

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-213			Issued on Date	08/09/2023
Assessment Reference	As Built	Prop Type Ref	1F Flat Semi		
Property	49, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	83 B	DER	13.67	TER	19.98
Environmental	91 B	% DER<TER	31.59		
CO ₂ Emissions (t/year)	0.58	DFEE	44.03	TFEE	49.26
General Requirements Compliance	Pass	% DFEE<TFEE	10.61		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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

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DWELLING AS BUILT

Top-floor flat, total floor area 51 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) 19.98 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.67 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.36 (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
Ideal LOGIC COMBI ESP1 30
Combi boiler
Efficiency: 89.6% 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

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.06 m², No overhang
Windows facing South: 6.50 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 0.63 W/m²K
Photovoltaic array 432.08 kWh/Year

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.3600
Number of sides sheltered					0.2180 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1853 (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	0.2363	0.2316	0.2270	0.2038	0.1992	0.1760	0.1760	0.1714	0.1853	0.1992	0.2085	0.2177 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.40)			7.4400	1.3258	9.8636		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1900	6.5721	9.0000	311.3100 (29a)
WTS	15.8900	2.1200	13.7700	0.1500	2.0655	18.0000	247.8600 (29a)
400mm Mineral Wool	50.6800		50.6800	0.1100	5.5748	9.0000	456.1200 (30)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.2222		(33)
Timebr Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Floor			50.6800			30.0000	1520.4000 (32d)
Timber			113.4100			9.0000	1020.6900 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3874.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 76.4440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6856 (36)
Total fabric heat loss (33) + (36) = 38.9078 (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	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805 (39)
Average = Sum(39)m / 12 =												59.9805 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835 (40)
HLP (average)												1.1835 (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												
Average daily hot water use (litres/day)												1.7101 (42)
												74.8157 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

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Energy content (annual)												Total = Sum(45)m = 1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m												
18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290	(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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172	14.5087 (61)
Total heat required for water heating calculated for each month												
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(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												
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)
Heat gains from water heating, kWh/month												
44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
13.4727	11.9663	9.7316	7.3675	5.5073	4.6495	5.0239	6.5303	8.7649	11.1291	12.9893	13.8471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)												
59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	273.5458	271.8506	262.1211	246.5718	231.0655	215.8971	205.9005	210.7280	218.5901	234.3102	252.3563	265.6217 (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	
North	3.0600				10.6334		0.7200		0.7000		0.7700		11.3647 (74)	
South	4.3800				46.7521		0.7200		0.7000		0.7700		71.5218 (78)	
South	2.1200				46.7521		0.7200		0.7000		0.7700		34.6179 (78)	
Solar gains	117.5044	195.5480	258.3330	309.5406	340.6422	336.4593	325.0283	301.4595	275.6794	213.3444	139.8316	101.1886	(83)	
Total gains	391.0502	467.3985	520.4540	556.1124	571.7077	552.3564	530.9288	512.1875	494.2695	447.6546	392.1879	366.8104	(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	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	
alpha	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	
util living area	0.9187	0.8837	0.8387	0.7727	0.6786	0.5563	0.4368	0.4646	0.6243	0.7916	0.8890	0.9280 (86)
MIT	18.3967	18.7605	19.2445	19.8002	20.3117	20.6896	20.8702	20.8461	20.5734	19.9081	19.0342	18.2960 (87)
Th 2	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332 (88)
util rest of house	0.9090	0.8704	0.8198	0.7445	0.6355	0.4902	0.3478	0.3766	0.5630	0.7599	0.8738	0.9193 (89)
MIT 2	16.4839	17.0012	17.6876	18.4654	19.1602	19.6421	19.8428	19.8205	19.5091	18.6319	17.4032	16.3402 (90)
Living area fraction												
MIT	17.2690	17.7233	18.3266	19.0132	19.6328	20.0720	20.2645	20.2414	19.9459	19.1557	18.0726	17.1429 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1190	17.5733	18.1766	18.8632	19.4828	19.9220	20.1145	20.0914	19.7959	19.0057	17.9226	16.9929 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.8742	0.8322	0.7816	0.7115	0.6152	0.4894	0.3638	0.3905	0.5543	0.7269	0.8364	0.8860	(94)
Useful gains	341.8475	388.9583	406.7985	395.6536	351.7263	270.3301	193.1615	200.0209	273.9770	325.4008	328.0400	325.0023 (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	768.8894	760.1501	700.3676	597.6006	466.8162	319.2157	210.7989	221.4146	341.6427	504.1759	649.1468	767.3262 (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	317.7192	249.4409	218.4154	145.4018	85.6269	0.0000	0.0000	0.0000	0.0000	133.0087	231.1969	329.0890 (98)
Space heating												1709.8989 (98)
Space heating per m2												(98) / (4) = 33.7391 (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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1889.3910	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	317.7192	249.4409	218.4154	145.4018	85.6269	0.0000	0.0000	0.0000	0.0000	133.0087	231.1969	329.0890	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	351.0709	275.6253	241.3430	160.6650	94.6154	0.0000	0.0000	0.0000	0.0000	146.9709	255.4662	363.6343	(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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)	
Efficiency of water heater (217)m	89.5136	89.4361	89.3107	89.0935	88.6974	87.3000	87.3000	87.3000	87.3000	88.9934	89.3633	89.5567	(216)	
Fuel for water heating, kWh/month	152.5608	133.9905	139.5310	123.4640	120.1313	107.0223	100.8532	113.3369	113.9795	128.2728	137.4810	148.1769	(219)	
Water heating fuel used												1518.8002	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1889.3910	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)														
mechanical ventilation fans (SFP = 0.2260)													35.2058	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													110.2058	(231)
Electricity for lighting (calculated in Appendix L)													237.9312	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
Total delivered energy for all uses													3756.3282	(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	1889.3910	0.2160	408.1085 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1518.8002	0.2160	328.0608 (264)
Space and water heating			736.1693 (265)
Pumps and fans	110.2058	0.5190	57.1968 (267)
Energy for lighting	237.9312	0.5190	123.4863 (268)
Energy saving/generation technologies			
PV Unit	-432.0800	0.5190	-224.2495 (269)
Total CO2, kg/year			692.6029 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6700 (273)

