

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-203			Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	2FF - Det (As)		
Property	105, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	83 B	DER	15.19	TER	18.85
Environmental	89 B	% DER<TER	19.40		
CO ₂ Emissions (t/year)	0.81	DFEE	44.85	TFEE	48.42
General Requirements Compliance	Pass	% DFEE<TFEE	7.37		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Top-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) 18.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.19 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 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	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
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: 4.47 (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 South East: 6.09 m², No overhang
Windows facing North 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 414.39 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	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					4.4700
Number of sides sheltered					0.3534 (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) =				0.3269 (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	0.4167	0.4086	0.4004	0.3595	0.3514	0.3105	0.3105	0.3023	0.3269	0.3514	0.3677	0.3841 (22b)
Effective ac	0.5868	0.5835	0.5802	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5738 (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)
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.2500	12.3825	60.0000	2971.8000 (29a)
APT Wall to Stairwell	19.0100		19.0100	0.2400	4.5624	110.0000	2091.1000 (29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671	9.0000	600.0300 (30)
Total net area of external elements Aum(A, m ²)			146.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6115		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Timber			83.3900			9.0000	750.5100 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11812.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.1732 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3759 (36)
Total fabric heat loss						(33) + (36) =	45.9874 (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	29.8247	29.6533	29.4853	28.6963	28.5487	27.8615	27.8615	27.7342	28.1262	28.5487	28.8473	29.1595 (38)
Heat transfer coeff	75.8121	75.6407	75.4727	74.6837	74.5361	73.8489	73.8489	73.7216	74.1136	74.5361	74.8347	75.1469 (39)
Average = Sum(39)m / 12 =												74.6830 (39)
HLP	1.1371	1.1346	1.1320	1.1202	1.1180	1.1077	1.1077	1.1058	1.1116	1.1180	1.1225	1.1271 (40)
HLP (average)												1.1202 (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)												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

Southeast					2.8800	36.7938		0.6200	0.7000	0.7700		31.8706 (77)
Northwest					2.5800	11.2829		0.6200	0.7000	0.7700		8.7552 (81)
Southeast					3.2100	36.7938		0.6200	0.7000	0.7700		35.5225 (77)

Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243 (83)
Total gains	412.0817	466.4676	510.8977	549.6911	571.7212	556.0297	531.1945	505.0913	476.7163	435.7444	401.2281	390.9382 (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	43.2800	43.3781	43.4747	43.9340	44.0210	44.4306	44.4306	44.5073	44.2719	44.0210	43.8453	43.6631	
alpha	3.8853	3.8919	3.8983	3.9289	3.9347	3.9620	3.9620	3.9672	3.9515	3.9347	3.9230	3.9109	
util living area	0.9914	0.9851	0.9720	0.9392	0.8662	0.7290	0.5746	0.6187	0.8250	0.9518	0.9852	0.9929 (86)	
MIT	19.4258	19.6072	19.9013	20.2860	20.6349	20.8756	20.9635	20.9508	20.7819	20.3353	19.8120	19.3912 (87)	
Th 2	19.9706	19.9727	19.9748	19.9844	19.9862	19.9946	19.9946	19.9961	19.9913	19.9862	19.9825	19.9787 (88)	
util rest of house	0.9893	0.9815	0.9648	0.9224	0.8269	0.6494	0.4589	0.5047	0.7616	0.9352	0.9810	0.9912 (89)	
MIT 2	17.8725	18.1372	18.5640	19.1185	19.5949	19.8937	19.9758	19.9686	19.7923	19.1972	18.4434	17.8275 (90)	
Living area fraction									fLA = Living area / (4) =				0.4870 (91)
MIT	18.6290	18.8531	19.2153	19.6871	20.1014	20.3719	20.4569	20.4469	20.2743	19.7515	19.1100	18.5891 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.4790	18.7031	19.0653	19.5371	19.9514	20.2219	20.3069	20.2969	20.1243	19.6015	18.9600	18.4391 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9850	0.9755	0.9565	0.9134	0.8254	0.6690	0.4966	0.5409	0.7711	0.9272	0.9752	0.9875 (94)
Useful gains	405.8988	455.0275	488.6851	502.0938	471.8862	371.9799	263.7803	273.2258	367.5912	404.0226	391.2675	386.0676 (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	1074.9378	1044.0771	948.3382	794.4155	615.0290	415.1714	273.7481	287.2867	446.4809	670.9367	887.5361	1070.0218 (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	497.7650	395.8413	341.9819	210.4716	106.4982	0.0000	0.0000	0.0000	0.0000	198.5840	357.3134	508.8619 (98)
Space heating												2617.3174 (98)
Space heating per m2										(98) / (4) =		39.2578 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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												2908.1305 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	497.7650	395.8413	341.9819	210.4716	106.4982	0.0000	0.0000	0.0000	0.0000	198.5840	357.3134	508.8619 (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)	553.0723	439.8237	379.9799	233.8573	118.3314	0.0000	0.0000	0.0000	0.0000	220.6489	397.0149	565.4021 (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	89.1693	89.1061	88.9789	88.7066	88.1752	86.7000	86.7000	86.7000	86.7000	88.6310	89.0198	86.7000 (216)
Fuel for water heating, kWh/month	180.8961	158.9838	165.8853	147.3352	143.9188	128.8453	121.9127	136.3149	136.8816	153.0163	163.3787	175.8762 (219)
Water heating fuel used												1813.2448 (219)
Annual totals kWh/year												
Space heating fuel - main system												2908.1305 (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												5121.5232 (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	2908.1305	0.2160	628.1562 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1813.2448	0.2160	391.6609 (264)	
Space and water heating			1019.8171 (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	-414.3879	0.5190	-215.0673 (269)	
Total CO2, kg/year			1012.4265 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			15.1900 (273)	

