

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-209				Issued on Date	21/05/2019
Assessment Reference	As Built	Prop Type Ref	2FF - Det (As)			
Property	46, St. Andrews, Botley, SOUTHAMPTON, SO32 2ST					
SAP Rating		83 B	DER	14.78	TER	18.89
Environmental		90 B	% DER<TER	21.76		
CO ₂ Emissions (t/year)		0.78	DFEE	45.68	TFEE	49.08
General Requirements Compliance		Pass	% DFEE<TFEE	6.92		
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

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) 18.89 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.78 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.7 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: 4.93 (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	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) =				20.0000 / (5) = 0.1299 (8)
Pressure test					Yes
Measured/design AP50					4.9300
Infiltration rate					0.3764 (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) =				0.3481 (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	0.4439	0.4352	0.4265	0.3830	0.3742	0.3307	0.3307	0.3220	0.3481	0.3742	0.3917	0.4091 (22b)
Effective ac	0.5985	0.5947	0.5909	0.5733	0.5700	0.5547	0.5547	0.5519	0.5606	0.5700	0.5767	0.5837 (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	60.0600	10.7900	49.2700	0.2500	12.3175	60.0000	2956.2000 (29a)
APT Wall to Stairwell	19.2400		19.2400	0.2400	4.6176	110.0000	2116.4000 (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)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6017		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Metal			36.5900			20.0000	731.8000 (32c)
2F - Timber			82.6100			9.0000	743.4900 (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) = 11814.8200 (34)
177.2134 (35)
7.1257 (36)
(33) + (36) = 45.7274 (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	30.4179	30.2235	30.0329	29.1379	28.9704	28.1908	28.1908	28.0464	28.4911	28.9704	29.3092	29.6633 (38)
Heat transfer coeff	76.1453	75.9509	75.7604	74.8653	74.6978	73.9183	73.9183	73.7739	74.2185	74.6978	75.0366	75.3908 (39)
Average = Sum(39)m / 12 =												74.8645 (39)
HLP	1.1421	1.1392	1.1363	1.1229	1.1204	1.1087	1.1087	1.1066	1.1132	1.1204	1.1255	1.1308 (40)
HLP (average)												1.1229 (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 OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	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	43.1004	43.2107	43.3194	43.8373	43.9356	44.3990	44.3990	44.4859	44.2193	43.9356	43.7372	43.5318		
alpha	3.8734	3.8807	3.8880	3.9225	3.9290	3.9599	3.9599	3.9657	3.9480	3.9290	3.9158	3.9021		
util living area	0.9930	0.9883	0.9760	0.9415	0.8633	0.7214	0.5679	0.6196	0.8388	0.9611	0.9884	0.9943	(86)	
MIT	19.3736	19.5437	19.8555	20.2732	20.6390	20.8802	20.9649	20.9504	20.7660	20.2875	19.7595	19.3448	(87)	
Th 2	19.9666	19.9689	19.9713	19.9822	19.9842	19.9937	19.9937	19.9955	19.9900	19.9842	19.9801	19.9758	(88)	
util rest of house	0.9913	0.9855	0.9698	0.9252	0.8235	0.6414	0.4529	0.5055	0.7776	0.9472	0.9851	0.9929	(89)	
MIT 2	17.7940	18.0430	18.4963	19.0993	19.5982	19.8971	19.9758	19.9677	19.7740	19.1301	18.3661	17.7580	(90)	
Living area fraction									fLA = Living area / (4) =			0.3364	(91)	
MIT	18.3254	18.5479	18.9536	19.4942	19.9484	20.2278	20.3086	20.2983	20.1078	19.5195	18.8349	18.2919	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.1754	18.3979	18.8036	19.3442	19.7984	20.0778	20.1586	20.1483	19.9578	19.3695	18.6849	18.1419	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9869	0.9792	0.9601	0.9123	0.8150	0.6487	0.4728	0.5242	0.7753	0.9359	0.9788	0.9891	(94)
Useful gains	382.0880	424.9907	467.3084	495.3802	470.8804	367.1366	254.9636	264.3961	356.1885	379.9503	365.4427	364.2131	(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	1056.5477	1025.1785	932.1217	781.9114	604.9301	404.9112	263.0432	276.5295	434.7537	655.0633	869.2938	1051.0881	(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	501.7980	403.3262	345.8210	206.3025	99.7329	0.0000	0.0000	0.0000	0.0000	204.6841	362.7728	511.0350	(98)
Space heating												2635.4726	(98)
Space heating per m2										(98) / (4) =		39.5301	(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													2928.3028 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	501.7980	403.3262	345.8210	206.3025	99.7329	0.0000	0.0000	0.0000	0.0000	204.6841	362.7728	511.0350	(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)	557.5534	448.1403	384.2456	229.2250	110.8144	0.0000	0.0000	0.0000	0.0000	227.4267	403.0809	567.8166	(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	89.1743	89.1183	88.9868	88.6908	88.1219	86.7000	86.7000	86.7000	86.7000	88.6552	89.0302	86.7000	(216)
Fuel for water heating, kWh/month	180.8859	158.9621	165.8707	147.3614	144.0059	128.8453	121.9127	136.3149	136.8816	152.9746	163.3595	175.8711	(219)
Water heating fuel used												1813.2457	(219)
Annual totals kWh/year													
Space heating fuel - main system												2928.3028	(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												5141.6964	(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	2928.3028	0.2160	632.5134	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1813.2457	0.2160	391.6611	(264)
Space and water heating			1024.1745	(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			985.0858	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7800	(273)