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

DER			13.6700	ZC1
Total Floor Area		TFA	50.6800	
Assumed number of occupants		N	1.7101	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.4219	ZC2
CO2 emissions from cooking, equation (L16)			3.1579	ZC3
Total CO2 emissions			34.2498	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			34.2498	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1566 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4066 (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) =				0.3456 (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	0.4407	0.4320	0.4234	0.3802	0.3715	0.3283	0.3283	0.3197	0.3456	0.3715	0.3888	0.4061 (22b)
Effective ac	0.5971	0.5933	0.5896	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5825 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			9.5600	1.3258	12.6742		(27)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1800	6.2262		(29a)
WTS	15.8900	2.1200	13.7700	0.1800	2.4786		(29a)
400mm Mineral Wool	50.6800		50.6800	0.1300	6.5884		(30)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	30.0874	(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)							5.8447 (36)
Total fabric heat loss						(33) + (36) =	35.9321 (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	25.1645	25.0057	24.8499	24.1184	23.9815	23.3444	23.3444	23.2264	23.5898	23.9815	24.2584	24.5479 (38)
Heat transfer coeff	61.0967	60.9378	60.7821	60.0505	59.9137	59.2765	59.2765	59.1586	59.5220	59.9137	60.1905	60.4800 (39)
Average = Sum(39)m / 12 =												60.0499 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2055	1.2024	1.1993	1.1849	1.1822	1.1696	1.1696	1.1673	1.1745	1.1822	1.1877	1.1934 (40)
HLP (average)												1.1849 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)
Energy content (annual)												1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m	18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Combi loss	41.9378	36.5019	38.8878	36.1575	35.8378	33.2059	34.3127	35.8378	36.1575	38.8878	39.1091	41.9378 (61)
Total heat required for water heating calculated for each month	163.9823	143.2428	149.0348	132.1864	127.9797	112.7174	107.9919	120.3856	121.7151	138.5969	147.9495	160.1314 (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	163.9823	143.2428	149.0348	132.1864	127.9797	112.7174	107.9919	120.3856	121.7151	138.5969	147.9495	160.1314 (64)
Heat gains from water heating, kWh/month	51.0642	44.6168	46.3458	40.9690	39.5966	34.7391	33.0765	37.0716	37.4873	42.8752	45.9667	49.7838 (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	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.4727	11.9663	9.7316	7.3675	5.5073	4.6495	5.0239	6.5303	8.7649	11.1291	12.9893	13.8471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	68.6347	66.3941	62.2928	56.9014	53.2213	48.2487	44.4576	49.8274	52.0657	57.6280	63.8426	66.9137	(72)
Total internal gains	282.7593	280.5585	270.3263	254.2760	238.2652	222.5940	212.6031	217.9331	226.3023	242.5234	261.0688	274.8385	(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
North					3.0600	10.6334	0.6300	0.7000			0.7700			9.9441 (74)
South					6.5000	46.7521	0.6300	0.7000			0.7000			92.8723 (78)
Solar gains	102.8163	171.1045	226.0413	270.8480	298.0619	294.4019	284.3997	263.7771	241.2195	186.6764	122.3526	88.5401	(83)	
Total gains	385.5757	451.6629	496.3676	525.1240	536.3272	516.9958	497.0029	481.7102	467.5218	429.1998	383.4214	363.3786	(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	57.6045	57.7547	57.9027	58.6080	58.7419	59.3733	59.3733	59.4917	59.1285	58.7419	58.4717	58.1919	
alpha	4.8403	4.8503	4.8602	4.9072	4.9161	4.9582	4.9582	4.9661	4.9419	4.9161	4.8981	4.8795	
util living area	0.9944	0.9873	0.9722	0.9340	0.8464	0.6838	0.5144	0.5500	0.7737	0.9440	0.9880	0.9957	(86)
MIT	19.8316	20.0177	20.2676	20.5651	20.8098	20.9523	20.9904	20.9867	20.9096	20.5985	20.1574	19.7971	(87)
Th 2	19.9156	19.9181	19.9205	19.9321	19.9343	19.9444	19.9444	19.9463	19.9405	19.9343	19.9299	19.9253	(88)
util rest of house	0.9925	0.9832	0.9630	0.9112	0.7945	0.5906	0.3964	0.4315	0.6903	0.9200	0.9834	0.9943	(89)
MIT 2	18.3803	18.6516	19.0120	19.4359	19.7528	19.9135	19.9410	19.9411	19.8732	19.4907	18.8646	18.3372	(90)
Living area fraction									fLA = Living area / (4) =			0.4104	(91)
MIT	18.9759	19.2123	19.5273	19.8993	20.1866	20.3398	20.3717	20.3702	20.2986	19.9454	19.3952	18.9364	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9759	19.2123	19.5273	19.8993	20.1866	20.3398	20.3717	20.3702	20.2986	19.9454	19.3952	18.9364	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9903	0.9798	0.9588	0.9104	0.8081	0.6273	0.4451	0.4804	0.7208	0.9203	0.9804	0.9925	(94)
Ext temp.	381.8510	442.5176	475.9043	478.0622	433.3851	324.3057	221.2103	231.4266	336.9828	394.9856	375.8901	360.6629	(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	896.6516	872.1576	791.8289	660.5161	508.4651	340.2353	223.5732	234.8723	368.9507	559.9149	740.0547	891.2557	(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	383.0116	288.7181	235.0479	131.3668	55.8595	0.0000	0.0000	0.0000	0.0000	122.7074	262.1985	394.7611	(98)
Space heating per m2												1873.6708	(98)
												36.9706	(99)

