

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-192			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	PF01 - Semi (As)		
Property	83, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2FW				
SAP Rating	85 B	DER	17.40	TER	22.77
Environmental	87 B	% DER<TER	23.59		
CO ₂ Emissions (t/year)	0.94	DFEE	64.93	TFEE	69.64
General Requirements Compliance	Pass	% DFEE<TFEE	6.76		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

End-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) 22.77 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 69.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 64.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (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: 4.77 (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 North East: 3.27 m², No overhang
Windows facing South 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

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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	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	=	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								4.7700				
Infiltration rate								0.3594 (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) =	0.3324 (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	0.4238	0.4155	0.4072	0.3656	0.3573	0.3158	0.3158	0.3075	0.3324	0.3573	0.3740	0.3906 (22b)
Effective ac	0.5898	0.5863	0.5829	0.5668	0.5638	0.5499	0.5499	0.5473	0.5552	0.5638	0.5699	0.5763 (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			24.9600	0.1900	4.7424	20.0000	499.2000 (28b)
Exposed Floor - Drive Through			38.3500	0.2100	8.0535	20.0000	767.0000 (28b)
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.2500	19.7025	60.0000	4728.6000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	2.3000		2.3000	0.7000	1.6100	9.0000	20.7000 (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)			230.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5619		(33)
E-WM-28			15.8500	0.0000	0.0000	110.0000	1743.5000 (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) =		9611.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2924 (36)
Total fabric heat loss					(33) + (36) =		72.8543 (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	32.2098	32.0193	31.8326	30.9558	30.7918	30.0281	30.0281	29.8867	30.3222	30.7918	31.1236	31.4706 (38)
Heat transfer coeff	105.0641	104.8736	104.6870	103.8101	103.6461	102.8824	102.8824	102.7410	103.1766	103.6461	103.9780	104.3249 (39)
Average = Sum(39)m / 12 =												103.8093 (39)
HLP	1.5389	1.5362	1.5334	1.5206	1.5182	1.5070	1.5070	1.5049	1.5113	1.5182	1.5230	1.5281 (40)
HLP (average)												1.5206 (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
Daily hot water use												

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Energy conte	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)
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 (63)	
							Solar input (sum of months) = Sum(63)m =				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)	
							Total per year (kWh/year) = Sum(64)m =				1615.7224 (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												
	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	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					
Northeast			3.2700	11.2829	0.6200	0.7000	0.7700	11.0967 (75)				
Southwest			5.0000	36.7938	0.6200	0.7000	0.7700	55.3309 (79)				
Solar gains	66.4276	116.8367	169.6514	226.6163	268.8075	273.4521	260.8952	228.4114	189.2200	131.7691	80.2362	56.4139 (83)
Total gains	408.1742	456.4428	496.8700	534.0647	556.3637	541.8543	516.9061	490.1880	461.2209	423.7378	395.0388	388.1683 (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	25.4123	25.4584	25.5038	25.7193	25.7600	25.9512	25.9512	25.9869	25.8772	25.7600	25.6777	25.5923
alpha	2.6942	2.6972	2.7003	2.7146	2.7173	2.7301	2.7301	2.7325	2.7251	2.7173	2.7118	2.7062
util living area												
	0.9848	0.9784	0.9665	0.9412	0.8909	0.7987	0.6817	0.7186	0.8654	0.9505	0.9783	0.9868 (86)
MIT	18.4353	18.6436	19.0296	19.5647	20.1075	20.5686	20.8083	20.7698	20.4028	19.7131	18.9842	18.3959 (87)
Th 2	19.6584	19.6605	19.6625	19.6721	19.6739	19.6823	19.6823	19.6838	19.6790	19.6739	19.6703	19.6665 (88)
util rest of house												
	0.9815	0.9735	0.9583	0.9249	0.8553	0.7187	0.5390	0.5855	0.8066	0.9336	0.9725	0.9838 (89)
MIT 2	16.2897	16.5934	17.1547	17.9303	18.6950	19.3087	19.5744	19.5427	19.1097	18.1528	17.0970	16.2367 (90)
Living area fraction												
MIT	16.9516	17.2258	17.7330	18.4345	19.1307	19.6974	19.9551	19.9212	19.5086	18.6341	17.6792	16.3085 (91)
Temperature adjustment												
adjusted MIT	16.8016	17.0758	17.5830	18.2845	18.9807	19.5474	19.8051	19.7712	19.3586	18.4841	17.5292	16.7528 (93)
												-0.1500

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9700	0.9590	0.9395	0.9010	0.8307	0.7086	0.5547	0.5961	0.7879	0.9115	0.9579	0.9735 (94)
Useful gains	395.9403	437.7353	466.7967	481.2053	462.1800	383.9713	286.7040	292.2048	363.3798	386.2234	378.4060	377.8877 (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												
	1313.4661	1276.9246	1160.2495	974.2040	754.6198	508.9967	329.7432	346.3609	542.5625	817.1555	1084.4069	1309.5656 (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												
	682.6392	563.9352	515.9288	354.9591	217.5752	0.0000	0.0000	0.0000	0.0000	320.6135	508.3206	693.1684 (98)
Space heating												3857.1400 (98)
Space heating per m2												56.4983 (99)
										(98) / (4) =		

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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													4285.7111 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	682.6392	563.9352	515.9288	354.9591	217.5752	0.0000	0.0000	0.0000	0.0000	320.6135	508.3206	693.1684	(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)	758.4880	626.5947	573.2543	394.3990	241.7502	0.0000	0.0000	0.0000	0.0000	356.2372	564.8007	770.1871	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.8959	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	89.3448	89.3121	89.2387	89.0812	88.7482	86.7000	86.7000	86.7000	86.7000	88.9864	89.2386	86.7000	(216)
(217)m	89.3448	89.3121	89.2387	89.0812	88.7482	86.7000	86.7000	86.7000	86.7000	88.9864	89.2386	89.3672	(217)
Fuel for water heating, kWh/month	182.3226	160.1756	167.0116	148.1206	144.3424	130.0398	123.0196	137.5854	138.1678	153.8660	164.5686	177.2723	(219)
Water heating fuel used	182.3226	160.1756	167.0116	148.1206	144.3424	130.0398	123.0196	137.5854	138.1678	153.8660	164.5686	1826.4923	(219)
Annual totals kWh/year													
Space heating fuel - main system												4285.7111	(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 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												5857.2604	(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	4285.7111	0.2160	925.7136	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1826.4923	0.2160	394.5223	(264)
Space and water heating			1320.2359	(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	-666.9130	0.5190	-346.1278	(269)
Total CO2, kg/year			1187.9205	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4000	(273)

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

DER			17.4000	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			36.6896	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			36.6896	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 165.4862 (5)
Dwelling volume			