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

DER		15.1900 ZC1
Total Floor Area	TFA	66.6700
Assumed number of occupants	N	2.1626
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.8347 ZC2
CO2 emissions from cooking, equation (L16)		2.5634 ZC3
Total CO2 emissions		34.5881 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		34.5881 ZC8

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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	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)
Effective ac	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 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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)					
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.1800	8.9154		(29a)					
APT Wall to Stairwell	19.0100		19.0100	0.1800	3.4218		(29a)					
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671		(30)					
Total net area of external elements Aum(A, m2)			146.0000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.6186		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1565 (36)					
Total fabric heat loss						(33) + (36) =	41.7751 (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	30.5115	30.3134	30.1193	29.2075	29.0369	28.2427	28.2427	28.0957	28.5486	29.0369	29.3820	29.7428 (38)
Heat transfer coeff	72.2866	72.0885	71.8944	70.9826	70.8120	70.0179	70.0179	69.8708	70.3238	70.8120	71.1571	71.5179 (39)
Average = Sum(39)m / 12 =												70.9818 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0842	1.0813	1.0784	1.0647	1.0621	1.0502	1.0502	1.0480	1.0548	1.0621	1.0673	1.0727 (40)
HLP (average)												1.0647 (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)
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)

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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)
Total heat required for water heating calculated for each month	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)
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	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)
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	g		Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Southeast				6.0900	36.7938			0.6300		0.7000	0.7700		68.4801 (77)
Northwest				2.5800	11.2829			0.6300		0.7000	0.7700		8.8964 (81)
Solar gains	77.3765	134.7557	192.2278	251.3357	293.5254	296.6849	283.8377	251.5548	212.5703	151.0501	93.2173	65.8699	(83)
Total gains	422.1252	476.8489	521.6239	560.7913	582.9203	566.7113	541.6833	515.6346	487.2165	445.8323	410.9587	400.8052	(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	64.0487	64.2247	64.3981	65.2253	65.3824	66.1240	66.1240	66.2632	65.8364	65.3824	65.0653	64.7371	
alpha	5.2699	5.2816	5.2932	5.3484	5.3588	5.4083	5.4083	5.4175	5.3891	5.3588	5.3377	5.3158	
util living area	0.9974	0.9946	0.9870	0.9620	0.8893	0.7310	0.5568	0.6043	0.8418	0.9721	0.9946	0.9981	(86)
MIT	19.8792	20.0209	20.2470	20.5429	20.7994	20.9514	20.9907	20.9859	20.8923	20.5661	20.1700	19.8549	(87)
Th 2	20.0137	20.0162	20.0185	20.0298	20.0319	20.0417	20.0417	20.0435	20.0379	20.0319	20.0276	20.0232	(88)
util rest of house	0.9966	0.9928	0.9825	0.9476	0.8478	0.6444	0.4418	0.4882	0.7719	0.9587	0.9925	0.9974	(89)
MIT 2	18.5202	18.7285	19.0581	19.4878	19.8310	20.0084	20.0382	20.0375	19.9508	19.5277	18.9550	18.4916	(90)
Living area fraction									fLA = Living area / (4) =			0.4870	(91)
MIT	19.1821	19.3579	19.6371	20.0017	20.3026	20.4677	20.5021	20.4994	20.4094	20.0334	19.5467	19.1555	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1821	19.3579	19.6371	20.0017	20.3026	20.4677	20.5021	20.4994	20.4094	20.0334	19.5467	19.1555	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9912	0.9802	0.9472	0.8607	0.6848	0.4981	0.5450	0.8015	0.9588	0.9910	0.9966	(94)
Useful gains	420.2664	472.6574	511.2950	531.1559	501.7127	388.1053	269.8312	281.0370	390.5033	427.4426	407.2747	399.4442	(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	1075.7728	1042.2522	944.4844	788.0269	609.1682	410.8434	273.2161	286.4292	443.6979	668.0007	885.6747	1069.5897	(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	487.6968	382.7677	322.2929	184.9471	79.9469	0.0000	0.0000	0.0000	0.0000	178.9752	344.4480	498.5882	(98)
Space heating												2479.6629	(98)
Space heating per m2										(98) / (4) =		37.1931	(99)

