

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-199				Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	1FF - Det (As)			
Property	97, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB					
SAP Rating		85 B	DER	12.50	TER	16.46
Environmental		92 A	% DER<TER	24.05		
CO ₂ Emissions (t/year)		0.65	DFEE	33.20	TFEE	36.51
General Requirements Compliance		Pass	% DFEE<TFEE	9.06		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 67 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.46 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.50 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)36.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.22 (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
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Hot water controls: No cylinder

Boiler interlock	Yes	OK
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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 m ² , No overhang	
Windows facing North West:	2.58 m ² , No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Door U-value	0.90 W/m ² K
Door U-value	0.71 W/m ² K
Air permeability	3.2 m ³ /m ² h
Photovoltaic array	419.48 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	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					3.2200
Number of sides sheltered					0.3021 (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) =				0.2795 (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												
	0.3563	0.3493	0.3423	0.3074	0.3004	0.2655	0.2655	0.2585	0.2795	0.3004	0.3144	0.3284 (22b)
Effective ac	0.5635	0.5610	0.5586	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.2600	12.2850	60.0000	2835.0000 (29a)
APT Wall to Stairwell	19.4100		19.4100	0.2400	4.6584	110.0000	2135.1000 (29a)
Total net area of external elements Aum (m ²)			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9429		(33)
E-FC-4			67.4900			70.0000	4724.3000 (32d)
E-FC-4			67.4900			70.0000	4724.3000 (32b)
1F - Timber			84.8100			9.0000	763.2900 (32c)
1F - Metal			37.9800			20.0000	759.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15941.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		236.2067 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2792 (36)
Total fabric heat loss	(33) + (36) =	36.2222 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.3541	26.2389	26.1259	25.5951	25.4958	25.0335	25.0335	24.9479	25.2116	25.4958	25.6967	25.9067 (38)
Heat transfer coeff	62.5763	62.4610	62.3480	61.8172	61.7179	61.2557	61.2557	61.1701	61.4337	61.7179	61.9188	62.1289 (39)
Average = Sum(39)m / 12 =												61.8168 (39)
HLP	0.9272	0.9255	0.9238	0.9159	0.9145	0.9076	0.9076	0.9064	0.9103	0.9145	0.9175	0.9206 (40)
HLP (average)												0.9159 (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												2.1837 (42)
Average daily hot water use (litres/day)												86.0624 (43)
Daily hot water use	94.6686	91.2261	87.7836	84.3411	80.8986	77.4561	77.4561	80.8986	84.3411	87.7836	91.2261	94.6686 (44)
Energy conte	140.3908	122.7867	126.7049	110.4644	105.9932	91.4641	84.7549	97.2575	98.4191	114.6980	125.2018	135.9610 (45)
Energy content (annual)												Total = Sum(45)m = 1354.0965 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0586	18.4180	19.0057	16.5697	15.8990	13.7196	12.7132	14.5886	14.7629	17.2047	18.7803	20.3942 (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	21.7345	19.5959	21.6391	20.8774	21.5270	20.7792	21.4386	21.4959	20.8327	21.5928	20.9701	21.7161	(61)
Total heat required for water heating calculated for each month	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(64)
Heat gains from water heating, kWh/month	52.1136	45.7256	47.5392	41.9488	40.6245	35.6066	33.5407	37.7121	37.9325	43.5353	46.8721	50.6361	(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	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6527	16.5672	13.4734	10.2002	7.6248	6.4371	6.9556	9.0411	12.1350	15.4081	17.9835	19.1712	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.3694	193.3553	188.3511	177.6977	164.2498	151.6107	143.1669	141.1811	146.1853	156.8386	170.2866	182.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	(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)	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	(71)
Water heating gains (Table 5)	70.0451	68.0440	63.8967	58.2622	54.6028	49.4536	45.0815	50.6883	52.6841	58.5151	65.1001	68.0592	(72)
Total internal gains	338.8225	336.7216	324.4763	304.9153	285.2326	266.2566	253.9592	259.6657	269.7595	289.5171	312.1255	328.9113	(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	414.9708	469.3384	513.6529	552.2616	574.0988	558.2322	533.2916	507.2276	478.9557	438.1696	403.8631	393.7356 (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	70.7651	70.8957	71.0242	71.6340	71.7493	72.2908	72.2908	72.3919	72.0812	71.7493	71.5165	71.2748	
alpha	5.7177	5.7264	5.7349	5.7756	5.7833	5.8194	5.8194	5.8261	5.8054	5.7833	5.7678	5.7517	
util living area	0.9969	0.9932	0.9827	0.9480	0.8525	0.6729	0.5006	0.5466	0.7963	0.9623	0.9932	0.9977	(86)
MIT	20.0407	20.1800	20.3929	20.6582	20.8712	20.9750	20.9961	20.9937	20.9352	20.6645	20.3004	20.0096	(87)
Th 2	20.1444	20.1459	20.1473	20.1540	20.1552	20.1610	20.1610	20.1621	20.1588	20.1552	20.1527	20.1501	(88)
util rest of house	0.9960	0.9911	0.9773	0.9313	0.8090	0.5963	0.4077	0.4512	0.7283	0.9468	0.9908	0.9970	(89)
MIT 2	18.8577	19.0614	19.3703	19.7494	20.0272	20.1437	20.1594	20.1593	20.1065	19.7650	19.2428	18.8165	(90)
Living area fraction	19.4414	19.6133	19.8749	20.1978	20.4436	20.5539	20.5723	20.5710	20.5154	20.2089	19.7646	19.4052	(91)
MIT	19.4414	19.6133	19.8749	20.1978	20.4436	20.5539	20.5723	20.5710	20.5154	20.2089	19.7646	19.4052	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2914	19.4633	19.7249	20.0478	20.2936	20.4039	20.4223	20.4210	20.3654	20.0589	19.6146	19.2552	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	412.7790	464.1409	500.2690	512.9586	468.9220	345.7215	233.0400	244.0828	357.4634	413.9109	399.2985	392.1585	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	938.1062	909.6406	824.5456	689.1259	530.3798	355.5188	234.1354	245.9644	384.9076	583.7810	774.8883	935.3631	(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	390.8434	299.3758	241.2618	126.8404	45.7246	0.0000	0.0000	0.0000	0.0000	126.3833	270.4246	404.1442	(98)
Space heating												1904.9982	(98)
Space heating per m2												28.2264	(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													2116.6647 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	390.8434	299.3758	241.2618	126.8404	45.7246	0.0000	0.0000	0.0000	0.0000	126.3833	270.4246	404.1442	(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)	434.2705	332.6398	268.0686	140.9338	50.8051	0.0000	0.0000	0.0000	0.0000	140.4259	300.4718	449.0491	(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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(64)
Efficiency of water heater (217)m	89.0067	88.9093	88.7143	88.2904	87.5472	86.7000	86.7000	86.7000	86.7000	88.2570	88.8139	86.7000	(216)
Fuel for water heating, kWh/month	182.1496	160.1437	167.2154	148.7611	145.6588	129.4617	122.4839	136.9705	137.5453	154.4248	164.5822	177.0683	(219)
Water heating fuel used												1826.4654	(219)
Annual totals kWh/year													
Space heating fuel - main system												2116.6647	(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)												329.4133	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4347.5434	(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	2116.6647	0.2160	457.1996 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1826.4654	0.2160	394.5165 (264)
Space and water heating			851.7161 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	329.4133	0.5190	170.9655 (268)
Energy saving/generation technologies			
PV Unit	-419.4847	0.5190	-217.7125 (269)
Total CO2, kg/year			843.8941 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5000 (273)

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

DER		12.5000	ZC1
Total Floor Area		67.4900	
Assumed number of occupants		2.1837	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.8027	ZC2
CO2 emissions from cooking, equation (L16)		2.5398	ZC3
Total CO2 emissions		31.8425	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		31.8425	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	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3911 (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) =	0.3618 (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	0.4613	0.4522	0.4432	0.3980	0.3889	0.3437	0.3437	0.3346	0.3618	0.3889	0.4070	0.4251 (22b)
	0.6064	0.6023	0.5982	0.5792	0.5756	0.5591	0.5591	0.5560	0.5654	0.5756	0.5828	0.5904 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.1800	8.5050		(29a)
APT Wall to Stairwell	19.4100		19.4100	0.1800	3.4938		(29a)
Total net area of external elements Aum(A, m ²)			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.6131		(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)							7.2612 (36)
Total fabric heat loss						(33) + (36) =	32.8743 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	28.3610	28.1678	27.9784	27.0888	26.9224	26.1476	26.1476
Heat transfer coeff	61.2353	61.0421	60.8527	59.9632	59.7967	59.0220	59.0220
Average = Sum(39)m / 12 =							
HLP	0.9073	0.9045	0.9017	0.8885	0.8860	0.8745	0.8745
HLP (average)						0.8724	0.8724
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1837 (42)
Average daily hot water use (litres/day)												86.0624 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6686	91.2261	87.7836	84.3411	80.8986	77.4561	77.4561	80.8986	84.3411	87.7836	91.2261	94.6686 (44)
Energy conte	140.3908	122.7867	126.7049	110.4644	105.9932	91.4641	84.7549	97.2575	98.4191	114.6980	125.2018	135.9610 (45)
Energy content (annual)										Total = Sum(45)m =		1354.0965 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0586	18.4180	19.0057	16.5697	15.8990	13.7196	12.7132	14.5886	14.7629	17.2047	18.7803	20.3942 (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	48.2421	41.9890	44.7336	41.5929	41.2251	38.1976	39.4708	41.2251	41.5929	44.7336	44.9882	48.2421 (61)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month												
	188.6329	164.7757	171.4385	152.0573	147.2183	129.6616	124.2257	138.4826	140.0120	159.4315	170.1900	184.2031 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
	188.6329	164.7757	171.4385	152.0573	147.2183	129.6616	124.2257	138.4826	140.0120	159.4315	170.1900	184.2031 (64)
Total per year (kWh/year) = Sum (64)m =												1870.3293 (64)
Heat gains from water heating, kWh/month												
	58.7405	51.3238	53.3128	47.1276	45.5490	39.9612	38.0487	42.6444	43.1226	49.3205	52.8767	57.2676 (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	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.6527	16.5672	13.4734	10.2002	7.6248	6.4371	6.9556	9.0411	12.1350	15.4081	17.9835	19.1712 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	191.3694	193.3553	188.3511	177.6977	164.2498	151.6107	143.1669	141.1811	146.1853	156.8386	170.2866	182.9257 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184 (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)												
	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472 (71)
Water heating gains (Table 5)												
	78.9523	76.3748	71.6570	65.4551	61.2218	55.5017	51.1407	57.3177	59.8925	66.2909	73.4398	76.9725 (72)
Total internal gains												
	347.7296	345.0524	332.2366	312.1082	291.8516	272.3047	260.0184	266.2952	276.9679	297.2929	320.4651	337.8246 (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		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
Total gains							
	425.1061	479.8082	524.4643	563.4439	585.3769	568.9895	543.8561