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

DER		14.7800	ZC1
Total Floor Area		66.6700	TFA
Assumed number of occupants		2.1626	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		16.8347	ZC2
CO2 emissions from cooking, equation (L16)		2.5634	ZC3
Total CO2 emissions		34.1781	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		34.1781	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)
	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	60.0600	10.7900	49.2700	0.1800	8.8686		(29a)
APT Wall to Stairwell	19.2400		19.2400	0.1800	3.4632		(29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671		(30)
Total net area of external elements Aum(A, m ²)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.6132		(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)							6.8780 (36)
Total fabric heat loss						(33) + (36) =	41.4912 (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	72.0027	71.8046	71.6105	70.6987	70.5281	69.7340	69.7340	69.5869	70.0399	70.5281	70.8732	71.2340 (39)
Average = Sum(39)m / 12 =												70.6979 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0800	1.0770	1.0741	1.0604	1.0579	1.0460	1.0460	1.0438	1.0505	1.0579	1.0630	1.0685 (40)
HLP (average)												1.0604 (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)
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	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	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, 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	64.3012	64.4786	64.6534	65.4872	65.6456	66.3932	66.3932	66.5335	66.1032	65.6456	65.3260	64.9951
alpha	5.2867	5.2986	5.3102	5.3658	5.3764	5.4262	5.4262	5.4356	5.4069	5.3764	5.3551	5.3330
util living area	0.9981	0.9961	0.9895	0.9635	0.8847	0.7199	0.5473	0.6030	0.8557	0.9790	0.9961	0.9985 (86)
MIT	19.8494	19.9808	20.2193	20.5393	20.8069	20.9554	20.9916	20.9862	20.8832	20.5320	20.1355	19.8281 (87)
Th 2	20.0172	20.0196	20.0220	20.0333	20.0354	20.0452	20.0452	20.0470	20.0414	20.0354	20.0311	20.0267 (88)
util rest of house	0.9974	0.9948	0.9857	0.9496	0.8423	0.6334	0.4341	0.4874	0.7887	0.9686	0.9946	0.9980 (89)
MIT 2	18.4793	18.6729	19.0212	19.4858	19.8430	20.0149	20.0420	20.0412	19.9454	19.4836	18.9076	18.4551 (90)
Living area fraction	18.9402	19.1129	19.4243	19.8402	20.1673	20.3313	20.3615	20.3591	20.2609	19.8363	19.3207	0.3364 (91)
MIT	18.9402	19.1129	19.4243	19.8402	20.1673	20.3313	20.3615	20.3591	20.2609	19.8363	19.3207	18.9170 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9402	19.1129	19.4243	19.8402	20.1673	20.3313	20.3615	20.3591	20.2609	19.8363	19.3207	18.9170 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9964	0.9931	0.9826	0.9462	0.8489	0.6608	0.4725	0.5266	0.8061	0.9657	0.9929	0.9972 (94)
Useful gains	395.3730	440.8331	488.4003	524.1866	500.0412	381.1457	259.8103	271.1491	378.5716	401.3436	379.9252	376.6844 (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	1054.1348	1020.5541	925.5143	773.4582	597.1809	399.6671	262.3030	275.5035	431.5083	651.4212	866.1211	1048.3529 (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	490.1188	389.5725	325.2128	179.4756	72.2719	0.0000	0.0000	0.0000	0.0000	186.0578	350.0611	499.7213 (98)
Space heating												2492.4918 (98)
Space heating per m2										(98) / (4) =		37.3855 (99)

