

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-131			Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	PF01 - Mid (Op)		
Property	41, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE				
SAP Rating	85 B	DER	17.42	TER	22.10
Environmental	87 B	% DER<TER	21.16		
CO ₂ Emissions (t/year)	0.95	DFEE	62.15	TFEE	66.11
General Requirements Compliance	Pass	% DFEE<TFEE	5.99		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Mid-Terrace Maisonette, total floor area 68 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) 22.10 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.42 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)66.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)62.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.29 (max. 0.30)	0.70 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.20 (max. 0.25)	0.21 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.30 (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: 4.79 (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): Slight OK
Based on:
Overshading: Average
Windows facing East: 3.27 m², No overhang
Windows facing West: 5.00 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array 0.81 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (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) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					4.7900
Infiltration rate					0.3604 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3063 (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	0.3905	0.3829	0.3752	0.3369	0.3293	0.2910	0.2910	0.2833	0.3063	0.3293	0.3446	0.3599 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5423	0.5423	0.5401	0.5469	0.5542	0.5594	0.5648 (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
Solid FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			8.2700	1.3258	10.9640		(27)
Jet Floor Lo			2.4800	0.1600	0.3968	75.0000	186.0000 (28a)
Exposed Floor over Garage			25.4600	0.1900	4.8374	20.0000	509.2000 (28b)
Exposed Floor - Drive Through			37.8500	0.2100	7.9485	20.0000	757.0000 (28b)
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.2500	10.7475	60.0000	2579.4000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	0.7000		0.7000	0.7000	0.4900	9.0000	6.3000 (29a)
E-WM-28	3.9600		3.9600	0.3000	1.1880	110.0000	435.6000 (29a)
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527	9.0000	592.1100 (30)
Total net area of external elements Aum(A, m ²)			196.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6649		(32)
E-WM-28			33.4300	0.0000	0.0000	110.0000	3677.3000 (32)
1F - Timber			102.2700			9.0000	920.4300 (32c)
Internal Floor			2.4800			18.0000	44.6400 (32d)
Internal Ceiling			2.4800			18.0000	44.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9817.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.8042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.7503 (36)
Total fabric heat loss						(33) + (36) =	68.4152 (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	31.4698	31.3081	31.1495	30.4050	30.2657	29.6173	29.6173	29.4972	29.8670	30.2657	30.5475	30.8421 (38)
Heat transfer coeff	99.8849	99.7232	99.5647	98.8202	98.6809	98.0324	98.0324	97.9123	98.2822	98.6809	98.9627	99.2573 (39)
Average = Sum(39)m / 12 =												98.8195 (39)
HLP	1.4631	1.4607	1.4584	1.4475	1.4455	1.4360	1.4360	1.4342	1.4396	1.4455	1.4496	1.4539 (40)
HLP (average)												1.4475 (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												2.2034 (42)
Average daily hot water use (litres/day)												86.5308 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	95.1839	91.7226	88.2614	84.8002	81.3390	77.8777	77.8777	81.3390	84.8002	88.2614	91.7226	95.1839 (44)
Energy conte	141.1549	123.4550	127.3945	111.0656	106.5701	91.9619	85.2162	97.7869	98.9547	115.3222	125.8832	136.7010 (45)
Energy content (annual)												1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m	21.1732	18.5183	19.1092	16.6598	15.9855	13.7943	12.7824	14.6680	14.8432	17.2983	18.8825	20.5052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7409	19.6012	21.6445	20.8819	21.5312	20.7826	21.4418	21.4997	20.8367	21.5976	20.9755	21.7223 (61)
Total heat required for water heating calculated for each month	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (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	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (64)
Heat gains from water heating, kWh/month	52.3692	45.9491	47.7698	42.1498	40.8174	35.7730	33.6948	37.8891	38.1116	43.7440	47.1001	50.8837 (65)
Total per year (kWh/year) = Sum(64)m = 1615.7224 (64)												

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	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0806	16.9473	13.7824	10.4342	7.7997	6.5848	7.1151	9.2485	12.4133	15.7616	18.3961	19.6109 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.2261	195.2312	190.1785	179.4218	165.8434	153.0816	144.5560	142.5509	147.6036	158.3603	171.9387	184.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170 (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)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361 (71)
Water heating gains (Table 5)	70.3888	68.3766	64.2067	58.5414	54.8620	49.6847	45.2888	50.9262	52.9328	58.7958	65.4167	68.3920 (72)
Total internal gains	341.7466	339.6061	327.2186	307.4484	287.5561	268.4022	256.0109	261.7766	272.0008	291.9687	314.8026	331.7545 (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				3.2700	19.6403	0.6200		0.7000		0.7700		19.3160 (76)	
West				5.0000	19.6403	0.6200		0.7000		0.7700		29.5352 (80)	
Solar gains	48.8513	95.5634	157.3794	229.5284	281.2957	287.9562	274.1460	235.4874	183.0387	113.3941	60.9118	40.1729 (83)	
Total gains	390.5978	435.1696	484.5980	536.9768	568.8518	556.3584	530.1569	497.2640	455.0395	405.3627	375.7143	371.9274 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.3023	27.3466	27.3901	27.5964	27.6354	27.8182	27.8182	27.8523	27.7475	27.6354	27.5567	27.4749
alpha	2.8202	2.8231	2.8260	2.8398	2.8424	2.8545	2.8545	2.8568	2.8498	2.8424	2.8371	2.8317
util living area	0.9872	0.9816	0.9691	0.9405	0.8839	0.7833	0.6602	0.7030	0.8655	0.9556	0.9816	0.9889 (86)
MIT	18.5538	18.7510	19.1399	19.6774	20.2050	20.6320	20.8438	20.8063	20.4545	19.7759	19.0731	18.5151 (87)
Th 2	19.7153	19.7171	19.7188	19.7271	19.7287	19.7359	19.7359	19.7372	19.7331	19.7287	19.7255	19.7223 (88)
util rest of house	0.9843	0.9774	0.9616	0.9243	0.8473	0.7025	0.5213	0.5725	0.8079	0.9404	0.9766	0.9864 (89)
MIT 2	16.4878	16.7756	17.3411	18.1183	18.8579	19.4191	19.6485	19.6188	19.2103	18.2705	17.2516	16.4353 (90)
Living area fraction	17.1251	17.3850	17.8960	18.5993	19.2734	19.7932	20.0172	19.9851	19.5941	18.7349	17.8135	17.0769 (92)
MIT	16.9751	17.2350	17.7460	18.4493	19.1234	19.6432	19.8672	19.8351	19.4441	18.5849	17.6635	16.9269 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	380.6876	419.9186	457.7296	484.2548	469.1964	386.8948	285.1742	290.5922	359.8256	373.0944	362.2491	363.6223 (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	1266.0542	1230.0859	1119.7015	943.6592	732.5513	494.4007	320.2931	336.3378	525.2308	787.9546	1045.3926	1263.2367 (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	658.7128	544.4324	492.5071	330.7712	195.9360	0.0000	0.0000	0.0000	0.0000	308.6560	491.8634	669.3131 (98)
Space heating												3692.1920 (98)
Space heating per m2												54.0822 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
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													4102.4355 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	658.7128	544.4324	492.5071	330.7712	195.9360	0.0000	0.0000	0.0000	0.0000	308.6560	491.8634	669.3131	(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)	731.9031	604.9249	547.2301	367.5236	217.7067	0.0000	0.0000	0.0000	0.0000	342.9511	546.5148	743.6812	(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	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233	(64)
Efficiency of water heater (217)m	89.3259	89.2928	89.2112	89.0337	88.6658	86.7000	86.7000	86.7000	86.7000	88.9595	89.2192	89.3491	(216)
Fuel for water heating, kWh/month	182.3613	160.2103	167.0632	148.1996	144.4765	130.0398	123.0196	137.5854	138.1678	153.9125	164.6044	177.3082	(219)
Water heating fuel used													1826.9486 (219)
Annual totals kWh/year													
Space heating fuel - main system													4102.4355 (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)													336.9700 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895			-588.2895 (233)
Total delivered energy for all uses													5753.0646 (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	4102.4355	0.2160	886.1261	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1826.9486	0.2160	394.6209	(264)
Space and water heating			1280.7470	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	336.9700	0.5190	174.8874	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total CO2, kg/year			1189.2371	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4200	(273)