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												2654.8853	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.6968	382.7677	322.2929	184.9471	79.9469	0.0000	0.0000	0.0000	0.0000	178.9752	344.4480	498.5882	(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)	522.1593	409.8155	345.0674	198.0162	85.5962	0.0000	0.0000	0.0000	0.0000	191.6223	368.7880	533.8204	(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	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	87.3486	87.1160	86.6308	85.5599	83.5995	80.3000	80.3000	80.3000	80.3000	85.3575	86.8035	87.4454	(216)
(217)m	87.3486	87.1160	86.6308	85.5599	83.5995	80.3000	80.3000	80.3000	80.3000	85.3575	86.8035	87.4454	(217)
Fuel for water heating, kWh/month	214.7008	188.0476	196.7469	176.6889	175.0774	160.5344	153.8042	171.4556	173.3492	185.6969	194.9257	209.4268	(219)
Water heating fuel used												2200.4542	(219)
Annual totals kWh/year													
Space heating fuel - main system												2654.8853	(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												5255.4875	(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	2654.8853	0.2160	573.4552 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2200.4542	0.2160	475.2981 (264)
Space and water heating			1048.7533 (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			1256.4301 (272)
Emissions per m2 for space and water heating			15.7305 (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) = (15.7305 * 1.00) + 2.5311 + 0.5838, rounded to 2 d.p.			18.8500 (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					4.4700
Number of sides sheltered					0.3534 (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) =				0.3269 (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												
	0.4167	0.4086	0.4004	0.3595	0.3514	0.3105	0.3105	0.3023	0.3269	0.3514	0.3677	0.3841 (22b)
Effective ac	0.5868	0.5835	0.5802	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5738 (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)
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.2500	12.3825	60.0000	2971.8000 (29a)
APT Wall to Stairwell	19.0100		19.0100	0.2400	4.5624	110.0000	2091.1000 (29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671	9.0000	600.0300 (30)
Total net area of external elements Aum(A, m ²)			146.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6115		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Timber			83.3900			9.0000	750.5100 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11812.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		177.1732 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3759 (36)
Total fabric heat loss	(33) + (36) =	45.9874 (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	29.8247	29.6533	29.4853	28.6963	28.5487	27.8615	27.8615	27.7342	28.1262	28.5487	28.8473	29.1595 (38)
Heat transfer coeff	75.8121	75.6407	75.4727	74.6837	74.5361	73.8489	73.8489	73.7216	74.1136	74.5361	74.8347	75.1469 (39)
Average = Sum(39)m / 12 =												74.6830 (39)
HLP	1.1371	1.1346	1.1320	1.1202	1.1180	1.1077	1.1077	1.1058	1.1116	1.1180	1.1225	Dec 1.1271 (40)
HLP (average)												1.1202 (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)

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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	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	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast	2.8800	36.7938	0.6200		0.7000	0.7700	31.8706 (77)
Northwest	2.5800	11.2829	0.6200		0.7000	0.7700	8.7552 (81)
Southeast	3.2100	36.7938	0.6200		0.7000	0.7700	35.5225 (77)

Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243 (83)
Total gains	379.2685	434.3807	480.3108	521.1398	544.4926	530.6604	507.4010	479.2739	450.1762	407.0982	370.2030	358.8414 (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	43.2800	43.3781	43.4747	43.9340	44.0210	44.4306	44.4306	44.5073	44.2719	44.0210	43.8453	43.6631	
alpha	3.8853	3.8919	3.8983	3.9289	3.9347	3.9620	3.9620	3.9672	3.9515	3.9347	3.9230	3.9109	
util living area	0.9935	0.9883	0.9770	0.9479	0.8808	0.7498	0.5962	0.6436	0.8455	0.9607	0.9887	0.9948	(86)
MIT	19.3676	19.5516	19.8511	20.2449	20.6062	20.8618	20.9585	20.9433	20.7585	20.2917	19.7581	19.3338	(87)
Th 2	19.9706	19.9727	19.9748	19.9844	19.9862	19.9946	19.9946	19.9961	19.9913	19.9862	19.9825	19.9787	(88)
util rest of house	0.9919	0.9854	0.9709	0.9330	0.8443	0.6716	0.4783	0.5282	0.7857	0.9467	0.9855	0.9935	(89)
MIT 2	18.4803	18.6647	18.9627	19.3548	19.6950	19.9169	19.9798	19.9740	19.8382	19.4067	18.8786	18.4529	(90)
Living area fraction									fLA = Living area / (4) =			0.4870	(91)
MIT	18.9124	19.0967	19.3954	19.7883	20.1387	20.3771	20.4564	20.4461	20.2864	19.8377	19.3070	18.8819	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9124	19.0967	19.3954	19.7883	20.1387	20.3771	20.4564	20.4461	20.2864	19.8377	19.3070	18.8819	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9897	0.9822	0.9667	0.9296	0.8505	0.7036	0.5348	0.5828	0.8053	0.9441	0.9826	0.9916	(94)
Ext temp.	375.3729	426.6507	464.3022	484.4624	463.0758	373.3583	271.3532	279.3218	362.5172	384.3536	363.7612	355.8345	(95)
Ext 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)
Heat loss rate W	1107.8001	1073.8458	973.2491	813.1764	628.9898	426.6329	284.7937	298.2860	458.4945	688.5441	913.5042	1103.3006	(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	544.9258	434.9151	378.6565	236.6741	123.4400	0.0000	0.0000	0.0000	0.0000	226.3178	395.8149	556.1147	(98)
Space heating												2896.8590	(98)
Space heating per m2												43.4507	(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	694.1793	546.4816	560.2842	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8025	0.8719	0.8487	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	557.1127	476.4979	475.5066	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	701.3444	672.6018	641.2306	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	103.8468	145.9014	123.2987	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												373.0468 (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	25.9617	36.4753	30.8247	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.2617 (107)
Space cooling per m2												1.3989 (108)
Energy for space heating												43.4507 (99)
Energy for space cooling												1.3989 (108)
Total												44.8496 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.8 (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	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)
					Air changes per hour
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												
	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)
Effective ac	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)
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.1800	8.9154		(29a)
APT Wall to Stairwell	19.0100		19.0100	0.1800	3.4218		(29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671		(30)
Total net area of external elements Aum(A, m ²)			146.0000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 34.6186		(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)							7.1565 (36)
Total fabric heat loss						(33) + (36) =	41.7751 (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	30.5115	30.3134	30.1193	29.2075	29.0369	28.2427	28.2427	28.0957	28.5486	29.0369	29.3820	29.7428 (38)
Heat transfer coeff	72.2866	72.0885	71.8944	70.9826	70.8120	70.0179	70.0179	69.8708	70.3238	70.8120	71.1571	71.5179 (39)
Average = Sum(39)m / 12 =												70.9818 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0842	1.0813	1.0784	1.0647	1.0621	1.0502	1.0502	1.0480	1.0548	1.0621	1.0673	1.0727 (40)
HLP (average)												1.0647 (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)												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)
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)

----- Mean internal temperature (heating season) -----												

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	64.0487	64.2247	64.3981	65.2253	65.3824	66.1240	66.1240	66.2632	65.8364	65.3824	65.0653	64.7371
alpha	5.2699	5.2816	5.2932	5.3484	5.3588	5.4083	5.4083	5.4175	5.3891	5.3588	5.3377	5.3158
util living area	0.9984	0.9964	0.9908	0.9707	0.9084	0.7604	0.5858	0.6387	0.8705	0.9804	0.9966	0.9988 (86)
MIT	19.8205	19.9648	20.1956	20.5004	20.7714	20.9411	20.9883	20.9817	20.8704	20.5205	20.1152	19.7969 (87)
Th 2	20.0137	20.0162	20.0185	20.0298	20.0319	20.0417	20.0417	20.0435	20.0379	20.0319	20.0276	20.0232 (88)
util rest of house	0.9979	0.9952	0.9874	0.9592	0.8713	0.6749	0.4665	0.5189	0.8066	0.9706	0.9953	0.9985 (89)
MIT 2	18.9356	19.0814	19.3125	19.6201	19.8723	20.0135	20.0386	20.0381	19.9638	19.6447	19.2410	18.9197 (90)
Living area fraction									fLA = Living area / (4) =			0.4870 (91)
MIT	19.3666	19.5116	19.7426	20.0488	20.3101	20.4653	20.5011	20.4976	20.4053	20.0712	19.6668	19.3469 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3666	19.5116	19.7426	20.0488	20.3101	20.4653	20.5011	20.4976	20.4053	20.0712	19.6668	19.3469 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9974	0.9944	0.9862	0.9595	0.8833	0.7150	0.5251	0.5778	0.8338	0.9711	0.9946	0.9981 (94)
Useful gains	379.5253	434.0720	476.6886	503.8512	485.0566	382.7748	268.8042	279.2152	378.1679	397.6450	369.6716	359.1995 (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	1089.1103	1053.3317	952.0701	791.3739	609.7017	410.6733	273.1457	286.3055	443.4133	670.6765	894.2158	1083.2774 (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	527.9313	416.1426	353.6838	207.0163	92.7359	0.0000	0.0000	0.0000	0.0000	203.1354	377.6718	538.7139 (98)
Space heating												2717.0311 (98)
Space heating per m2												40.7534 (99)
										(98) / (4) =		