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	2006.0716	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	383.0116 288.7181 235.0479 131.3668 55.8595 0.0000 0.0000 0.0000 0.0000 122.7074 262.1985 394.7611	(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)	410.0767 309.1200 251.6573 140.6497 59.8067 0.0000 0.0000 0.0000 0.0000 131.3784 280.7265 422.6564	(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	163.9823 143.2428 149.0348 132.1864 127.9797 112.7174 107.9919 120.3856 121.7151 138.5969 147.9495 160.1314	(64)
Efficiency of water heater	87.1152 86.7804 86.1933 85.0356 83.1218 80.3000 80.3000 80.3000 80.3000 84.7463 86.4765 87.2337	(216)
Fuel for water heating, kWh/month	188.2362 165.0634 172.9077 155.4484 153.9665 140.3704 134.4855 149.9198 151.5755 163.5434 171.0864 183.5660	(219)
Water heating fuel used		1930.1692 (219)
Annual totals kWh/year		
Space heating fuel - main system		2006.0716 (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)		237.9312 (232)
Total delivered energy for all uses		4249.1720 (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	2006.0716	0.2160	433.3115 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1930.1692	0.2160	416.9166 (264)
Space and water heating			850.2280 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	237.9312	0.5190	123.4863 (268)
Total CO2, kg/m2/year			1012.6393 (272)
Emissions per m2 for space and water heating			16.7764 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4366 (272b)
Emissions per m2 for pumps and fans			0.7681 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7764 * 1.00) + 2.4366 + 0.7681, rounded to 2 d.p.			19.9800 (273)

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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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1566 (8)
Pressure test					Yes
Measured/design AP50					4.3600
Infiltration rate					0.3746 (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) =				0.3184 (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	0.4060	0.3980	0.3901	0.3503	0.3423	0.3025	0.3025	0.2945	0.3184	0.3423	0.3582	0.3741 (22b)
Effective ac	0.5824	0.5792	0.5761	0.5613	0.5586	0.5458	0.5458	0.5434	0.5507	0.5586	0.5642	0.5700 (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
Window (Uw = 1.40)			7.4400	1.3258	9.8636		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1900	6.5721	9.0000	311.3100 (29a)
WTS	15.8900	2.1200	13.7700	0.1500	2.0655	18.0000	247.8600 (29a)
400mm Mineral Wool	50.6800		50.6800	0.1100	5.5748	9.0000	456.1200 (30)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.2222		(33)
Timber Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Floor			50.6800			30.0000	1520.4000 (32d)
Timber			113.4100			9.0000	1020.6900 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	3874.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		76.4440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.6856 (36)
Total fabric heat loss	(33) + (36) =	38.9078 (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	24.5458	24.4110	24.2788	23.6579	23.5417	23.0009	23.0009	22.9008	23.2092	23.5417	23.7767	24.0224 (38)
Heat transfer coeff	63.4536	63.3188	63.1866	62.5657	62.4495	61.9087	61.9087	61.8085	62.1170	62.4495	62.6845	62.9302 (39)
Average = Sum(39)m / 12 =												62.5651 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2520	1.2494	1.2468	1.2345	1.2322	1.2216	1.2216	1.2196	1.2257	1.2322	1.2369	1.2417 (40)
HLP (average)												1.2345 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)
Energy content (annual)										Total = Sum(45)m =		1177.1425 (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)

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	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	25.9345	22.6824	23.4062	20.4061	19.5802	16.8962	15.6568	17.9664	18.1810	21.1882	23.1286	(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	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.4727	11.9663	9.7316	7.3675	5.5073	4.6495	5.0239	6.5303	8.7649	11.1291	12.9893	13.8471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	34.8581	33.7536	31.4600	28.3419	26.3174	23.4669	21.0441	24.1484	25.2514	28.4788	32.1230	33.7582	(72)
Total internal gains	245.9827	244.9180	236.4935	222.7165	208.3614	194.8122	186.1896	189.2541	196.4880	210.3742	226.3492	238.6830	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	3.0600	10.6334	0.7200		0.7000	0.7700	11.3647 (74)
South	4.3800	46.7521	0.7200		0.7000	0.7700	71.5218 (78)
South	2.1200	46.7521	0.7200		0.7000	0.7700	34.6179 (78)