8c. Space cooling requirement

Not applicable

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

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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													2668.6208 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	490.1188	389.5725	325.2128	179.4756	72.2719	0.0000	0.0000	0.0000	0.0000	186.0578	350.0611	499.7213	(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)	524.7524	417.1012	348.1936	192.1580	77.3789	0.0000	0.0000	0.0000	0.0000	199.2053	374.7977	535.0336	(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	87.3592	87.1549	86.6521	85.4841	83.3794	80.3000	80.3000	80.3000	80.3000	85.4555	86.8408	87.4501	(216)
(217)m	87.3592	87.1549	86.6521	85.4841	83.3794	80.3000	80.3000	80.3000	80.3000	85.4555	86.8408	87.4501	(217)
Fuel for water heating, kWh/month	214.6749	187.9636	196.6986	176.8455	175.5397	160.5344	153.8042	171.4556	173.3492	185.4839	194.8418	209.4155	(219)
Water heating fuel used												2200.6068	(219)
Annual totals kWh/year													
Space heating fuel - main system												2668.6208	(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												5269.3755	(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	2668.6208	0.2160	576.4221 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2200.6068	0.2160	475.3311 (264)
Space and water heating			1051.7532 (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			1259.4299 (272)
Emissions per m2 for space and water heating			15.7755 (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) = (15.7755 * 1.00) + 2.5311 + 0.5838, rounded to 2 d.p.			18.8900 (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	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					4.9300
Number of sides sheltered					0.3764 (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) =				0.3481 (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	0.4439	0.4352	0.4265	0.3830	0.3742	0.3307	0.3307	0.3220	0.3481	0.3742	0.3917	0.4091 (22b)
	0.5985	0.5947	0.5909	0.5733	0.5700	0.5547	0.5547	0.5519	0.5606	0.5700	0.5767	0.5837 (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	60.0600	10.7900	49.2700	0.2500	12.3175	60.0000	2956.2000 (29a)
APT Wall to Stairwell	19.2400		19.2400	0.2400	4.6176	110.0000	2116.4000 (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)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6017		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Metal			36.5900			20.0000	731.8000 (32c)
2F - Timber			82.6100			9.0000	743.4900 (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) = 11814.8200 (34)
177.2134 (35)
7.1257 (36)
(33) + (36) = 45.7274 (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	30.4179	30.2235	30.0329	29.1379	28.9704	28.1908	28.1908	28.0464	28.4911	28.9704	29.3092	29.6633 (38)
Heat transfer coeff	76.1453	75.9509	75.7604	74.8653	74.6978	73.9183	73.9183	73.7739	74.2185	74.6978	75.0366	75.3908 (39)
Average = Sum(39)m / 12 =												74.8645 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1421	1.1392	1.1363	1.1229	1.1204	1.1087	1.1087	1.1066	1.1132	1.1204	1.1255	1.1308 (40)
HLP (average)												1.1229 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total = Sum(45)m =												1346.2376 (45)