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					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3430 (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	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031 (22b)
	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812 (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			24.9600	0.1300	3.2448		(28b)
Exposed Floor - Drive Through			38.3500	0.1300	4.9855		(28b)
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.1800	14.1858		(29a)
Wall to Garage	7.2100		7.2100	0.1800	1.2978		(29a)
Wall to Garage/Store	2.3000		2.3000	0.1800	0.4140		(29a)
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527		(30)
Total net area of external elements Aum(A, m ²)			230.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1170		(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)							17.0413 (36)
Total fabric heat loss						(33) + (36) =	63.1583 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	32.5287	32.3259	32.1271	31.1932	31.0185	30.2051	30.2051	30.0545	30.5184	31.0185	31.3719	31.7415 (38)
Heat transfer coeff	95.6870	95.4842	95.2854	94.3515	94.1768	93.3635	93.3635	93.2128	93.6768	94.1768	94.5303	94.8998 (39)
Average = Sum(39)m / 12 =												94.3507 (39)
HLP	1.4016	1.3986	1.3957	1.3820	1.3795	1.3676	1.3676	1.3654	1.3722	1.3795	1.3847	1.3901 (40)
HLP (average)												1.3820 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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	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	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)	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
Northeast					3.2700	11.2829	0.6300	0.7000			0.7700	11.2757 (75)
Southwest					5.0000	36.7938	0.6300	0.7000			0.7700	56.2234 (79)
Solar gains	67.4990	118.7211	172.3877	230.2714	273.1431	277.8627	265.1032	232.0955	192.2720	133.8944	81.5303	57.3238 (83)
Total gains	418.2388	466.7411	507.4466	544.9897	567.3922	552.3839	527.2444	500.5756	471.5584	433.7191	404.7557	398.0777 (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	49.5467	49.6519	49.7555	50.2480	50.3412	50.7797	50.7797	50.8618	50.6099	50.3412	50.1530	49.9577	
alpha	4.3031	4.3101	4.3170	4.3499	4.3561	4.3853	4.3853	4.3908	4.3740	4.3561	4.3435	4.3305	
util living area	0.9977	0.9959	0.9916	0.9786	0.9411	0.8448	0.7012	0.7466	0.9166	0.9838	0.9958	0.9982	(86)
MIT	19.4469	19.5886	19.8433	20.1971	20.5486	20.8268	20.9456	20.9271	20.7169	20.2701	19.7983	19.4224	(87)
Th 2	19.7621	19.7644	19.7666	19.7771	19.7791	19.7883	19.7883	19.7900	19.7847	19.7791	19.7751	19.7710	(88)
util rest of house	0.9969	0.9944	0.9883	0.9691	0.9106	0.7573	0.5436	0.5976	0.8598	0.9747	0.9940	0.9975	(89)
MIT 2	17.7150	17.9232	18.2959	18.8141	19.3068	19.6602	19.7668	19.7573	19.5386	18.9248	18.2373	17.6849	(90)
Living area fraction	18.2492	18.4370	18.7732	19.2408	19.6899	20.0201	20.1305	20.1182	19.9021	19.3398	18.7189	18.2209	(92)
Temperature adjustment	18.2492	18.4370	18.7732	19.2408	19.6899	20.0201	20.1305	20.1182	19.9021	19.3398	18.7189	18.2209	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	416.2871	463.0278	499.5380	525.0002	515.0515	429.1879	312.5049	321.9660	408.7216	420.7061	401.3940	396.5753	(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	1334.7612	1292.5653	1169.4592	975.6672	752.4608	506.0366	329.6166	346.5797	543.5222	823.0865	1098.3344	1330.5799	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	683.3447	557.4492	498.4213	324.4803	176.6325	0.0000	0.0000	0.0000	0.0000	299.3710	501.7971	694.8994	(98)
Space heating												3736.3956	(98)
Space heating per m2												54.7297	(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													4000.4235 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	683.3447	557.4492	498.4213	324.4803	176.6325	0.0000	0.0000	0.0000	0.0000	299.3710	501.7971	694.8994	(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)	731.6325	596.8407	533.6417	347.4093	189.1140	0.0000	0.0000	0.0000	0.0000	320.5257	537.2560	744.0036	(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	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	87.9955	87.8679	87.5697	86.8994	85.4970	80.3000	80.3000	80.3000	80.3000	86.6015	87.5982	88.0690	(216)
Fuel for water heating, kWh/month	215.5333	188.5472	196.8393	175.9331	173.1283	162.3504	155.5440	173.3951	175.3101	185.1000	195.3422	210.2962	(219)
Water heating fuel used												2207.3193	(219)
Annual totals kWh/year													
Space heating fuel - main system												4000.4235	(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												6619.7128	(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	4000.4235	0.2160	864.0915 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2207.3193	0.2160	476.7810 (264)
Space and water heating			1340.8724 (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			1554.6849 (272)
Emissions per m2 for space and water heating			19.6407 (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) = (19.6407 * 1.00) + 2.5617 + 0.5702, rounded to 2 d.p.			22.7700 (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					4.7700
Infiltration rate					0.3594 (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) =	0.3324 (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	0.4238	0.4155	0.4072	0.3656	0.3573	0.3158	0.3158	0.3075	0.3324	0.3573	0.3740	0.3906 (22b)
Effective ac	0.5898	0.5863	0.5829	0.5668	0.5638	0.5499	0.5499	0.5473	0.5552	0.5638	0.5699	0.5763 (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			24.9600	0.1900	4.7424	20.0000	499.2000 (28b)
Exposed Floor - Drive Through			38.3500	0.2100	8.0535	20.0000	767.0000 (28b)
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.2500	19.7025	60.0000	4728.6000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	2.3000		2.3000	0.7000	1.6100	9.0000	20.7000 (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)			230.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5619		(33)
E-WM-28			15.8500	0.0000	0.0000	110.0000	1743.5000 (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) =		9589.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.4627 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2924 (36)
Total fabric heat loss					(33) + (36) =		72.8543 (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	32.2098	32.0193	31.8326	30.9558	30.7918	30.0281	30.0281	29.8867	30.3222	30.7918	31.1236	31.4706 (38)
Heat transfer coeff	105.0641	104.8736	104.6870	103.8101	103.6461	102.8824	102.8824	102.7410	103.1766	103.6461	103.9780	104.3249 (39)
Average = Sum(39)m / 12 =												103.8093 (39)
HLP	1.5389	1.5362	1.5334	1.5206	1.5182	1.5070	1.5070	1.5049	1.5113	1.5182	1.5230	1.5281 (40)
HLP (average)												1.5206 (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	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1361.4664 (45)
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)
(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	
Northeast					3.2700	11.2829	0.6200	0.7000	0.7700		11.0967 (75)	
Southwest					5.0000	36.7938	0.6200	0.7000	0.7700		55.3309 (79)	
Solar gains	66.4276	116.8367	169.6514	226.6163	268.8075	273.4521	260.8952	228.4114	189.2200	131.7691	80.2362	56.4139 (83)
Total gains	375.1018	424.1051	466.0495	505.3031	528.9400	516.3111	492.9567	464.1916	434.4934	394.8802	363.7751	355.8206 (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	25.3533	25.3993	25.4446	25.6595	25.7001	25.8909	25.8909	25.9266	25.8171	25.7001	25.6181	25.5329	
alpha	2.6902	2.6933	2.6963	2.7106	2.7133	2.7261	2.7261	2.7284	2.7211	2.7133	2.7079	2.7022	
util living area	0.9876	0.9818	0.9709	0.9476	0.9007	0.8133	0.6997	0.7383	0.8791	0.9574	0.9820	0.9892	(86)
MIT	18.3717	18.5828	18.9740	19.5172	20.0695	20.5434	20.7938	20.7512	20.3691	19.6641	18.9257	18.3331	(87)
Th 2	19.6584	19.6605	19.6625	19.6721	19.6739	19.6823	19.6823	19.6838	19.6790	19.6739	19.6703	19.6665	(88)
util rest of house	0.9848	0.9776	0.9638	0.9328	0.8675	0.7362	0.5578	0.6073	0.8242	0.9426	0.9772	0.9868	(89)
MIT 2	17.2958	17.5069	17.8964	18.4381	18.9722	19.4090	19.6016	19.5776	19.2632	18.5892	17.8562	17.2628	(90)
Living area fraction	17.6277	17.8388	18.2289	18.7710	19.3107	19.7589	19.9694	19.9396	19.6043	18.9208	18.1861	17.5930	(91)
MIT	17.6277	17.8388	18.2289	18.7710	19.3107	19.7589	19.9694	19.9396	19.6043	18.9208	18.1861	17.5930	(92)
Temperature adjustment	17.6277	17.8388	18.2289	18.7710	19.3107	19.7589	19.9694	19.9396	19.6043	18.9208	18.1861	17.5930	(93)
adjusted MIT	17.6277	17.8388	18.2289	18.7710	19.3107	19.7589	19.9694	19.9396	19.6043	18.9208	18.1861	17.5930	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9787	0.9696	0.9532	0.9196	0.8560	0.7416	0.5938	0.6375	0.8203	0.9311	0.9694	0.9814	(94)
Ext temp.	367.1009	411.2126	444.2213	464.6704	452.7494	382.9157	292.7313	295.9368	356.4121	367.6773	352.6605	349.1963	(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	1400.2652	1356.9356	1227.8590	1024.7047	788.8179	530.7642	346.6498	363.6647	567.9152	862.4193	1152.7078	1397.2219	(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	768.6742	635.5258	583.0264	403.2247	250.0350	0.0000	0.0000	0.0000	0.0000	368.0881	576.0341	779.7311	(98)
Space heating per m2												4364.3394	(98)
												63.9276	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	967.0945	761.3297	780.8314	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.5975	0.6759	0.6463	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	577.7977	514.5758	504.6453	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	686.1948	657.3166	625.2797	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	78.0459	106.1992	89.7520	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			273.9971 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	19.5115	26.5498	22.4380	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												68.4993 (107)
Energy for space heating												1.0034 (108)
Energy for space cooling												63.9276 (99)
Total												1.0034 (108)
Dwelling Fabric Energy Efficiency (DFEE)												64.9310 (109)
												64.9 (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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 165.4862 (5)
Dwelling volume			

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										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3430 (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)				
	0.4374	0.4288	0.4202	0.3773	0.3688	0.3259	0.3259	0.3173	0.3430	0.3688	0.3859	0.4031	(22b)				
Effective ac	0.5956	0.5919	0.5883	0.5712	0.5680	0.5531	0.5531	0.5503	0.5588	0.5680	0.5745	0.5812	(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			24.9600	0.1300	3.2448		(28b)					
Exposed Floor - Drive Through			38.3500	0.1300	4.9855		(28b)					
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.1800	14.1858		(29a)					
Wall to Garage	7.2100		7.2100	0.1800	1.2978		(29a)					
Wall to Garage/Store	2.3000		2.3000	0.1800	0.4140		(29a)					
External Plane Ceiling	65.7900		65.7900	0.1300	8.5527		(30)					
Total net area of external elements Aum(A, m2)			230.3200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1170		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.0413 (36)					
Total fabric heat loss						(33) + (36) =	63.1583 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.5287	Feb 32.3259	Mar 32.1271	Apr 31.1932	May 31.0185	Jun 30.2051	Jul 30.2051	Aug 30.0545	Sep 30.5184	Oct 31.0185	Nov 31.3719	Dec 31.7415 (38)
Heat transfer coeff	95.6870	95.4842	95.2854	94.3515	94.1768	93.3635	93.3635	93.2128	93.6768	94.1768	94.5303	94.8998 (39)
Average = Sum(39)m / 12 =												94.3507 (39)
HLP	Jan 1.4016	Feb 1.3986	Mar 1.3957	Apr 1.3820	May 1.3795	Jun 1.3676	Jul 1.3676	Aug 1.3654	Sep 1.3722	Oct 1.3795	Nov 1.3847	Dec 1.3901 (40)
HLP (average)												1.3820 (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	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 TARGET 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	29.9954	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	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast												3.2700	11.2829	0.6300	0.7000	0.7700	11.2757	(75)
Southwest												5.0000	36.7938	0.6300	0.7000	0.7700	56.2234	(79)
Solar gains	67.4990	118.7211	172.3877	230.2714	273.1431	277.8627	265.1032	232.0955	192.2720	133.8944	81.5303	57.3238	(83)					
Total gains	376.1733	425.9896	468.7858	508.9582	533.2756	520.7217	497.1646	467.8756	437.5454	397.0055	365.0692	356.7305	(84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	49.5467	49.6519	49.7555	50.2480	50.3412	50.7797	50.7797	50.8618	50.6099	50.3412	50.1530	49.9577		
alpha	4.3031	4.3101	4.3170	4.3499	4.3561	4.3853	4.3853	4.3908	4.3740	4.3561	4.3435	4.3305		
util living area	0.9985	0.9971	0.9938	0.9833	0.9516	0.8657	0.7295	0.7773	0.9332	0.9883	0.9972	0.9988	(86)	
MIT	19.3921	19.5359	19.7942	20.1537	20.5135	20.8058	20.9363	20.9138	20.6852	20.2248	19.7468	19.3683	(87)	
Th 2	19.7621	19.7644	19.7666	19.7771	19.7791	19.7883	19.7883	19.7900	19.7847	19.7791	19.7751	19.7710	(88)	
util rest of house	0.9979	0.9961	0.9913	0.9756	0.9253	0.7837	0.5717	0.6309	0.8842	0.9815	0.9960	0.9984	(89)	
MIT 2	18.3098	18.4549	18.7140	19.0779	19.4260	19.6873	19.7705	19.7624	19.5922	19.1521	18.6741	18.2928	(90)	
Living area fraction														
MIT	18.6437	18.7884	19.0472	19.4098	19.7615	20.0324	20.1301	20.1176	19.9294	19.4830	19.0050	18.6245	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6437	18.7884	19.0472	19.4098	19.7615	20.0324	20.1301	20.1176	19.9294	19.4830	19.0050	18.6245	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9949	0.9892	0.9725	0.9248	0.8034	0.6216	0.6765	0.8917	0.9792	0.9949	0.9978	(94)
Ext temp.	375.1313	423.8195	463.7449	494.9488	493.1617	418.3625	309.0250	316.5348	390.1429	388.7392	363.2094	355.9499	(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	1372.5016	1326.1193	1195.5658	991.6139	759.2017	507.1842	329.5851	346.5302	546.0747	836.5749	1125.3834	1368.8854	(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	742.0435	606.3455	544.4747	357.5989	197.9338	0.0000	0.0000	0.0000	0.0000	333.1898	548.7653	753.6240	(98)
Space heating per m2												4083.9754	(98)
												59.8209	(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	877.6166	690.8896	708.4176	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7066	0.7967	0.7635	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	620.0853	550.4059	540.8945	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	691.3500	662.2350	629.5858	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)

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	51.3106	83.2009	65.9863	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												200.4977 (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	12.8276	20.8002	16.4966	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												50.1244 (107)
Space cooling per m2												0.7342 (108)
Energy for space heating												59.8209 (99)
Energy for space cooling												0.7342 (108)
Total												60.5551 (109)
Target Fabric Energy Efficiency (TFEE)												69.6 (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					4.7700
Infiltration rate					0.3594 (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)	=	0.3324 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3490	0.3241	0.3324	0.3158	0.3158	0.3075	0.2992	0.2909	0.2825	0.3075	0.2909	0.3075 (22b)
	0.5609	0.5525	0.5552	0.5499	0.5499	0.5473	0.5447	0.5423	0.5399	0.5473	0.5423	0.5473 (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			24.9600	0.1900	4.7424	20.0000	499.2000 (28b)
Exposed Floor - Drive Through			38.3500	0.2100	8.0535	20.0000	767.0000 (28b)
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.2500	19.7025	60.0000	4728.6000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	2.3000		2.3000	0.7000	1.6100	9.0000	20.7000 (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)			230.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5619		(33)
E-WM-28			15.8500	0.0000	0.0000	110.0000	1743.5000 (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) =		9611.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2924 (36)
Total fabric heat loss					(33) + (36) =		72.8543 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.6315	30.1733	30.3222	30.0281	30.0281	29.8867	29.7490	29.6151	29.4850	29.8867	29.6151	29.8867 (38)
Average = Sum(39)m / 12 =	103.4858	103.0276	103.1766	102.8824	102.8824	102.7410	102.6033	102.4694	102.3393	102.7410	102.4694	102.7410 (39)
												102.7966 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5158	1.5091	1.5113	1.5070	1.5070	1.5049	1.5029	1.5009	1.4990	1.5049	1.5009	1.5049 (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
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1361.4664 (45)
	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)
RHI water heating demand												
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)
												1616 (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	
Northeast				3.2700	14.6176		0.6200	0.7000	0.7700		14.3763 (75)	
Southwest				5.0000	45.1778		0.6200	0.7000	0.7700		67.9389 (79)	
Solar gains	82.3152	123.5333	181.8086	246.0601	278.6904	308.4529	291.7932	260.8843	214.7724	150.5829	99.1637	68.6840 (83)
Total gains	586.2946	623.1598	661.8117	695.9725	698.0710	700.5715	668.1168	645.1861	616.5343	582.6331	564.6875	559.2676 (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	25.7999	25.9146	25.8772	25.9512	25.9512	25.9869	26.0218	26.0558	26.0889	25.9869	26.0558	25.9869
alpha	2.7200	2.7276	2.7251	2.7301	2.7301	2.7325	2.7348	2.7371	2.7393	2.7325	2.7371	2.7325
util living area	0.9614	0.9531	0.9317	0.8878	0.8082	0.6636	0.5296	0.5431	0.7487	0.8870	0.9436	0.9647 (86)
MIT	18.8974	19.0444	19.4193	19.9195	20.4068	20.7691	20.9113	20.9058	20.6493	20.1021	19.4503	18.8880 (87)
Th 2	19.6756	19.6807	19.6790	19.6823	19.6823	19.6838	19.6853	19.6868	19.6882	19.6838	19.6868	19.6838 (88)
util rest of house	0.9532	0.9432	0.9162	0.8595	0.7524	0.5579	0.3773	0.3888	0.6603	0.8520	0.9294	0.9571 (89)
MIT 2	16.9655	17.1795	17.7164	18.4242	19.0839	19.5170	19.6483	19.6470	19.3981	18.6904	17.7718	16.9574 (90)
Living area fraction									fLA = Living area / (4) =			0.3085 (91)
MIT	17.5614	17.7548	18.2417	18.8855	19.4920	19.9033	20.0379	20.0353	19.7841	19.1259	18.2896	17.5530 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4114	17.6048	18.0917	18.7355	19.3420	19.7533	19.8879	19.8853	19.6341	18.9759	18.1396	17.4030 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9331	0.9211	0.8910	0.8335	0.7350	0.5642	0.4030	0.4146	0.6559	0.8275	0.9060	0.9380 (94)
Ext temp.	547.0494	574.0158	589.6905	580.1140	513.0514	395.2908	269.2674	267.4855	404.3984	482.1421	511.6030	524.5960 (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	1294.7560	1267.7361	1144.4015	950.1674	703.9214	457.5322	286.0508	285.4088	504.9485	778.3522	1049.2473	1274.2914 (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	556.2937	466.1800	412.7050	266.4384	142.0073	0.0000	0.0000	0.0000	0.0000	220.3803	387.1039	557.7734 (98)
RHI space heating demand												3008.8820 (98)
												3009 (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	=	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								4.7700				
Infiltration rate								0.3594 (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) =	0.3324 (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	0.4238	0.4155	0.4072	0.3656	0.3573	0.3158	0.3158	0.3075	0.3324	0.3573	0.3740	0.3906 (22b)
Effective ac	0.5898	0.5863	0.5829	0.5668	0.5638	0.5499	0.5499	0.5473	0.5552	0.5638	0.5699	0.5763 (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			24.9600	0.1900	4.7424	20.0000	499.2000 (28b)
Exposed Floor - Drive Through			38.3500	0.2100	8.0535	20.0000	767.0000 (28b)
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.2500	19.7025	60.0000	4728.6000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	2.3000		2.3000	0.7000	1.6100	9.0000	20.7000 (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)			230.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5619		(33)
E-WM-28			15.8500	0.0000	0.0000	110.0000	1743.5000 (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) =		9611.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2924 (36)
Total fabric heat loss					(33) + (36) =		72.8543 (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	32.2098	32.0193	31.8326	30.9558	30.7918	30.0281	30.0281	29.8867	30.3222	30.7918	31.1236	31.4706 (38)
Heat transfer coeff	105.0641	104.8736	104.6870	103.8101	103.6461	102.8824	102.8824	102.7410	103.1766	103.6461	103.9780	104.3249 (39)
Average = Sum(39)m / 12 =												103.8093 (39)
HLP	1.5389	1.5362	1.5334	1.5206	1.5182	1.5070	1.5070	1.5049	1.5113	1.5182	1.5230	1.5281 (40)
HLP (average)												1.5206 (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
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1361.4664 (45)
	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)
								Solar input (sum of months) = Sum (63)m =				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												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	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					
Northeast			3.2700	11.2829	0.6200	0.7000	0.7700	11.0967 (75)				
Southwest			5.0000	36.7938	0.6200	0.7000	0.7700	55.3309 (79)				
Solar gains	66.4276	116.8367	169.6514	226.6163	268.8075	273.4521	260.8952	228.4114	189.2200	131.7691	80.2362	56.4139 (83)
Total gains	570.4070	616.4632	649.6545	676.5287	688.1881	665.5708	637.2188	612.7132	590.9820	563.8193	545.7599	546.9974 (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	25.4123	25.4584	25.5038	25.7193	25.7600	25.9512	25.9512	25.9869	25.8772	25.7600	25.6777	25.5923
alpha	2.6942	2.6972	2.7003	2.7146	2.7173	2.7301	2.7301	2.7325	2.7251	2.7173	2.7118	2.7062
util living area	0.9668	0.9570	0.9396	0.9044	0.8397	0.7280	0.5982	0.6315	0.7955	0.9099	0.9544	0.9702 (86)
MIT	18.7187	18.9157	19.2767	19.7727	20.2642	20.6675	20.8633	20.8362	20.5384	19.9233	19.2401	18.6766 (87)
Th 2	19.6584	19.6605	19.6625	19.6721	19.6739	19.6823	19.6823	19.6838	19.6790	19.6739	19.6703	19.6665 (88)
util rest of house	0.9599	0.9480	0.9260	0.8806	0.7939	0.6387	0.4575	0.4963	0.7219	0.8828	0.9432	0.9640 (89)
MIT 2	16.6977	16.9827	17.5035	18.2143	18.8920	19.4086	19.6106	19.5906	19.2623	18.4379	17.4612	16.6415 (90)
Living area fraction									fLA = Living area / (4) =			0.3085 (91)
MIT	17.3211	17.5790	18.0505	18.6950	19.3153	19.7969	19.9970	19.9748	19.6559	18.8961	18.0100	17.2693 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1711	17.4290	17.9005	18.5450	19.1653	19.6469	19.8470	19.8248	19.5059	18.7461	17.8600	17.1193 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9411	0.9266	0.9014	0.8541	0.7723	0.6359	0.4772	0.5128	0.7101	0.8573	0.9214	0.9463 (94)
Useful gains	536.7917	571.2091	585.6152	577.8233	531.4582	423.2640	304.1086	314.2086	419.6320	483.3620	502.8698	517.6429 (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	1352.2950	1313.9577	1193.4829	1001.2506	773.7462	519.2421	334.0619	351.8697	557.7644	844.3105	1118.8024	1347.8068 (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	606.7345	499.1271	452.2536	304.8676	180.2623	0.0000	0.0000	0.0000	0.0000	268.5457	443.4715	617.6419 (98)
Space heating												3372.9042 (98)
Space heating per m2										(98) / (4) =		49.4054 (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													3747.6713 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	606.7345	499.1271	452.2536	304.8676	180.2623	0.0000	0.0000	0.0000	0.0000	268.5457	443.4715	617.6419	(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)	674.1494	554.5856	502.5040	338.7418	200.2914	0.0000	0.0000	0.0000	0.0000	298.3841	492.7461	686.2688	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.8959	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	89.2807	89.2433	89.1589	88.9770	88.5991	86.7000	86.7000	86.7000	86.7000	88.8579	89.1558	86.7000	(216)
Fuel for water heating, kWh/month	182.4535	160.2991	167.1612	148.2940	144.5853	130.0398	123.0196	137.5854	138.1678	154.0885	164.7215	177.3936	(219)
Water heating fuel used												1827.8094	(219)
Annual totals kWh/year													
Space heating fuel - main system												3747.6713	(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 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												5320.5377	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3747.6713	3.4800	130.4190	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1827.8094	3.4800	63.6078	(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	-666.9130	13.1900	-87.9658	(252)
Total energy cost			280.3997	(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] =	1.0397 (257)
SAP value	85.4961	
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	3747.6713	0.2160	809.4970	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1827.8094	0.2160	394.8068	(264)
Space and water heating			1204.3038	(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	-666.9130	0.5190	-346.1278	(269)
Total kg/year			1071.9884	(272)
CO2 emissions per m2			15.7000	(273)
EI value			87.3182	
EI rating			87	(274)
EI band			B	

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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 $3.48 / 0.8828 = 3.942$, stars = 4
Water heating environmental impact $0.216 / 0.8828 = 0.2447$, 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 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					4.7700
Infiltration rate					0.3594 (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)	=	0.3324 (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	0.3490	0.3241	0.3324	0.3158	0.3158	0.3075	0.2992	0.2909	0.2825	0.3075	0.2909	0.3075 (22b)
Effective ac	0.5609	0.5525	0.5552	0.5499	0.5499	0.5473	0.5447	0.5423	0.5399	0.5473	0.5423	0.5473 (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			24.9600	0.1900	4.7424	20.0000	499.2000 (28b)
Exposed Floor - Drive Through			38.3500	0.2100	8.0535	20.0000	767.0000 (28b)
100mm Knauf Supafil	89.2300	10.4200	78.8100	0.2500	19.7025	60.0000	4728.6000 (29a)
Wall to Garage	7.2100		7.2100	0.5000	3.6050	9.0000	64.8900 (29a)
Wall to Garage/Store	2.3000		2.3000	0.7000	1.6100	9.0000	20.7000 (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)			230.3200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.5619		(33)
E-WM-28			15.8500	0.0000	0.0000	110.0000	1743.5000 (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) =		9611.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2924 (36)
Total fabric heat loss					(33) + (36) =		72.8543 (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	30.6315	30.1733	30.3222	30.0281	30.0281	29.8867	29.7490	29.6151	29.4850	29.8867	29.6151	29.8867 (38)
Heat transfer coeff	103.4858	103.0276	103.1766	102.8824	102.8824	102.7410	102.6033	102.4694	102.3393	102.7410	102.4694	102.7410 (39)
Average = Sum(39)m / 12 =												102.7966 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5158	1.5091	1.5113	1.5070	1.5070	1.5049	1.5029	1.5009	1.4990	1.5049	1.5009	1.5049 (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
Daily hot water use												

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Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1361.4664 (45)
	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)
								Solar input (sum of months) =	Sum (63)m =			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												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	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					
Northeast			3.2700	14.6176	0.6200	0.7000	0.7700	14.3763 (75)				
Southwest			5.0000	45.1778	0.6200	0.7000	0.7700	67.9389 (79)				
Solar gains	82.3152	123.5333	181.8086	246.0601	278.6904	308.4529	291.7932	260.8843	214.7724	150.5829	99.1637	68.6840 (83)
Total gains	586.2946	623.1598	661.8117	695.9725	698.0710	700.5715	668.1168	645.1861	616.5343	582.6331	564.6875	559.2676 (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	25.7999	25.9146	25.8772	25.9512	25.9512	25.9869	26.0218	26.0558	26.0889	25.9869	26.0558	25.9869
alpha	2.7200	2.7276	2.7251	2.7301	2.7301	2.7325	2.7348	2.7371	2.7393	2.7325	2.7371	2.7325
util living area	0.9614	0.9531	0.9317	0.8878	0.8082	0.6636	0.5296	0.5431	0.7487	0.8870	0.9436	0.9647 (86)
MIT	18.8974	19.0444	19.4193	19.9195	20.4068	20.7691	20.9113	20.9058	20.6493	20.1021	19.4503	18.8880 (87)
Th 2	19.6756	19.6807	19.6790	19.6823	19.6823	19.6838	19.6853	19.6868	19.6882	19.6838	19.6868	19.6838 (88)
util rest of house	0.9532	0.9432	0.9162	0.8595	0.7524	0.5579	0.3773	0.3888	0.6603	0.8520	0.9294	0.9571 (89)
MIT 2	16.9655	17.1795	17.7164	18.4242	19.0839	19.5170	19.6483	19.6470	19.3981	18.6904	17.7718	16.9574 (90)
Living area fraction									fLA = Living area / (4) =			0.3085 (91)
MIT	17.5614	17.7548	18.2417	18.8855	19.4920	19.9033	20.0379	20.0353	19.7841	19.1259	18.2896	17.5530 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4114	17.6048	18.0917	18.7355	19.3420	19.7533	19.8879	19.8853	19.6341	18.9759	18.1396	17.4030 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9331	0.9211	0.8910	0.8335	0.7350	0.5642	0.4030	0.4146	0.6559	0.8275	0.9060	0.9380 (94)
Useful gains	547.0494	574.0158	589.6905	580.1140	513.0514	395.2908	269.2674	267.4855	404.3984	482.1421	511.6030	524.5960 (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	1294.7560	1267.7361	1144.4015	950.1674	703.9214	457.5322	286.0508	285.4088	504.9485	778.3522	1049.2473	1274.2914 (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	556.2937	466.1800	412.7050	266.4384	142.0073	0.0000	0.0000	0.0000	0.0000	220.3803	387.1039	557.7734 (98)
Space heating												3008.8820 (98)
Space heating per m2										(98) / (4) =		44.0733 (99)

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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													3343.2022 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.2937	466.1800	412.7050	266.4384	142.0073	0.0000	0.0000	0.0000	0.0000	220.3803	387.1039	557.7734	(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)	618.1041	517.9778	458.5611	296.0427	157.7858	0.0000	0.0000	0.0000	0.0000	244.8670	430.1155	619.7482	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.8959	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	89.2307	89.2028	89.1002	88.8795	88.4042	86.7000	86.7000	86.7000	86.7000	88.7062	89.0676	86.7000	(216)
Fuel for water heating, kWh/month	182.5558	160.3720	167.2712	148.4566	144.9041	130.0398	123.0196	137.5854	138.1678	154.3521	164.8846	177.5079	(219)
Water heating fuel used												1829.1169	(219)
Annual totals kWh/year													
Space heating fuel - main system												3343.2022	(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 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												4835.0517	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3343.2022	3.9200	131.0535 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.1169	3.9200	71.7014 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	336.9700	16.9600	57.1501 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-749.2375	16.9600	-127.0707 (252)
Total energy cost			233.5543 (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	3343.2022	0.2160	722.1317 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.1169	0.2160	395.0893 (264)
Space and water heating			1117.2209 (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	-749.2375	0.5190	-388.8543 (269)
Total kg/year			942.1791 (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	3343.2022	1.2200	4078.7067 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.1169	1.2200	2231.5226 (264)
Space and water heating			6310.2293 (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	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			5274.8182 (272)
Primary energy kWh/m2/year			77.2641 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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: (none) SAP change Cost change CO2 change

Recommended measures (none) Typical annual savings Energy efficiency Environmental 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 443 TEST (28 May 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£70	£70	£0
Mains gas	£291	£291	£0
Space heating	£232	£232	£0
Water heating	£72	£72	£0
Lighting	£57	£57	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£234	£234	£0
Total cost of uses	£234	£234	£0
Delivered energy	71 kWh/m²	71 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	77 kWh/m²	77 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	EndTerrace Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	140.8 (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	72.85 (37)
Summer heat loss coefficient	291.30 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Shading	Gains W
North East	3.2700	106.0502	0.6200	0.7000	0.9000	121.9085
South West	5.0000	127.3119	0.6200	0.7000	0.9000	223.7760
total:						345.6846

	Jun	Jul	Aug	
Solar gains	371	346	308	(P3)
Internal gains	389	373	381	
Total summer gains	761	719	689	(P5)

Summer gain/loss ratio	2.61	2.47	2.37	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 140.8)	1.01	1.01	1.01	
Threshold temperature	19.03	20.78	20.68	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight