

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-206			Issued on Date	21/05/2019
Assessment Reference	As Built	Prop Type Ref	1FF - Det (As)		
Property	49, St. Andrews, Botley, SOUTHAMPTON, SO32 2ST				
SAP Rating	84 B	DER	13.30	TER	17.42
Environmental	91 B	% DER<TER	23.65		
CO ₂ Emissions (t/year)	0.68	DFEE	38.59	TFEE	41.50
General Requirements Compliance	Pass	% DFEE<TFEE	7.02		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client					

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 67 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.42 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.30 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)41.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)38.6 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.38 (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 476.68 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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.3800
Number of sides sheltered					0.3485 (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) =				0.3224 (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	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788 (22b)
	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717 (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	62.9200	10.7900	52.1300	0.2600	13.5538	60.0000	3127.8000 (29a)
APT Wall to Stairwell	19.2900		19.2900	0.2400	4.6296	110.0000	2121.9000 (29a)
Total net area of external elements Aum (A, m ²)			82.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1829		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
E-FC-4			66.8400			70.0000	4678.8000 (32b)
1F - Timber			89.9200			9.0000	809.2800 (32c)
1F - Metal			39.3300			20.0000	786.6000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16203.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							242.4174 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.2841 (36)
Total fabric heat loss						(33) + (36) =	37.4670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.7806	29.6134	29.4496	28.6800	28.5361	27.8658	27.8658	27.7417	28.1240	28.5361	28.8273	29.1318 (38)
Heat transfer coeff	67.2476	67.0804	66.9166	66.1470	66.0030	65.3328	65.3328	65.2087	65.5910	66.0030	66.2943	66.5988 (39)
Average = Sum(39)m / 12 =												66.1463 (39)
HLP	1.0061	1.0036	1.0011	0.9896	0.9875	0.9775	0.9775	0.9756	0.9813	0.9875	0.9918	0.9964 (40)
HLP (average)												0.9896 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)												Total = Sum(45)m = 1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (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	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	336.5344	334.4480	322.2943	302.8795	283.3496	264.5124	252.2985	257.9739	267.9860	287.5964	310.0386	326.6957	(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	387.7485	434.6336	487.2857	543.5097	578.2508	566.3963	539.7043	504.8512	459.8778	406.4751	373.8965	368.8117 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	66.9301	67.0968	67.2611	68.0436	68.1921	68.8916	68.8916	69.0228	68.6205	68.1921	67.8924	67.5820		
alpha	5.4620	5.4731	5.4841	5.5362	5.5461	5.5928	5.5928	5.6015	5.5747	5.5461	5.5262	5.5055		
util living area	0.9980	0.9959	0.9885	0.9591	0.8713	0.6973	0.5252	0.5807	0.8410	0.9769	0.9959	0.9985	(86)	
MIT	19.9111	20.0422	20.2765	20.5858	20.8367	20.9655	20.9940	20.9899	20.9022	20.5705	20.1854	19.8875	(87)	
Th 2	20.0783	20.0803	20.0824	20.0920	20.0938	20.1022	20.1022	20.1037	20.0989	20.0938	20.0901	20.0863	(88)	
util rest of house	0.9974	0.9946	0.9845	0.9446	0.8285	0.6155	0.4219	0.4743	0.7748	0.9662	0.9943	0.9980	(89)	
MIT 2	18.6172	18.8100	19.1517	19.5988	19.9309	20.0785	20.0998	20.0993	20.0181	19.5852	19.0269	18.5887	(90)	
Living area fraction									fLA = Living area / (4) =			0.3861	(91)	
MIT	19.1169	19.2858	19.5860	19.9799	20.2807	20.4210	20.4451	20.4432	20.3595	19.9656	19.4743	19.0902	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.9669	19.1358	19.4360	19.8299	20.1307	20.2710	20.2951	20.2932	20.2095	19.8156	19.3243	18.9402	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9926	0.9808	0.9395	0.8305	0.6317	0.4445	0.4975	0.7840	0.9618	0.9925	0.9971	(94)
Useful gains	386.3096	431.4268	477.9451	510.6159	480.2350	357.7947	239.9202	251.1559	360.5547	390.9458	371.0759	367.7592	(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													
	986.3112	954.9422	865.6341	722.9812	556.4499	370.5027	241.4106	253.8686	400.7263	608.2600	810.3984	981.6826	(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													
	446.4012	351.8023	288.4407	152.9030	56.7039	0.0000	0.0000	0.0000	0.0000	161.6818	316.3122	456.7590	(98)
Space heating												2231.0041	(98)
Space heating per m2												(98) / (4) =	33.3783 (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													2478.8935 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	446.4012	351.8023	288.4407	152.9030	56.7039	0.0000	0.0000	0.0000	0.0000	161.6818	316.3122	456.7590	(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)	496.0014	390.8915	320.4896	169.8923	63.0043	0.0000	0.0000	0.0000	0.0000	179.6464	351.4580	507.5100	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Efficiency of water heater (217)m	89.0991	89.0265	88.8544	88.4477	87.6923	86.7000	86.7000	86.7000	86.7000	88.4632	88.9331	86.7000	(216)
Fuel for water heating, kWh/month	181.2308	159.2942	166.2917	147.9187	144.8586	128.9738	122.0318	136.4516	137.0200	153.4647	163.7098	176.1964	(219)
Water heating fuel used												1817.4421	(219)
Annual totals kWh/year													
Space heating fuel - main system												2478.8935	(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)												326.0333	(232)
Energy saving/generation technologies (Appendices M,N and Q)													
Total delivered energy for all uses												4697.3688	(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	2478.8935	0.2160	535.4410	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1817.4421	0.2160	392.5675	(264)
Space and water heating			928.0085	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	326.0333	0.5190	169.2113	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	0.5190	-247.3947	(269)
Total CO2, kg/year			888.7500	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3000	(273)

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

DER		13.3000	ZC1
Total Floor Area		66.8400	TFA
Assumed number of occupants		2.1670	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		16.8281	ZC2
CO2 emissions from cooking, equation (L16)		2.5585	ZC3
Total CO2 emissions		32.6866	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6866	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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3795 (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) =				0.3511 (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	0.4476	0.4388	0.4301	0.3862	0.3774	0.3335	0.3335	0.3247	0.3511	0.3774	0.3950	0.4125 (22b)
Effective ac	0.6002	0.5963	0.5925	0.5746	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5780	0.5851 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)					
APT 100mm Knauf Supafil	62.9200	10.7900	52.1300	0.1800	9.3834		(29a)					
APT Wall to Stairwell	19.2900		19.2900	0.1800	3.4722		(29a)					
Total net area of external elements Aum(A, m2)			82.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.4699		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3026 (36)					
Total fabric heat loss						(33) + (36) =	33.7725 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 30.5804	Feb 30.3822	Mar 30.1879	Apr 29.2753	May 29.1046	Jun 28.3098	Jul 28.3098	Aug 28.1626	Sep 28.6160	Oct 29.1046	Nov 29.4500	Dec 29.8111 (38)
Heat transfer coeff	64.3529	64.1547	63.9604	63.0479	62.8771	62.0823	62.0823	61.9352	62.3885	62.8771	63.2225	63.5836 (39)
Average = Sum(39)m / 12 =												63.0470 (39)
HLP	Jan 0.9628	Feb 0.9598	Mar 0.9569	Apr 0.9433	May 0.9407	Jun 0.9288	Jul 0.9288	Aug 0.9266	Sep 0.9334	Oct 0.9407	Nov 0.9459	Dec 0.9513 (40)
HLP (average)												0.9433 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)											Total = Sum(45)m =	1347.8761 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (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	48.0205	41.7961	44.5281	41.4018	41.0357	38.0221	39.2895	41.0357	41.4018	44.5281	44.7816	48.0205 (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												
	187.7664	164.0188	170.6509	151.3588	146.5420	129.0660	123.6551	137.8464	139.3688	158.6991	169.4082	183.3569 (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												
	187.7664	164.0188	170.6509	151.3588	146.5420	129.0660	123.6551	137.8464	139.3688	158.6991	169.4082	183.3569 (64)
Total per year (kWh/year) = Sum (64)m =												1861.7375 (64)
Heat gains from water heating, kWh/month												
	58.4706	51.0881	53.0679	46.9111	45.3398	39.7776	37.8739	42.4485	42.9245	49.0939	52.6337	57.0045 (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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352 (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)												
	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813 (71)
Water heating gains (Table 5)												
	78.5896	76.0239	71.3278	65.1544	60.9406	55.2467	50.9058	57.0544	59.6173	65.9864	73.1024	76.6189 (72)
Total internal gains												
	345.3689	342.7087	329.9870	310.0074	289.9060	270.5004	258.2976	264.5407	275.1292	295.3045	318.3080	335.5363 (73)

6. Solar gains

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

Solar gains	52.0401	101.8015	167.6526	244.5113	299.6578	306.7530	292.0414	250.8592	194.9869	120.7961	64.8879	42.7953 (83)
Total gains	397.4090	444.5102	497.6396	554.5186	589.5638	577.2535	550.3390	515.4000	470.1161	416.1006	383.1959	378.3316 (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	72.1283	72.3512	72.5710	73.6213	73.8212	74.7663	74.7663	74.9440	74.3994	73.8212	73.4179	73.0010
alpha	5.8086	5.8234	5.8381	5.9081	5.9214	5.9844	5.9844	5.9963	5.9600	5.9214	5.8945	5.8667
util living area												
	0.9980	0.9958	0.9876	0.9534	0.8520	0.6635	0.4925	0.5456	0.8160	0.9738	0.9958	0.9985 (86)
MIT												
	20.0136	20.1409	20.3651	20.6580	20.8796	20.9791	20.9969	20.9946	20.9315	20.6367	20.2744	19.9935 (87)
Th 2												
	20.1145	20.1169	20.1194	20.1309	20.1330	20.1431	20.1431	20.1449	20.1392	20.1330	20.1287	20.1241 (88)
util rest of house												
	0.9974	0.9944	0.9833	0.9372	0.8065	0.5849	0.3987	0.4480	0.7473	0.9617	0.9941	0.9981 (89)
MIT 2												
	18.7907	18.9781	19.3051	19.7281	20.0159	20.1292	20.1419	20.1426	20.0847	19.7068	19.1823	18.7684 (90)
Living area fraction												
	19.2629	19.4271	19.7144	20.0872	20.3494	20.4574	20.4721	20.4716	20.4117	20.0659	19.6040	19.2415 (92)
Temperature adjustment												
	19.2629	19.4271	19.7144	20.0872	20.3494	20.4574	20.4721	20.4716	20.4117	20.0659	19.6040	19.2415 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9966	0.9929	0.9808	0.9363	0.8188	0.6147	0.4351	0.4858	0.7709	0.9606	0.9927	0.9974 (94)
Useful gains	396.0392	441.3709	488.0954	519.1912	482.7562	354.8200	239.4315	250.3924	362.3915	399.6879	380.4125	377.3383 (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												
	962.9059	931.9817	845.1995	705.3270	543.8487	363.6399	240.3870	252.1762	393.7744	595.1857	790.5339	956.3908 (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												
	421.7488	329.6905	265.6854	134.0177	45.4528	0.0000	0.0000	0.0000	0.0000	145.4504	295.2874	430.8150 (98)
Space heating												
												2068.1481 (98)
Space heating per m2												30.9418 (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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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													2214.2913 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	421.7488	329.6905	265.6854	134.0177	45.4528	0.0000	0.0000	0.0000	0.0000	145.4504	295.2874	430.8150	(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)	451.5512	352.9877	284.4598	143.4879	48.6647	0.0000	0.0000	0.0000	0.0000	155.7284	316.1536	461.2581	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	187.7664	164.0188	170.6509	151.3588	146.5420	129.0660	123.6551	137.8464	139.3688	158.6991	169.4082	183.3569	(64)
Efficiency of water heater	87.0279	86.7741	86.1616	84.7465	82.4816	80.3000	80.3000	80.3000	80.3000	84.8326	86.4366	87.1283	(217)
Fuel for water heating, kWh/month	215.7542	189.0182	198.0593	178.6018	177.6662	160.7298	153.9914	171.6643	173.5601	187.0734	195.9913	210.4447	(219)
Water heating fuel used												2212.5547	(219)
Annual totals kWh/year													
Space heating fuel - main system												2214.2913	(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)												326.0333	(232)
Total delivered energy for all uses												4827.8793	(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	2214.2913	0.2160	478.2869 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2212.5547	0.2160	477.9118 (264)
Space and water heating			956.1987 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.0333	0.5190	169.2113 (268)
Total CO2, kg/m2/year			1164.3350 (272)
Emissions per m2 for space and water heating			14.3058 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5316 (272b)
Emissions per m2 for pumps and fans			0.5824 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3058 * 1.00) + 2.5316 + 0.5824, rounded to 2 d.p.			17.4200 (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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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)
Infiltation due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1295 (8)
Pressure test					Yes
Measured/design AP50					4.3800
Infiltation rate					0.3485 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltation rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3224 (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	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788 (22b)
	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717 (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	62.9200	10.7900	52.1300	0.2600	13.5538	60.0000	3127.8000 (29a)
APT Wall to Stairwell	19.2900		19.2900	0.2400	4.6296	110.0000	2121.9000 (29a)
Total net area of external elements Aum (m ²)			82.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1829		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
E-FC-4			66.8400			30.0000	2005.2000 (32b)
1F - Timber			89.9200			9.0000	809.2800 (32c)
1F - Metal			39.3300			20.0000	786.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13529.5800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		202.4174 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2841 (36)
Total fabric heat loss	(33) + (36) =	37.4670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	29.7806	29.6134	29.4496	28.6800	28.5361	27.8658	27.8658	27.7417	28.1240	28.5361	28.8273	29.1318 (38)
Heat transfer coeff	67.2476	67.0804	66.9166	66.1470	66.0030	65.3328	65.3328	65.2087	65.5910	66.0030	66.2943	66.5988 (39)
Average = Sum(39)m / 12 =												66.1463 (39)
HLP	1.0061	1.0036	1.0011	0.9896	0.9875	0.9775	0.9775	0.9756	0.9813	0.9875	0.9918	0.9964 (40)
HLP (average)												0.9896 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)												Total = Sum(45)m = 1347.8761 (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	29.6960	25.9723	26.8011	23.3659	22.4201	19.3468	17.9277	20.5723	20.8180	24.2613	26.4832	28.7590	(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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	39.9140	38.6493	36.0230	32.4526	30.1345	26.8706	24.0964	27.6509	28.9139	32.6093	36.7822	38.6546	(72)
Total internal gains	303.6933	302.3341	291.6822	274.3056	256.1000	239.1243	228.4882	232.1372	241.4257	258.9274	278.9878	294.5719	(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	354.9074	402.5197	456.6736	514.9357	551.0013	541.0083	515.8940	479.0146	433.3176	377.8061	342.8457	336.6879	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.8863	56.0255	56.1627	56.8161	56.9401	57.5242	57.5242	57.6337	57.2978	56.9401	56.6899	56.4307	
alpha	4.7258	4.7350	4.7442	4.7877	4.7960	4.8349	4.8349	4.8422	4.8199	4.7960	4.7793	4.7620	
util living area	0.9970	0.9941	0.9850	0.9532	0.8689	0.7079	0.5421	0.6003	0.8457	0.9735	0.9944	0.9977	(86)
MIT	19.6873	19.8391	20.1108	20.4698	20.7686	20.9396	20.9866	20.9786	20.8522	20.4540	20.0061	19.6610	(87)
Th 2	20.0783	20.0803	20.0824	20.0920	20.0938	20.1022	20.1022	20.1037	20.0989	20.0938	20.0901	20.0863	(88)
util rest of house	0.9962	0.9925	0.9806	0.9390	0.8297	0.6304	0.4386	0.4949	0.7859	0.9629	0.9926	0.9971	(89)
MIT 2	18.8709	19.0237	19.2947	19.6521	19.9278	20.0706	20.0978	20.0961	20.0081	19.6434	19.1984	18.8510	(90)
Living area fraction									fLA = Living area / (4) =			0.3861	(91)
MIT	19.1861	19.3386	19.6098	19.9679	20.2525	20.4061	20.4410	20.4369	20.3341	19.9564	19.5103	19.1638	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1861	19.3386	19.6098	19.9679	20.2525	20.4061	20.4410	20.4369	20.3341	19.9564	19.5103	19.1638	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9952	0.9908	0.9778	0.9367	0.8373	0.6581	0.4787	0.5355	0.8033	0.9610	0.9911	0.9962	(94)
Ext temp.	353.1976	398.8154	446.5443	482.3501	461.3632	356.0257	246.9329	256.5050	348.0855	363.0562	339.7778	335.4151	(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	1001.0567	968.5461	877.2635	732.1070	564.4893	379.3320	250.9458	263.2408	408.8985	617.5515	822.7318	996.5687	(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	482.0071	382.8591	320.4551	179.8250	76.7258	0.0000	0.0000	0.0000	0.0000	189.3445	347.7269	491.8983	(98)
Space heating												2470.8418	(98)
Space heating per m2												36.9665	(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	614.1282	483.4626	495.5859	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8844	0.9365	0.9161	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	543.1346	452.7606	454.0079	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	713.6031	682.6891	641.0933	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	122.7373	171.0668	139.1915	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												432.9956 (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	30.6843	42.7667	34.7979	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												108.2489 (107)
Space cooling per m2												1.6195 (108)
Energy for space heating												36.9665 (99)
Energy for space cooling												1.6195 (108)
Total												38.5860 (109)
Dwelling Fabric Energy Efficiency (DFEE)												38.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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 20.0000 / (5) = 0.1295 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3795 (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) =		0.3511 (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	0.4476	0.4388	0.4301	0.3862	0.3774	0.3335	0.3335	0.3247	0.3511	0.3774	0.3950	0.4125 (22b)
Effective ac	0.6002	0.5963	0.5925	0.5746	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5780	0.5851 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)					
APT 100mm Knauf Supafil	62.9200	10.7900	52.1300	0.1800	9.3834		(29a)					
APT Wall to Stairwell	19.2900		19.2900	0.1800	3.4722		(29a)					
Total net area of external elements Aum(A, m2)			82.2100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.4699		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3026 (36)					
Total fabric heat loss						(33) + (36) =	33.7725 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 30.5804	Feb 30.3822	Mar 30.1879	Apr 29.2753	May 29.1046	Jun 28.3098	Jul 28.3098	Aug 28.1626	Sep 28.6160	Oct 29.1046	Nov 29.4500	Dec 29.8111 (38)
Heat transfer coeff	64.3529	64.1547	63.9604	63.0479	62.8771	62.0823	62.0823	61.9352	62.3885	62.8771	63.2225	63.5836 (39)
Average = Sum(39)m / 12 =												63.0470 (39)
HLP	Jan 0.9628	Feb 0.9598	Mar 0.9569	Apr 0.9433	May 0.9407	Jun 0.9288	Jul 0.9288	Aug 0.9266	Sep 0.9334	Oct 0.9407	Nov 0.9459	Dec 0.9513 (40)
HLP (average)												0.9433 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)	Total = Sum(45)m =											1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
29.6960 25.9723 26.8011 23.3659 22.4201 19.3468 17.9277 20.5723 20.8180 24.2613 26.4832 28.7590 (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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	39.9140	38.6493	36.0230	32.4526	30.1345	26.8706	24.0964	27.6509	28.9139	32.6093	36.7822	38.6546	(72)
Total internal gains	303.6933	302.3341	291.6822	274.3056	256.1000	239.1243	228.4882	232.1372	241.4257	258.9274	278.9878	294.5719	(73)

6. Solar gains

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

Solar gains	52.0401	101.8015	167.6526	244.5113	299.6578	306.7530	292.0414	250.8592	194.9869	120.7961	64.8879	42.7953 (83)
Total gains	355.7334	404.1356	459.3348	518.8169	555.7578	545.8774	520.5296	482.9965	436.4126	379.7235	343.8757	337.3672 (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	72.1283	72.3512	72.5710	73.6213	73.8212	74.7663	74.7663	74.9440	74.3994	73.8212	73.4179	73.0010	
alpha	5.8086	5.8234	5.8381	5.9081	5.9214	5.9844	5.9844	5.9963	5.9600	5.9214	5.8945	5.8667	
util living area	0.9989	0.9974	0.9916	0.9647	0.8763	0.6947	0.5195	0.5794	0.8504	0.9828	0.9976	0.9992	(86)
MIT	19.9536	20.0833	20.3127	20.6170	20.8573	20.9735	20.9959	20.9926	20.9132	20.5899	20.2182	19.9342	(87)
Th 2	20.1145	20.1169	20.1194	20.1309	20.1330	20.1431	20.1431	20.1449	20.1392	20.1330	20.1287	20.1241	(88)
util rest of house	0.9985	0.9965	0.9886	0.9518	0.8347	0.6151	0.4212	0.4771	0.7866	0.9744	0.9966	0.9989	(89)
MIT 2	19.1507	19.2822	19.5121	19.8180	20.0361	20.1308	20.1420	20.1427	20.0902	19.7979	19.4267	19.1393	(90)
Living area fraction	19.4608	19.5916	19.8212	20.1265	20.3532	20.4562	20.4717	20.4709	20.4080	20.1037	19.7323	19.4463	(92)
MIT	19.4608	19.5916	19.8212	20.1265	20.3532	20.4562	20.4717	20.4709	20.4080	20.1037	19.7323	19.4463	(93)
Temperature adjustment													
adjusted MIT	19.4608	19.5916	19.8212	20.1265	20.3532	20.4562	20.4717	20.4709	20.4080	20.1037	19.7323	19.4463	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9959	0.9873	0.9517	0.8463	0.6453	0.4593	0.5169	0.8085	0.9740	0.9960	0.9987	(94)
Useful gains	355.0885	402.4645	453.5054	493.7815	470.3301	352.2380	239.0917	249.6619	352.8600	369.8509	342.5079	336.9171	(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	975.6381	942.5324	852.0319	707.8092	544.0866	363.5663	240.3670	252.1326	393.5462	597.5678	798.6486	969.4121	(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	461.6889	362.9257	296.5037	154.1000	54.8749	0.0000	0.0000	0.0000	0.0000	169.4214	328.4213	470.5763	(98)
Space heating												2298.5122	(98)
Space heating per m2												34.3883	(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	583.5740	459.4093	470.7072	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9297	0.9685	0.9543	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	542.5442	444.9402	449.1881	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	719.2943	688.1073	645.7474	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	127.2601	180.9164	146.2401	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												454.4165	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.8150	45.2291	36.5600	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												113.6041 (107)
Space cooling per m2												1.6996 (108)
Energy for space heating												34.3883 (99)
Energy for space cooling												1.6996 (108)
Total												36.0879 (109)
Target Fabric Energy Efficiency (TFEE)												41.5 (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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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) = 0.1295 (8)
Pressure test					Yes
Measured/design AP50					4.3800
Infiltration rate					0.3485 (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) =				0.3224 (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	0.3385	0.3143	0.3224	0.3063	0.3063	0.2982	0.2902	0.2821	0.2740	0.2982	0.2821	0.2982 (22b)
Effective ac	0.5573	0.5494	0.5520	0.5469	0.5469	0.5445	0.5421	0.5398	0.5375	0.5445	0.5398	0.5445 (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	62.9200	10.7900	52.1300	0.2600	13.5538	60.0000	3127.8000 (29a)
APT Wall to Stairwell	19.2900		19.2900	0.2400	4.6296	110.0000	2121.9000 (29a)
Total net area of external elements Aum (m ²)			82.2100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				31.1829		(33)
E-FC-4					66.8400	70.0000	4678.8000 (32d)
E-FC-4					66.8400	70.0000	4678.8000 (32b)
1F - Timber					89.9200	9.0000	809.2800 (32c)
1F - Metal					39.3300	20.0000	786.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16203.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		242.4174 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2841 (36)
Total fabric heat loss	(33) + (36) =	37.4670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.3954	27.9932	28.1240	27.8658	27.8658	27.7417	27.6209	27.5034	27.3892	27.7417	27.5034	27.7417 (38)
Heat transfer coeff	65.8624	65.4602	65.5910	65.3328	65.3328	65.2087	65.0879	64.9704	64.8562	65.2087	64.9704	65.2087 (39)
Average = Sum(39)m / 12 =												65.2575 (39)
HLP	0.9854	0.9794	0.9813	0.9775	0.9775	0.9756	0.9738	0.9720	0.9703	0.9756	0.9720	0.9756 (40)
HLP (average)												0.9763 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)												Total = Sum(45)m = 1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (46)

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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	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1534	40.9930	33.3378	25.2388	18.8663	15.9277	17.2105	22.3708	30.0261	38.1250	44.4976	47.4361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.3022	286.2419	278.8338	263.0626	243.1544	224.4435	211.9435	209.0037	216.4118	232.1830	252.0912	270.8021	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	495.7206	491.5081	472.3165	442.8379	412.9147	386.1398	370.5705	378.3720	395.4220	425.0962	457.9316	482.5265	(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	561.4128	600.8196	653.2987	707.2783	719.9659	727.1705	692.8593	662.7298	617.3685	564.9299	539.5730	535.6278	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	68.3377	68.7575	68.6205	68.8916	68.8916	69.0228	69.1509	69.2760	69.3979	69.0228	69.2760	69.0228		
alpha	5.5558	5.5838	5.5747	5.5928	5.5928	5.6015	5.6101	5.6184	5.6265	5.6015	5.6184	5.6015		
util living area	0.9860	0.9786	0.9516	0.8727	0.7209	0.5053	0.3655	0.3813	0.6384	0.8885	0.9703	0.9882	(86)	
MIT	20.2473	20.3461	20.5591	20.8006	20.9460	20.9936	20.9991	20.9989	20.9784	20.8154	20.5122	20.2351	(87)	
Th 2	20.0955	20.1006	20.0989	20.1022	20.1022	20.1037	20.1052	20.1067	20.1081	20.1037	20.1067	20.1037	(88)	
util rest of house	0.9819	0.9725	0.9377	0.8393	0.6605	0.4286	0.2821	0.2945	0.5577	0.8505	0.9602	0.9847	(89)	
MIT 2	19.1176	19.2630	19.5621	19.8864	20.0561	20.1002	20.1050	20.1064	20.0941	19.9139	19.5070	19.1067	(90)	
Living area fraction	19.5538	19.6813	19.9471	20.2394	20.3998	20.4452	20.4503	20.4511	20.4356	20.2620	19.8951	19.5424	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.4038	19.5313	19.7971	20.0894	20.2498	20.2952	20.3003	20.3011	20.2856	20.1120	19.7451	19.3924	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	548.9529	581.3058	608.9459	593.2644	483.0535	323.7206	208.1260	207.7612	354.5777	480.6886	515.3245	525.4407	(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	955.2556	931.5811	839.3739	691.8356	506.3130	325.7312	208.2980	207.9734	362.2584	568.0977	769.5825	938.5113	(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	302.2892	235.3850	171.4384	70.9713	17.3050	0.0000	0.0000	0.0000	0.0000	65.0324	183.0658	307.3246	(98)	
Space heating												1352.8117	(98)	
RHI space heating demand												1353	(98)	

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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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.3800
Number of sides sheltered					0.3485 (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) =	0.3224 (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	0.4111	0.4030	0.3949	0.3546	0.3466	0.3063	0.3063	0.2982	0.3224	0.3466	0.3627	0.3788 (22b)
	0.5845	0.5812	0.5780	0.5629	0.5601	0.5469	0.5469	0.5445	0.5520	0.5601	0.5658	0.5717 (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	62.9200	10.7900	52.1300	0.2600	13.5538	60.0000	3127.8000 (29a)
APT Wall to Stairwell	19.2900		19.2900	0.2400	4.6296	110.0000	2121.9000 (29a)
Total net area of external elements Aum (A, m ²)			82.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1829		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
E-FC-4			66.8400			70.0000	4678.8000 (32b)
1F - Timber			89.9200			9.0000	809.2800 (32c)
1F - Metal			39.3300			20.0000	786.6000 (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) =	16203.1800 (34)
	242.4174 (35)
	6.2841 (36)
(33) + (36) =	37.4670 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	29.7806
Heat transfer coeff	67.2476
Average = Sum(39)m / 12 =	
HLP	1.0061
HLP (average)	0.9896
Days in month	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy content (annual)	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											1347.8761 (45)
	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (46)