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	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)

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	43.1004	43.2107	43.3194	43.8373	43.9356	44.3990	44.3990	44.4859	44.2193	43.9356	43.7372	43.5318	
alpha	3.8734	3.8807	3.8880	3.9225	3.9290	3.9599	3.9599	3.9657	3.9480	3.9290	3.9158	3.9021	
util living area	0.9949	0.9910	0.9806	0.9500	0.8780	0.7420	0.5891	0.6446	0.8589	0.9690	0.9914	0.9958 (86)	
MIT	19.3151	19.4875	19.8044	20.2317	20.6106	20.8670	20.9601	20.9430	20.7410	20.2422	19.7050	19.2871 (87)	
Th 2	19.9666	19.9689	19.9713	19.9822	19.9842	19.9937	19.9937	19.9955	19.9900	19.9842	19.9801	19.9758 (88)	
util rest of house	0.9936	0.9887	0.9754	0.9356	0.8409	0.6631	0.4718	0.5291	0.8018	0.9575	0.9888	0.9948 (89)	
MIT 2	18.4251	18.5984	18.9144	19.3406	19.6969	19.9194	19.9796	19.9732	19.8238	19.3582	18.8243	18.4042 (90)	
Living area fraction									fLA = Living area / (4) =			0.3364 (91)	
MIT	18.7245	18.8975	19.2138	19.6404	20.0043	20.2382	20.3095	20.2995	20.1324	19.6556	19.1206	18.7012 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7245	18.8975	19.2138	19.6404	20.0043	20.2382	20.3095	20.2995	20.1324	19.6556	19.1206	18.7012 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9915	0.9856	0.9704	0.9297	0.8417	0.6840	0.5106	0.5665	0.8111	0.9527	0.9859	0.9930	(94)
Ext temp.	351.3219	396.1629	442.6463	478.2743	463.3908	369.7459	263.1778	271.1122	351.1100	359.4832	337.5009	333.7910	(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	1098.3573	1063.1262	963.2059	804.0818	620.3157	416.7648	274.1978	287.6808	447.7132	676.4360	901.9833	1093.2602	(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	555.7943	448.1993	387.2963	234.5814	116.7521	0.0000	0.0000	0.0000	0.0000	235.8129	406.4273	565.0451	(98)
Space heating												2949.9088	(98)
Space heating per m2												44.2464	(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	694.8316	546.9951	560.6816	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8085	0.8758	0.8480	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	561.7912	479.0439	475.4365	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	108.8239	151.0279	122.7555	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												382.6074 (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	27.2060	37.7570	30.6889	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												95.6518 (107)
Space cooling per m2												1.4347 (108)
Energy for space heating												44.2464 (99)
Energy for space cooling												1.4347 (108)
Total												45.6811 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.7 (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)
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					5.0000
Number of sides sheltered					0.3799 (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) =	0.3514 (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)
APT2F 100mm Knauf Supafil	60.0600	10.7900	49.2700	0.1800	8.8686		(29a)
APT Wall to Stairwell	19.2400		19.2400	0.1800	3.4632		(29a)
APT External Plane Ceiling	66.6700		66.6700	0.1300	8.6671		(30)
Total net area of external elements Aum(A, m ²)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.6132		(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)							6.8780 (36)
Total fabric heat loss						(33) + (36) =	41.4912 (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	72.0027	71.8046	71.6105	70.6987	70.5281	69.7340	69.7340	69.5869	70.0399	70.5281	70.8732	71.2340 (39)
Average = Sum(39)m / 12 =												70.6979 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0800	1.0770	1.0741	1.0604	1.0579	1.0460	1.0460	1.0438	1.0505	1.0579	1.0630	1.0685 (40)
HLP (average)												1.0604 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	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)
	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]												Gains
						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	64.3012	64.4786	64.6534	65.4872	65.6456	66.3932	66.3932	66.5335	66.1032	65.6456	65.3260	64.9951
util living area	5.2867	5.2986	5.3102	5.3658	5.3764	5.4262	5.4262	5.4356	5.4069	5.3764	5.3551	5.3330
	0.9989	0.9975	0.9927	0.9721	0.9042	0.7491	0.5756	0.6375	0.8839	0.9859	0.9977	0.9992 (86)
MIT	19.7905	19.9243	20.1673	20.4965	20.7796	20.9459	20.9893	20.9821	20.8595	20.4848	20.0803	19.7700 (87)
Th 2	20.0172	20.0196	20.0220	20.0333	20.0354	20.0452	20.0452	20.0470	20.0414	20.0354	20.0311	20.0267 (88)
util rest of house	0.9985	0.9967	0.9899	0.9610	0.8662	0.6633	0.4581	0.5182	0.8236	0.9785	0.9967	0.9989 (89)
MIT 2	18.9085	19.0439	19.2876	19.6194	19.8822	20.0195	20.0424	20.0417	19.9596	19.6136	19.2092	18.8957 (90)
Living area fraction									fLA = Living area / (4) =			0.3364 (91)
MIT	19.2052	19.3401	19.5836	19.9145	20.1841	20.3312	20.3610	20.3581	20.2623	19.9067	19.5023	19.1898 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2052	19.3401	19.5836	19.9145	20.1841	20.3312	20.3610	20.3581	20.2623	19.9067	19.5023	19.1898 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9981	0.9959	0.9884	0.9593	0.8729	0.6908	0.4981	0.5588	0.8396	0.9772	0.9960	0.9985 (94)
Ext temp.	354.4728	401.8999	453.4458	497.2157	484.7018	376.7977	259.0619	269.6652	366.0587	370.5936	341.9869	336.3217 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1073.2141	1036.8673	936.9221	778.7080	598.3708	399.6560	262.2672	275.4303	431.6093	656.3848	878.9874	1067.7854 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	534.7435	426.6981	359.7064	202.6745	84.5697	0.0000	0.0000	0.0000	0.0000	212.6287	386.6404	544.2090 (98)
Space heating per m2												2751.8703 (98)
										(98) / (4) =		41.2760 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	655.4992	516.0313	528.8604	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8804	0.9375	0.9152	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	577.1289	483.7901	484.0060	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	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)
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	101.8712	151.5278	119.8426	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												373.2416 (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

	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	25.4678	37.8820	29.9606	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.3104 (107)
Space cooling per m2												1.3996 (108)
Energy for space heating												41.2760 (99)
Energy for space cooling												1.3996 (108)
Total												42.6756 (109)
Target Fabric Energy Efficiency (TFEE)												49.1 (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	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)
					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					4.9300
Infiltration rate					0.3764 (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) =		0.3481 (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												
	0.3655	0.3394	0.3481	0.3307	0.3307	0.3220	0.3133	0.3046	0.2959	0.3220	0.3046	0.3220 (22b)
Effective ac	0.5668	0.5576	0.5606	0.5547	0.5547	0.5519	0.5491	0.5464	0.5438	0.5519	0.5464	0.5519 (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	60.0600	10.7900	49.2700	0.2500	12.3175	60.0000	2956.2000 (29a)
APT Wall to Stairwell	19.2400		19.2400	0.2400	4.6176	110.0000	2116.4000 (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)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6017		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Metal			36.5900			20.0000	731.8000 (32c)
2F - Timber			82.6100			9.0000	743.4900 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11814.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		177.2134 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.1257 (36)
Total fabric heat loss	(33) + (36) =	45.7274 (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	28.8068	28.3390	28.4911	28.1908	28.1908	28.0464	27.9059	27.7693	27.6364	28.0464	27.7693	28.0464 (38)
Heat transfer coeff												
	74.5342	74.0665	74.2185	73.9183	73.9183	73.7739	73.6334	73.4967	73.3639	73.7739	73.4967	73.7739 (39)
Average = Sum(39)m / 12 =												73.8307 (39)
HLP												
HLP (average)	1.1180	1.1109	1.1132	1.1087	1.1087	1.1066	1.1044	1.1024	1.1004	1.1066	1.1024	1.1066 (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)
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	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
								118.1850	118.6764	135.6199	145.4394	156.8815 (64)
								Total per year (kWh/year) = Sum(64)m =				1600.3771 (64)
RHI water heating demand												1600 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9563	0.9435	0.9057	0.8234	0.6846	0.4772	0.3249	0.3387	0.5991	0.8328	0.9293	0.9608 (94)
Useful gains	536.0087	565.9912	590.9000	581.7309	492.3716	346.6641	224.8898	224.2116	369.4205	469.8226	500.6122	513.7523 (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	1030.5759	1006.7656	909.8592	753.8590	555.2092	357.9678	226.7082	226.3062	396.9673	617.1589	831.9038	1012.0487 (97)
Month fractl	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	367.9580	296.2004	237.3056	123.9323	46.7511	0.0000	0.0000	0.0000	0.0000	109.6183	238.5299	370.7325 (98)
Space heating BHI space heating demand												1791.0281 (98) 1791 (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					4.9300
Number of sides sheltered					0.3764 (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) =	0.3481 (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	0.4439	0.4352	0.4265	0.3830	0.3742	0.3307	0.3307	0.3220	0.3481	0.3742	0.3917	0.4091 (22b)
	0.5985	0.5947	0.5909	0.5733	0.5700	0.5547	0.5547	0.5519	0.5606	0.5700	0.5767	0.5837 (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	60.0600	10.7900	49.2700	0.2500	12.3175	60.0000	2956.2000 (29a)
APT Wall to Stairwell	19.2400		19.2400	0.2400	4.6176	110.0000	2116.4000 (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)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6017		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Metal			36.5900			20.0000	731.8000 (32c)
2F - Timber			82.6100			9.0000	743.4900 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11814.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		177.2134 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.1257 (36)
Total fabric heat loss	(33) + (36) =	45.7274 (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	30.4179	30.2235	30.0329	29.1379	28.9704	28.1908	28.1908	28.0464	28.4911	28.9704	29.3092	29.6633 (38)
Heat transfer coeff	76.1453	75.9509	75.7604	74.8653	74.6978	73.9183	73.9183	73.7739	74.2185	74.6978	75.0366	75.3908 (39)
Average = Sum(39)m / 12 =												74.8645 (39)
HLP	1.1421	1.1392	1.1363	1.1229	1.1204	1.1087	1.1087	1.1066	1.1132	1.1204	1.1255	1.1308 (40)
HLP (average)												1.1229 (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	(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	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	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	43.1004	43.2107	43.3194	43.8373	43.9356	44.3990	44.3990	44.4859	44.2193	43.9356	43.7372	43.5318
alpha	3.8734	3.8807	3.8880	3.9225	3.9290	3.9599	3.9599	3.9657	3.9480	3.9290	3.9158	3.9021
util living area	0.9781	0.9684	0.9459	0.8919	0.7900	0.6303	0.4789	0.5201	0.7405	0.9110	0.9659	0.9811 (86)
MIT	19.6478	19.8063	20.0885	20.4530	20.7492	20.9264	20.9807	20.9732	20.8565	20.4803	20.0064	19.6163 (87)
Th 2	19.9666	19.9689	19.9713	19.9822	19.9842	19.9937	19.9937	19.9955	19.9900	19.9842	19.9801	19.9758 (88)
util rest of house	0.9731	0.9613	0.9334	0.8664	0.7409	0.5499	0.3764	0.4164	0.6677	0.8845	0.9569	0.9768 (89)
MIT 2	18.1901	18.4197	18.8243	19.3396	19.7279	19.9375	19.9844	19.9814	19.8670	19.3890	18.7186	18.1510 (90)
Living area fraction									fLA = Living area / (4) =			0.3364 (91)
MIT	18.6805	18.8862	19.2496	19.7142	20.0715	20.2702	20.3196	20.3151	20.1999	19.7562	19.1518	18.6440 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5305	18.7362	19.0996	19.5642	19.9215	20.1202	20.1696	20.1651	20.0499	19.6062	19.0018	18.4940 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9638	0.9502	0.9201	0.8541	0.7375	0.5606	0.3949	0.4346	0.6724	0.8725	0.9457	0.9683 (94)
Useful gains	526.2591	561.3306	585.5552	583.0256	521.4598	385.3014	259.5565	271.4497	394.4431	473.9133	492.6410	507.1371 (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	1083.5895	1050.8707	954.5523	798.3780	614.1278	408.0436	263.8567	277.7663	441.5939	672.7404	893.0738	1077.6351 (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	414.6538	328.9710	274.5339	155.0537	68.9450	0.0000	0.0000	0.0000	0.0000	147.9274	288.3116	424.4505 (98)
Space heating												2102.8468 (98)
Space heating per m2												(98) / (4) = 31.5411 (99)

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													2336.4965 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	414.6538	328.9710	274.5339	155.0537	68.9450	0.0000	0.0000	0.0000	0.0000	147.9274	288.3116	424.4505	(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)	460.7264	365.5233	305.0376	172.2819	76.6055	0.0000	0.0000	0.0000	0.0000	164.3637	320.3462	471.6117	(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	89.0507	88.9806	88.8179	88.4600	87.8338	86.7000	86.7000	86.7000	86.7000	88.3908	88.8658	86.7000	(216)
Fuel for water heating, kWh/month	181.1370	159.2081	166.1860	147.7458	144.4783	128.8453	121.9127	136.3149	136.8816	153.4321	163.6617	176.1032	(219)
Water heating fuel used												1815.9068	(219)
Annual totals kWh/year													
Space heating fuel - main system												2336.4965	(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												4552.5512	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2336.4965	3.4800	81.3101 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1815.9068	3.4800	63.1936 (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			317.2831 (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] =	1.1933 (257)
SAP value		83.3531
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	2336.4965	0.2160	504.6832 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1815.9068	0.2160	392.2359 (264)
Space and water heating			896.9191 (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			857.8304 (272)
CO2 emissions per m2			12.8700 (273)
EI value			89.7063
EI rating			90 (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	$3.48 / 0.8802 = 3.953$, 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					4.9300
Number of sides sheltered					0.3764 (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) =				0.3481 (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												
	0.3655	0.3394	0.3481	0.3307	0.3307	0.3220	0.3133	0.3046	0.2959	0.3220	0.3046	0.3220 (22b)
Effective ac	0.5668	0.5576	0.5606	0.5547	0.5547	0.5519	0.5491	0.5464	0.5438	0.5519	0.5464	0.5519 (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	60.0600	10.7900	49.2700	0.2500	12.3175	60.0000	2956.2000 (29a)
APT Wall to Stairwell	19.2400		19.2400	0.2400	4.6176	110.0000	2116.4000 (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)			145.9700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6017		(33)
E-FC-4			66.6700			70.0000	4666.9000 (32d)
2F - Metal			36.5900			20.0000	731.8000 (32c)
2F - Timber			82.6100			9.0000	743.4900 (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) = 11814.8200 (34)
177.2134 (35)
7.1257 (36)
(33) + (36) = 45.7274 (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	28.8068	28.3390	28.4911	28.1908	28.1908	28.0464	27.9059	27.7693	27.6364	28.0464	27.7693	28.0464 (38)
Heat transfer coeff	74.5342	74.0665	74.2185	73.9183	73.9183	73.7739	73.6334	73.4967	73.3639	73.7739	73.4967	73.7739 (39)
Average = Sum(39)m / 12 =												73.8307 (39)
HLP	1.1180	1.1109	1.1132	1.1087	1.1087	1.1066	1.1044	1.1024	1.1004	1.1066	1.1024	1.1066 (40)
HLP (average)												1.1074 (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)