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	76.5376	76.7799	77.0189	78.1614	78.3790	79.4078	79.4078	79.6013	79.0083	78.3790	77.9401	77.4865
alpha	6.1025	6.1187	6.1346	6.2108	6.2253	6.2939	6.2939	6.3068	6.2672	6.2253	6.1960	6.1658
util living area												
	0.9972	0.9936	0.9829	0.9446	0.8385	0.6460	0.4751	0.5188	0.7748	0.9598	0.9935	0.9980 (86)
MIT												
	20.1284	20.2628	20.4653	20.7175	20.9046	20.9851	20.9981	20.9968	20.9560	20.7200	20.3795	20.1052 (87)
Th 2												
	20.1613	20.1637	20.1661	20.1773	20.1794	20.1892	20.1892	20.1910	20.1854	20.1794	20.1752	20.1707 (88)
util rest of house												
	0.9964	0.9916	0.9773	0.9266	0.7928	0.5717	0.3889	0.4298	0.7052	0.9430	0.9910	0.9973 (89)
MIT 2												
	18.9933	19.1909	19.4850	19.8475	20.0874	20.1794	20.1885	20.1897	20.1516	19.8582	19.3703	18.9668 (90)
Living area fraction												
	19.5534	19.7198	19.9687	20.2767	20.4906	20.5770	20.5879	20.5879	20.5485	20.2834	19.8682	19.5285 (92)
Temperature adjustment												
	19.5534	19.7198	19.9687	20.2767	20.4906	20.5770	20.5879	20.5879	20.5485	20.2834	19.8682	19.5285 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9902	0.9757	0.9291	0.8112	0.6080	0.4315	0.4738	0.7377	0.9455	0.9899	0.9966 (94)
Useful gains	423.2000	475.1040	511.7276	523.4730	474.8718	345.9463	234.6888	245.3735	361.1467	423.9089	409.4989	402.3379 (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												
	934.0443	904.6312	819.6064	682.1857	525.6516	352.7714	235.3763	246.5778	382.5291	579.0360	767.7981	927.1513 (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												
	380.0682	288.6423	229.0619	114.2731	37.7801	0.0000	0.0000	0.0000	0.0000	115.4145	257.9755	390.4612 (98)
Space heating												
												1813.6768 (98)
Space heating per m2												26.8733 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1941.8381 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	380.0682	288.6423	229.0619	114.2731	37.7801	0.0000	0.0000	0.0000	0.0000	115.4145	257.9755	390.4612	(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)	406.9253	309.0389	245.2483	122.3481	40.4498	0.0000	0.0000	0.0000	0.0000	123.5701	276.2050	418.0526	(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	188.6329	164.7757	171.4385	152.0573	147.2183	129.6616	124.2257	138.4826	140.0120	159.4315	170.1900	184.2031	(64)
Efficiency of water heater	86.7796	86.4485	85.7815	84.3432	82.1749	80.3000	80.3000	80.3000	80.3000	84.2528	86.0956	86.8966	(217)
Fuel for water heating, kWh/month	217.3701	190.6056	199.8549	180.2840	179.1523	161.4715	154.7020	172.4565	174.3611	189.2299	197.6755	211.9797	(219)
Water heating fuel used												2229.1433	(219)
Annual totals kWh/year													
Space heating fuel - main system												1941.8381	(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)												329.4133	(232)
Total delivered energy for all uses												4575.3947	(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	1941.8381	0.2160	419.4370 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2229.1433	0.2160	481.4949 (264)
Space and water heating			900.9320 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	329.4133	0.5190	170.9655 (268)
Total CO2, kg/m2/year			1110.8225 (272)
Emissions per m2 for space and water heating			13.3491 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5332 (272b)
Emissions per m2 for pumps and fans			0.5768 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3491 * 1.00) + 2.5332 + 0.5768, rounded to 2 d.p.			16.4600 (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	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					3.2200
Number of sides sheltered					0.3021 (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) =				0.2795 (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	0.3563	0.3493	0.3423	0.3074	0.3004	0.2655	0.2655	0.2585	0.2795	0.3004	0.3144	0.3284 (22b)
Effective ac	0.5635	0.5610	0.5586	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.2600	12.2850	60.0000	2835.0000 (29a)
APT Wall to Stairwell	19.4100		19.4100	0.2400	4.6584	110.0000	2135.1000 (29a)
Total net area of external elements Aum (m ²)			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9429		(33)
E-FC-4			67.4900			70.0000	4724.3000 (32d)
E-FC-4			67.4900			30.0000	2024.7000 (32b)
1F - Timber			84.8100			9.0000	763.2900 (32c)
1F - Metal			37.9800			20.0000	759.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13241.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		196.2067 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2792 (36)
Total fabric heat loss	(33) + (36) =	36.2222 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.3541	26.2389	26.1259	25.5951	25.4958	25.0335	25.0335	24.9479	25.2116	25.4958	25.6967	25.9067 (38)
Heat transfer coeff	62.5763	62.4610	62.3480	61.8172	61.7179	61.2557	61.2557	61.1701	61.4337	61.7179	61.9188	62.1289 (39)
Average = Sum(39)m / 12 =												61.8168 (39)
HLP	0.9272	0.9255	0.9238	0.9159	0.9145	0.9076	0.9076	0.9064	0.9103	0.9145	0.9175	0.9206 (40)
HLP (average)												0.9159 (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												2.1837 (42)
Average daily hot water use (litres/day)												86.0624 (43)
Daily hot water use	94.6686	91.2261	87.7836	84.3411	80.8986	77.4561	77.4561	80.8986	84.3411	87.7836	91.2261	94.6686 (44)
Energy conte	140.3908	122.7867	126.7049	110.4644	105.9932	91.4641	84.7549	97.2575	98.4191	114.6980	125.2018	135.9610 (45)
Energy content (annual)												Total = Sum(45)m = 1354.0965 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	29.8331	26.0922	26.9248	23.4737	22.5236	19.4361	18.0104	20.6672	20.9141	24.3733	26.6054	28.8917	(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	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6527	16.5672	13.4734	10.2002	7.6248	6.4371	6.9556	9.0411	12.1350	15.4081	17.9835	19.1712	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.3694	193.3553	188.3511	177.6977	164.2498	151.6107	143.1669	141.1811	146.1853	156.8386	170.2866	182.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	(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)	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	(71)