Solar gains	117.5044	195.5480	258.3330	309.5406	340.6422	336.4593	325.0283	301.4595	275.6794	213.3444	139.8316	101.1886	(83)
Total gains	363.4871	440.4660	494.8264	532.2571	549.0036	531.2715	511.2178	490.7136	472.1674	423.7186	366.1807	339.8717	(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	16.9598	16.9959	17.0315	17.2005	17.2325	17.3830	17.3830	17.4112	17.3247	17.2325	17.1679	17.1009	
alpha	2.1307	2.1331	2.1354	2.1467	2.1488	2.1589	2.1589	2.1607	2.1550	2.1488	2.1445	2.1401	
util living area	0.9303	0.8978	0.8557	0.7920	0.7014	0.5792	0.4588	0.4882	0.6494	0.8122	0.9033	0.9384	(86)
MIT	18.1539	18.5361	19.0521	19.6674	20.2220	20.6467	20.8488	20.8212	20.5139	19.7863	18.8552	18.0760	(87)
Th 2	19.8786	19.8807	19.8828	19.8925	19.8943	19.9028	19.9028	19.9044	19.8995	19.8943	19.8906	19.8868	(88)
util rest of house	0.9216	0.8853	0.8376	0.7644	0.6581	0.5111	0.3648	0.3958	0.5871	0.7816	0.8894	0.9306	(89)
MIT 2	17.3006	17.6749	18.1786	18.7769	19.2964	19.6761	19.8311	19.8151	19.5686	18.9036	18.0015	17.2297	(90)
Living area fraction									fLA = Living area / (4) =			0.4104	(91)
MIT	17.6508	18.0284	18.5371	19.1424	19.6763	20.0745	20.2488	20.2280	19.9566	19.2659	18.3518	17.5771	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.6508	18.0284	18.5371	19.1424	19.6763	20.0745	20.2488	20.2280	19.9566	19.2659	18.3518	17.5771	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8987	0.8595	0.8115	0.7429	0.6487	0.5225	0.3961	0.4248	0.5907	0.7612	0.8649	0.9091	(94)
Ext temp.	326.6769	378.5773	401.5510	395.4198	356.1222	277.5985	202.4978	208.4665	278.8960	322.5254	316.7163	308.9896	(95)
Ext 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)
Heat loss rate W	847.1553	831.2711	760.5837	640.8214	498.1143	338.9164	225.8911	236.6040	363.7929	541.1780	705.3158	841.8203	(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	387.2360	304.2102	267.1203	176.6891	105.6421	0.0000	0.0000	0.0000	0.0000	162.6776	279.7917	396.4261	(98)
Space heating												2079.7930	(98)
Space heating per m ²												41.0377	(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	581.9417	458.1243	469.7450	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7375	0.7972	0.7805	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	429.1639	365.2351	366.6474	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	685.7131	661.0531	638.0678	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	184.7155	220.0886	201.9368	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												606.7408 (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												151.6852 (107)
Energy for space heating												2.9930 (108)
Energy for space cooling												41.0377 (99)
Total												2.9930 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.0307 (109)
												44.0 (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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1566 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4066	(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) =		0.3456 (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	0.4407	0.4320	0.4234	0.3802	0.3715	0.3283	0.3283	0.3197	0.3456	0.3715	0.3888	0.4061 (22b)
Effective ac	0.5971	0.5933	0.5896	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5825 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			9.5600	1.3258	12.6742		(27)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1800	6.2262		(29a)
WTS	15.8900	2.1200	13.7700	0.1800	2.4786		(29a)
400mm Mineral Wool	50.6800		50.6800	0.1300	6.5884		(30)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	30.0874	(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)							5.8447 (36)
Total fabric heat loss						(33) + (36) =	35.9321 (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	25.1645	25.0057	24.8499	24.1184	23.9815	23.3444	23.3444	23.2264	23.5898	23.9815	24.2584	24.5479 (38)
Heat transfer coeff	61.0967	60.9378	60.7821	60.0505	59.9137	59.2765	59.2765	59.1586	59.5220	59.9137	60.1905	60.4800 (39)
Average = Sum(39)m / 12 =												60.0499 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2055	1.2024	1.1993	1.1849	1.1822	1.1696	1.1696	1.1673	1.1745	1.1822	1.1877	1.1934 (40)
HLP (average)												1.1849 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
Energy conte	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)
Energy content (annual)												1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	25.9345	22.6824	23.4062	20.4061	19.5802	16.8962	15.6568	17.9664	18.1810	21.1882	23.1286	25.1161 (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	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	85.5068	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.4727	11.9663	9.7316	7.3675	5.5073	4.6495	5.0239	6.5303	8.7649	11.1291	12.9893	13.8471	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.9999	150.5461	146.6498	138.3551	127.8846	118.0438	111.4695	109.9234	113.8196	122.1143	132.5848	142.4256	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	31.5507	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	34.8581	33.7536	31.4600	28.3419	26.3174	23.4669	21.0441	24.1484	25.2514	28.4788	32.1230	33.7582	(72)
Total internal gains	245.9827	244.9180	236.4935	222.7165	208.3614	194.8122	186.1896	189.2541	196.4880	210.3742	226.3492	238.6830	(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
North	3.0600				10.6334		0.6300		0.7000		0.7700		9.9441 (74)
South	6.5000				46.7521		0.6300		0.7000		0.7700		92.8723 (78)
Solar gains	102.8163	171.1045	226.0413	270.8480	298.0619	294.4019	284.3997	263.7771	241.2195	186.6764	122.3526	88.5401	(83)
Total gains	348.7991	416.0225	462.5348	493.5645	506.4233	489.2141	470.5893	453.0312	437.7075	397.0506	348.7018	327.2231	(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	57.6045	57.7547	57.9027	58.6080	58.7419	59.3733	59.3733	59.4917	59.1285	58.7419	58.4717	58.1919	
alpha	4.8403	4.8503	4.8602	4.9072	4.9161	4.9582	4.9582	4.9661	4.9419	4.9161	4.8981	4.8795	
util living area	0.9963	0.9910	0.9788	0.9465	0.8681	0.7122	0.5406	0.5806	0.8042	0.9575	0.9919	0.9973	(86)
MIT	19.7657	19.9558	20.2128	20.5222	20.7834	20.9429	20.9881	20.9832	20.8917	20.5524	20.0968	19.7319	(87)
Th 2	19.9156	19.9181	19.9205	19.9321	19.9343	19.9444	19.9444	19.9463	19.9405	19.9343	19.9299	19.9253	(88)
util rest of house	0.9951	0.9880	0.9715	0.9270	0.8199	0.6189	0.4179	0.4576	0.7240	0.9380	0.9887	0.9964	(89)
MIT 2	18.8021	18.9927	19.2476	19.5547	19.7903	19.9185	19.9414	19.9417	19.8838	19.5901	19.1431	18.7761	(90)
Living area fraction									fLA = Living area / (4) =			0.4104	(91)
MIT	19.1976	19.3880	19.6438	19.9518	20.1979	20.3389	20.3710	20.3691	20.2974	19.9850	19.5345	19.1684	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1976	19.3880	19.6438	19.9518	20.1979	20.3389	20.3710	20.3691	20.2974	19.9850	19.5345	19.1684	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9940	0.9861	0.9692	0.9275	0.8332	0.6559	0.4687	0.5086	0.7536	0.9391	0.9872	0.9955	(94)
Ext temp.	346.7191	410.2312	448.2813	457.7570	421.9448	320.8598	220.5709	230.3949	329.8559	372.8738	344.2331	325.7620	(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	910.1921	882.8649	798.9054	663.6668	509.1404	340.1843	223.5335	234.8084	368.8842	562.2925	748.4407	905.2887	(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	419.2239	317.6098	260.8644	148.2551	64.8735	0.0000	0.0000	0.0000	0.0000	140.9275	291.0295	431.1679	(98)
Space heating												2073.9516	(98)
Space heating per m2												40.9225	(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	557.1995	438.6464	449.6050	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8824	0.9376	0.9248	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	491.6559	411.2538	415.7761	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	636.5551	613.5653	594.0234	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	104.3274	150.5197	132.6160	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												387.4631	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