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	
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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	44.0320	44.3101	44.2193	44.3990	44.3990	44.4859	44.5707	44.6536	44.7345	44.8159	44.8989	44.9814	44.4859	
alpha	3.9355	3.9540	3.9480	3.9599	3.9599	3.9657	3.9714	3.9769	3.9823	3.9877	3.9930	3.9983	3.9657	
util living area	0.9727	0.9633	0.9342	0.8648	0.7412	0.5490	0.4074	0.4240	0.6714	0.8780	0.9537	0.9759	(86)	
MIT	19.7927	19.9196	20.2070	20.5582	20.8240	20.9599	20.9904	20.9891	20.9108	20.6064	20.1690	19.7824	(87)	
Th 2	19.9862	19.9919	19.9900	19.9937	19.9937	19.9955	19.9972	19.9989	20.0005	19.9955	19.9989	19.9955	(88)	
util rest of house	0.9665	0.9551	0.9191	0.8339	0.6835	0.4633	0.3062	0.3194	0.5893	0.8424	0.9414	0.9703	(89)	
MIT 2	18.4126	18.5982	19.0047	19.4888	19.8250	19.9688	19.9935	19.9945	19.9315	19.5653	18.9633	18.4048	(90)	
Living area fraction									fLA = Living area / (4) =			0.3364	(91)	
MIT	18.8769	19.0427	19.4092	19.8485	20.1611	20.3022	20.3289	20.3291	20.2609	19.9155	19.3689	18.8683	(92)	
Temperature adjustment												-0.1500	(93)	
adjusted MIT	18.7269	18.8927	19.2592	19.6985	20.0111	20.1522	20.1789	20.1791	20.1109	19.7655	19.2189	18.7183		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	536.0082	565.9912	590.9000	581.7309	492.3716	346.6641	224.8898	224.2116	369.4205	469.8226	500.6122	513.7523	(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	1030.5759	1006.7656	909.8592	753.8590	555.2092	357.9678	226.7082	226.3062	396.9673	617.1589	831.9038	1012.0487	(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	367.9580	296.2004	237.3056	123.9323	46.7511	0.0000	0.0000	0.0000	0.0000	109.6183	238.5299	370.7325	(98)
Space heating												1791.0281	(98)
Space heating per m2												26.8641	(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													1990.0313 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	367.9580	296.2004	237.3056	123.9323	46.7511	0.0000	0.0000	0.0000	0.0000	109.6183	238.5299	370.7325	(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)	408.8423	329.1116	263.6729	137.7025	51.9457	0.0000	0.0000	0.0000	0.0000	121.7981	265.0332	411.9250	(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	88.9679	88.9052	88.7053	88.2754	87.5644	86.7000	86.7000	86.7000	86.7000	88.1446	88.7209	86.7000	(216)
Fuel for water heating, kWh/month	181.3055	159.3431	166.3971	148.0548	144.9228	128.8453	121.9127	136.3149	136.8816	153.8606	163.9291	176.2855	(219)
Water heating fuel used												1818.0531	(219)
Annual totals kWh/year													
Space heating fuel - main system												1990.0313	(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													4208.2323 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1990.0313	3.9200	78.0092 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1818.0531	3.9200	71.2677 (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			305.1420 (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	1990.0313	0.2160	429.8468 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1818.0531	0.2160	392.6995 (264)
Space and water heating			822.5462 (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			783.4575 (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	1990.0313	1.2200	2427.8382 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1818.0531	1.2200	2218.0248 (264)
Space and water heating			4645.8630 (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			4414.6445 (272)
Primary energy kWh/m2/year			66.2164 (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 90

(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 90

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	£237	£237	£0
Space heating	£179	£179	£0
Water heating	£71	£71	£0
Lighting	£55	£55	£0
Total cost of fuels	£305	£305	£0
Total cost of uses	£305	£305	£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	66 kWh/m²	66 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	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	45.73 (37)
Summer heat loss coefficient	350.66 (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	2.26	2.14	2.03	(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	18.42	20.19	20.09	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			