Water heating gains (Table 5)	40.0982	38.8276	36.1892	32.6023	30.2736	26.9946	24.2076	27.7785	29.0473	32.7598	36.9519	38.8330	(72)
Total internal gains	305.8756	304.5053	293.7688	276.2555	257.9034	240.7976	230.0853	233.7559	243.1228	260.7618	280.9772	296.6850	(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	382.0238	437.1221	482.9454	523.6017	546.7696	532.7732	509.4176	481.3178	452.3189	409.4143	372.7149	361.5094	(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	58.7815	58.8900	58.9968	59.5033	59.5990	60.0488	60.0488	60.1329	59.8748	59.5990	59.4057	59.2049	
alpha	4.9188	4.9260	4.9331	4.9669	4.9733	5.0033	5.0033	5.0089	4.9917	4.9733	4.9604	4.9470	
util living area	0.9955	0.9906	0.9783	0.9421	0.8521	0.6861	0.5185	0.5674	0.8049	0.9585	0.9910	0.9965	(86)
MIT	19.8281	19.9901	20.2386	20.5498	20.8089	20.9530	20.9905	20.9853	20.8942	20.5589	20.1319	19.7931	(87)
Th 2	20.1444	20.1459	20.1473	20.1540	20.1552	20.1610	20.1610	20.1621	20.1588	20.1552	20.1527	20.1501	(88)
util rest of house	0.9943	0.9882	0.9726	0.9261	0.8126	0.6130	0.4247	0.4719	0.7430	0.9439	0.9883	0.9957	(89)
MIT 2	19.0662	19.2282	19.4748	19.7814	20.0181	20.1361	20.1578	20.1568	20.0948	19.7957	19.3755	19.0359	(90)
Living area fraction									fLA = Living area / (4) =			0.4934	(91)
MIT	19.4421	19.6041	19.8516	20.1605	20.4083	20.5392	20.5687	20.5656	20.4892	20.1723	19.7487	19.4095	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4421	19.6041	19.8516	20.1605	20.4083	20.5392	20.5687	20.5656	20.4892	20.1723	19.7487	19.4095	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9931	0.9863	0.9702	0.9263	0.8254	0.6471	0.4710	0.5189	0.7690	0.9442	0.9867	0.9947	(94)
Ext temp.	379.3968	431.1382	468.5563	485.0043	451.2801	344.7711	239.9282	249.7399	347.8480	386.5716	367.7450	359.5782	(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	947.5370	918.4357	832.4481	696.0955	537.4586	363.8085	243.1036	254.8092	392.5124	590.7827	783.1925	944.9498	(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 per m2	422.6963	327.4639	270.7355	151.9857	64.1168	0.0000	0.0000	0.0000	0.0000	151.9331	299.1222	435.5165	(98)
												2123.5700	(98)
												31.4650	(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	575.8033	453.2919	464.8925	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9052	0.9509	0.9368	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	521.2211	431.0224	435.5318	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	704.6016	675.7302	644.4168	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	132.0339	182.0626	155.4104	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												469.5069 (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	33.0085	45.5156	38.8526	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												117.3767 (107)
Space cooling per m2												1.7392 (108)
Energy for space heating												31.4650 (99)
Energy for space cooling												1.7392 (108)
Total												33.2041 (109)
Dwelling Fabric Energy Efficiency (DFEE)												33.2 (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	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3911 (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) =				0.3618 (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	0.4613	0.4522	0.4432	0.3980	0.3889	0.3437	0.3437	0.3346	0.3618	0.3889	0.4070	0.4251 (22b)
Effective ac	0.6064	0.6023	0.5982	0.5792	0.5756	0.5591	0.5591	0.5560	0.5654	0.5756	0.5828	0.5904 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.1800	8.5050		(29a)
APT Wall to Stairwell	19.4100		19.4100	0.1800	3.4938		(29a)
Total net area of external elements Aum(A, m ²)			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.6131		(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)							7.2612 (36)
Total fabric heat loss						(33) + (36) =	32.8743 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	28.3610	28.1678	27.9784	27.0888	26.9224	26.1476	26.1476
Heat transfer coeff	61.2353	61.0421	60.8527	59.9632	59.7967	59.0220	59.0220
Average = Sum(39)m / 12 =							
HLP	0.9073	0.9045	0.9017	0.8885	0.8860	0.8745	0.8745
HLP (average)						0.8724	0.8724
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1837 (42)
Average daily hot water use (litres/day)												86.0624 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6686	91.2261	87.7836	84.3411	80.8986	77.4561	77.4561	80.8986	84.3411	87.7836	91.2261	94.6686 (44)
Energy content (annual)	140.3908	122.7867	126.7049	110.4644	105.9932	91.4641	84.7549	97.2575	98.4191	114.6980	125.2018	135.9610 (45)
Distribution loss	Total = Sum(45)m = 1354.0965 (45)											
$(46)m = 0.15 \times (45)m$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
29.8331 26.0922 26.9248 23.4737 22.5236 19.4361 18.0104 20.6672 20.9141 24.3733 26.6054 28.8917 (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	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	109.1840	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.6527	16.5672	13.4734	10.2002	7.6248	6.4371	6.9556	9.0411	12.1350	15.4081	17.9835	19.1712	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.3694	193.3553	188.3511	177.6977	164.2498	151.6107	143.1669	141.1811	146.1853	156.8386	170.2866	182.9257	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	33.9184	(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)	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	(71)
Water heating gains (Table 5)	40.0982	38.8276	36.1892	32.6023	30.2736	26.9946	24.2076	27.7785	29.0473	32.7598	36.9519	38.8330	(72)
Total internal gains	305.8756	304.5053	293.7688	276.2555	257.9034	240.7976	230.0853	233.7559	243.1228	260.7618	280.9772	296.6850	(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				6.0900	36.7938	0.6300	0.7000	0.7700	68.4801
Northwest				2.5800	11.2829	0.6300	0.7000	0.7700	8.8964
Solar gains	77.3765	134.7557	192.2278	251.3357	293.5254	296.6849	283.8377	251.5548	212.5703
Total gains	383.2520	439.2610	485.9966	527.5912	551.4288	537.4825	513.9229	485.3107	455.6931

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	76.5376	76.7799	77.0189	78.1614	78.3790	79.4078	79.4078	79.6013	79.0083	78.3790	77.9401	77.4865	
alpha	6.1025	6.1187	6.1346	6.2108	6.2253	6.2939	6.2939	6.3068	6.2672	6.2253	6.1960	6.1658	
util living area	0.9984	0.9960	0.9883	0.9581	0.8652	0.6782	0.5019	0.5518	0.8121	0.9727	0.9962	0.9989	(86)
MIT	20.0683	20.2057	20.4140	20.6784	20.8845	20.9807	20.9974	20.9955	20.9425	20.6764	20.3237	20.0458	(87)
Th 2	20.1613	20.1637	20.1661	20.1773	20.1794	20.1892	20.1892	20.1910	20.1854	20.1794	20.1752	20.1707	(88)
util rest of house	0.9979	0.9947	0.9843	0.9435	0.8230	0.6025	0.4113	0.4581	0.7453	0.9603	0.9947	0.9985	(89)
MIT 2	19.3040	19.4429	19.6512	19.9166	20.1016	20.1803	20.1885	20.1897	20.1542	19.9202	19.5705	19.2895	(90)
Living area fraction									fLA = Living area / (4) =			0.4934	(91)
MIT	19.6811	19.8193	20.0276	20.2925	20.4879	20.5752	20.5876	20.5873	20.5432	20.2933	19.9421	19.6627	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6811	19.8193	20.0276	20.2925	20.4879	20.5752	20.5876	20.5873	20.5432	20.2933	19.9421	19.6627	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9940	0.9835	0.9458	0.8400	0.6395	0.4561	0.5045	0.7765	0.9623	0.9942	0.9982	(94)
Useful gains	382.3095	436.6205	477.9568	499.0152	463.1966	343.7033	234.4192	244.8354	353.8303	396.3012	372.0166	361.9104	(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	941.8660	910.7036	823.1889	683.1293	525.4865	352.6683	235.3579	246.5412	382.2109	579.6282	772.2402	935.2663	(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	416.3100	318.5839	256.8527	132.5621	46.3437	0.0000	0.0000	0.0000	0.0000	136.3953	288.1610	426.5768	(98)
Space heating												2021.7855	(98)
Space heating per m2												29.9568	(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	554.8065	436.7626	447.4765	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9446	0.9772	0.9681	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	524.0551	426.8043	433.2234	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	710.1059	680.9962	649.0838	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	133.9566	189.1187	160.6001	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												483.6754	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.4891	47.2797	40.1500	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.9189 (107)
Space cooling per m2												1.7917 (108)
Energy for space heating												29.9568 (99)
Energy for space cooling												1.7917 (108)
Total												31.7485 (109)
Target Fabric Energy Efficiency (TFEE)												36.5 (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	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					3.2200
Number of sides sheltered					0.3021 (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) =				0.2795 (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												
	0.2934	0.2725	0.2795	0.2655	0.2655	0.2585	0.2515	0.2445	0.2375	0.2585	0.2445	0.2585 (22b)
Effective ac	0.5431	0.5371	0.5390	0.5352	0.5352	0.5334	0.5316	0.5299	0.5282	0.5334	0.5299	0.5334 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.2600	12.2850	60.0000	2835.0000 (29a)
APT Wall to Stairwell	19.4100		19.4100	0.2400	4.6584	110.0000	2135.1000 (29a)
Total net area of external elements Aum (m ²)			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9429		(33)
E-FC-4			67.4900			70.0000	4724.3000 (32d)
E-FC-4			67.4900			70.0000	4724.3000 (32b)
1F - Timber			84.8100			9.0000	763.2900 (32c)
1F - Metal			37.9800			20.0000	759.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15941.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		236.2067 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2792 (36)
Total fabric heat loss	(33) + (36) =	36.2222 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	25.3988	25.1214	25.2116	25.0335	25.0335	24.9479	24.8646	24.7835	24.7048	24.9479	24.7835	24.9479 (38)
Heat transfer coeff	61.6209	61.3436	61.4337	61.2557	61.2557	61.1701	61.0867	61.0057	60.9269	61.1701	61.0057	61.1701 (39)
Average = Sum(39)m / 12 =												61.2037 (39)
HLP	0.9130	0.9089	0.9103	0.9076	0.9076	0.9064	0.9051	0.9039	0.9028	0.9064	0.9039	0.9064 (40)
HLP (average)												0.9069 (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												2.1837 (42)
Average daily hot water use (litres/day)												86.0624 (43)
Daily hot water use	94.6686	91.2261	87.7836	84.3411	80.8986	77.4561	77.4561	80.8986	84.3411	87.7836	91.2261	94.6686 (44)
Energy conte	140.3908	122.7867	126.7049	110.4644	105.9932	91.4641	84.7549	97.2575	98.4191	114.6980	125.2018	135.9610 (45)
Energy content (annual)												Total = Sum(45)m = 1354.0965 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0586	18.4180	19.0057	16.5697	15.8990	13.7196	12.7132	14.5886	14.7629	17.2047	18.7803	20.3942 (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	21.7345	19.5959	21.6391	20.8774	21.5270	20.7792	21.4386	21.4959	20.8327	21.5928	20.9701	21.7161	(61)
Total heat required for water heating calculated for each month	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	52.1136	45.7256	47.5392	41.9488	40.6245	35.6066	33.5407	37.7121	37.9325	43.5353	46.8721	50.6361	(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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	46.6319	41.4180	33.6834	25.5005	19.0619	16.0929	17.3889	22.6028	30.3374	38.5203	44.9589	47.9279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	285.6260	288.5899	281.1210	265.2205	245.1490	226.2846	213.6820	210.7181	218.1870	234.0875	254.1591	273.0235	(69)
Pumps, fans	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	(70)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(71)
Water heating gains (Table 5)	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	(72)
Total internal gains	70.0451	68.0440	63.8967	58.2622	54.6028	49.4536	45.0815	50.6883	52.6841	58.5151	65.1001	68.0592	(73)
	499.2624	495.0113	475.6605	445.9425	415.7731	388.7904	373.1118	380.9685	398.1678	428.0823	461.1774	485.9699	(74)

6. Solar gains

[Jan]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
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	593.3547	634.7171	677.4798	713.2955	714.1139	717.0363	684.4120	662.5134	634.5103	597.2741	574.2064	564.6876	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	71.8623	72.1872	72.0812	72.2908	72.2908	72.3919	72.4907	72.5870	72.6808	72.3919	72.5870	72.3919		
util living area	5.7908	5.8125	5.8054	5.8194	5.8194	5.8261	5.8327	5.8391	5.8454	5.8261	5.8391	5.8261		
	0.9789	0.9679	0.9338	0.8480	0.6936	0.4825	0.3476	0.3585	0.5919	0.8462	0.9544	0.9824	(86)	
MIT	20.3733	20.4682	20.6533	20.8481	20.9613	20.9959	20.9995	20.9994	20.9873	20.8751	20.6166	20.3531	(87)	
Th 2	20.1564	20.1599	20.1588	20.1610	20.1610	20.1621	20.1631	20.1642	20.1652	20.1621	20.1642	20.1621	(88)	
util rest of house	0.9731	0.9595	0.9170	0.8132	0.6364	0.4133	0.2733	0.2820	0.5190	0.8036	0.9407	0.9775	(89)	
MIT 2	19.3470	19.4842	19.7409	19.9979	20.1279	20.1598	20.1630	20.1640	20.1569	20.0369	19.6991	19.3230	(90)	
Living area fraction	19.8534	19.9697	20.1911	20.4174	20.5391	20.5723	20.5757	20.5762	20.5666	20.4505	20.1518	19.8313	(92)	
MIT	19.8534	19.9697	20.1911	20.4174	20.5391	20.5723	20.5757	20.5762	20.5666	20.4505	20.1518	19.8313	(92)	
Temperature adjustment	19.7034	19.8197	20.0411	20.2674	20.3891	20.4223	20.4257	20.4262	20.4166	20.3005	20.0018	19.6813	(93)	
adjusted MIT	19.7034	19.8197	20.0411	20.2674	20.3891	20.4223	20.4257	20.4262	20.4166	20.3005	20.0018	19.6813	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9694	0.9555	0.9143	0.8180	0.6525	0.4350	0.2967	0.3061	0.5414	0.8112	0.9376	0.9740	(94)
Ext temp.	575.1874	606.4518	619.4231	583.4429	465.9451	311.9090	203.0381	202.7758	343.5024	484.5253	538.3698	550.0257	(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	912.1973	890.6884	801.1605	659.5648	483.2521	313.3324	203.1579	202.9164	348.2971	544.4436	738.2777	898.0537	(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)
RHI space heating demand	250.7354	191.0070	135.2126	54.8078	12.8764	0.0000	0.0000	0.0000	0.0000	44.5793	143.9337	258.9328	(98)
												1092.0850	(98)
												1092	(98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					3.2200
Number of sides sheltered					0.3021 (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) =	0.2795 (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												
	0.3563	0.3493	0.3423	0.3074	0.3004	0.2655	0.2655	0.2585	0.2795	0.3004	0.3144	0.3284 (22b)
Effective ac	0.5635	0.5610	0.5586	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.2600	12.2850	60.0000	2835.0000 (29a)
APT Wall to Stairwell	19.4100		19.4100	0.2400	4.6584	110.0000	2135.1000 (29a)
Total net area of external elements Aum (A, m ²)			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9429		(33)
E-FC-4			67.4900			70.0000	4724.3000 (32d)
E-FC-4			67.4900			70.0000	4724.3000 (32b)
1F - Timber			84.8100			9.0000	763.2900 (32c)
1F - Metal			37.9800			20.0000	759.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15941.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		236.2067 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2792 (36)
Total fabric heat loss	(33) + (36) =	36.2222 (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	26.3541	26.2389	26.1259	25.5951	25.4958	25.0335	25.0335	24.9479	25.2116	25.4958	25.6967	25.9067 (38)
Heat transfer coeff	62.5763	62.4610	62.3480	61.8172	61.7179	61.2557	61.2557	61.1701	61.4337	61.7179	61.9188	62.1289 (39)
Average = Sum(39)m / 12 =												61.8168 (39)
HLP	0.9272	0.9255	0.9238	0.9159	0.9145	0.9076	0.9076	0.9064	0.9103	0.9145	0.9175	0.9206 (40)
HLP (average)												0.9159 (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												2.1837 (42)
Average daily hot water use (litres/day)												86.0624 (43)
Daily hot water use	94.6686	91.2261	87.7836	84.3411	80.8986	77.4561	77.4561	80.8986	84.3411	87.7836	91.2261	94.6686 (44)
Energy conte	140.3908	122.7867	126.7049	110.4644	105.9932	91.4641	84.7549	97.2575	98.4191	114.6980	125.2018	135.9610 (45)
Energy content (annual)												Total = Sum(45)m = 1354.0965 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0586	18.4180	19.0057	16.5697	15.8990	13.7196	12.7132	14.5886	14.7629	17.2047	18.7803	20.3942 (46)

FULL SAP CALCULATION PRINTOUT

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	21.7345	19.5959	21.6391	20.8774	21.5270	20.7792	21.4386	21.4959	20.8327	21.5928	20.9701	(61)
Total heat required for water heating calculated for each month	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771 (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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771 (64)
Heat gains from water heating, kWh/month	52.1136	45.7256	47.5392	41.9488	40.6245	35.6066	33.5407	37.7121	37.9325	43.5353	46.8721	50.6361 (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	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.6319	41.4180	33.6834	25.5005	19.0619	16.0929	17.3889	22.6028	30.3374	38.5203	44.9589	47.9279	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.6260	288.5899	281.1210	265.2205	245.1490	226.2846	213.6820	210.7181	218.1870	234.0875	254.1591	273.0235	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	(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)	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	(71)
Water heating gains (Table 5)	70.0451	68.0440	63.8967	58.2622	54.6028	49.4536	45.0815	50.6883	52.6841	58.5151	65.1001	68.0592	(72)
Total internal gains	499.2624	495.0113	475.6605	445.9425	415.7731	388.7904	373.1118	380.9685	398.1678	428.0823	461.1774	485.9699	(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	575.4106	627.6280	664.8370	693.2888	704.6393	680.7660	652.4441	628.5304	607.3640	576.7348	552.9151	550.7943 (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	70.7651	70.8957	71.0242	71.6340	71.7493	72.2908	72.2908	72.3919	72.0812	71.7493	71.5165	71.2748	
alpha	5.7177	5.7264	5.7349	5.7756	5.7833	5.8194	5.8194	5.8261	5.8054	5.7833	5.7678	5.7517	
util living area	0.9849	0.9736	0.9480	0.8827	0.7532	0.5658	0.4117	0.4454	0.6693	0.8941	0.9707	0.9879	(86)
MIT	20.2732	20.4003	20.5837	20.7929	20.9341	20.9895	20.9986	20.9978	20.9735	20.8077	20.5068	20.2398	(87)
Th 2	20.1444	20.1459	20.1473	20.1540	20.1552	20.1610	20.1610	20.1621	20.1588	20.1552	20.1527	20.1501	(88)
util rest of house	0.9808	0.9667	0.9344	0.8539	0.7017	0.4959	0.3340	0.3655	0.5985	0.8619	0.9617	0.9846	(89)
MIT 2	19.1939	19.3766	19.6359	19.9227	20.0941	20.1542	20.1605	20.1612	20.1393	19.9485	19.5362	19.1502	(90)
Living area fraction	19.7264	19.8817	20.1036	20.3520	20.5085	20.5664	20.5740	20.5740	20.5509	20.3725	20.0151	0.4934	(91)
MIT	19.7264	19.8817	20.1036	20.3520	20.5085	20.5664	20.5740	20.5740	20.5509	20.3725	20.0151	19.6878	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.5764	19.7317	19.9536	20.2020	20.3585	20.4164	20.4240	20.4240	20.4009	20.2225	19.8651	19.5378	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	562.4076	604.1428	618.8720	593.2342	503.5860	352.3144	233.8547	245.5092	376.3171	498.7427	529.6946	540.6113	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	955.9430	926.4009	838.8041	698.6609	534.3869	356.2850	234.2419	246.1461	387.0893	593.8789	790.3995	952.9210	(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	292.7903	216.5575	163.6294	75.9073	22.9159	0.0000	0.0000	0.0000	0.0000	70.7813	187.7076	306.7584	(98)
Space heating												1337.0477	(98)
Space heating per m2												(98) / (4) =	19.8110 (99)

8c. Space cooling requirement

Not applicable

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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												1485.6086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	292.7903	216.5575	163.6294	75.9073	22.9159	0.0000	0.0000	0.0000	0.0000	70.7813	187.7076	306.7584 (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)	325.3226	240.6194	181.8105	84.3414	25.4621	0.0000	0.0000	0.0000	0.0000	78.6459	208.5640	340.8427 (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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771 (64)
Efficiency of water heater (217)m	88.7955	88.6614	88.4001	87.8802	87.1870	86.7000	86.7000	86.7000	86.7000	87.8004	88.5249	86.7000 (216)
Fuel for water heating, kWh/month	182.5829	160.5915	167.8099	149.4556	146.2607	129.4617	122.4839	136.9705	137.5453	155.2278	165.1195	177.4607 (219)
Water heating fuel used												1830.9701 (219)
Annual totals kWh/year												
Space heating fuel - main system												1485.6086 (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)												329.4133 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												3720.9919 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1485.6086	3.4800	51.6992 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1830.9701	3.4800	63.7178 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	329.4133	13.1900	43.4496 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			288.7591 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0781 (257)
SAP value		84.9601
SAP rating (Section 12)		85 (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	1485.6086	0.2160	320.8914 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1830.9701	0.2160	395.4895 (264)
Space and water heating			716.3810 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	329.4133	0.5190	170.9655 (268)
Energy saving/generation technologies			
PV Unit	-419.4847	0.5190	-217.7125 (269)
Total kg/year			708.5590 (272)
CO2 emissions per m2			10.5000 (273)
EI value			91.5595
EI rating			92 (274)
EI band			A

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	$3.48 / 0.8774 = 3.966$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8774 = 0.2462$, 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	67.4900 (1b)	x 2.1000 (2b)	= 141.7290 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 141.7290 (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) = 0.1411 (8)
Measured/design AP50					Yes
Infiltration rate					3.2200
Number of sides sheltered					0.3021 (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) =				0.2795 (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												
	0.2934	0.2725	0.2795	0.2655	0.2655	0.2585	0.2515	0.2445	0.2375	0.2585	0.2445	0.2585 (22b)
Effective ac	0.5431	0.5371	0.5390	0.5352	0.5352	0.5334	0.5316	0.5299	0.5282	0.5334	0.5299	0.5334 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	58.0400	10.7900	47.2500	0.2600	12.2850	60.0000	2835.0000 (29a)
APT Wall to Stairwell	19.4100		19.4100	0.2400	4.6584	110.0000	2135.1000 (29a)
Total net area of external elements Aum, m ²			77.4500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.9429		(33)
E-FC-4			67.4900			70.0000	4724.3000 (32d)
E-FC-4			67.4900			70.0000	4724.3000 (32b)
1F - Timber			84.8100			9.0000	763.2900 (32c)
1F - Metal			37.9800			20.0000	759.6000 (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) =	15941.5900 (34)
	236.2067 (35)
	6.2792 (36)
(33) + (36) =	36.2222 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	25.3988
Heat transfer coeff	61.6209
Average = Sum(39)m / 12 =	61.2037 (39)
HLP	0.9130
HLP (average)	0.9069 (40)
Days in month	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.1837 (42)
Average daily hot water use (litres/day)		86.0624 (43)
Daily hot water use	94.6686	94.6686 (44)
Energy conte	140.3908	135.9610 (45)
Energy content (annual)	122.7867	125.2018
Distribution loss (46)m = 0.15 x (45)m	21.0586	20.3942 (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	21.7345	19.5959	21.6391	20.8774	21.5270	20.7792	21.4386	21.4959	20.8327	21.5928	20.9701	21.7161	(61)
Total heat required for water heating calculated for each month	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(64)
Heat gains from water heating, kWh/month	52.1136	45.7256	47.5392	41.9488	40.6245	35.6066	33.5407	37.7121	37.9325	43.5353	46.8721	50.6361	(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	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	131.0208	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.6319	41.4180	33.6834	25.5005	19.0619	16.0929	17.3889	22.6028	30.3374	38.5203	44.9589	47.9279	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.6260	288.5899	281.1210	265.2205	245.1490	226.2846	213.6820	210.7181	218.1870	234.0875	254.1591	273.0235	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	50.2858	(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)	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	-87.3472	(71)
Water heating gains (Table 5)	70.0451	68.0440	63.8967	58.2622	54.6028	49.4536	45.0815	50.6883	52.6841	58.5151	65.1001	68.0592	(72)
Total internal gains	499.2624	495.0113	475.6605	445.9425	415.7731	388.7904	373.1118	380.9685	398.1678	428.0823	461.1774	485.9699	(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	593.3547	634.7171	677.4798	713.2955	714.1139	717.0363	684.4120	662.5134	634.5103	597.2741	574.2064	564.6876 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	71.8623	72.1872	72.0812	72.2908	72.2908	72.3919	72.4907	72.5870	72.6808	72.3919	72.5870	72.3919		
alpha	5.7908	5.8125	5.8054	5.8194	5.8194	5.8261	5.8327	5.8391	5.8454	5.8261	5.8391	5.8261		
util living area	0.9789	0.9679	0.9338	0.8480	0.6936	0.4825	0.3476	0.3585	0.5919	0.8462	0.9544	0.9824	(86)	
MIT	20.3733	20.4682	20.6533	20.8481	20.9613	20.9959	20.9995	20.9994	20.9873	20.8751	20.6166	20.3531	(87)	
Th 2	20.1564	20.1599	20.1588	20.1610	20.1610	20.1621	20.1631	20.1642	20.1652	20.1621	20.1642	20.1621	(88)	
util rest of house	0.9731	0.9595	0.9170	0.8132	0.6364	0.4133	0.2733	0.2820	0.5190	0.8036	0.9407	0.9775	(89)	
MIT 2	19.3470	19.4842	19.7409	19.9979	20.1279	20.1598	20.1630	20.1640	20.1569	20.0369	19.6991	19.3230	(90)	
Living area fraction	19.8534	19.9697	20.1911	20.4174	20.5391	20.5723	20.5757	20.5762	20.5666	20.4505	20.1518	19.8313	(91)	
MIT	19.8534	19.9697	20.1911	20.4174	20.5391	20.5723	20.5757	20.5762	20.5666	20.4505	20.1518	19.8313	(92)	
Temperature adjustment	19.7034	19.8197	20.0411	20.2674	20.3891	20.4223	20.4257	20.4262	20.4166	20.3005	20.0018	-0.1500		
adjusted MIT	19.7034	19.8197	20.0411	20.2674	20.3891	20.4223	20.4257	20.4262	20.4166	20.3005	20.0018	19.6813	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	575.1874	606.4518	619.4231	583.4429	465.9451	311.9090	203.0381	202.7758	343.5024	484.5253	538.3698	550.0257	(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	912.1973	890.6884	801.1605	659.5648	483.2521	313.3324	203.1579	202.9164	348.2971	544.4436	738.2777	898.0537	(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	250.7354	191.0070	135.2126	54.8078	12.8764	0.0000	0.0000	0.0000	0.0000	44.5793	143.9337	258.9328	(98)	
Space heating												1092.0850	(98)	
Space heating per m2												16.1814	(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													1213.4277 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	250.7354	191.0070	135.2126	54.8078	12.8764	0.0000	0.0000	0.0000	0.0000	44.5793	143.9337	258.9328	(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)	278.5949	212.2300	150.2363	60.8975	14.3071	0.0000	0.0000	0.0000	0.0000	49.5325	159.9263	287.7031	(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	162.1254	142.3826	148.3440	131.3418	127.5203	112.2433	106.1935	118.7535	119.2518	136.2907	146.1718	157.6771	(64)
Efficiency of water heater (217)m	88.6746	88.5604	88.2429	87.6462	86.9925	86.7000	86.7000	86.7000	86.7000	87.4907	88.3065	86.7000	(216)
Fuel for water heating, kWh/month	182.8318	160.7745	168.1088	149.8546	146.5876	129.4617	122.4839	136.9705	137.5453	155.7774	165.5279	177.7206	(219)
Water heating fuel used												1833.6447	(219)
Annual totals kWh/year													
Space heating fuel - main system												1213.4277	(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)													329.4133 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3451.4858 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1213.4277	3.9200	47.5664 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1833.6447	3.9200	71.8789 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	329.4133	16.9600	55.8685 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			276.0337 (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	1213.4277	0.2160	262.1004 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1833.6447	0.2160	396.0673 (264)
Space and water heating			658.1677 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	329.4133	0.5190	170.9655 (268)
Energy saving/generation technologies			
PV Unit	-419.4847	0.5190	-217.7125 (269)
Total kg/year			650.3456 (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	1213.4277	1.2200	1480.3818 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1833.6447	1.2200	2237.0466 (264)
Space and water heating			3717.4284 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	329.4133	3.0700	1011.2989 (268)
Energy saving/generation technologies			
PV Unit	-419.4847	3.0700	-1287.8179 (269)
Primary energy kWh/year			3671.1594 (272)
Primary energy kWh/m2/year			54.3956 (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 85
Current environmental impact rating: A 92

(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 85
Potential environmental impact rating: A 92

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	£69	£69	£0
Mains gas	£207	£207	£0
Space heating	£148	£148	£0
Water heating	£72	£72	£0
Lighting	£56	£56	£0
Total cost of fuels	£276	£276	£0
Total cost of uses	£276	£276	£0
Delivered energy	51 kWh/m²	51 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	54 kWh/m²	54 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	236.2 (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	280.62 (P1)
Transmission heat loss coefficient	36.22 (37)
Summer heat loss coefficient	316.85 (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

	Jun	Jul	Aug	
Solar gains	395	369	332	(P3)
Internal gains	386	370	378	
Total summer gains	781	739	710	(P5)
Summer gain/loss ratio	2.47	2.33	2.24	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 236.2)	0.35	0.35	0.35	
Threshold temperature	18.21	19.98	19.89	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			