$$fC = \text{cooled area} / (4) =$$

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	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	26.0819	37.6299	33.1540	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												96.8658 (107)
Energy for space heating												1.9113 (108)
Energy for space cooling												40.9225 (99)
Total												1.9113 (108)
Target Fabric Energy Efficiency (TFEE)												42.8338 (109)
												49.3 (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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.3600
Infiltration rate					0.2180 (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) =				0.1853 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2038	0.1899	0.1899	0.1807	0.1807	0.1714	0.1714	0.1621	0.1621	0.1760	0.1714	0.1807 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.40)			7.4400	1.3258	9.8636		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1900	6.5721	9.0000	311.3100 (29a)
WTS	15.8900	2.1200	13.7700	0.1500	2.0655	18.0000	247.8600 (29a)
400mm Mineral Wool	50.6800		50.6800	0.1100	5.5748	9.0000	456.1200 (30)
Total net area of external elements Aum(A, m2)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.2222		(33)
Timebr Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Floor			50.6800			30.0000	1520.4000 (32d)
Timber			113.4100			9.0000	1020.6900 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 3874.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 76.4440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6856 (36)
Total fabric heat loss (33) + (36) = 38.9078 (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	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805 (39)
Average = Sum(39)m / 12 =												59.9805 (39)
HLP	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835 (40)
HLP (average)												1.1835 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172	14.5087 (61)
Total heat required for water heating calculated for each month	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265 (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	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.6816	29.9157	24.3291	18.4187	13.7682	11.6237	12.5598	16.3257	21.9123	27.8227	32.4732	34.6177	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.3879	224.6956	218.8803	206.5002	190.8726	176.1848	166.3724	164.0647	169.8800	182.2601	197.8878	212.5756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	399.6644	396.4712	381.4707	358.2898	334.8360	313.5339	300.8609	307.1864	320.3196	343.6713	369.6649	389.0640	(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			
North				3.0600	13.4839	0.7200	0.7000	0.7700	14.4112 (74)			
South				4.3800	56.7559	0.7200	0.7000	0.7700	86.8258 (78)			
South				2.1200	56.7559	0.7200	0.7000	0.7700	42.0253 (78)			
Solar gains	143.2622	202.6842	270.4478	328.6921	345.2448	375.5494	349.3322	335.4460	303.3303	235.5904	169.8487	116.8491 (83)
Total gains	542.9266	599.1554	651.9184	686.9819	680.0807	689.0834	650.1931	642.6324	623.6498	579.2617	539.5136	505.9130 (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	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418
alpha	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961
util living area	0.8459	0.8137	0.7555	0.6731	0.5572	0.3991	0.2885	0.2916	0.4707	0.6626	0.7930	0.8602 (86)
MIT	19.0694	19.3053	19.7389	20.2003	20.6155	20.8748	20.9581	20.9572	20.8041	20.3678	19.6712	18.9961 (87)
Th 2	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332 (88)
util rest of house	0.8290	0.7938	0.7293	0.6370	0.5044	0.3274	0.2009	0.2031	0.4003	0.6174	0.7674	0.8443 (89)
MIT 2	17.4354	17.7644	18.3674	18.9960	19.5375	19.8364	19.9135	19.9130	19.7659	19.2329	18.2878	17.3349 (90)
Living area fraction	fLA = Living area / (4) =											0.4104 (91)
MIT	18.1060	18.3968	18.9303	19.4902	19.9799	20.2626	20.3422	20.3416	20.1920	19.6987	18.8556	18.0167 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9560	18.2468	18.7803	19.3402	19.8299	20.1126	20.1922	20.1916	20.0420	19.5487	18.7056	17.8667 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7903	0.7563	0.6968	0.6148	0.4990	0.3400	0.2228	0.2252	0.4079	0.5993	0.7324	0.8056 (94)
Useful gains	429.0648	453.1359	454.2384	422.3302	339.3403	234.2559	144.8815	144.7418	254.3989	347.1634	395.1608	407.5398 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	753.1162	740.5671	670.6007	560.2329	403.6644	252.6749	149.4841	149.4456	284.4282	452.7745	618.1331	741.7600 (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	241.0943	193.1538	160.9735	99.2899	47.8572	0.0000	0.0000	0.0000	0.0000	78.5747	160.5401	248.6599 (98)
Space heating												1230.1433 (98)
RHI space heating demand												1230 (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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design AP50					Yes
Infiltration rate					4.3600
Number of sides sheltered					0.2180 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1853 (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	0.2363	0.2316	0.2270	0.2038	0.1992	0.1760	0.1760	0.1714	0.1853	0.1992	0.2085	0.2177 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.40)			7.4400	1.3258	9.8636		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1900	6.5721	9.0000	311.3100 (29a)
WTS	15.8900	2.1200	13.7700	0.1500	2.0655	18.0000	247.8600 (29a)
400mm Mineral Wool	50.6800		50.6800	0.1100	5.5748	9.0000	456.1200 (30)
Total net area of external elements Aum(A, m ²)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.2222		(33)
Timebr Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Floor			50.6800			30.0000	1520.4000 (32d)
Timber			113.4100			9.0000	1020.6900 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