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	658.1679	518.1322	531.0181	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8724	0.9329	0.9140	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	574.2005	483.3764	485.3278	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	706.8487	677.8678	645.8977	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	95.5067	144.7016	119.4640	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												359.6723 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)

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	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	23.8767	36.1754	29.8660	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												89.9181 (107)
Energy for space heating												1.3487 (108)
Energy for space cooling												40.7534 (99)
Total												1.3487 (108)
Target Fabric Energy Efficiency (TFEE)												42.1021 (109)
												48.4 (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					4.4700
Number of sides sheltered					0.3534 (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) =				0.3269 (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	0.3432	0.3187	0.3269	0.3105	0.3105	0.3023	0.2942	0.2860	0.2778	0.3023	0.2860	0.3023 (22b)
Effective ac	0.5589	0.5508	0.5534	0.5482	0.5482	0.5457	0.5433	0.5409	0.5386	0.5457	0.5409	0.5457 (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)
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.2500	12.3825	60.0000	2971.8000 (29a)
APT Wall to Stairwell	19.0100		19.0100	0.2400	4.5624	110.0000	2091.1000 (29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671	9.0000	600.0300 (30)
Total net area of external elements Aum(A, m ²)			146.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6115		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Timber			83.3900			9.0000	750.5100 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	11812.1400 (34)
	177.1732 (35)
	7.3759 (36)
(33) + (36) =	45.9874 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	28.4044 Jan 27.9921 Feb 28.1262 Mar 27.8615 Apr 27.8615 May 27.7342 Jun 27.6103 Jul 27.4899 Aug 27.3728 Sep 27.7342 Oct 27.4899 Nov 27.7342 Dec 27.7342 (38)
Heat transfer coeff	74.3918 Jan 73.9795 Feb 74.1136 Mar 73.8489 Apr 73.8489 May 73.7216 Jun 73.5977 Jul 73.4773 Aug 73.3602 Sep 73.7216 Oct 73.4773 Nov 73.7216 Dec 73.7216 (39)
Average = Sum(39)m / 12 =	73.7717 (39)
HLP	1.1158 Jan 1.1096 Feb 1.1116 Mar 1.1077 Apr 1.1077 May 1.1058 Jun 1.1039 Jul 1.1021 Aug 1.1003 Sep 1.1058 Oct 1.1021 Nov 1.1058 Dec 1.1058 (40)
HLP (average)	1.1065 (40)
Days in month	31 Jan 28 Feb 31 Mar 30 Apr 31 May 30 Jun 31 Jul 31 Aug 30 Sep 31 Oct 30 Nov 31 Dec 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)												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													(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													
(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

Southeast		2.8800												45.1778	0.6200	0.7000	0.7700	39.1328 (77)	
Northwest		2.5800												14.6176	0.6200	0.7000	0.7700	11.3428 (81)	
Southeast		3.2100												45.1778	0.6200	0.7000	0.7700	43.6168 (77)	

Solar gains	94.0923	139.7058	201.8193	267.3530	298.3409	328.2459	311.3002	281.5449	236.3425	169.1918	113.0290	78.7177	(83)						
Total gains	588.8829	630.2940	673.2577	709.3756	710.5049	713.6894	681.2032	659.2349	631.0433	593.5038	570.1083	560.3399	(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	44.1063	44.3521	44.2719	44.4306	44.4306	44.5073	44.5822	44.6553	44.7266	44.8013	44.8753	44.9503		
alpha	3.9404	3.9568	3.9515	3.9620	3.9620	3.9672	3.9721	3.9770	3.9818	3.9867	3.9915	3.9962		
util living area	0.9681	0.9572	0.9280	0.8633	0.7463	0.5569	0.4134	0.4256	0.6604	0.8623	0.9452	0.9719	(86)	
MIT	19.8420	19.9687	20.2376	20.5621	20.8198	20.9579	20.9899	20.9889	20.9159	20.6375	20.2157	19.8257	(87)	
Th 2	19.9879	19.9930	19.9913	19.9946	19.9946	19.9961	19.9976	19.9991	20.0005	19.9961	19.9991	19.9961	(88)	
util rest of house	0.9610	0.9479	0.9118	0.8322	0.6889	0.4705	0.3109	0.3207	0.5784	0.8240	0.9312	0.9655	(89)	
MIT 2	18.4840	18.6681	19.0475	19.4945	19.8213	19.9680	19.9937	19.9947	19.9359	19.6042	19.0281	18.4670	(90)	
Living area fraction	19.1454	19.3015	19.6271	20.0145	20.3076	20.4501	20.4789	20.4789	20.4132	20.1075	19.6065	19.1287	(92)	
Temperature adjustment	18.9954	19.1515	19.4771	19.8645	20.1576	20.3001	20.3289	20.3289	20.2632	19.9575	19.4565	18.9787	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9521	0.9382	0.9021	0.8276	0.6989	0.4976	0.3454	0.3559	0.6013	0.8223	0.9219	0.9572	(94)
Ext temp.	560.6729	591.3288	607.3166	587.0983	496.5798	355.1469	235.2664	234.6277	379.4194	488.0351	525.5579	536.3790	(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	1048.5806	1024.7277	924.7205	765.4045	565.5024	368.6141	237.6389	237.2522	408.1154	630.8697	849.1392	1030.5314	(97)
Space heating kWh	363.0033	291.2441	236.1486	128.3805	51.2784	0.0000	0.0000	0.0000	0.0000	106.2689	232.9785	367.6494	(98)
Space heating													(98)
RHI space heating demand													(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	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					4.4700
Number of sides sheltered					0.3534 (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) =	0.3269 (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												
	0.4167	0.4086	0.4004	0.3595	0.3514	0.3105	0.3105	0.3023	0.3269	0.3514	0.3677	0.3841 (22b)
Effective ac	0.5868	0.5835	0.5802	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5738 (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)
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.2500	12.3825	60.0000	2971.8000 (29a)
APT Wall to Stairwell	19.0100		19.0100	0.2400	4.5624	110.0000	2091.1000 (29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671	9.0000	600.0300 (30)
Total net area of external elements Aum(A, m ²)			146.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6115		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Timber			83.3900			9.0000	750.5100 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11812.1400 (34)
177.1732 (35)
7.3759 (36)
(33) + (36) = 45.9874 (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	29.8247	29.6533	29.4853	28.6963	28.5487	27.8615	27.8615	27.7342	28.1262	28.5487	28.8473	29.1595 (38)
Heat transfer coeff	75.8121	75.6407	75.4727	74.6837	74.5361	73.8489	73.8489	73.7216	74.1136	74.5361	74.8347	75.1469 (39)
Average = Sum(39)m / 12 =												74.6830 (39)
HLP	1.1371	1.1346	1.1320	1.1202	1.1180	1.1077	1.1077	1.1058	1.1116	1.1180	1.1225	Dec 1.1271 (40)
HLP (average)												1.1202 (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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Calculation Type: New Build (As Built)

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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	(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)
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)
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)

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	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
Southeast				2.8800	36.7938		0.6200		0.7000		0.7700		31.8706 (77)
Northwest				2.5800	11.2829		0.6200		0.7000		0.7700		8.7552 (81)
Southeast				3.2100	36.7938		0.6200		0.7000		0.7700		35.5225 (77)
Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377		64.8243 (83)
Total gains	570.9388	623.2049	660.6149	689.3689	701.0302	677.4191	649.2353	625.2519	603.8970	572.9645	548.8169		546.4466 (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	43.2800	43.3781	43.4747	43.9340	44.0210	44.4306	44.4306	44.5073	44.2719	44.0210	43.8453	43.6631
alpha	3.8853	3.8919	3.8983	3.9289	3.9347	3.9620	3.9620	3.9672	3.9515	3.9347	3.9230	3.9109
util living area	0.9746	0.9626	0.9395	0.8889	0.7928	0.6368	0.4838	0.5194	0.7269	0.8975	0.9598	0.9782 (86)
MIT	19.6973	19.8650	20.1293	20.4638	20.7467	20.9238	20.9800	20.9734	20.8663	20.5188	20.0542	19.6605 (87)
Th 2	19.9706	19.9727	19.9748	19.9844	19.9862	19.9946	19.9946	19.9961	19.9913	19.9862	19.9825	19.9787 (88)
util rest of house	0.9690	0.9544	0.9258	0.8629	0.7440	0.5562	0.3806	0.4158	0.6535	0.8684	0.9496	0.9733 (89)
MIT 2	18.2639	18.5056	18.8836	19.3554	19.7268	19.9361	19.9849	19.9822	19.8777	19.4404	18.7876	18.2166 (90)
Living area fraction									fLA = Living area / (4) =			0.4870 (91)
MIT	18.9620	19.1677	19.4903	19.8952	20.2235	20.4171	20.4695	20.4649	20.3592	19.9656	19.4044	18.9198 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8120	19.0177	19.3403	19.7452	20.0735	20.2671	20.3195	20.3149	20.2092	19.8156	19.2544	18.7698 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	548.5551	588.8316	604.8700	589.9967	524.8060	392.3855	269.3632	281.2191	404.9851	494.2409	516.1015	527.7621 (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	1100.1861	1067.8704	969.0926	809.9627	624.1264	418.5125	274.6840	288.6142	452.7736	686.8961	909.5739	1094.8775 (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	410.4134	321.9141	270.9816	158.3755	73.8944	0.0000	0.0000	0.0000	0.0000	143.3354	283.3001	421.9339 (98)
Space heating												2084.1483 (98)
Space heating per m2												(98) / (4) = 31.2607 (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													2315.7204 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	410.4134	321.9141	270.9816	158.3755	73.8944	0.0000	0.0000	0.0000	0.0000	143.3354	283.3001	421.9339	(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)	456.0149	357.6823	301.0907	175.9727	82.1049	0.0000	0.0000	0.0000	0.0000	159.2616	314.7779	468.8154	(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	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	89.0438	88.9652	88.8080	88.4774	87.8859	86.7000	86.7000	86.7000	86.7000	88.3648	88.8528	86.7000	(216)
Fuel for water heating, kWh/month	181.1511	159.2356	166.2046	147.7168	144.3926	128.8453	121.9127	136.3149	136.8816	153.4773	163.6858	176.1110	(219)
Water heating fuel used												1815.9293	(219)
Annual totals kWh/year													
Space heating fuel - main system												2315.7204	(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													4531.7975 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2315.7204	3.4800	80.5871 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1815.9293	3.4800	63.1943 (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			316.5609 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.1906 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	83.3910
SAP rating (Section 12)		83 (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	2315.7204	0.2160	500.1956 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1815.9293	0.2160	392.2407 (264)
Space and water heating			892.4363 (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	-414.3879	0.5190	-215.0673 (269)
Total kg/year			885.0457 (272)
CO2 emissions per m2			13.2800 (273)
EI value			89.3798
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8802 = 3.954$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8802 = 0.2454$, 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	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					4.4700
Number of sides sheltered					0.3534 (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) =	0.3269 (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												
Effective ac	0.3432	0.3187	0.3269	0.3105	0.3105	0.3023	0.2942	0.2860	0.2778	0.3023	0.2860	0.3023 (22b)
	0.5589	0.5508	0.5534	0.5482	0.5482	0.5457	0.5433	0.5409	0.5386	0.5457	0.5409	0.5457 (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)
APT2F 100mm Knauf Supafil	60.3200	10.7900	49.5300	0.2500	12.3825	60.0000	2971.8000 (29a)
APT Wall to Stairwell	19.0100		19.0100	0.2400	4.5624	110.0000	2091.1000 (29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671	9.0000	600.0300 (30)
Total net area of external elements Aum(A, m ²)			146.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6115		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Timber			83.3900			9.0000	750.5100 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	11812.1400 (34)
	177.1732 (35)
	7.3759 (36)
(33) + (36) =	45.9874 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	28.4044
Heat transfer coeff	74.3918
Average = Sum(39)m / 12 =	73.7717 (39)
HLP	1.1158
HLP (average)	1.1058 (40)
Days in month	31

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	94.1192 (44)
Energy conte	139.5760	135.1719 (45)
Energy content (annual)	122.0741	124.4751
Distribution loss (46)m = 0.15 x (45)m	18.3111	18.6713
	20.9364	20.2758 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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)
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	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	
Southeast				2.8800	45.1778		0.6200	0.7000	0.7700		39.1328 (77)	
Northwest				2.5800	14.6176		0.6200	0.7000	0.7700		11.3428 (81)	
Southeast				3.2100	45.1778		0.6200	0.7000	0.7700		43.6168 (77)	
Solar gains	94.0923	139.7058	201.8193	267.3530	298.3409	328.2459	311.3002	281.5449	236.3425	169.1918	113.0290	78.7177 (83)
Total gains	588.8829	630.2940	673.2577	709.3756	710.5049	713.6894	681.2032	659.2349	631.0433	593.5038	570.1083	560.3399 (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	44.1063	44.3521	44.2719	44.4306	44.4306	44.5073	44.5822	44.6553	44.7266	44.5073	44.6553	44.5073		
alpha	3.9404	3.9568	3.9515	3.9620	3.9620	3.9672	3.9721	3.9770	3.9818	3.9672	3.9770	3.9672		
util living area	0.9681	0.9572	0.9280	0.8633	0.7463	0.5569	0.4134	0.4256	0.6604	0.8623	0.9452	0.9719	(86)	
MIT	19.8420	19.9687	20.2376	20.5621	20.8198	20.9579	20.9899	20.9889	20.9159	20.6375	20.2157	19.8257	(87)	
Th 2	19.9879	19.9930	19.9913	19.9946	19.9946	19.9961	19.9976	19.9991	20.0005	19.9961	19.9991	19.9961	(88)	
util rest of house	0.9610	0.9479	0.9118	0.8322	0.6889	0.4705	0.3109	0.3207	0.5784	0.8240	0.9312	0.9655	(89)	
MIT 2	18.4840	18.6681	19.0475	19.4945	19.8213	19.9680	19.9937	19.9947	19.9359	19.6042	19.0281	18.4670	(90)	
Living area fraction									fLA = Living area / (4) =			0.4870	(91)	
MIT	19.1454	19.3015	19.6271	20.0145	20.3076	20.4501	20.4789	20.4789	20.4132	20.1075	19.6065	19.1287	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.9954	19.1515	19.4771	19.8645	20.1576	20.3001	20.3289	20.3289	20.2632	19.9575	19.4565	18.9787	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	560.6729	591.3288	607.3166	587.0983	496.5798	355.1469	235.2664	234.6277	379.4194	488.0351	525.5579	536.3790	(94)	
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)	
Heat loss rate W	1048.5806	1024.7277	924.7205	765.4045	565.5024	368.6141	237.6389	237.2522	408.1154	630.8697	849.1392	1030.5314	(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	363.0033	291.2441	236.1486	128.3805	51.2784	0.0000	0.0000	0.0000	0.0000	106.2689	232.9785	367.6494	(98)	
Space heating												1776.9517	(98)	
Space heating per m2												26.6529	(99)	

8c. Space cooling requirement

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													1974.3907 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	363.0033	291.2441	236.1486	128.3805	51.2784	0.0000	0.0000	0.0000	0.0000	106.2689	232.9785	367.6494	(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)	403.3370	323.6046	262.3873	142.6450	56.9760	0.0000	0.0000	0.0000	0.0000	118.0765	258.8650	408.4993	(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	88.9583	88.8928	88.7014	88.3044	87.6246	86.7000	86.7000	86.7000	86.7000	88.1195	88.7024	86.7000	(216)
Fuel for water heating, kWh/month	181.3252	159.3653	166.4044	148.0061	144.8231	128.8453	121.9127	136.3149	136.8816	153.9046	163.9633	176.2971	(219)
Water heating fuel used												1818.0435	(219)
Annual totals kWh/year													
Space heating fuel - main system												1974.3907	(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												4192.5822	(238)

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1974.3907	3.9200	77.3961 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1818.0435	3.9200	71.2673 (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			304.5285 (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	1974.3907	0.2160	426.4684 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1818.0435	0.2160	392.6974 (264)
Space and water heating			819.1658 (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	-414.3879	0.5190	-215.0673 (269)
Total kg/year			811.7752 (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	1974.3907	1.2200	2408.7567 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1818.0435	1.2200	2218.0131 (264)
Space and water heating			4626.7698 (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	-414.3879	3.0700	-1272.1710 (269)
Primary energy kWh/year			4583.0529 (272)
Primary energy kWh/m2/year			68.7424 (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 83
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	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 83
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 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	£237	£237	£0
Space heating	£178	£178	£0
Water heating	£71	£71	£0
Lighting	£55	£55	£0
Total cost of fuels	£305	£305	£0
Total cost of uses	£304	£304	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	69 kWh/m²	69 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 West
Overshading	Average or unknown
Thermal mass parameter	177.2 (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	45.99 (37)
Summer heat loss coefficient	350.92 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	2.8800	127.3119	0.6200	0.7000	0.9000	128.8950
North West	2.5800	106.0502	0.6200	0.7000	0.9000	96.1847
South East	3.2100	127.3119	0.6200	0.7000	0.9000	143.6642

total:						368.7439
Solar gains	Jun	Jul	Aug			
Internal gains	395	369	332			(P3)
Total summer gains	382	367	375			
	778	736	707			(P5)

Summer gain/loss ratio	2.22	2.10	2.01			(P6)
Summer external temperature	15.40	17.30	17.30			
Thermal mass temperature increment (TMP = 177.2)	0.76	0.76	0.76			
Threshold temperature	18.38	20.16	20.07			(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant			

Assessment of likelihood of high internal temperature: Not significant