space heating												3277.6827	(98)
Space heating per m2												29.9250	(99)

(98) / (4) = 29.9250 (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													3641.8697 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	666.8385	535.3189	429.3782	225.2392	87.3544	0.0000	0.0000	0.0000	0.0000	214.9981	443.9010	674.6544	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	740.9317	594.7988	477.0869	250.2658	97.0604	0.0000	0.0000	0.0000	0.0000	238.8868	493.2234	749.6160	(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	89.3549	89.3736	89.3730	89.3635	89.1304	86.7000	86.7000	86.7000	86.7000	88.9460	89.2212	86.7000	(216)
Fuel for water heating, kWh/month	174.6717	135.1843	108.5623	58.0240	33.7796	5.1524	0.0000	31.3640	59.1869	109.2788	148.0472	174.7303	(219)
Water heating fuel used												1037.9815	(219)
Annual totals kWh/year													
Space heating fuel - main system												3641.8697	(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												4505.8751	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3641.8697	3.9400	143.4897	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1037.9815	3.9400	40.8965	(247)
Pumps and fans for heating	75.0000	16.5500	12.4125	(249)
Pump for solar water heating	50.0000	16.5500	8.2750	(249)
Energy for lighting	428.0285	16.5500	70.8387	(250)
Additional standing charges			87.0000	(251)
Energy saving/generation technologies				
PV Unit		-727.0046	16.5500	-120.3193 (252)
Total energy cost			242.5931	(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	3641.8697	0.2160	786.6439	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1037.9815	0.2160	224.2040	(264)
Space and water heating			1010.8479	(265)

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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			920.5543 (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	3641.8697	1.2200	4443.0810 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1037.9815	1.2200	1266.3375 (264)
Space and water heating			5709.4185 (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			5175.3119 (272)
Primary energy kWh/m2/year			47.2502 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-188	Issued on Date	07/02/2019
Assessment Reference	As Built	Prop Type Ref	P308 - Semi (As)
Property	75, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW		

SAP Rating	88 B	DER	13.16	TER	16.71
Environmental	89 B	% DER<TER	21.23		
CO ₂ Emissions (t/year)	1.12	DFEE	47.37	TFEE	52.13
General Requirements Compliance	Pass	% DFEE<TFEE	9.13		

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

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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 West	0.000	1.000	None
North 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 West	1.000	0.90	1.000	0.900 (P8)
North 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 West	7.0800	127.3119	0.6200	0.7000	0.9000	316.8669
North West	1.8000	106.0502	0.6200	0.7000	0.9000	67.1056
North East	10.9700	106.0502	0.6200	0.7000	0.9000	408.9714
total:						900.3129

	Jun	Jul	Aug	
Solar gains	975	900	772	(P3)
Internal gains	509	487	497	
Total summer gains	1484	1388	1269	(P5)
Summer gain/loss ratio	3.41	3.19	2.92	(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	19.78	21.46	21.19	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			