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	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff												
	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805 (39)
Average = Sum(39)m / 12 =												59.9805 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1177.1425 (45)										
Distribution loss (46)m = 0.15 x (45)m											
18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172 (61)
Total heat required for water heating calculated for each month											
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (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											
136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (64)
Heat gains from water heating, kWh/month											
44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265 (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	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.6816	29.9157	24.3291	18.4187	13.7682	11.6237	12.5598	16.3257	21.9123	27.8227	32.4732	34.6177	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.3879	224.6956	218.8803	206.5002	190.8726	176.1848	166.3724	164.0647	169.8800	182.2601	197.8878	212.5756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	399.6644	396.4712	381.4707	358.2898	334.8360	313.5339	300.8609	307.1864	320.3196	343.6713	369.6649	389.0640	(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
North			3.0600	10.6334		0.7200		0.7000		0.7700		11.3647 (74)
South			4.3800	46.7521		0.7200		0.7000		0.7700		71.5218 (78)
South			2.1200	46.7521		0.7200		0.7000		0.7700		34.6179 (78)
Solar gains	117.5044	195.5480	258.3330	309.5406	340.6422	336.4593	325.0283	301.4595	275.6794	213.3444	139.8316	101.1886 (83)
Total gains	517.1688	592.0192	639.8036	667.8303	675.4782	649.9932	625.8892	608.6459	595.9990	557.0158	509.4964	490.2526 (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	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418
alpha	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961
util living area	0.8712	0.8329	0.7845	0.7152	0.6193	0.4972	0.3826	0.4059	0.5560	0.7251	0.8337	0.8828 (86)
MIT	18.7666	19.0849	19.5096	19.9945	20.4348	20.7539	20.9009	20.8831	20.6657	20.1088	19.3427	18.6703 (87)
Th 2	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332 (88)
util rest of house	0.8573	0.8156	0.7620	0.6840	0.5749	0.4334	0.3012	0.3250	0.4950	0.6888	0.8135	0.8699 (89)
MIT 2	17.0047	17.4519	18.0480	18.7188	19.3080	19.7069	19.8657	19.8497	19.6083	18.8898	17.8285	16.8690 (90)
Living area fraction	17.7278	18.1221	18.6479	19.2423	19.7705	20.1366	20.2906	20.2738	20.0423	19.3901	18.4499	17.6083 (92)
MIT	17.7278	18.1221	18.6479	19.2423	19.7705	20.1366	20.2906	20.2738	20.0423	19.3901	18.4499	17.6083 (92)
Temperature adjustment	17.5778	17.9721	18.4979	19.0923	19.6205	19.9866	20.1406	20.1238	19.8923	19.2401	18.2999	-0.1500
adjusted MIT	17.5778	17.9721	18.4979	19.0923	19.6205	19.9866	20.1406	20.1238	19.8923	19.2401	18.2999	17.4583 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.8185	0.7770	0.7265	0.6563	0.5607	0.4368	0.3177	0.3402	0.4925	0.6620	0.7757	0.8315	(94)	
Useful gains	423.2915	459.9931	464.8014	438.2750	378.7178	283.8893	198.8706	207.0523	293.5270	368.7428	395.2092	407.6638	(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	796.4089	784.0709	719.6405	611.3414	475.0731	323.0922	212.3645	223.3567	347.4228	518.2376	671.7787	795.2397	(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	277.5993	217.7803	189.6003	124.6078	71.6884	0.0000	0.0000	0.0000	0.0000	111.2241	199.1300	288.3565	(98)	
Space heating												1479.9868	(98)	
Space heating per m2												(98) / (4) =	29.2026	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1635.3445	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	277.5993	217.7803	189.6003	124.6078	71.6884	0.0000	0.0000	0.0000	0.0000	111.2241	199.1300	288.3565	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	306.7396	240.6413	209.5031	137.6881	79.2137	0.0000	0.0000	0.0000	0.0000	122.8996	220.0332	318.6260	(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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)	
Efficiency of water heater (217)m	89.4192	89.3377	89.2032	88.9709	88.5594	87.3000	87.3000	87.3000	87.3000	88.8504	89.2517	87.3000	(216)	
Fuel for water heating, kWh/month	152.7219	134.1382	139.6991	123.6341	120.3184	107.0223	100.8532	113.3369	113.9795	128.4793	137.6529	148.3263	(219)	
Water heating fuel used												1520.1621	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1635.3445	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)														
mechanical ventilation fans (SFP = 0.2260)													35.2058	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													110.2058	(231)
Electricity for lighting (calculated in Appendix L)													237.9312	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
Total delivered energy for all uses													3503.6436	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1635.3445	3.4800	56.9100	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1520.1621	3.4800	52.9016	(247)
Mechanical ventilation fans	35.2058	13.1900	4.6436	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	237.9312	13.1900	31.3831	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			275.7309	(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] =	1.2104	(257)
SAP value		83.1155	
SAP rating (Section 12)		83	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1635.3445	0.2160	353.2344	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1520.1621	0.2160	328.3550	(264)
Space and water heating			681.5894	(265)
Pumps and fans	110.2058	0.5190	57.1968	(267)
Energy for lighting	237.9312	0.5190	123.4863	(268)
Energy saving/generation technologies				
PV Unit	-432.0800	0.5190	-224.2495	(269)
Total kg/year			638.0230	(272)
CO2 emissions per m2			12.5900	(273)
EI value			91.0645	
EI rating			91	(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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8852 = 3.931$, stars = 4
Water heating environmental impact	$0.216 / 0.8852 = 0.2440$, 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	50.6800 (1b)	x 2.5200 (2b)	= 127.7136 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.7136 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.3600
Infiltration rate					0.2180 (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) =				0.1853 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2038	0.1899	0.1899	0.1807	0.1807	0.1714	0.1714	0.1621	0.1621	0.1760	0.1714	0.1807 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.40)			7.4400	1.3258	9.8636		(27)
French Door (Uw = 1.40)			2.1200	1.3258	2.8106		(27)
DTC			2.1200	0.6300	1.3356		(26)
140mm Timber Frame	44.1500	9.5600	34.5900	0.1900	6.5721	9.0000	311.3100 (29a)
WTS	15.8900	2.1200	13.7700	0.1500	2.0655	18.0000	247.8600 (29a)
400mm Mineral Wool	50.6800		50.6800	0.1100	5.5748	9.0000	456.1200 (30)
Total net area of external elements Aum(A, m2)			110.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.2222		(33)
Timebr Frame			15.8900	0.0000	0.0000	20.0000	317.8000 (32)
Party Floor			50.6800			30.0000	1520.4000 (32d)
Timber			113.4100			9.0000	1020.6900 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 38.9078 (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	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727	21.0727 (38)
Heat transfer coeff	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805 (39)
Average = Sum(39)m / 12 =	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805	59.9805 (39)
HLP	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835 (40)
HLP (average)	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835	1.1835 (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												1.7101 (42)
Average daily hot water use (litres/day)												74.8157 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	82.2973	79.3047	76.3120	73.3194	70.3268	67.3341	67.3341	70.3268	73.3194	76.3120	79.3047	82.2973 (44)
	122.0445	106.7409	110.1470	96.0289	92.1420	79.5115	73.6791	84.5479	85.5576	99.7092	108.8404	118.1936 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m = 1177.1425 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.3067	16.0111	16.5221	14.4043	13.8213	11.9267	11.0519	12.6822	12.8336	14.9564	16.3261	17.7290 (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	14.5182	13.0950	14.4691	13.9695	14.4113	13.9189	14.3657	14.3953	13.9465	14.4452	14.0172	14.5087 (61)
Total heat required for water heating calculated for each month	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023 (64)
												Total per year (kWh/year) = Sum(64)m = 1347.2033 (64)
Heat gains from water heating, kWh/month	44.2094	38.7651	40.2412	35.4220	34.2400	29.9173	28.0897	31.7110	31.9345	36.7646	39.6937	42.9265 (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	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	102.6081	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.6816	29.9157	24.3291	18.4187	13.7682	11.6237	12.5598	16.3257	21.9123	27.8227	32.4732	34.6177	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.3879	224.6956	218.8803	206.5002	190.8726	176.1848	166.3724	164.0647	169.8800	182.2601	197.8878	212.5756	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	46.9709	(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)	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	-68.4054	(71)
Water heating gains (Table 5)	59.4212	57.6862	54.0876	49.1972	46.0216	41.5518	37.7550	42.6223	44.3535	49.4148	55.1302	57.6970	(72)
Total internal gains	399.6644	396.4712	381.4707	358.2898	334.8360	313.5339	300.8609	307.1864	320.3196	343.6713	369.6649	389.0640	(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		
North					3.0600	13.4839	0.7200	0.7000	0.7700	14.4112 (74)		
South					4.3800	56.7559	0.7200	0.7000	0.7700	86.8258 (78)		
South					2.1200	56.7559	0.7200	0.7000	0.7700	42.0253 (78)		
Solar gains	143.2622	202.6842	270.4478	328.6921	345.2448	375.5494	349.3322	335.4460	303.3303	235.5904	169.8487	116.8491 (83)
Total gains	542.9266	599.1554	651.9184	686.9819	680.0807	689.0834	650.1931	642.6324	623.6498	579.2617	539.5136	505.9130 (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	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418	17.9418
alpha	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961	2.1961
util living area	0.8459	0.8137	0.7555	0.6731	0.5572	0.3991	0.2885	0.2916	0.4707	0.6626	0.7930	0.8602 (86)
MIT	19.0694	19.3053	19.7389	20.2003	20.6155	20.8748	20.9581	20.9572	20.8041	20.3678	19.6712	18.9961 (87)
Th 2	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332	19.9332 (88)
util rest of house	0.8290	0.7938	0.7293	0.6370	0.5044	0.3274	0.2009	0.2031	0.4003	0.6174	0.7674	0.8443 (89)
MIT 2	17.4354	17.7644	18.3674	18.9960	19.5375	19.8364	19.9135	19.9130	19.7659	19.2329	18.2878	17.3349 (90)
Living area fraction	18.1060	18.3968	18.9303	19.4902	19.9799	20.2626	20.3422	20.3416	20.1920	19.6987	18.8556	18.0167 (91)
MIT	18.1060	18.3968	18.9303	19.4902	19.9799	20.2626	20.3422	20.3416	20.1920	19.6987	18.8556	18.0167 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9560	18.2468	18.7803	19.3402	19.8299	20.1126	20.1922	20.1916	20.0420	19.5487	18.7056	17.8667 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	429.0648	453.1359	454.2384	422.3302	339.3403	234.2559	144.8815	144.7418	254.3989	347.1634	395.1608	407.5398	(94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	753.1162	740.5671	670.6007	560.2329	403.6644	252.6749	149.4841	149.4456	284.4282	452.7745	618.1331	741.7600	(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	241.0943	193.1538	160.9735	99.2899	47.8572	0.0000	0.0000	0.0000	0.0000	78.5747	160.5401	248.6599	(98)
Space heating												1230.1433	(98)
Space heating per m2												(98) / (4) = 24.2728	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1359.2744 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	241.0943	193.1538	160.9735	99.2899	47.8572	0.0000	0.0000	0.0000	0.0000	78.5747	160.5401	248.6599	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	266.4025	213.4296	177.8713	109.7126	52.8809	0.0000	0.0000	0.0000	0.0000	86.8229	177.3923	274.7623	(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	136.5627	119.8359	124.6161	109.9984	106.5533	93.4304	88.0449	98.9431	99.5041	114.1543	122.8576	132.7023	(64)
Efficiency of water heater (217)m	89.3161	89.2475	89.0753	88.7894	88.2673	87.3000	87.3000	87.3000	87.3000	88.5769	89.0844	89.3602	(216)
Fuel for water heating, kWh/month	152.8981	134.2738	139.8998	123.8868	120.7166	107.0223	100.8532	113.3369	113.9795	128.8760	137.9115	148.5027	(219)
Water heating fuel used												1522.1571	(219)
Annual totals kWh/year													
Space heating fuel - main system												1359.2744	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													35.2058 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.2058 (231)
Electricity for lighting (calculated in Appendix L)													237.9312 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3229.5685 (238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1359.2744	10.2300	139.0538 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1522.1571	10.2300	155.7167 (247)
Mechanical ventilation fans	35.2058	36.7200	12.9276 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	237.9312	36.7200	87.3683 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	36.7200	0.0000 (252)
Total energy cost			525.6064 (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	1359.2744	0.2160	293.6033 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1522.1571	0.2160	328.7859 (264)
Space and water heating			622.3892 (265)
Pumps and fans	110.2058	0.5190	57.1968 (267)
Energy for lighting	237.9312	0.5190	123.4863 (268)
Energy saving/generation technologies			
PV Unit	-432.0800	0.5190	-224.2495 (269)
Total kg/year			578.8228 (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	1359.2744	1.2200	1658.3148 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1522.1571	1.2200	1857.0316 (264)
Space and water heating			3515.3464 (265)
Pumps and fans	110.2058	3.0700	338.3317 (267)
Energy for lighting	237.9312	3.0700	730.4489 (268)
Energy saving/generation technologies			
PV Unit	-432.0800	3.0700	-1326.4856 (269)
Primary energy kWh/year			3257.6414 (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

64.2786 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 91

(For testing purposes):

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

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

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m ²	

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
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	£128	£128	£0
Mains gas	£398	£398	£0
Space heating	£283	£283	£0
Water heating	£156	£156	£0
Lighting	£87	£87	£0
Total cost of fuels	£526	£526	£0
Total cost of uses	£526	£526	£0
Delivered energy	64 kWh/m ²	64 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m ²	11 kg/m ²	11 kg/m ²	0 kg/m ²
Primary energy	64 kWh/m ²	64 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	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	76.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	252.87 (P1)
Transmission heat loss coefficient	38.91 (37)
Summer heat loss coefficient	291.78 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
South	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
North	3.0600	87.1704	0.7200	0.7000	0.9000	108.8946
South	4.3800	118.5567	0.7200	0.7000	0.9000	211.9901
South	2.1200	118.5567	0.7200	0.7000	0.9000	102.6071
total:						423.4918

	Jun	Jul	Aug	
Solar gains	450	423	398	(P3)
Internal gains	311	298	304	
Total summer gains	761	721	702	(P5)

	2.61	2.47	2.41	
Summer gain/loss ratio				(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 76.4)	1.46	1.46	1.46	
Threshold temperature	19.47	21.24	21.17	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight