

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-207				Issued on Date	21/05/2019
Assessment Reference	As Built	Prop Type Ref	1FF - Det (As)			
Property	48, St. Andrews, Botley, SOUTHAMPTON, SO32 2ST					
SAP Rating		84 B	DER	13.56	TER	17.58
Environmental		91 B	% DER<TER	22.87		
CO ₂ Emissions (t/year)		0.69	DFEE	39.63	TFEE	42.27
General Requirements Compliance		Pass	% DFEE<TFEE	6.24		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	4907-0015
Client						

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 67 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) 17.58 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.56 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)42.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.26 (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: 4.61 (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 28 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): Not significant OK

Based on:

Overshading: Average
Windows facing East: 6.09 m², No overhang
Windows facing West: 2.58 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Door U-value 0.71 W/m²K
Photovoltaic array 475.46 kWh/Year

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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	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1299 (8)
Measured/design AP50					Yes
Infiltration rate					4.6100
Number of sides sheltered					0.3604 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3333 (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												
	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
Effective ac	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (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
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.2600	13.9594	60.0000	3221.4000 (29a)
APT Wall to Stairwell	20.6600		20.6600	0.2400	4.9584	110.0000	2272.6000 (29a)
Total net area of external elements Aum(A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9173		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
E-FC-4			66.6700			70.0000	4666.9000 (32b)
1F - Timber			89.1300			9.0000	802.1700 (32c)
1F - Metal			39.2800			20.0000	785.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16415.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		246.2212 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.4127 (36)
Total fabric heat loss	(33) + (36) =	38.3300 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	30.0013	29.8230	29.6483	28.8277	28.6742	27.9595	27.9595	27.8271	28.2348	28.6742	28.9848	29.3095 (38)
Heat transfer coeff	68.3313	68.1531	67.9784	67.1578	67.0042	66.2895	66.2895	66.1572	66.5648	67.0042	67.3148	67.6395 (39)
Average = Sum(39)m / 12 =												67.1570 (39)
HLP	1.0249	1.0222	1.0196	1.0073	1.0050	0.9943	0.9943	0.9923	0.9984	1.0050	1.0097	1.0145 (40)
HLP (average)												1.0073 (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												2.1626 (42)
Average daily hot water use (litres/day)												85.5629 (43)
Daily hot water use	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy conte	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Energy content (annual)												Total = Sum(45)m = 1346.2376 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9364	18.3111	18.8954	16.4735	15.8067	13.6400	12.6395	14.5040	14.6772	17.1048	18.6713	20.2758 (46)

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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	21.7278	19.5902	21.6335	20.8727	21.5227	20.7756	21.4353	21.4919	20.8285	21.5876	20.9642	21.7095	(61)
Total heat required for water heating calculated for each month	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(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	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(64)
Heat gains from water heating, kWh/month	51.8410	45.4872	47.2932	41.7344	40.4189	35.4292	33.3763	37.5234	37.7415	43.3126	46.6290	50.3721	(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	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4112	16.3527	13.2989	10.0681	7.5260	6.3538	6.8655	8.9240	11.9778	15.2086	17.7507	18.9229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.4038	191.3692	186.4164	175.8725	162.5627	150.0534	141.6964	139.7310	144.6838	155.2277	168.5375	181.0468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	(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)	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	(71)
Water heating gains (Table 5)	69.6787	67.6893	63.5662	57.9645	54.3264	49.2072	44.8606	50.4347	52.4188	58.2159	64.7626	67.7044	(72)
Total internal gains	335.9335	333.8509	321.7212	302.3448	282.8549	264.0542	251.8622	257.5295	267.5201	287.0919	309.4904	326.1138	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				2.8800	19.6403	0.6200	0.7000	0.7700	17.0123 (76)			
West				2.5800	19.6403	0.6200	0.7000	0.7700	15.2402 (80)			
East				3.2100	19.6403	0.6200	0.7000	0.7700	18.9616 (76)			
Solar gains	51.2141	100.1856	164.9914	240.6302	294.9013	301.8839	287.4058	246.8774	191.8919	118.8787	63.8579	42.1160 (83)
Total gains	387.1476	434.0365	486.7126	542.9750	577.7562	565.9381	539.2680	504.4068	459.4120	405.9706	373.3484	368.2298 (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	66.7319	66.9065	67.0784	67.8980	68.0536	68.7873	68.7873	68.9249	68.5028	68.0536	67.7396	67.4144		
alpha	5.4488	5.4604	5.4719	5.5265	5.5369	5.5858	5.5858	5.5950	5.5669	5.5369	5.5160	5.4943		
util living area	0.9982	0.9962	0.9892	0.9615	0.8771	0.7055	0.5327	0.5886	0.8476	0.9784	0.9962	0.9986	(86)	
MIT	19.8986	20.0292	20.2634	20.5746	20.8295	20.9633	20.9935	20.9891	20.8975	20.5611	20.1749	19.8761	(87)	
Th 2	20.0626	20.0648	20.0670	20.0772	20.0792	20.0881	20.0881	20.0897	20.0846	20.0792	20.0753	20.0712	(88)	
util rest of house	0.9976	0.9949	0.9855	0.9475	0.8346	0.6223	0.4266	0.4796	0.7814	0.9680	0.9947	0.9982	(89)	
MIT 2	18.5859	18.7781	19.1200	19.5707	19.9092	20.0631	20.0856	20.0850	20.0001	19.5596	18.9991	18.5593	(90)	
Living area fraction									fLA = Living area / (4) =			0.3871	(91)	
MIT	19.0941	19.2624	19.5627	19.9593	20.2655	20.4116	20.4371	20.4350	20.3475	19.9473	19.4543	19.0691	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.9441	19.1124	19.4127	19.8093	20.1155	20.2616	20.2871	20.2850	20.1975	19.7973	19.3043	18.9191	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9965	0.9931	0.9819	0.9424	0.8365	0.6390	0.4502	0.5037	0.7907	0.9638	0.9929	0.9973	(94)	
Useful gains	385.8009	431.0292	477.9148	511.7091	483.3132	361.6439	242.7981	254.0894	363.2560	391.2739	370.7046	367.2460	(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	1000.6512	968.6203	877.7810	732.6468	563.8729	375.3034	244.4146	257.0231	405.8782	616.2584	821.5291	995.5916	(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	457.4486	361.2612	297.5004	159.0751	59.9364	0.0000	0.0000	0.0000	0.0000	167.3885	324.5936	467.4891	(98)	
Space heating												2294.6929	(98)	
Space heating per m2												(98) / (4) =	34.4187	(99)

8c. Space cooling requirement

Not applicable

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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													2549.6588 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	457.4486	361.2612	297.5004	159.0751	59.9364	0.0000	0.0000	0.0000	0.0000	167.3885	324.5936	467.4891	(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)	508.2762	401.4013	330.5560	176.7501	66.5960	0.0000	0.0000	0.0000	0.0000	185.9872	360.6596	519.4323	(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	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(64)
Efficiency of water heater (217)m	89.1157	89.0453	88.8782	88.4810	87.7319	86.7000	86.7000	86.7000	86.7000	88.4925	88.9524	86.7000	(216)
Fuel for water heating, kWh/month	181.0048	159.0923	166.0734	147.7108	144.6460	128.8453	121.9127	136.3149	136.8816	153.2559	163.5025	175.9798	(219)
Water heating fuel used												1815.2201	(219)
Annual totals kWh/year													
Space heating fuel - main system												2549.6588	(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)												325.1479	(232)
Energy saving/generation technologies (Appendices M,N and Q)													
Total delivered energy for all uses												4765.0267	(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	2549.6588	0.2160	550.7263 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1815.2201	0.2160	392.0875 (264)
Space and water heating			942.8138 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	325.1479	0.5190	168.7518 (268)
Energy saving/generation technologies			
PV Unit	-475.4634	0.5190	-246.7655 (269)
Total CO2, kg/year			903.7251 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5600 (273)

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

DER		13.5600	ZC1
Total Floor Area		66.6700	
Assumed number of occupants		2.1626	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.8347	ZC2
CO2 emissions from cooking, equation (L16)		2.5634	ZC3
Total CO2 emissions		32.9581	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.9581	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1299 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3799 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3514 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4480	0.4392	0.4304	0.3865	0.3777	0.3338	0.3338	0.3250	0.3514	0.3777	0.3953	0.4129 (22b)
	0.6004	0.5965	0.5926	0.5747	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5852 (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			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.1800	9.6642		(29a)
APT Wall to Stairwell	20.6600		20.6600	0.1800	3.7188		(29a)
Total net area of external elements Aum(A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9973		(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)							7.4678 (36)
Total fabric heat loss						(33) + (36) =	34.4651 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	30.5115	30.3134	30.1193	29.2075	29.0369	28.2427	28.2427
Heat transfer coeff	64.9766	64.7785	64.5844	63.6726	63.5020	62.7079	62.7079
Average = Sum(39)m / 12 =							
HLP	0.9746	0.9716	0.9687	0.9550	0.9525	0.9406	0.9406
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.1626 (42)
												85.5629 (43)
Daily hot water use	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy conte	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	20.9364	18.3111	18.8954	16.4735	15.8067	13.6400	12.6395	14.5040	14.6772	17.1048	18.6713	20.2758 (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	47.9621	41.7453	44.4740	41.3515	40.9858	37.9759	39.2417	40.9858	41.3515	44.4740	44.7271	47.9621 (61)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month												
Solar input	187.5382	163.8194	170.4435	151.1748	146.3639	128.9091	123.5048	137.6789	139.1994	158.5062	169.2023	183.1341 (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												
	187.5382	163.8194	170.4435	151.1748	146.3639	128.9091	123.5048	137.6789	139.1994	158.5062	169.2023	183.1341 (64)
Total per year (kWh/year) = Sum (64)m =												1859.4744 (64)
Heat gains from water heating, kWh/month												
	58.3996	51.0260	53.0034	46.8541	45.2847	39.7293	37.8279	42.3969	42.8723	49.0342	52.5698	56.9352 (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	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.4112	16.3527	13.2989	10.0681	7.5260	6.3538	6.8655	8.9240	11.9778	15.2086	17.7507	18.9229 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	189.4038	191.3692	186.4164	175.8725	162.5627	150.0534	141.6964	139.7310	144.6838	155.2277	168.5375	181.0468 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132 (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)												
	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059 (71)
Water heating gains (Table 5)												
	78.4940	75.9315	71.2411	65.0752	60.8665	55.1795	50.8439	56.9851	59.5449	65.9062	73.0136	76.5258 (72)
Total internal gains	344.7488	342.0931	329.3961	309.4555	289.3950	270.0265	257.8456	264.0798	274.6462	294.7822	317.7414	334.9353 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
East	6.0900	19.6403	0.6300	0.7000	0.7700	36.5541 (76)
West	2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)

Solar gains	52.0401	101.8015	167.6526	244.5113	299.6578	306.7530	292.0414	250.8592	194.9869	120.7961	64.8879	42.7953 (83)
Total gains	396.7889	443.8946	497.0487	553.9668	589.0527	576.7795	549.8870	514.9391	469.6331	415.5783	382.6294	377.7305 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	71.2543	71.4722	71.6870	72.7136	72.9089	73.8322	73.8322	74.0058	73.4738	72.9089	72.5148	72.1073
alpha	5.7503	5.7648	5.7791	5.8476	5.8606	5.9221	5.9221	5.9337	5.8983	5.8606	5.8343	5.8072
util living area	0.9980	0.9958	0.9878	0.9544	0.8553	0.6689	0.4975	0.5509	0.8201	0.9744	0.9958	0.9985 (86)
MIT	19.9973	20.1251	20.3510	20.6469	20.8733	20.9773	20.9966	20.9940	20.9274	20.6267	20.2607	19.9770 (87)
Th 2	20.1046	20.1070	20.1095	20.1210	20.1231	20.1332	20.1332	20.1350	20.1293	20.1231	20.1188	20.1142 (88)
util rest of house	0.9974	0.9944	0.9835	0.9385	0.8100	0.5894	0.4018	0.4515	0.7514	0.9624	0.9941	0.9980 (89)
MIT 2	18.7594	18.9477	19.2772	19.7047	19.9996	20.1181	20.1318	20.1325	20.0713	19.6849	19.1549	18.7369 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.2386	19.4035	19.6929	20.0695	20.3378	20.4507	20.4666	20.4660	20.4027	20.0495	19.5829	19.2170 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.2386	19.4035	19.6929	20.0695	20.3378	20.4507	20.4666	20.4660	20.4027	20.0495	19.5829	19.2170 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9965	0.9930	0.9810	0.9374	0.8221	0.6195	0.4390	0.4902	0.7748	0.9612	0.9928	0.9974 (94)
Useful gains	395.4170	440.7678	487.6113	519.2842	484.2685	357.3063	241.4014	252.3977	363.8824	399.4414	379.8604	376.7338 (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	970.6581	939.5151	852.0540	711.1908	548.5177	366.8853	242.4669	254.3724	397.1573	600.0598	797.0001	964.2090 (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	427.9793	335.1582	271.1453	138.1728	47.8014	0.0000	0.0000	0.0000	0.0000	149.2601	300.3406	437.0815 (98)
Space heating												2106.9392 (98)
Space heating per m2												31.6025 (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)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2255.8236 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	427.9793	335.1582	271.1453	138.1728	47.8014	0.0000	0.0000	0.0000	0.0000	149.2601	300.3406	437.0815	(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)	458.2220	358.8417	290.3055	147.9366	51.1792	0.0000	0.0000	0.0000	0.0000	159.8074	321.5638	467.9673	(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	187.5382	163.8194	170.4435	151.1748	146.3639	128.9091	123.5048	137.6789	139.1994	158.5062	169.2023	183.1341	(64)
Efficiency of water heater	87.0635	86.8150	86.2145	84.8257	82.5712	80.3000	80.3000	80.3000	80.3000	84.9003	86.4803	87.1628	(216)
Fuel for water heating, kWh/month	215.4039	188.6994	197.6970	178.2182	177.2578	160.5344	153.8042	171.4556	173.3492	186.6969	195.6541	210.1056	(219)
Water heating fuel used												2208.8764	(219)
Annual totals kWh/year													
Space heating fuel - main system												2255.8236	(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)												325.1479	(232)
Total delivered energy for all uses												4864.8479	(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	2255.8236	0.2160	487.2579 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2208.8764	0.2160	477.1173 (264)
Space and water heating			964.3752 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	325.1479	0.5190	168.7518 (268)
Total CO2, kg/m2/year			1172.0520 (272)
Emissions per m2 for space and water heating			14.4649 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5311 (272b)
Emissions per m2 for pumps and fans			0.5838 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4649 * 1.00) + 2.5311 + 0.5838, rounded to 2 d.p.			17.5800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1299 (8)
Measured/design AP50					Yes
Infiltration rate					4.6100
Number of sides sheltered					0.3604 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3333 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (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
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.2600	13.9594	60.0000	3221.4000 (29a)
APT Wall to Stairwell	20.6600		20.6600	0.2400	4.9584	110.0000	2272.6000 (29a)
Total net area of external elements Aum(A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9173		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
E-FC-4			66.6700			30.0000	2000.1000 (32b)
1F - Timber			89.1300			9.0000	802.1700 (32c)
1F - Metal			39.2800			20.0000	785.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13748.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		206.2212 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.4127 (36)
Total fabric heat loss	(33) + (36) =	38.3300 (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	30.0013	29.8230	29.6483	28.8277	28.6742	27.9595	27.9595	27.8271	28.2348	28.6742	28.9848	29.3095 (38)
Heat transfer coeff	68.3313	68.1531	67.9784	67.1578	67.0042	66.2895	66.2895	66.1572	66.5648	67.0042	67.3148	67.6395 (39)
Average = Sum(39)m / 12 =												67.1570 (39)
HLP	1.0249	1.0222	1.0196	1.0073	1.0050	0.9943	0.9943	0.9923	0.9984	1.0050	1.0097	1.0145 (40)
HLP (average)												1.0073 (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												2.1626 (42)
Average daily hot water use (litres/day)												85.5629 (43)
Daily hot water use	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy conte	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Energy content (annual)										Total = Sum(45)m =		1346.2376 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	29.6599	25.9407	26.7685	23.3375	22.3928	19.3233	17.9059	20.5473	20.7927	24.2319	26.4510	(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	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4112	16.3527	13.2989	10.0681	7.5260	6.3538	6.8655	8.9240	11.9778	15.2086	17.7507	18.9229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.4038	191.3692	186.4164	175.8725	162.5627	150.0534	141.6964	139.7310	144.6838	155.2277	168.5375	181.0468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	(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)	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	(71)
Water heating gains (Table 5)	39.8655	38.6023	35.9792	32.4131	30.0979	26.8379	24.0671	27.6173	28.8787	32.5697	36.7375	38.6076	(72)
Total internal gains	303.1202	301.7639	291.1342	273.7935	255.6264	238.6849	228.0687	231.7121	240.9800	258.4457	278.4653	294.0170	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	2.8800	19.6403	0.6200		0.7000	0.7700	17.0123 (76)
West	2.5800	19.6403	0.6200		0.7000	0.7700	15.2402 (80)
East	3.2100	19.6403	0.6200		0.7000	0.7700	18.9616 (76)

Solar gains	51.2141	100.1856	164.9914	240.6302	294.9013	301.8839	287.4058	246.8774	191.8919	118.8787	63.8579	42.1160	(83)
Total gains	354.3343	401.9495	456.1257	514.4236	550.5277	540.5688	515.4745	478.5894	432.8719	377.3244	342.3233	336.1330	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8910	56.0371	56.1812	56.8676	56.9979	57.6124	57.6124	57.7277	57.3742	56.9979	56.7349	56.4626	
alpha	4.7261	4.7358	4.7454	4.7912	4.7999	4.8408	4.8408	4.8485	4.8249	4.7999	4.7823	4.7642	
util living area	0.9973	0.9945	0.9860	0.9558	0.8746	0.7158	0.5497	0.6081	0.8519	0.9752	0.9948	0.9979	(86)
MIT	19.6770	19.8279	20.0989	20.4590	20.7610	20.9369	20.9859	20.9775	20.8471	20.4453	19.9972	19.6519	(87)
Th 2	20.0626	20.0648	20.0670	20.0772	20.0792	20.0881	20.0881	20.0897	20.0846	20.0792	20.0753	20.0712	(88)
util rest of house	0.9965	0.9930	0.9818	0.9420	0.8356	0.6371	0.4434	0.5003	0.7922	0.9650	0.9931	0.9973	(89)
MIT 2	18.8467	18.9988	19.2693	19.6287	19.9081	20.0553	20.0836	20.0819	19.9910	19.6220	19.1764	18.8285	(90)
Living area fraction									fLA = Living area / (4) =			0.3871	(91)
MIT	19.1682	19.3198	19.5904	19.9502	20.2383	20.3966	20.4329	20.4286	20.3224	19.9407	19.4941	19.1473	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1682	19.3198	19.5904	19.9502	20.2383	20.3966	20.4329	20.4286	20.3224	19.9407	19.4941	19.1473	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9955	0.9914	0.9791	0.9398	0.8431	0.6652	0.4846	0.5420	0.8096	0.9630	0.9916	0.9965	(94)
Ext temp.	352.7414	398.4857	446.5951	483.4421	464.1456	359.6046	249.8177	259.3765	350.4350	363.3769	339.4568	334.9492	(95)
Ext loss	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	1015.9604	982.7515	889.8672	742.1037	572.1023	384.2527	254.0817	266.5213	414.1938	625.8664	834.3097	1011.0255	(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	493.4350	392.6266	329.7944	186.2363	80.3197	0.0000	0.0000	0.0000	0.0000	195.2922	356.2940	503.0007	(98)
Space heating												2536.9990	(98)
Space heating per m2												38.0531	(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	623.1217	490.5426	502.7946	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8794	0.9333	0.9122	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	547.9995	457.8365	458.6366	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	712.9256	682.0384	640.4306	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	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	118.7468	166.8062	135.2547	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												420.8077 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.6867	41.7016	33.8137	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												105.2019 (107)
Space cooling per m2												1.5779 (108)
Energy for space heating												38.0531 (99)
Energy for space cooling												1.5779 (108)
Total												39.6310 (109)
Dwelling Fabric Energy Efficiency (DFEE)												39.6 (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	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1299 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3799 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3514 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4480	0.4392	0.4304	0.3865	0.3777	0.3338	0.3338	0.3250	0.3514	0.3777	0.3953	0.4129 (22b)
	0.6004	0.5965	0.5926	0.5747	0.5713	0.5557	0.5557	0.5528	0.5617	0.5713	0.5781	0.5852 (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			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.1800	9.6642		(29a)
APT Wall to Stairwell	20.6600		20.6600	0.1800	3.7188		(29a)
Total net area of external elements Aum(A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.9973		(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)							7.4678 (36)
Total fabric heat loss						(33) + (36) =	34.4651 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	30.5115	30.3134	30.1193	29.2075	29.0369	28.2427	28.2427
Heat transfer coeff	64.9766	64.7785	64.5844	63.6726	63.5020	62.7079	62.7079
Average = Sum(39)m / 12 =							
HLP	0.9746	0.9716	0.9687	0.9550	0.9525	0.9406	0.9406
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.1626 (42)
												85.5629 (43)
Daily hot water use	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy conte	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Energy content (annual)												Total = Sum(45)m = 1346.2376 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
29.6599 25.9407 26.7685 23.3375 22.3928 19.3233 17.9059 20.5473 20.7927 24.2319 26.4510 28.7240 (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	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	108.1324	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4112	16.3527	13.2989	10.0681	7.5260	6.3538	6.8655	8.9240	11.9778	15.2086	17.7507	18.9229	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.4038	191.3692	186.4164	175.8725	162.5627	150.0534	141.6964	139.7310	144.6838	155.2277	168.5375	181.0468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	33.8132	(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)	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	(71)
Water heating gains (Table 5)	39.8655	38.6023	35.9792	32.4131	30.0979	26.8379	24.0671	27.6173	28.8787	32.5697	36.7375	38.6076	(72)
Total internal gains	303.1202	301.7639	291.1342	273.7935	255.6264	238.6849	228.0687	231.7121	240.9800	258.4457	278.4653	294.0170	(73)

6. Solar gains

[Jan]											Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East											6.0900	19.6403	0.6300	0.7000	0.7700	36.5541 (76)
West											2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)

Solar gains	52.0401	101.8015	167.6526	244.5113	299.6578	306.7530	292.0414	250.8592	194.9869	120.7961	64.8879	42.7953 (83)				
Total gains	355.1603	403.5654	458.7868	518.3048	555.2841	545.4379	520.1101	482.5713	435.9669	379.2418	343.3532	336.8123 (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	71.2543	71.4722	71.6870	72.7136	72.9089	73.8322	73.8322	74.0058	73.4738	72.9089	72.5148	72.1073	
alpha	5.7503	5.7648	5.7791	5.8476	5.8606	5.9221	5.9221	5.9337	5.8983	5.8606	5.8343	5.8072	
util living area	0.9989	0.9974	0.9917	0.9655	0.8792	0.6999	0.5246	0.5848	0.8539	0.9831	0.9976	0.9992	(86)
MIT	19.9372	20.0676	20.2986	20.6056	20.8504	20.9713	20.9955	20.9919	20.9085	20.5798	20.2045	19.9177	(87)
Th 2	20.1046	20.1070	20.1095	20.1210	20.1231	20.1332	20.1332	20.1350	20.1293	20.1231	20.1188	20.1142	(88)
util rest of house	0.9985	0.9965	0.9887	0.9527	0.8378	0.6195	0.4244	0.4808	0.7903	0.9748	0.9966	0.9989	(89)
MIT 2	19.1263	19.2583	19.4898	19.7987	20.0213	20.1199	20.1320	20.1326	20.0775	19.7796	19.4049	19.1147	(90)
Living area fraction									fLA = Living area / (4) =			0.3871	(91)
MIT	19.4402	19.5716	19.8029	20.1111	20.3423	20.4495	20.4663	20.4652	20.3992	20.0894	19.7144	19.4256	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4402	19.5716	19.8029	20.1111	20.3423	20.4495	20.4663	20.4652	20.3992	20.0894	19.7144	19.4256	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9959	0.9874	0.9526	0.8492	0.6501	0.4634	0.5214	0.8121	0.9744	0.9960	0.9987	(94)
Useful gains	354.5116	401.8955	453.0109	493.7150	471.5347	354.5628	241.0288	251.6038	354.0355	369.5196	341.9873	336.3585	(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	983.7599	950.4057	859.1609	713.8381	548.8021	366.8099	242.4451	254.3252	396.9365	602.5957	805.3953	977.6035	(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	468.1608	368.5989	302.1756	158.4886	57.4869	0.0000	0.0000	0.0000	0.0000	173.4086	333.6538	477.0863	(98)
Space heating												2339.0595	(98)
Space heating per m2												35.0841	(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	589.4539	464.0382	475.4621	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9255	0.9661	0.9511	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	545.5396	448.2932	452.2045	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	718.6168	687.4566	645.0847	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	124.6156	177.9376	143.5029	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												446.0560	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.1539	44.4844	35.8757	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												111.5140 (107)
Space cooling per m2												1.6726 (108)
Energy for space heating												35.0841 (99)
Energy for space cooling												1.6726 (108)
Total												36.7568 (109)
Target Fabric Energy Efficiency (TFEE)												42.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1299 (8)
Measured/design AP50					Yes
Infiltration rate					4.6100
Number of sides sheltered					0.3604 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3333 (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												
	0.3500	0.3250	0.3333	0.3167	0.3167	0.3083	0.3000	0.2917	0.2833	0.3083	0.2917	0.3083 (22b)
Effective ac	0.5613	0.5528	0.5556	0.5501	0.5501	0.5475	0.5450	0.5425	0.5401	0.5475	0.5425	0.5475 (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
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.2600	13.9594	60.0000	3221.4000 (29a)
APT Wall to Stairwell	20.6600		20.6600	0.2400	4.9584	110.0000	2272.6000 (29a)
Total net area of external elements Aum (A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.9173		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
E-FC-4			66.6700			70.0000	4666.9000 (32b)
1F - Timber			89.1300			9.0000	802.1700 (32c)
1F - Metal			39.2800			20.0000	785.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16415.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		246.2212 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.4127 (36)
Total fabric heat loss	(33) + (36) =	38.3300 (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
	28.5242	28.0954	28.2348	27.9595	27.9595	27.8271	27.6983	27.5730	27.4513	27.8271	27.5730	27.8271 (38)
Heat transfer coeff	66.8542	66.4254	66.5648	66.2895	66.2895	66.1572	66.0284	65.9031	65.7813	66.1572	65.9031	66.1572 (39)
Average = Sum(39)m / 12 =												66.2092 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0028	0.9963	0.9984	0.9943	0.9943	0.9923	0.9904	0.9885	0.9867	0.9923	0.9885	0.9923 (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												2.1626 (42)
Average daily hot water use (litres/day)												85.5629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy conte	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Energy content (annual)												Total = Sum(45)m = 1346.2376 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.9364	18.3111	18.8954	16.4735	15.8067	13.6400	12.6395	14.5040	14.6772	17.1048	18.6713	20.2758 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	21.7278	19.5902	21.6335	20.8727	21.5227	20.7756	21.4353	21.4919	20.8285	21.5876	20.9642	21.7095	(61)
Total heat required for water heating calculated for each month	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(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	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	51.8410	45.4872	47.2932	41.7344	40.4189	35.4292	33.3763	37.5234	37.7415	43.3126	46.6290	50.3721	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0281	40.8817	33.2472	25.1703	18.8151	15.8845	17.1638	22.3101	29.9446	38.0215	44.3767	47.3073	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.6922	285.6257	278.2335	262.4963	242.6309	223.9603	211.4872	208.5537	215.9459	231.6831	251.5485	270.2191	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	(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)	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	(71)
Water heating gains (Table 5)	69.6787	67.6893	63.5662	57.9645	54.3264	49.2072	44.8606	50.4347	52.4188	58.2159	64.7626	67.7044	(72)
Total internal gains	494.7905	490.5882	471.4384	442.0226	412.1640	385.4435	369.9030	377.6900	394.7008	424.3120	457.0792	481.6223	(73)

6. Solar gains

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

East					2.8800	25.1925		0.6200	0.7000	0.7700		21.8216 (76)
West					2.5800	25.1925		0.6200	0.7000	0.7700		19.5486 (80)
East					3.2100	25.1925		0.6200	0.7000	0.7700		24.3220 (76)

Solar gains	65.6922	109.3116	180.9821	264.4403	307.0512	341.0308	322.2888	284.3578	221.9465	139.8337	81.6414	53.1013 (83)
Total gains	560.4828	599.8997	652.4205	706.4629	719.2151	726.4743	692.1919	662.0478	616.6473	564.1457	538.7206	534.7236 (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	68.2063	68.6466	68.5028	68.7873	68.7873	68.9249	69.0594	69.1907	69.3188	68.9249	69.1907	68.9249	
alpha	5.5471	5.5764	5.5669	5.5858	5.5858	5.5950	5.6040	5.6127	5.6213	5.5950	5.6127	5.5950	
util living area	0.9870	0.9800	0.9544	0.8785	0.7292	0.5126	0.3711	0.3870	0.6466	0.8938	0.9721	0.9890	(86)
MIT	20.2333	20.3324	20.5465	20.7920	20.9427	20.9931	20.9991	20.9989	20.9769	20.8078	20.5009	20.2223	(87)
Th 2	20.0810	20.0864	20.0846	20.0881	20.0881	20.0897	20.0914	20.0929	20.0945	20.0897	20.0929	20.0897	(88)
util rest of house	0.9830	0.9741	0.9409	0.8454	0.6679	0.4338	0.2852	0.2977	0.5642	0.8563	0.9624	0.9856	(89)
MIT 2	19.0852	19.2314	19.5323	19.8631	20.0393	20.0860	20.0911	20.0926	20.0796	19.8922	19.4793	19.0762	(90)
Living area fraction	19.5297	19.6577	19.9249	20.2227	20.3891	20.4372	20.4426	20.4434	20.4270	20.2467	19.8748	19.5199	(91)
MIT	19.5297	19.6577	19.9249	20.2227	20.3891	20.4372	20.4426	20.4434	20.4270	20.2467	19.8748	19.5199	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3797	19.5077	19.7749	20.0727	20.2391	20.2872	20.2926	20.2934	20.2770	20.0967	19.7248	19.3699	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9791	0.9693	0.9354	0.8448	0.6786	0.4512	0.3043	0.3175	0.5815	0.8566	0.9574	0.9821	(94)
Ext temp.	548.7691	581.4957	610.2832	596.7927	488.0360	327.7508	210.6146	210.2264	358.5725	483.2381	515.7838	525.1557	(95)
Heat loss rate W	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)
Month fracti	968.0279	943.7502	850.3604	700.8600	513.0188	329.9385	210.8019	210.4574	366.8597	575.3486	779.2927	950.6725	(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	(98)
Space heating	311.9285	243.4350	178.6175	74.9285	18.5872	0.0000	0.0000	0.0000	0.0000	68.5302	189.7264	316.5845	(98)
RHI space heating demand												1402.3377	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1299 (8)
Measured/design AP50					Yes
Infiltration rate					4.6100
Number of sides sheltered					0.3604 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3333 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4250	0.4167	0.4083	0.3667	0.3583	0.3167	0.3167	0.3083	0.3333	0.3583	0.3750	0.3917 (22b)
	0.5903	0.5868	0.5834	0.5672	0.5642	0.5501	0.5501	0.5475	0.5556	0.5642	0.5703	0.5767 (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
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.2600	13.9594	60.0000	3221.4000 (29a)
APT Wall to Stairwell	20.6600		20.6600	0.2400	4.9584	110.0000	2272.6000 (29a)
Total net area of external elements Aum (A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9173		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
E-FC-4			66.6700			70.0000	4666.9000 (32b)
1F - Timber			89.1300			9.0000	802.1700 (32c)
1F - Metal			39.2800			20.0000	785.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16415.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		246.2212 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.4127 (36)
Total fabric heat loss	(33) + (36) =	38.3300 (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	30.0013	29.8230	29.6483	28.8277	28.6742	27.9595	27.9595	27.8271	28.2348	28.6742	28.9848	29.3095 (38)
Heat transfer coeff	68.3313	68.1531	67.9784	67.1578	67.0042	66.2895	66.2895	66.1572	66.5648	67.0042	67.3148	67.6395 (39)
Average = Sum(39)m / 12 =												67.1570 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0249	1.0222	1.0196	1.0073	1.0050	0.9943	0.9943	0.9923	0.9984	1.0050	1.0097	1.0145 (40)
HLP (average)												1.0073 (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		2.1626 (42)
Average daily hot water use (litres/day)		85.5629 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy conte	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	20.9364	18.3111	18.8954	16.4735	15.8067	13.6400	12.6395	14.5040	14.6772	17.1048	18.6713	20.2758 (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	(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	(57)
Combi loss	21.7278	19.5902	21.6335	20.8727	21.5227	20.7756	21.4353	21.4919	20.8285	21.5876	20.9642	(61)
Total heat required for water heating calculated for each month	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =			0.0000	(63)
Output from w/h	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	(64)
								Total per year (kWh/year) = Sum(64)m =			1600.3771	(64)
Heat gains from water heating, kWh/month	51.8410	45.4872	47.2932	41.7344	40.4189	35.4292	33.3763	37.5234	37.7415	43.3126	46.6290	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0281	40.8817	33.2472	25.1703	18.8151	15.8845	17.1638	22.3101	29.9446	38.0215	44.3767	47.3073 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.6922	285.6257	278.2335	262.4963	242.6309	223.9603	211.4872	208.5537	215.9459	231.6831	251.5485	270.2191 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385 (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)	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059 (71)
Water heating gains (Table 5)	69.6787	67.6893	63.5662	57.9645	54.3264	49.2072	44.8606	50.4347	52.4188	58.2159	64.7626	67.7044 (72)
Total internal gains	494.7905	490.5882	471.4384	442.0226	412.1640	385.4435	369.9030	377.6900	394.7008	424.3120	457.0792	481.6223 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				2.8800	19.6403	0.6200	0.7000		17.0123 (76)			
West				2.5800	19.6403	0.6200	0.7000		15.2402 (80)			
East				3.2100	19.6403	0.6200	0.7000		18.9616 (76)			
Solar gains	51.2141	100.1856	164.9914	240.6302	294.9013	301.8839	287.4058	246.8774	191.8919	118.8787	63.8579	42.1160 (83)
Total gains	546.0046	590.7738	636.4298	682.6527	707.0653	687.3275	657.3088	624.5674	586.5927	543.1907	520.9372	523.7383 (84)

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	66.7319	66.9065	67.0784	67.8980	68.0536	68.7873	68.7873	68.9249	68.5028	68.0536	67.7396	67.4144
alpha	5.4488	5.4604	5.4719	5.5265	5.5369	5.5858	5.5858	5.5950	5.5669	5.5369	5.5160	5.4943
util living area	0.9905	0.9840	0.9656	0.9101	0.7889	0.6006	0.4411	0.4827	0.7285	0.9309	0.9821	0.9923 (86)
MIT	20.1239	20.2467	20.4578	20.7199	20.9043	20.9832	20.9974	20.9959	20.9532	20.7200	20.3793	20.0983 (87)
Th 2	20.0626	20.0648	20.0670	20.0772	20.0792	20.0881	20.0881	20.0897	20.0846	20.0792	20.0753	20.0712 (88)
util rest of house	0.9877	0.9792	0.9552	0.8840	0.7355	0.5221	0.3511	0.3896	0.6517	0.9049	0.9758	0.9900 (89)
MIT 2	18.9131	19.0918	19.3945	19.7616	19.9903	20.0774	20.0871	20.0881	20.0501	19.7710	19.2927	18.8826 (90)
Living area fraction	19.3819	19.5389	19.8061	20.1326	20.3441	20.4281	20.4396	20.4395	fLA = Living area / (4) =	20.1384	19.7134	0.3871 (91)
MIT	19.3819	19.5389	19.8061	20.1326	20.3441	20.4281	20.4396	20.4395	20.3997	20.1384	19.7134	19.3532 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2319	19.3889	19.6561	19.9826	20.1941	20.2781	20.2896	20.2895	20.2497	19.9884	19.5634	19.2032 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9843	0.9748	0.9496	0.8809	0.7426	0.5389	0.3712	0.4103	0.6664	0.9018	0.9714	0.9870 (94)
Useful gains	537.4392	575.8751	604.3561	601.3348	525.0876	370.3889	243.9640	256.2562	390.9225	489.8601	506.0150	516.9543 (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	1020.3130	987.4605	894.3333	744.2798	569.1416	376.3960	244.5787	257.3189	409.3524	629.0614	838.9696	1014.8111 (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	359.2581	276.5854	215.7430	102.9204	32.7762	0.0000	0.0000	0.0000	0.0000	103.5657	239.7273	370.4055 (98)
Space heating												1700.9815 (98)
Space heating per m2												25.5134 (99)
										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1889.9795 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	359.2581	276.5854	215.7430	102.9204	32.7762	0.0000	0.0000	0.0000	0.0000	103.5657	239.7273	370.4055	(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)	399.1756	307.3171	239.7144	114.3560	36.4180	0.0000	0.0000	0.0000	0.0000	115.0730	266.3637	411.5616	(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	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(64)
Efficiency of water heater (217)m	88.9509	88.8545	88.6296	88.1235	87.3575	86.7000	86.7000	86.7000	86.7000	88.0987	88.7248	88.9922	(216)
Fuel for water heating, kWh/month	181.3403	159.4340	166.5392	148.3100	145.2660	128.8453	121.9127	136.3149	136.8816	153.9409	163.9219	176.2868	(219)
Water heating fuel used												1818.9935	(219)
Annual totals kWh/year													
Space heating fuel - main system												1889.9795	(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)												325.1479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4109.1209	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1889.9795	3.4800	65.7713	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1818.9935	3.4800	63.3010	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	325.1479	13.1900	42.8870	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			301.8518	(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] =	1.1353 (257)
SAP value		84.1627
SAP rating (Section 12)		84 (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	1889.9795	0.2160	408.2356	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1818.9935	0.2160	392.9026	(264)
Space and water heating			801.1382	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	325.1479	0.5190	168.7518	(268)
Energy saving/generation technologies				
PV Unit	-475.4634	0.5190	-246.7655	(269)
Total kg/year			762.0494	(272)
CO2 emissions per m2			11.4300	(273)
EI value			90.8557	
EI rating			91 (274)	
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8788 = 3.960$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8788 = 0.2458$, 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	66.6700 (1b)	x 2.3100 (2b)	= 154.0077 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.0077 (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					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1299 (8)
Measured/design AP50					Yes
Infiltration rate					4.6100
Number of sides sheltered					0.3604 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3333 (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												
	0.3500	0.3250	0.3333	0.3167	0.3167	0.3083	0.3000	0.2917	0.2833	0.3083	0.2917	0.3083 (22b)
Effective ac	0.5613	0.5528	0.5556	0.5501	0.5501	0.5475	0.5450	0.5425	0.5401	0.5475	0.5425	0.5475 (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
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	64.4800	10.7900	53.6900	0.2600	13.9594	60.0000	3221.4000 (29a)
APT Wall to Stairwell	20.6600		20.6600	0.2400	4.9584	110.0000	2272.6000 (29a)
Total net area of external elements Aum (A, m ²)			85.1400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.9173		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
E-FC-4			66.6700			70.0000	4666.9000 (32b)
1F - Timber			89.1300			9.0000	802.1700 (32c)
1F - Metal			39.2800			20.0000	785.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16415.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		246.2212 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.4127 (36)
Total fabric heat loss	(33) + (36) =	38.3300 (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	28.5242	28.0954	28.2348	27.9595	27.9595	27.8271	27.6983	27.5730	27.4513	27.8271	27.5730	27.8271 (38)
Average = Sum(39)m / 12 =	66.8542	66.4254	66.5648	66.2895	66.2895	66.1572	66.0284	65.9031	65.7813	66.1572	65.9031	66.1572 (39)
	66.2092											66.2092 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0028	0.9963	0.9984	0.9943	0.9943	0.9923	0.9904	0.9885	0.9867	0.9923	0.9885	0.9923 (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												2.1626 (42)
Average daily hot water use (litres/day)												85.5629 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.1192	90.6967	87.2742	83.8516	80.4291	77.0066	77.0066	80.4291	83.8516	87.2742	90.6967	94.1192 (44)
Energy content (annual)	139.5760	122.0741	125.9695	109.8233	105.3781	90.9333	84.2630	96.6931	97.8479	114.0323	124.4751	135.1719 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.9364	18.3111	18.8954	16.4735	15.8067	13.6400	12.6395	14.5040	14.6772	17.1048	18.6713	20.2758 (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	21.7278	19.5902	21.6335	20.8727	21.5227	20.7756	21.4353	21.4919	20.8285	21.5876	20.9642	21.7095 (61)	
Total heat required for water heating calculated for each month	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815 (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	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815 (64)	
								Total per year (kWh/year) = Sum(64)m =					1600.3771 (64)
Heat gains from water heating, kWh/month	51.8410	45.4872	47.2932	41.7344	40.4189	35.4292	33.3763	37.5234	37.7415	43.3126	46.6290	50.3721 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589	129.7589 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0281	40.8817	33.2472	25.1703	18.8151	15.8845	17.1638	22.3101	29.9446	38.0215	44.3767	47.3073 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	282.6922	285.6257	278.2335	262.4963	242.6309	223.9603	211.4872	208.5537	215.9459	231.6831	251.5485	270.2191 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385	50.1385 (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)	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059	-86.5059 (71)
Water heating gains (Table 5)	69.6787	67.6893	63.5662	57.9645	54.3264	49.2072	44.8606	50.4347	52.4188	58.2159	64.7626	67.7044 (72)
Total internal gains	494.7905	490.5882	471.4384	442.0226	412.1640	385.4435	369.9030	377.6900	394.7008	424.3120	457.0792	481.6223 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					2.8800	25.1925	0.6200	0.7000	0.7700		21.8216 (76)	
West					2.5800	25.1925	0.6200	0.7000	0.7700		19.5486 (80)	
East					3.2100	25.1925	0.6200	0.7000	0.7700		24.3220 (76)	
Solar gains	65.6922	109.3116	180.9821	264.4403	307.0512	341.0308	322.2888	284.3578	221.9465	139.8337	81.6414	53.1013 (83)
Total gains	560.4828	599.8997	652.4205	706.4629	719.2151	726.4743	692.1919	662.0478	616.6473	564.1457	538.7206	534.7236 (84)

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	68.2063	68.6466	68.5028	68.7873	68.7873	68.9249	69.0594	69.1907	69.3188	68.9249	69.1907	68.9249
alpha	5.5471	5.5764	5.5669	5.5858	5.5858	5.5950	5.6040	5.6127	5.6213	5.5950	5.6127	5.5950
util living area	0.9870	0.9800	0.9544	0.8785	0.7292	0.5126	0.3711	0.3870	0.6466	0.8938	0.9721	0.9890 (86)
MIT	20.2333	20.3324	20.5465	20.7920	20.9427	20.9931	20.9991	20.9989	20.9769	20.8078	20.5009	20.2223 (87)
Th 2	20.0810	20.0864	20.0846	20.0881	20.0881	20.0897	20.0914	20.0929	20.0945	20.0897	20.0929	20.0897 (88)
util rest of house	0.9830	0.9741	0.9409	0.8454	0.6679	0.4338	0.2852	0.2977	0.5642	0.8563	0.9624	0.9856 (89)
MIT 2	19.0852	19.2314	19.5323	19.8631	20.0393	20.0860	20.0911	20.0926	20.0796	19.8922	19.4793	19.0762 (90)
Living area fraction										fLA = Living area / (4) =	0.3871	0.4411 (91)
MIT	19.5297	19.6577	19.9249	20.2227	20.3891	20.4372	20.4426	20.4434	20.4270	20.2467	19.8748	19.5199 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3797	19.5077	19.7749	20.0727	20.2391	20.2872	20.2926	20.2934	20.2770	20.0967	19.7248	19.3699 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9791	0.9693	0.9354	0.8448	0.6786	0.4512	0.3043	0.3175	0.5815	0.8566	0.9574	0.9821 (94)
Useful gains	548.7691	581.4957	610.2832	596.7927	488.0360	327.7508	210.6146	210.2264	358.5725	483.2381	515.7838	525.1557 (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	968.0279	943.7502	850.3604	700.8600	513.0188	329.9385	210.8019	210.4574	366.8597	575.3486	779.2927	950.6725 (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	311.9285	243.4350	178.6175	74.9285	18.5872	0.0000	0.0000	0.0000	0.0000	68.5302	189.7264	316.5845 (98)
Space heating												1402.3377 (98)
Space heating per m2										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1558.1531 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	311.9285	243.4350	178.6175	74.9285	18.5872	0.0000	0.0000	0.0000	0.0000	68.5302	189.7264	316.5845	(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)	346.5872	270.4833	198.4638	83.2539	20.6524	0.0000	0.0000	0.0000	0.0000	76.1447	210.8071	351.7605	(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	161.3038	141.6643	147.6030	130.6960	126.9007	111.7089	105.6983	118.1850	118.6764	135.6199	145.4394	156.8815	(64)
Efficiency of water heater (217)m	88.8473	88.7572	88.4763	87.8741	87.1081	86.7000	86.7000	86.7000	86.7000	87.7804	88.5377	86.7000	(216)
Fuel for water heating, kWh/month	181.5517	159.6087	166.8278	148.7310	145.6820	128.8453	121.9127	136.3149	136.8816	154.4990	164.2684	176.5112	(219)
Water heating fuel used												1821.6341	(219)
Annual totals kWh/year													
Space heating fuel - main system												1558.1531	(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)													325.1479 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3779.9351 (238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1558.1531	3.9200	61.0796 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1821.6341	3.9200	71.4081 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	325.1479	16.9600	55.1451 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			288.3527 (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	1558.1531	0.2160	336.5611 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1821.6341	0.2160	393.4730 (264)
Space and water heating			730.0340 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	325.1479	0.5190	168.7518 (268)
Energy saving/generation technologies			
PV Unit	-475.4634	0.5190	-246.7655 (269)
Total kg/year			690.9453 (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	1558.1531	1.2200	1900.9467 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1821.6341	1.2200	2222.3936 (264)
Space and water heating			4123.3403 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	325.1479	3.0700	998.2041 (268)
Energy saving/generation technologies			
PV Unit	-475.4634	3.0700	-1459.6726 (269)
Primary energy kWh/year			3892.1219 (272)
Primary energy kWh/m2/year			58.3789 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Current energy efficiency rating: B 84
Current environmental impact rating: B 91

(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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£68	£68	£0
Mains gas	£220	£220	£0
Space heating	£162	£162	£0
Water heating	£71	£71	£0
Lighting	£55	£55	£0
Total cost of fuels	£288	£288	£0
Total cost of uses	£288	£288	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	58 kWh/m²	58 kWh/m²	0 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

No improvements selected / applicable

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	246.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	304.94 (P1)
Transmission heat loss coefficient	38.33 (37)
Summer heat loss coefficient	343.27 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	2.8800	125.2818	0.6200	0.7000	0.9000	126.8397
West	2.5800	125.2818	0.6200	0.7000	0.9000	113.6272
East	3.2100	125.2818	0.6200	0.7000	0.9000	141.3734
total:						381.8403

	Jun	Jul	Aug	
Solar gains	411	382	336	(P3)
Internal gains	382	367	375	
Total summer gains	793	749	711	(P5)

Summer gain/loss ratio	2.31	2.18	2.07	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 246.2)	0.28	0.28	0.28	
Threshold temperature	17.99	19.76	19.65	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			