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

DER			17.4200	ZC1
Total Floor Area		TFA	68.2700	
Assumed number of occupants		N	2.2034	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.7719	ZC2
CO2 emissions from cooking, equation (L16)			2.5177	ZC3
Total CO2 emissions			36.7096	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			36.7096	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (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) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3709 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3152 (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	0.4019	0.3940	0.3862	0.3468	0.3389	0.2995	0.2995	0.2916	0.3152	0.3389	0.3546	0.3704 (22b)
Effective ac	0.5808	0.5776	0.5746	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (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			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			8.2700	1.3258	10.9640		(27)
Jet Floor Lo			2.4800	0.1300	0.3224		(28a)
Exposed Floor over Garage			25.4600	0.1300	3.3098		(28b)
Exposed Floor - Drive Through			37.8500	0.1300	4.9205		(28b)
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.1800	7.7382		(29a)
Wall to Garage	7.2100		7.2100	0.1800	1.2978		(29a)
Wall to Garage/Store	0.7000		0.7000	0.1800	0.1260		(29a)
E-WM-28	3.9600		3.9600	0.1800	0.7128		(29a)
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527		(30)
Total net area of external elements Aum(A, m ²)			196.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.0942	(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)	18.9379 (36)
Total fabric heat loss	(33) + (36) = 59.0321 (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	31.7160	31.5447	31.3768	30.5883	30.4408	29.7540	29.7540	29.6268	30.0185	30.4408	30.7392	31.0512 (38)
Heat transfer coeff	90.7481	90.5768	90.4090	89.6204	89.4729	88.7861	88.7861	88.6589	89.0506	89.4729	89.7713	90.0834 (39)
Average = Sum(39)m / 12 =												89.6197 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3293	1.3267	1.3243	1.3127	1.3106	1.3005	1.3005	1.2987	1.3044	1.3106	1.3149	1.3195 (40)
HLP (average)												1.3127 (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	2.2034 (42)
Average daily hot water use (litres/day)	86.5308 (43)
Daily hot water use	Jan 95.1839, Feb 91.7226, Mar 88.2614, Apr 84.8002, May 81.3390, Jun 77.8777, Jul 77.8777, Aug 81.3390, Sep 84.8002, Oct 88.2614, Nov 91.7226, Dec 95.1839 (44)
Energy conte	141.1549, 123.4550, 127.3945, 111.0656, 106.5701, 91.9619, 85.2162, 97.7869, 98.9547, 115.3222, 125.8832, 136.7010 (45)
Energy content (annual)	Total = Sum(45)m = 1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	21.1732	18.5183	19.1092	16.6598	15.9855	13.7943	12.7824	14.6680	14.8432	17.2983	18.8825	20.5052 (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	48.5047	42.2175	44.9771	41.8193	41.4494	38.4055	39.6856	41.4494	41.8193	44.9771	45.2331	48.5047 (61)
Total heat required for water heating calculated for each month	189.6596	165.6726	172.3716	152.8849	148.0196	130.3674	124.9019	139.2363	140.7740	160.2993	171.1163	185.2057 (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	189.6596	165.6726	172.3716	152.8849	148.0196	130.3674	124.9019	139.2363	140.7740	160.2993	171.1163	185.2057 (64)
Heat gains from water heating, kWh/month	59.0602	51.6032	53.6029	47.3841	45.7969	40.1787	38.2558	42.8765	43.3573	49.5889	53.1644	57.5793 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0806	16.9473	13.7824	10.4342	7.7997	6.5848	7.1151	9.2485	12.4133	15.7616	18.3961	19.6109 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.2261	195.2312	190.1785	179.4218	165.8434	153.0816	144.5560	142.5509	147.6036	158.3603	171.9387	184.7005 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170 (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)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361 (71)
Water heating gains (Table 5)	79.3820	76.7904	72.0470	65.8113	61.5550	55.8037	51.4191	57.6297	60.2184	66.6517	73.8395	77.3915 (72)
Total internal gains	350.7398	348.0199	335.0589	314.7183	294.2491	274.5212	262.1412	268.4801	279.2864	299.8247	323.2253	340.7539 (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					3.2700	19.6403	0.6300	0.7000			0.7700	19.6276 (76)
West					5.0000	19.6403	0.6300	0.7000			0.7700	30.0116 (80)

Solar gains	49.6392	97.1048	159.9177	233.2305	285.8327	292.6006	278.5677	239.2856	185.9909	115.2230	61.8942	40.8209 (83)
Total gains	400.3789	445.1247	494.9766	547.9488	580.0818	567.1218	540.7090	507.7657	465.2774	415.0477	385.1196	381.5748 (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	52.2432	52.3420	52.4392	52.9006	52.9878	53.3977	53.3977	53.4743	53.2391	52.9878	52.8117	52.6287
alpha	4.4829	4.4895	4.4959	4.5267	4.5325	4.5598	4.5598	4.5650	4.5493	4.5325	4.5208	4.5086
util living area	0.9981	0.9966	0.9922	0.9770	0.9317	0.8209	0.6680	0.7207	0.9129	0.9856	0.9966	0.9985 (86)
MIT	19.5135	19.6477	19.9069	20.2664	20.6102	20.8625	20.9606	20.9439	20.7462	20.3030	19.8461	19.4889 (87)
Th 2	19.8180	19.8199	19.8219	19.8309	19.8326	19.8404	19.8404	19.8419	19.8374	19.8326	19.8291	19.8256 (88)
util rest of house	0.9974	0.9954	0.9891	0.9669	0.8984	0.7309	0.5176	0.5760	0.8559	0.9775	0.9951	0.9980 (89)
MIT 2	17.8495	18.0469	18.4259	18.9507	19.4283	19.7409	19.8251	19.8171	19.6166	19.0097	18.3436	17.8187 (90)
Living area fraction	18.3628	18.5407	18.8828	19.3565	19.7929	20.0869	20.1754	20.1647	19.9650	19.4087	18.8071	18.3339 (92)
MIT	18.3628	18.5407	18.8828	19.3565	19.7929	20.0869	20.1754	20.1647	19.9650	19.4087	18.8071	18.3339 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3628	18.5407	18.8828	19.3565	19.7929	20.0869	20.1754	20.1647	19.9650	19.4087	18.8071	18.3339 (93)