FULL SAP CALCULATION PRINTOUT

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Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	(57)
Combi loss	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	157.0474	(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	0.0000	(63)
Output from w/h	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	157.0474	(64)
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	50.4271	(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	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1534	40.9930	33.3378	25.2388	18.8663	15.9277	17.2105	22.3708	30.0261	38.1250	44.4976	47.4361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.3022	286.2419	278.8338	263.0626	243.1544	224.4435	211.9435	209.0037	216.4118	232.1830	252.0912	270.8021	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	495.7206	491.5081	472.3165	442.8379	412.9147	386.1398	370.5705	378.3720	395.4220	425.0962	457.9316	482.5265	(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	546.9346	591.6937	637.3080	683.4681	707.8160	688.0237	657.9763	625.2494	587.3138	543.9749	521.7895	524.6425 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.9301	67.0968	67.2611	68.0436	68.1921	68.8916	68.8916	69.0228	68.6205	68.1921	67.8924	67.5820	
alpha	5.4620	5.4731	5.4841	5.5362	5.5461	5.5928	5.5928	5.6015	5.5747	5.5461	5.5262	5.5055	
util living area	0.9898	0.9829	0.9634	0.9053	0.7811	0.5924	0.4345	0.4756	0.7201	0.9269	0.9808	0.9917	(86)
MIT	20.1395	20.2623	20.4724	20.7305	20.9095	20.9844	20.9976	20.9962	20.9560	20.7295	20.3922	20.1129	(87)
Th 2	20.0783	20.0803	20.0824	20.0920	20.0938	20.1022	20.1022	20.1037	20.0989	20.0938	20.0901	20.0863	(88)
util rest of house	0.9868	0.9779	0.9526	0.8787	0.7280	0.5158	0.3471	0.3851	0.6444	0.9003	0.9743	0.9893	(89)
MIT 2	18.9487	19.1272	19.4279	19.7882	20.0096	20.0921	20.1013	20.1022	20.0663	19.7962	19.3236	18.9163	(90)
Living area fraction	19.4085	19.5655	19.8312	20.1521	20.3571	20.4367	20.4474	20.4474	20.4098	20.1566	19.7363	19.3784	(91)
MIT	19.4085	19.5655	19.8312	20.1521	20.3571	20.4367	20.4474	20.4474	20.4098	20.1566	19.7363	19.3784	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2585	19.4155	19.6812	20.0021	20.2071	20.2867	20.2974	20.2974	20.2598	20.0066	19.5863	19.2284	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	537.8080	575.8677	603.4369	598.5215	520.3200	365.9840	240.9983	253.1663	386.8962	488.0994	505.9525	517.4067	(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	1005.9258	973.7058	882.0412	734.3699	561.4920	371.5249	241.5620	254.1427	404.0288	620.8620	827.7693	1000.8723	(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	348.2797	267.3472	207.2816	97.8108	30.6320	0.0000	0.0000	0.0000	0.0000	98.7753	231.7081	359.6984	(98)
Space heating												1641.5332	(98)
Space heating per m2												24.5591	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1823.9258 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	348.2797	267.3472	207.2816	97.8108	30.6320	0.0000	0.0000	0.0000	0.0000	98.7753	231.7081	359.6984	(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)	386.9774	297.0524	230.3129	108.6787	34.0356	0.0000	0.0000	0.0000	0.0000	109.7504	257.4535	399.6649	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Efficiency of water heater (217)m	88.9278	88.8282	88.5966	88.0816	87.3221	86.7000	86.7000	86.7000	86.7000	88.0598	88.6973	88.9708	(216)
Fuel for water heating, kWh/month	181.5800	159.6498	166.7756	148.5334	145.4728	128.9738	122.0318	136.4516	137.0200	154.1676	164.1450	176.5156	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1823.9258 (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)													326.0333 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4046.2761 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1823.9258	3.4800	63.4726	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1821.3170	3.4800	63.3818	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	326.0333	13.1900	43.0038	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			299.7507	(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] =	1.1257 (257)
SAP value		84.2969
SAP rating (Section 12)		84 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1823.9258	0.2160	393.9680	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1821.3170	0.2160	393.4045	(264)
Space and water heating			787.3724	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	326.0333	0.5190	169.2113	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	0.5190	-247.3947	(269)
Total kg/year			748.1140	(272)
CO2 emissions per m2			11.1900	(273)
EI value			91.0365	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8786 = 3.961$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8786 = 0.2459$, 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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.3800
Number of sides sheltered					0.3485 (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) =				0.3224 (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												
	0.3385	0.3143	0.3224	0.3063	0.3063	0.2982	0.2902	0.2821	0.2740	0.2982	0.2821	0.2982 (22b)
Effective ac	0.5573	0.5494	0.5520	0.5469	0.5469	0.5445	0.5421	0.5398	0.5375	0.5445	0.5398	0.5445 (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	62.9200	10.7900	52.1300	0.2600	13.5538	60.0000	3127.8000 (29a)
APT Wall to Stairwell	19.2900		19.2900	0.2400	4.6296	110.0000	2121.9000 (29a)
Total net area of external elements Aum (m ²)			82.2100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1829		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
E-FC-4			66.8400			70.0000	4678.8000 (32b)
1F - Timber			89.9200			9.0000	809.2800 (32c)
1F - Metal			39.3300			20.0000	786.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16203.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		242.4174 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.2841 (36)
Total fabric heat loss	(33) + (36) =	37.4670 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.3954	27.9932	28.1240	27.8658	27.8658	27.7417	27.6209	27.5034	27.3892	27.7417	27.5034	27.7417 (38)
Heat transfer coeff	65.8624	65.4602	65.5910	65.3328	65.3328	65.2087	65.0879	64.9704	64.8562	65.2087	64.9704	65.2087 (39)
Average = Sum(39)m / 12 =												65.2575 (39)
HLP	0.9854	0.9794	0.9813	0.9775	0.9775	0.9756	0.9738	0.9720	0.9703	0.9756	0.9720	0.9756 (40)
HLP (average)												0.9763 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)												Total = Sum(45)m = 1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (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	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(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	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1534	40.9930	33.3378	25.2388	18.8663	15.9277	17.2105	22.3708	30.0261	38.1250	44.4976	47.4361	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.3022	286.2419	278.8338	263.0626	243.1544	224.4435	211.9435	209.0037	216.4118	232.1830	252.0912	270.8021	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	495.7206	491.5081	472.3165	442.8379	412.9147	386.1398	370.5705	378.3720	395.4220	425.0962	457.9316	482.5265	(73)

6. Solar gains													
[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
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	561.4128	600.8196	653.2987	707.2783	719.9659	727.1705	692.8593	662.7298	617.3685	564.9299	539.5730	535.6278	(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	68.3377	68.7575	68.6205	68.8916	68.8916	69.0228	69.1509	69.2760	69.3979	69.0228	69.2760	69.0228	
alpha	5.5558	5.5838	5.5747	5.5928	5.5928	5.6015	5.6101	5.6184	5.6265	5.6015	5.6184	5.6015	
util living area	0.9860	0.9786	0.9516	0.8727	0.7209	0.5053	0.3655	0.3813	0.6384	0.8885	0.9703	0.9882	(86)
MIT	20.2473	20.3461	20.5591	20.8006	20.9460	20.9936	20.9991	20.9989	20.9784	20.8154	20.5122	20.2351	(87)
Th 2	20.0955	20.1006	20.0989	20.1022	20.1022	20.1037	20.1052	20.1067	20.1081	20.1037	20.1067	20.1037	(88)
util rest of house	0.9819	0.9725	0.9377	0.8393	0.6605	0.4286	0.2821	0.2945	0.5577	0.8505	0.9602	0.9847	(89)
MIT 2	19.1176	19.2630	19.5621	19.8864	20.0561	20.1002	20.1050	20.1064	20.0941	19.9139	19.5070	19.1067	(90)
Living area fraction	19.5538	19.6813	19.9471	20.2394	20.3998	20.4452	20.4503	20.4511	20.4356	20.2620	19.8951	19.5424	(91)
MIT	19.5538	19.6813	19.9471	20.2394	20.3998	20.4452	20.4503	20.4511	20.4356	20.2620	19.8951	19.5424	(92)
Temperature adjustment	19.4038	19.5313	19.7971	20.0894	20.2498	20.2952	20.3003	20.3011	20.2856	20.1120	19.7451	19.3924	(93)

8. Space heating requirement													
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	548.9529	581.3058	608.9459	593.2644	483.0535	323.7206	208.1260	207.7612	354.5777	480.6886	515.3245	525.4407	(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	955.2556	931.5811	839.3739	691.8356	506.3130	325.7312	208.2980	207.9734	362.2584	568.0977	769.5825	938.5113	(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	302.2892	235.3850	171.4384	70.9713	17.3050	0.0000	0.0000	0.0000	0.0000	65.0324	183.0658	307.3246	(98)
Space heating												1352.8117	(98)
Space heating per m2												20.2396	(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													1503.1241 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	302.2892	235.3850	171.4384	70.9713	17.3050	0.0000	0.0000	0.0000	0.0000	65.0324	183.0658	307.3246	(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)	335.8769	261.5389	190.4871	78.8570	19.2278	0.0000	0.0000	0.0000	0.0000	72.2582	203.4065	341.4718	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Efficiency of water heater (217)m	88.8229	88.7303	88.4417	87.8326	87.0828	86.7000	86.7000	86.7000	86.7000	87.7420	88.5077	86.7000	(216)
Fuel for water heating, kWh/month	181.7945	159.8260	167.0676	148.9545	145.8725	128.9738	122.0318	136.4516	137.0200	154.7261	164.4966	176.7433	(219)
Water heating fuel used												1823.9583	(219)
Annual totals kWh/year													
Space heating fuel - main system												1503.1241	(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)													326.0333 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3728.1157 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1503.1241	3.9200	58.9225	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1823.9583	3.9200	71.4992	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	326.0333	16.9600	55.2952	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	16.9600	0.0000	(252)
Total energy cost			286.4369	(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	1503.1241	0.2160	324.6748	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1823.9583	0.2160	393.9750	(264)
Space and water heating			718.6498	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	326.0333	0.5190	169.2113	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	0.5190	-247.3947	(269)
Total kg/year			679.3914	(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	1503.1241	1.2200	1833.8114	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1823.9583	1.2200	2225.2291	(264)
Space and water heating			4059.0405	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	326.0333	3.0700	1000.9221	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	3.0700	-1463.3945	(269)
Primary energy kWh/year			3826.8181	(272)
Primary energy kWh/m2/year			57.2534	(273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

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

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

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

	Current	Potential	Saving
Electricity	£68	£68	£0
Mains gas	£218	£218	£0
Space heating	£160	£160	£0
Water heating	£71	£71	£0
Lighting	£55	£55	£0
Total cost of fuels	£286	£286	£0
Total cost of uses	£286	£286	£0
Delivered energy	56 kWh/m²	56 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	57 kWh/m²	57 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	North
Overshading	Average or unknown
Thermal mass parameter	242.4 (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	305.71 (P1)
Transmission heat loss coefficient	37.47 (37)
Summer heat loss coefficient	343.18 (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	383	368	375	
Total summer gains	794	749	711	(P5)

Summer gain/loss ratio	2.31	2.18	2.07	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 242.4)	0.30	0.30	0.30	
Threshold temperature	18.02	19.79	19.68	(P7)

Likelihood of high internal temperature	Not significant	Not significant	Not significant
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Assessment of likelihood of high internal temperature: Not significant