8. Space heating requirement

Utilisation	0.9962	0.9934	0.9856	0.9614	0.8970	0.7528	0.5645	0.6206	0.8637	0.9734	0.9932	0.9969 (94)
Useful gains	398.8554	442.2034	487.8567	526.8097	520.3377	426.9450	305.2554	315.1184	401.8724	403.9898	382.5009	380.4053 (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	1276.1754	1235.5324	1119.5120	937.1187	724.0964	487.1580	317.4432	333.7715	522.2845	788.1366	1050.9586	1273.2297 (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	652.7261	533.1171	469.9515	295.4225	151.5964	0.0000	0.0000	0.0000	0.0000	285.8052	481.2895	664.2613 (98)
Space heating												3534.1696 (98)
Space heating per m2												51.7675 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3783.9075 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	652.7261	533.1171	469.9515	295.4225	151.5964	0.0000	0.0000	0.0000	0.0000	285.8052	481.2895	664.2613	(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)	698.8502	570.7892	503.1601	316.2982	162.3088	0.0000	0.0000	0.0000	0.0000	306.0013	515.2993	711.2006	(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	189.6596	165.6726	172.3716	152.8849	148.0196	130.3674	124.9019	139.2363	140.7740	160.2993	171.1163	185.2057	(64)
Efficiency of water heater (217)m	87.9105	87.7823	87.4483	86.6819	85.1113	80.3000	80.3000	80.3000	80.3000	86.4909	87.5130	80.3000	(216)
Fuel for water heating, kWh/month	215.7417	188.7311	197.1125	176.3747	173.9129	162.3504	155.5440	173.3951	175.3101	185.3365	195.5325	210.4918	(219)
Water heating fuel used												2209.8333	(219)
Annual totals kWh/year													
Space heating fuel - main system												3783.9075	(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)												336.9700	(232)
Total delivered energy for all uses												6405.7108	(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	3783.9075	0.2160	817.3240 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2209.8333	0.2160	477.3240 (264)
Space and water heating			1294.6480 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.9700	0.5190	174.8874 (268)
Total CO2, kg/m2/year			1508.4605 (272)
Emissions per m2 for space and water heating			18.9636 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5617 (272b)
Emissions per m2 for pumps and fans			0.5702 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.9636 * 1.00) + 2.5617 + 0.5702, rounded to 2 d.p.			22.1000 (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	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (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) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					4.7900
Infiltration rate					0.3604 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3063 (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	0.3905	0.3829	0.3752	0.3369	0.3293	0.2910	0.2910	0.2833	0.3063	0.3293	0.3446	0.3599 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5423	0.5423	0.5401	0.5469	0.5542	0.5594	0.5648 (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
Solid FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			8.2700	1.3258	10.9640		(27)
Jet Floor Lo			2.4800	0.1600	0.3968	75.0000	186.0000 (28a)
Exposed Floor over Garage			25.4600	0.1900	4.8374	20.0000	509.2000 (28b)
Exposed Floor - Drive Through			37.8500	0.2100	7.9485	20.0000	757.0000 (28b)
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.2500	10.7475	60.0000	2579.4000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	0.7000		0.7000	0.7000	0.4900	9.0000	6.3000 (29a)
E-WM-28	3.9600		3.9600	0.3000	1.1880	110.0000	435.6000 (29a)
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527	9.0000	592.1100 (30)
Total net area of external elements Aum(A, m ²)			196.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6649		(32)
E-WM-28			33.4300	0.0000	0.0000	110.0000	3677.3000 (32)
1F - Timber			102.2700			9.0000	920.4300 (32c)
Internal Floor			2.4800			18.0000	44.6400 (32d)
Internal Ceiling			2.4800			9.0000	22.3200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9795.1900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.4772 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.7503 (36)
Total fabric heat loss (33) + (36) = 68.4152 (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	31.4698	31.3081	31.1495	30.4050	30.2657	29.6173	29.6173	29.4972	29.8670	30.2657	30.5475	30.8421 (38)
Heat transfer coeff	99.8849	99.7232	99.5647	98.8202	98.6809	98.0324	98.0324	97.9123	98.2822	98.6809	98.9627	99.2573 (39)
Average = Sum(39)m / 12 =												98.8195 (39)
HLP	1.4631	1.4607	1.4584	1.4475	1.4455	1.4360	1.4360	1.4342	1.4396	1.4455	1.4496	1.4539 (40)
HLP (average)												1.4475 (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												2.2034 (42)
Average daily hot water use (litres/day)												86.5308 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	95.1839	91.7226	88.2614	84.8002	81.3390	77.8777	77.8777	81.3390	84.8002	88.2614	91.7226	95.1839 (44)
Energy conte	141.1549	123.4550	127.3945	111.0656	106.5701	91.9619	85.2162	97.7869	98.9547	115.3222	125.8832	136.7010 (45)
Energy content (annual)										Total =	Sum (45)m =	1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	29.9954	26.2342	27.0713	23.6014	22.6461	19.5419	18.1084	20.7797	21.0279	24.5060	26.7502	29.0490 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	19.0806	16.9473	13.7824	10.4342	7.7997	6.5848	7.1151	9.2485	12.4133	15.7616	18.3961	19.6109 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	193.2261	195.2312	190.1785	179.4218	165.8434	153.0816	144.5560	142.5509	147.6036	158.3603	171.9387	184.7005 (68)
Pumps, fans	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361 (71)
Total internal gains	40.3164	39.0390	36.3862	32.7798	30.4384	27.1415	24.3393	27.9297	29.2054	32.9381	37.1530	39.0443 (72)
	308.6742	307.2685	296.3981	278.6868	260.1325	242.8590	232.0614	235.7801	245.2734	263.1111	283.5389	299.4068 (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				3.2700	19.6403		0.6200		0.7000		0.7700		19.3160 (76)
West				5.0000	19.6403		0.6200		0.7000		0.7700		29.5352 (80)

Solar gains	48.8513	95.5634	157.3794	229.5284	281.2957	287.9562	274.1460	235.4874	183.0387	113.3941	60.9118		40.1729 (83)
Total gains	357.5255	402.8319	453.7775	508.2152	541.4282	530.8152	506.2075	471.2675	428.3121	376.5051	344.4506		339.5797 (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	27.2402	27.2844	27.3278	27.5337	27.5726	27.7550	27.7550	27.7890	27.6844	27.5726	27.4941	27.4125	
alpha	2.8160	2.8190	2.8219	2.8356	2.8382	2.8503	2.8503	2.8526	2.8456	2.8382	2.8329	2.8275	
util living area													
	0.9897	0.9847	0.9735	0.9472	0.8944	0.7986	0.6785	0.7234	0.8798	0.9624	0.9851	0.9911 (86)	
MIT	18.4896	18.6895	19.0839	19.6301	20.1682	20.6086	20.8310	20.7894	20.4210	19.7261	19.0138	18.4518 (87)	
Th 2	19.7153	19.7171	19.7188	19.7271	19.7287	19.7359	19.7359	19.7372	19.7331	19.7287	19.7255	19.7223 (88)	
util rest of house													
	0.9874	0.9812	0.9670	0.9325	0.8601	0.7204	0.5399	0.5944	0.8262	0.9493	0.9810	0.9891 (89)	
MIT 2	17.4484	17.6484	18.0410	18.5841	19.1020	19.5030	19.6702	19.6475	19.3492	18.6860	17.9784	17.4155 (90)	
Living area fraction													
MIT	17.7696	17.9696	18.3627	18.9068	19.4309	19.8441	20.0283	19.9997	19.6798	19.0069	18.2978	17.7352 (92)	
Temperature adjustment													
adjusted MIT	17.7696	17.9696	18.3627	18.9068	19.4309	19.8441	20.0283	19.9997	19.6798	19.0069	18.2978	17.7352 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9823	0.9745	0.9575	0.9202	0.8501	0.7283	0.5764	0.6256	0.8233	0.9390	0.9746	0.9846 (94)
Ext temp.	351.1988	392.5517	434.4879	467.6469	460.2756	386.6012	291.7878	294.8481	352.6371	353.5551	335.6855	334.3577 (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	1345.4130	1303.3404	1181.1083	988.8733	762.8933	514.0878	336.0837	352.4597	548.3995	829.5969	1108.1641	1343.4664 (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	739.6954	612.0500	555.4855	375.2830	225.1476	0.0000	0.0000	0.0000	0.0000	354.1751	556.1846	750.7768 (98)
Space heating per m2										(98) / (4) =		61.0634 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	921.5048	725.4399	744.1338	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6338	0.7118	0.6783	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	584.0131	516.3631	504.7520	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.1476	672.8046	633.5504	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	85.7768	116.3924	95.8260	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												297.9953	(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	21.4442	29.0981	23.9565	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												74.4988	(107)
Space cooling per m2												1.0912	(108)
Energy for space heating												61.0634	(99)
Energy for space cooling												1.0912	(108)
Total												62.1546	(109)
Dwelling Fabric Energy Efficiency (DFEE)												62.2	(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	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										20.0000 / (5) =							0.1209 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3709 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3152 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4019	0.3940	0.3862	0.3468	0.3389	0.2995	0.2995	0.2916	0.3152	0.3389	0.3546	0.3704	(22b)				
Effective ac	0.5808	0.5776	0.5746	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686	(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			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			8.2700	1.3258	10.9640		(27)					
Jet Floor Lo			2.4800	0.1300	0.3224		(28a)					
Exposed Floor over Garage			25.4600	0.1300	3.3098		(28b)					
Exposed Floor - Drive Through			37.8500	0.1300	4.9205		(28b)					
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.1800	7.7382		(29a)					
Wall to Garage	7.2100		7.2100	0.1800	1.2978		(29a)					
Wall to Garage/Store	0.7000		0.7000	0.1800	0.1260		(29a)					
E-WM-28	3.9600		3.9600	0.1800	0.7128		(29a)					
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527		(30)					
Total net area of external elements Aum(A, m2)			196.8600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.0942		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.9379 (36)					
Total fabric heat loss						(33) + (36) =	59.0321 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 31.7160	Feb 31.5447	Mar 31.3768	Apr 30.5883	May 30.4408	Jun 29.7540	Jul 29.7540	Aug 29.6268	Sep 30.0185	Oct 30.4408	Nov 30.7392	Dec 31.0512 (38)
Heat transfer coeff	90.7481	90.5768	90.4090	89.6204	89.4729	88.7861	88.7861	88.6589	89.0506	89.4729	89.7713	90.0834 (39)
Average = Sum(39)m / 12 =												89.6197 (39)
HLP	Jan 1.3293	Feb 1.3267	Mar 1.3243	Apr 1.3127	May 1.3106	Jun 1.3005	Jul 1.3005	Aug 1.2987	Sep 1.3044	Oct 1.3106	Nov 1.3149	Dec 1.3195 (40)
HLP (average)												1.3127 (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												2.2034 (42)
Average daily hot water use (litres/day)												86.5308 (43)
Daily hot water use	Jan 95.1839	Feb 91.7226	Mar 88.2614	Apr 84.8002	May 81.3390	Jun 77.8777	Jul 77.8777	Aug 81.3390	Sep 84.8002	Oct 88.2614	Nov 91.7226	Dec 95.1839 (44)
Energy conte	141.1549	123.4550	127.3945	111.0656	106.5701	91.9619	85.2162	97.7869	98.9547	115.3222	125.8832	136.7010 (45)
Energy content (annual)												Total = Sum(45)m = 1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water 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	(46)
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	29.9954	26.2342	27.0713	23.6014	22.6461	19.5419	18.1084	20.7797	21.0279	24.5060	26.7502	29.0490	(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	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	110.1701	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0806	16.9473	13.7824	10.4342	7.7997	6.5848	7.1151	9.2485	12.4133	15.7616	18.3961	19.6109	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.2261	195.2312	190.1785	179.4218	165.8434	153.0816	144.5560	142.5509	147.6036	158.3603	171.9387	184.7005	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	34.0170	(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)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	(71)
Water heating gains (Table 5)	40.3164	39.0390	36.3862	32.7798	30.4384	27.1415	24.3393	27.9297	29.2054	32.9381	37.1530	39.0443	(72)
Total internal gains	308.6742	307.2685	296.3981	278.6868	260.1325	242.8590	232.0614	235.7801	245.2734	263.1111	283.5389	299.4068	(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					3.2700	19.6403	0.6300	0.7000			0.7700			19.6276 (76)
West					5.0000	19.6403	0.6300	0.7000			0.7700			30.0116 (80)

Solar gains	49.6392	97.1048	159.9177	233.2305	285.8327	292.6006	278.5677	239.2856	185.9909	115.2230	61.8942	40.8209 (83)		
Total gains	358.3134	404.3732	456.3159	511.9173	545.9652	535.4596	510.6292	475.0657	431.2643	378.3341	345.4331	340.2276 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	52.2432	52.3420	52.4392	52.9006	52.9878	53.3977	53.3977	53.4743	53.2391	52.9878	52.8117	52.6287		
alpha	4.4829	4.4895	4.4959	4.5267	4.5325	4.5598	4.5598	4.5650	4.5493	4.5325	4.5208	4.5086		
util living area	0.9988	0.9977	0.9943	0.9821	0.9436	0.8436	0.6966	0.7527	0.9307	0.9899	0.9978	0.9991	(86)	
MIT	19.4579	19.5942	19.8571	20.2229	20.5764	20.8440	20.9532	20.9327	20.7149	20.2569	19.7938	19.4340	(87)	
Th 2	19.8180	19.8199	19.8219	19.8309	19.8326	19.8404	19.8404	19.8419	19.8374	19.8326	19.8291	19.8256	(88)	
util rest of house	0.9984	0.9969	0.9921	0.9740	0.9147	0.7582	0.5447	0.6090	0.8817	0.9841	0.9969	0.9987	(89)	
MIT 2	18.4186	18.5561	18.8196	19.1882	19.5275	19.7611	19.8276	19.8207	19.6626	19.2261	18.7629	18.4006	(90)	
Living area fraction									fLA = Living area / (4) =			0.3085	(91)	
MIT	18.7392	18.8763	19.1396	19.5074	19.8510	20.0951	20.1748	20.1637	19.9872	19.5441	19.0809	18.7194	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7392	18.8763	19.1396	19.5074	19.8510	20.0951	20.1748	20.1637	19.9872	19.5441	19.0809	18.7194	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9978	0.9959	0.9902	0.9710	0.9152	0.7800	0.5926	0.6539	0.8897	0.9820	0.9960	0.9983	(94)
Ext temp.	357.5345	402.7312	451.8668	497.0935	499.6927	417.6696	302.6052	310.6648	383.7020	371.5396	344.0495	339.6462	(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	1310.3276	1265.9318	1142.7337	950.6363	729.2978	487.8904	317.3955	333.6882	524.2578	800.2501	1075.5438	1307.9584	(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	708.8781	580.0708	514.0050	326.5508	170.8262	0.0000	0.0000	0.0000	0.0000	318.9606	526.6759	720.4243	(98)
Space heating per m2												3866.3917	(98)
												56.6338	(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	834.5891	657.0169	673.8075	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7473	0.8328	0.7972	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	623.6869	547.1437	537.1597	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	708.5762	677.9728	637.9898	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET 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	61.1203	97.3369	75.0176	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												233.4748 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												58.3687 (107)
Energy for space heating												0.8550 (108)
Energy for space cooling												56.6338 (99)
Total												0.8550 (108)
Target Fabric Energy Efficiency (TFEE)												57.4888 (109)
												66.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (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) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					4.7900
Infiltration rate					0.3604 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3063 (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	0.3216	0.2986	0.3063	0.2910	0.2910	0.2833	0.2757	0.2680	0.2604	0.2833	0.2680	0.2833 (22b)
Effective ac	0.5517	0.5446	0.5469	0.5423	0.5423	0.5401	0.5380	0.5359	0.5339	0.5401	0.5359	0.5401 (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
Solid FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			8.2700	1.3258	10.9640		(27)
Jet Floor Lo			2.4800	0.1600	0.3968	75.0000	186.0000 (28a)
Exposed Floor over Garage			25.4600	0.1900	4.8374	20.0000	509.2000 (28b)
Exposed Floor - Drive Through			37.8500	0.2100	7.9485	20.0000	757.0000 (28b)
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.2500	10.7475	60.0000	2579.4000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	0.7000		0.7000	0.7000	0.4900	9.0000	6.3000 (29a)
E-WM-28	3.9600		3.9600	0.3000	1.1880	110.0000	435.6000 (29a)
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527	9.0000	592.1100 (30)
Total net area of external elements Aum(A, m ²)			196.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6649		(32)
E-WM-28			33.4300	0.0000	0.0000	110.0000	3677.3000 (32)
1F - Timber			102.2700			9.0000	920.4300 (32c)
Internal Floor			2.4800			18.0000	44.6400 (32d)
Internal Ceiling			2.4800			18.0000	44.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 9817.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 143.8042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.7503 (36)
Total fabric heat loss (33) + (36) = 68.4152 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.1296	29.7405	29.8670	29.6173	29.6173	29.4972	29.3803	29.2666	29.1561	29.4972	29.2666	29.4972 (38)
Heat transfer coeff	98.5448	98.1557	98.2822	98.0324	98.0324	97.9123	97.7955	97.6818	97.5713	97.9123	97.6818	97.9123 (39)
Average = Sum(39)m / 12 =												97.9596 (39)
HLP	1.4435	1.4378	1.4396	1.4360	1.4360	1.4342	1.4325	1.4308	1.4292	1.4342	1.4308	1.4342 (40)
HLP (average)												1.4349 (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												2.2034 (42)
Average daily hot water use (litres/day)												86.5308 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	95.1839	91.7226	88.2614	84.8002	81.3390	77.8777	77.8777	81.3390	84.8002	88.2614	91.7226	95.1839 (44)
Energy conte	141.1549	123.4550	127.3945	111.0656	106.5701	91.9619	85.2162	97.7869	98.9547	115.3222	125.8832	136.7010 (45)
Energy content (annual)										Total = Sum (45)m =		1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m	21.1732	18.5183	19.1092	16.6598	15.9855	13.7943	12.7824	14.6680	14.8432	17.2983	18.8825	20.5052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7409	19.6012	21.6445	20.8819	21.5312	20.7826	21.4418	21.4997	20.8367	21.5976	20.9755	21.7223 (61)
Total heat required for water heating calculated for each month												
Solar input	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (64)
RHI water heating demand												1616 (64)
Heat gains from water heating, kWh/month	52.3692	45.9491	47.7698	42.1498	40.8174	35.7730	33.6948	37.8891	38.1116	43.7440	47.1001	50.8837 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7016	42.3681	34.4561	26.0855	19.4992	16.4620	17.7878	23.1213	31.0333	39.4039	45.9902	49.0274 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3972	291.3899	283.8485	267.7937	247.5274	228.4800	215.7552	212.7625	220.3039	236.3587	256.6249	275.6724 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238 (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)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361 (71)
Water heating gains (Table 5)	70.3888	68.3766	64.2067	58.5414	54.8620	49.6847	45.2888	50.9262	52.9328	58.7958	65.4167	68.3920 (72)
Total internal gains	503.9794	499.6265	480.0031	449.9124	419.3805	392.1186	376.3236	384.3018	401.7619	432.0502	465.5237	490.5836 (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				3.2700	25.1925	0.6200		0.7000		0.7700		24.7767 (76)
West				5.0000	25.1925	0.6200		0.7000		0.7700		37.8848 (80)

Solar gains	62.6615	104.2684	172.6323	252.2401	292.8850	325.2969	307.4197	271.2386	211.7068	133.3823	77.8748	50.6514 (83)
Total gains	566.6409	603.8949	652.6354	702.1525	712.2655	717.4156	683.7433	655.5404	613.4687	565.4325	543.3985	541.2350 (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	27.6736	27.7833	27.7475	27.8182	27.8182	27.8523	27.8856	27.9181	27.9497	27.8523	27.9181	27.8523
alpha	2.8449	2.8522	2.8498	2.8545	2.8545	2.8568	2.8590	2.8612	2.8633	2.8568	2.8612	2.8568
util living area	0.9650	0.9568	0.9335	0.8836	0.7955	0.6420	0.5059	0.5224	0.7419	0.8914	0.9485	0.9680 (86)
MIT	19.0068	19.1509	19.5288	20.0264	20.4879	20.8127	20.9317	20.9260	20.6930	20.1624	19.5303	18.9966 (87)
Th 2	19.7302	19.7345	19.7331	19.7359	19.7359	19.7372	19.7385	19.7398	19.7410	19.7372	19.7398	19.7372 (88)
util rest of house	0.9576	0.9476	0.9185	0.8550	0.7390	0.5390	0.3626	0.3764	0.6547	0.8579	0.9354	0.9612 (89)
MIT 2	17.1504	17.3599	17.9008	18.6020	19.2212	19.6027	19.7100	19.7084	19.4868	18.8050	17.9140	17.1404 (90)
Living area fraction									fLA = Living area / (4) =			0.3085 (91)
MIT	17.7231	17.9124	18.4030	19.0414	19.6120	19.9760	20.0869	20.0840	19.8589	19.2237	18.4126	17.7130 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5731	17.7624	18.2530	18.8914	19.4620	19.8260	19.9369	19.9340	19.7089	19.0737	18.2626	17.5630 (93)

8. Space heating requirement

Utilisation	0.9394	0.9276	0.8951	0.8310	0.7246	0.5470	0.3869	0.4008	0.6521	0.8351	0.9141	0.9440 (94)
Useful gains	532.3131	560.1784	584.1447	583.4994	516.0774	392.4610	264.5281	262.7508	400.0446	472.1682	496.7238	510.9177 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1248.8670	1223.2549	1105.9719	920.6630	682.4997	443.1467	277.4316	276.8300	488.7246	751.3540	1012.2384	1230.0756 (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	533.1161	445.5874	388.2395	242.7578	123.8181	0.0000	0.0000	0.0000	0.0000	207.7142	371.1705	535.0535 (98)
Space heating												2847.4571 (98)
RHI space heating demand												2847 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (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) = 0.1209 (8)
Pressure test					Yes
Measured/design AP50					4.7900
Infiltration rate					0.3604 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3063 (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	0.3905	0.3829	0.3752	0.3369	0.3293	0.2910	0.2910	0.2833	0.3063	0.3293	0.3446	0.3599 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5423	0.5423	0.5401	0.5469	0.5542	0.5594	0.5648 (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
Solid FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			8.2700	1.3258	10.9640		(27)
Jet Floor Lo			2.4800	0.1600	0.3968	75.0000	186.0000 (28a)
Exposed Floor over Garage			25.4600	0.1900	4.8374	20.0000	509.2000 (28b)
Exposed Floor - Drive Through			37.8500	0.2100	7.9485	20.0000	757.0000 (28b)
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.2500	10.7475	60.0000	2579.4000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	0.7000		0.7000	0.7000	0.4900	9.0000	6.3000 (29a)
E-WM-28	3.9600		3.9600	0.3000	1.1880	110.0000	435.6000 (29a)
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527	9.0000	592.1100 (30)
Total net area of external elements Aum(A, m ²)			196.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6649		(32)
E-WM-28			33.4300	0.0000	0.0000	110.0000	3677.3000 (32)
1F - Timber			102.2700			9.0000	920.4300 (32c)
Internal Floor			2.4800			18.0000	44.6400 (32d)
Internal Ceiling			2.4800			18.0000	44.6400 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9817.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		143.8042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		17.7503 (36)
Total fabric heat loss	(33) + (36) =	68.4152 (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	31.4698	31.3081	31.1495	30.4050	30.2657	29.6173	29.6173	29.4972	29.8670	30.2657	30.5475	30.8421 (38)
Heat transfer coeff	99.8849	99.7232	99.5647	98.8202	98.6809	98.0324	98.0324	97.9123	98.2822	98.6809	98.9627	99.2573 (39)
Average = Sum(39)m / 12 =												98.8195 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4631	1.4607	1.4584	1.4475	1.4455	1.4360	1.4360	1.4342	1.4396	1.4455	1.4496	1.4539 (40)
HLP (average)												1.4475 (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		2.2034 (42)
Average daily hot water use (litres/day)		86.5308 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	95.1839	91.7226	88.2614	84.8002	81.3390	77.8777	77.8777	81.3390	84.8002	88.2614	91.7226	95.1839 (44)
Energy conte	141.1549	123.4550	127.3945	111.0656	106.5701	91.9619	85.2162	97.7869	98.9547	115.3222	125.8832	136.7010 (45)
Energy content (annual)										Total = Sum (45)m =		1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m	21.1732	18.5183	19.1092	16.6598	15.9855	13.7943	12.7824	14.6680	14.8432	17.2983	18.8825	20.5052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7409	19.6012	21.6445	20.8819	21.5312	20.7826	21.4418	21.4997	20.8367	21.5976	20.9755	21.7223 (61)
Total heat required for water heating calculated for each month	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (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	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (64)
Heat gains from water heating, kWh/month	52.3692	45.9491	47.7698	42.1498	40.8174	35.7730	33.6948	37.8891	38.1116	43.7440	47.1001	50.8837 (65)
										Total per year (kWh/year) = Sum (64)m =		1615.7224 (64)

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	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7016	42.3681	34.4561	26.0855	19.4992	16.4620	17.7878	23.1213	31.0333	39.4039	45.9902	49.0274 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3972	291.3899	283.8485	267.7937	247.5274	228.4800	215.7552	212.7625	220.3039	236.3587	256.6249	275.6724 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238 (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)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361 (71)
Water heating gains (Table 5)	70.3888	68.3766	64.2067	58.5414	54.8620	49.6847	45.2888	50.9262	52.9328	58.7958	65.4167	68.3920 (72)
Total internal gains	503.9794	499.6265	480.0031	449.9124	419.3805	392.1186	376.3236	384.3018	401.7619	432.0502	465.5237	490.5836 (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				3.2700	19.6403	0.6200	0.7000			0.7700	19.3160 (76)	
West				5.0000	19.6403	0.6200	0.7000			0.7700	29.5352 (80)	
Solar gains	48.8513	95.5634	157.3794	229.5284	281.2957	287.9562	274.1460	235.4874	183.0387	113.3941	60.9118	40.1729 (83)
Total gains	552.8307	595.1899	637.3825	679.4408	700.6762	680.0748	650.4696	619.7892	584.8006	545.4443	526.4355	530.7565 (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	27.3023	27.3466	27.3901	27.5964	27.6354	27.8182	27.8182	27.8523	27.7475	27.6354	27.5567	27.4749
alpha	2.8202	2.8231	2.8260	2.8398	2.8424	2.8545	2.8545	2.8568	2.8498	2.8424	2.8371	2.8317
util living area	0.9699	0.9609	0.9421	0.9021	0.8298	0.7100	0.5761	0.6140	0.7923	0.9148	0.9585	0.9730 (86)
MIT	18.8410	19.0273	19.3897	19.8840	20.3557	20.7224	20.8913	20.8658	20.5878	19.9897	19.3330	18.7993 (87)
Th 2	19.7153	19.7171	19.7188	19.7271	19.7287	19.7359	19.7359	19.7372	19.7331	19.7287	19.7255	19.7223 (88)
util rest of house	0.9636	0.9527	0.9291	0.8782	0.7833	0.6216	0.4415	0.4835	0.7196	0.8891	0.9483	0.9674 (89)
MIT 2	16.9019	17.1717	17.6940	18.3997	19.0456	19.5087	19.6790	19.6609	19.3599	18.5616	17.6224	16.8458 (90)
Living area fraction										fLA = Living area / (4) =		0.3085 (91)
MIT	17.5001	17.7441	18.2171	18.8576	19.4497	19.8831	20.0530	20.0326	19.7387	19.0022	18.1501	17.4484 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3501	17.5941	18.0671	18.7076	19.2997	19.7331	19.9030	19.8826	19.5887	18.8522	18.0001	17.2984 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9467	0.9333	0.9064	0.8535	0.7643	0.6213	0.4612	0.5003	0.7097	0.8655	0.9286	0.9516 (94)
Ext temp.	523.3813	555.5170	577.6954	579.9117	535.5463	422.5610	299.9802	310.0810	415.0162	472.0594	488.8274	505.0796 (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	1303.5088	1265.8993	1151.6768	969.1875	749.9474	503.2092	323.8001	340.9914	539.4430	814.3302	1078.7034	1300.1113 (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	580.4148	477.3769	427.0422	280.2786	159.5145	0.0000	0.0000	0.0000	0.0000	254.6494	424.7107	591.5036 (98)
Space heating per m2												3195.4906 (98)
										(98) / (4) =		46.8067 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
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													3550.5451 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	580.4148	477.3769	427.0422	280.2786	159.5145	0.0000	0.0000	0.0000	0.0000	254.6494	424.7107	591.5036	(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)	644.9053	530.4188	474.4913	311.4206	177.2383	0.0000	0.0000	0.0000	0.0000	282.9438	471.9008	657.2262	(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	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233	(64)
Efficiency of water heater (217)m	89.2555	89.2170	89.1224	88.9167	88.4997	86.7000	86.7000	86.7000	86.7000	88.8179	89.1284	89.2821	(216)
Fuel for water heating, kWh/month	182.5051	160.3464	167.2296	148.3945	144.7477	130.0398	123.0196	137.5854	138.1678	154.1579	164.7722	177.4413	(219)
Water heating fuel used												1828.4073	(219)
Annual totals kWh/year													
Space heating fuel - main system												3550.5451	(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)												336.9700	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5202.6329	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3550.5451	3.4800	123.5590 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1828.4073	3.4800	63.6286 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	336.9700	13.1900	44.4463 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-588.2895	13.1900	-77.5954 (252)
Total energy cost			283.9310 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.0528 (257)
SAP value	85.3134
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	3550.5451	0.2160	766.9177 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.4073	0.2160	394.9360 (264)
Space and water heating			1161.8537 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.9700	0.5190	174.8874 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1070.3439 (272)
CO2 emissions per m2			15.6800 (273)
EI value			87.3377
EI rating			87 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8825 = 3.943$, stars = 4
Water heating environmental impact	$0.216 / 0.8825 = 0.2448$, 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	2.4800 (1b)	x 2.5300 (2b)	= 6.2744 (1b) - (3b)
First floor	65.7900 (1c)	x 2.4200 (2c)	= 159.2118 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4862 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																2 * 10 =	20.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										20.0000 / (5) =							0.1209 (8)
Pressure test										Yes							
Measured/design AP50																	4.7900
Infiltration rate																	0.3604 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3063 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.3216	0.2986	0.3063	0.2910	0.2910	0.2833	0.2757	0.2680	0.2604	0.2833	0.2680	0.2833	(22b)				
Effective ac	0.5517	0.5446	0.5469	0.5423	0.5423	0.5401	0.5380	0.5359	0.5339	0.5401	0.5359	0.5401	(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						
Solid FD			2.1500	0.9000	1.9350			(26)					
Windows (Uw = 1.40)			8.2700	1.3258	10.9640			(27)					
Jet Floor Lo			2.4800	0.1600	0.3968	75.0000	186.0000	(28a)					
Exposed Floor over Garage			25.4600	0.1900	4.8374	20.0000	509.2000	(28b)					
Exposed Floor - Drive Through			37.8500	0.2100	7.9485	20.0000	757.0000	(28b)					
100mm Knauf Supafil	53.4100	10.4200	42.9900	0.2500	10.7475	60.0000	2579.4000	(29a)					
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900	(29a)					
Wall to Garage/Store	0.7000		0.7000	0.7000	0.4900	9.0000	6.3000	(29a)					
E-WM-28	3.9600		3.9600	0.3000	1.1880	110.0000	435.6000	(29a)					
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527	9.0000	592.1100	(30)					
Total net area of external elements Aum(A, m2)			196.8600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.6649			(33)					
E-WM-28			33.4300	0.0000	0.0000	110.0000	3677.3000	(32)					
1F - Timber			102.2700			9.0000	920.4300	(32c)					
Internal Floor			2.4800			18.0000	44.6400	(32d)					
Internal Ceiling			2.4800			18.0000	44.6400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9817.5100	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.8042	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.7503	(36)					
Total fabric heat loss						(33) + (36) =	68.4152	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.1296	29.7405	29.8670	29.6173	29.6173	29.4972	29.3803	29.2666	29.1561	29.4972	29.2666	29.4972	(38)
Heat transfer coeff	98.5448	98.1557	98.2822	98.0324	98.0324	97.9123	97.7955	97.6818	97.5713	97.9123	97.6818	97.9123	(39)
Average = Sum(39)m / 12 =												97.9596	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4435	1.4378	1.4396	1.4360	1.4360	1.4342	1.4325	1.4308	1.4292	1.4342	1.4308	1.4342	(40)
HLP (average)												1.4349	(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												2.2034 (42)
Average daily hot water use (litres/day)												86.5308 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	95.1839	91.7226	88.2614	84.8002	81.3390	77.8777	77.8777	81.3390	84.8002	88.2614	91.7226	95.1839 (44)
Energy conte	141.1549	123.4550	127.3945	111.0656	106.5701	91.9619	85.2162	97.7869	98.9547	115.3222	125.8832	136.7010 (45)
Energy content (annual)										Total = Sum (45)m =		1361.4664 (45)
Distribution loss (46)m = 0.15 x (45)m	21.1732	18.5183	19.1092	16.6598	15.9855	13.7943	12.7824	14.6680	14.8432	17.2983	18.8825	20.5052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7409	19.6012	21.6445	20.8819	21.5312	20.7826	21.4418	21.4997	20.8367	21.5976	20.9755	21.7223 (61)
Total heat required for water heating calculated for each month												
Solar input	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (62)
Solar input (sum of months) = Sum (63)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 (63)
Output from w/h	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233 (64)
Heat gains from water heating, kWh/month	52.3692	45.9491	47.7698	42.1498	40.8174	35.7730	33.6948	37.8891	38.1116	43.7440	47.1001	50.8837 (65)
Total per year (kWh/year) = Sum (64)m =												1615.7224 (64)

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	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041	132.2041 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.7016	42.3681	34.4561	26.0855	19.4992	16.4620	17.7878	23.1213	31.0333	39.4039	45.9902	49.0274 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3972	291.3899	283.8485	267.7937	247.5274	228.4800	215.7552	212.7625	220.3039	236.3587	256.6249	275.6724 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238	50.4238 (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)	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361	-88.1361 (71)
Water heating gains (Table 5)	70.3888	68.3766	64.2067	58.5414	54.8620	49.6847	45.2888	50.9262	52.9328	58.7958	65.4167	68.3920 (72)
Total internal gains	503.9794	499.6265	480.0031	449.9124	419.3805	392.1186	376.3236	384.3018	401.7619	432.0502	465.5237	490.5836 (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				3.2700	25.1925	0.6200		0.7000		0.7700		24.7767 (76)
West				5.0000	25.1925	0.6200		0.7000		0.7700		37.8848 (80)
Solar gains	62.6615	104.2684	172.6323	252.2401	292.8850	325.2969	307.4197	271.2386	211.7068	133.3823	77.8748	50.6514 (83)
Total gains	566.6409	603.8949	652.6354	702.1525	712.2655	717.4156	683.7433	655.5404	613.4687	565.4325	543.3985	541.2350 (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	27.6736	27.7833	27.7475	27.8182	27.8182	27.8523	27.8856	27.9181	27.9497	27.9523	27.9181	27.8523
alpha	2.8449	2.8522	2.8498	2.8545	2.8545	2.8568	2.8590	2.8612	2.8633	2.8568	2.8612	2.8568
util living area	0.9650	0.9568	0.9335	0.8836	0.7955	0.6420	0.5059	0.5224	0.7419	0.8914	0.9485	0.9680 (86)
MIT	19.0068	19.1509	19.5288	20.0264	20.4879	20.8127	20.9317	20.9260	20.6930	20.1624	19.5303	18.9966 (87)
Th 2	19.7302	19.7345	19.7331	19.7359	19.7359	19.7372	19.7385	19.7398	19.7410	19.7372	19.7398	19.7372 (88)
util rest of house	0.9576	0.9476	0.9185	0.8550	0.7390	0.5390	0.3626	0.3764	0.6547	0.8579	0.9354	0.9612 (89)
MIT 2	17.1504	17.3599	17.9008	18.6020	19.2212	19.6027	19.7100	19.7084	19.4868	18.8050	17.9140	17.1404 (90)
Living area fraction									fLA = Living area / (4) =			0.3085 (91)
MIT	17.7231	17.9124	18.4030	19.0414	19.6120	19.9760	20.0869	20.0840	19.8589	19.2237	18.4126	17.7130 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5731	17.7624	18.2530	18.8914	19.4620	19.8260	19.9369	19.9340	19.7089	19.0737	18.2626	17.5630 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9394	0.9276	0.8951	0.8310	0.7246	0.5470	0.3869	0.4008	0.6521	0.8351	0.9141	0.9440 (94)
Ext temp.	532.3131	560.1784	584.1447	583.4994	516.0774	392.4610	264.5281	262.7508	400.0446	472.1682	496.7238	510.9177 (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	1248.8670	1223.2549	1105.9719	920.6630	682.4997	443.1467	277.4316	276.8300	488.7246	751.3540	1012.2384	1230.0756 (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	533.1161	445.5874	388.2395	242.7578	123.8181	0.0000	0.0000	0.0000	0.0000	207.7142	371.1705	535.0535 (98)
Space heating per m2												2847.4571 (98)
										(98) / (4) =		41.7088 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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)
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													3163.8412 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	533.1161	445.5874	388.2395	242.7578	123.8181	0.0000	0.0000	0.0000	0.0000	207.7142	371.1705	535.0535	(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)	592.3512	495.0971	431.3772	269.7309	137.5757	0.0000	0.0000	0.0000	0.0000	230.7936	412.4116	594.5039	(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	162.8959	143.0563	149.0390	131.9475	128.1013	112.7445	106.6580	119.2866	119.7915	136.9198	146.8588	158.4233	(64)
Efficiency of water heater (217)m	89.2053	89.1751	89.0597	88.8097	88.2912	86.7000	86.7000	86.7000	86.7000	88.6593	89.0392	89.2242	(216)
Fuel for water heating, kWh/month	182.6077	160.4217	167.3473	148.5734	145.0896	130.0398	123.0196	137.5854	138.1678	154.4337	164.9371	177.5565	(219)
Water heating fuel used												1829.7797	(219)
Annual totals kWh/year													
Space heating fuel - main system												3163.8412	(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)													336.9700 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 + 1031 + 1.00) =									-668.0993			-668.0993	(233)
Total delivered energy for all uses												4737.4916	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3163.8412	3.9300	124.3390 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.7797	3.9300	71.9103 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	336.9700	17.5600	59.1719 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.0993	17.5600	-117.3182 (252)
Total energy cost			239.2730 (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	3163.8412	0.2160	683.3897 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.7797	0.2160	395.2324 (264)
Space and water heating			1078.6221 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	336.9700	0.5190	174.8874 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			945.6910 (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	3163.8412	1.2200	3859.8863 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.7797	1.2200	2232.3312 (264)
Space and water heating			6092.2175 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	336.9700	3.0700	1034.4979 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			5305.9006 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

77.7194 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 87

(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 Environmental
(none) efficiency impact

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 85
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 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	£72	£72	£0
Mains gas	£284	£284	£0
Space heating	£226	£226	£0
Water heating	£72	£72	£0
Lighting	£59	£59	£0
Generated (PV)	-£117	-£117	£0
Total cost of fuels	£239	£239	£0
Total cost of uses	£240	£240	£0
Delivered energy	69 kWh/m ²	69 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	14 kg/m ²	14 kg/m ²	0 kg/m ²
Primary energy	78 kWh/m ²	78 kWh/m ²	0 kWh/m ²

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	MidTerrace Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	143.8 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	218.44 (P1)
Transmission heat loss coefficient	68.42 (37)
Summer heat loss coefficient	286.86 (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	3.2700	125.2818	0.6200	0.7000	0.9000	144.0159
West	5.0000	125.2818	0.6200	0.7000	0.9000	220.2078
total:						364.2237

	Jun	Jul	Aug	
Solar gains	392	364	320	(P3)
Internal gains	389	373	381	
Total summer gains	781	738	702	(P5)

Summer gain/loss ratio	2.72	2.57	2.45	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 143.8)	0.99	0.99	0.99	
Threshold temperature	19.12	20.86	20.74	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight