

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-200			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	2FF - Det (As)		
Property	99, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	82 B	DER	17.18	TER	20.83
Environmental	89 B	% DER<TER	17.52		
CO ₂ Emissions (t/year)	0.73	DFEE	48.93	TFEE	52.83
General Requirements Compliance	Pass	% DFEE<TFEE	7.39		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Top-floor flat, total floor area 52 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) 20.83 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.18 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.23 (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: 4.37 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 28 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North East: 2.88 m², No overhang
Windows facing South West: 3.83 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Door U-value 0.71 W/m²K
Photovoltaic array 322.83 kWh/Year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					4.3700
Number of sides sheltered					0.3852 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3563 (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	0.4543	0.4454	0.4365	0.3919	0.3830	0.3385	0.3385	0.3296	0.3563	0.3830	0.4008	0.4187 (22b)
	0.6032	0.5992	0.5953	0.5768	0.5734	0.5573	0.5573	0.5543	0.5635	0.5734	0.5803	0.5876 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			6.7100	1.3258	8.8958		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.2500	10.3250	60.0000	2478.0000 (29a)
APT Wall to Stairwell	16.4700		16.4700	0.2400	3.9528	110.0000	1811.7000 (29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522	9.0000	467.4600 (30)
Total net area of external elements Aum (m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4310		(33)
E-FC-4			51.9400			70.0000	3635.8000 (32d)
2F - Timber			82.1400			9.0000	739.2600 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	9132.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							175.8225 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1660 (36)
Total fabric heat loss						(33) + (36) =	39.5970 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	23.8825	23.7239	23.5684	22.8380	22.7013	22.0651	22.0651	21.9473	22.3102	22.7013	22.9778	23.2668 (38)
Heat transfer coeff	63.4796	63.3209	63.1654	62.4350	62.2983	61.6622	61.6622	61.5444	61.9072	62.2983	62.5748	62.8638 (39)
Average = Sum(39)m / 12 =												62.4343 (39)
HLP	1.2222	1.2191	1.2161	1.2021	1.1994	1.1872	1.1872	1.1849	1.1919	1.1994	1.2048	1.2103 (40)
HLP (average)												1.2020 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)												1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 (56)
Combi 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 (57)
Total heat required for water heating calculated for each month	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Solar input	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (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	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8233	13.1659	10.7072	8.1061	6.0594	5.1156	5.5276	7.1849	9.6436	12.2448	14.2915	15.2353	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	281.7481	279.9121	269.8258	253.7942	237.8302	222.3024	212.1514	217.1583	225.3530	241.5574	260.0938	273.6954	(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					2.8800	11.2829	0.6200	0.7000				0.7700	9.7732 (75)
Southwest					3.8300	36.7938	0.6200	0.7000				0.7700	42.3835 (79)
Solar gains	52.1567	92.0885	134.6221	181.2562	216.2141	220.4532	210.1256	183.1584	150.6320	104.1023	63.0629	44.2527	(83)
Total gains	333.9048	372.0005	404.4479	435.0505	454.0442	442.7556	422.2770	400.3166	375.9850	345.6597	323.1567	317.9482	(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	39.9613	40.0615	40.1601	40.6299	40.7190	41.1391	41.1391	41.2179	40.9763	40.7190	40.5391	40.3528	
alpha	3.6641	3.6708	3.6773	3.7087	3.7146	3.7426	3.7426	3.7479	3.7318	3.7146	3.7026	3.6902	
util living area	0.9900	0.9842	0.9717	0.9408	0.8720	0.7416	0.5925	0.6372	0.8358	0.9523	0.9838	0.9916	(86)
MIT	19.3057	19.4816	19.7840	20.1923	20.5716	20.8447	20.9506	20.9343	20.7359	20.2558	19.7131	19.2748	(87)
Th 2	19.9023	19.9047	19.9071	19.9184	19.9205	19.9303	19.9303	19.9321	19.9265	19.9205	19.9162	19.9118	(88)
util rest of house	0.9876	0.9803	0.9644	0.9240	0.8325	0.6595	0.4689	0.5164	0.7720	0.9355	0.9791	0.9896	(89)
MIT 2	17.6551	17.9119	18.3511	18.9412	19.4618	19.8044	19.9051	19.8955	19.6852	19.0406	18.2578	17.6160	(90)
Living area fraction	18.3940	18.6146	18.9925	19.5012	19.9586	20.2701	20.3731	20.3605	20.1555	19.5846	18.9092	18.3585	(91)
MIT	18.3940	18.6146	18.9925	19.5012	19.9586	20.2701	20.3731	20.3605	20.1555	19.5846	18.9092	18.3585	(92)
Temperature adjustment	18.2440	18.4646	18.8425	19.3512	19.8086	20.1201	20.2231	20.2105	20.0055	19.4346	18.7592	18.2085	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9823	0.9732	0.9548	0.9130	0.8278	0.6756	0.5049	0.5503	0.7775	0.9256	0.9721	0.9850	(94)
Ext temp.	327.9999	362.0266	386.1775	397.1966	375.8360	299.1036	213.1979	220.3016	292.3182	319.9482	314.1326	313.1748	(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	885.1566	858.9202	779.6169	652.5209	505.1535	340.3809	223.4067	234.5151	365.5947	550.3798	729.5735	880.6288	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	414.5246	333.9125	292.7189	183.8335	96.2122	0.0000	0.0000	0.0000	0.0000	171.4411	299.1175	422.1857	(98)
												2213.9460	(98)
												42.6251	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2459.9400 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	414.5246	333.9125	292.7189	183.8335	96.2122	0.0000	0.0000	0.0000	0.0000	171.4411	299.1175	422.1857	(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)	460.5829	371.0138	325.2433	204.2594	106.9025	0.0000	0.0000	0.0000	0.0000	190.4901	332.3528	469.0952	(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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759	(64)
Efficiency of water heater (217)m	89.1205	89.0634	88.9425	88.6808	88.1750	86.7000	86.7000	86.7000	86.7000	88.5955	88.9687	89.1497	(216)
Fuel for water heating, kWh/month	162.7981	143.1392	149.5066	133.0012	130.0489	116.6762	110.6362	123.3713	123.7798	138.1313	147.2211	158.3583	(219)
Water heating fuel used												1636.6683	(219)
Annual totals kWh/year													
Space heating fuel - main system												2459.9400	(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)												261.7838	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4433.3921	(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	2459.9400	0.2160	531.3470 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1636.6683	0.2160	353.5203 (264)
Space and water heating			884.8674 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	261.7838	0.5190	135.8658 (268)
Energy saving/generation technologies			
PV Unit	-322.8335	0.5190	-167.5506 (269)
Total CO2, kg/year			892.1076 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1800 (273)

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

DER			17.1800 ZC1
Total Floor Area	TFA		51.9400
Assumed number of occupants	N		1.7473
CO2 emission factor in Table 12 for electricity displaced from grid	EF		0.5190
CO2 emissions from appliances, equation (L14)			17.3724 ZC2
CO2 emissions from cooking, equation (L16)			3.0985 ZC3
Total CO2 emissions			37.6509 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			37.6509 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =				0.3854 (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	0.4914	0.4818	0.4722	0.4240	0.4143	0.3662	0.3662	0.3565	0.3854	0.4143	0.4336	0.4529 (22b)
	0.6208	0.6161	0.6115	0.5899	0.5858	0.5670	0.5670	0.5636	0.5743	0.5858	0.5940	0.6026 (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)			6.7100	1.3258	8.8958		(27)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.1800	7.4340		(29a)
APT Wall to Stairwell	16.4700		16.4700	0.1800	2.9646		(29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522		(30)
Total net area of external elements Aum(A, m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.1666	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5552 (36)
Total fabric heat loss						(33) + (36) =	35.7218 (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	24.5781	24.3924	24.2104	23.3557	23.1958	22.4513	22.4513	22.3134	22.7381	23.1958	23.5193	23.8575 (38)
Heat transfer coeff	60.2999	60.1143	59.9323	59.0775	58.9176	58.1731	58.1731	58.0353	58.4599	58.9176	59.2411	59.5793 (39)
Average = Sum(39)m / 12 =												59.0768 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1610	1.1574	1.1539	1.1374	1.1343	1.1200	1.1200	1.1174	1.1255	1.1343	1.1406	1.1471 (40)
HLP (average)												1.1374 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (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 EMISSIONS 09 Jan 2014

Combi loss	42.4326	36.9325	39.3466	36.5841	36.2606	33.5976	34.7176	36.2606	36.5841	39.3466	39.5706	42.4326 (61)
Total heat required for water heating calculated for each month	165.9170	144.9328	150.7931	133.7459	129.4896	114.0472	109.2659	121.8059	123.1511	140.2321	149.6950	162.0206 (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	165.9170	144.9328	150.7931	133.7459	129.4896	114.0472	109.2659	121.8059	123.1511	140.2321	149.6950	162.0206 (64)
Heat gains from water heating, kWh/month	51.6667	45.1432	46.8926	41.4523	40.0638	35.1489	33.4667	37.5090	37.9296	43.3811	46.5090	50.3712 (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	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8233	13.1659	10.7072	8.1061	6.0594	5.1156	5.5276	7.1849	9.6436	12.2448	14.2915	15.2353 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365 (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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920 (71)
Water heating gains (Table 5)	69.4445	67.1774	63.0277	57.5727	53.8492	48.8179	44.9822	50.4153	52.6800	58.3079	64.5959	67.7032 (72)
Total internal gains	288.7476	286.4032	275.8131	259.2802	242.8096	226.7778	216.6354	222.1458	230.8509	247.5568	266.5918	280.6997 (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					2.8800	11.2829	0.6300	0.7000	0.7700		9.9309 (75)	
Southwest					3.8300	36.7938	0.6300	0.7000	0.7700		43.0671 (79)	
Solar gains	52.9980	93.5737	136.7934	184.1797	219.7014	224.0089	213.5147	186.1125	153.0616	105.7813	64.0800	44.9665 (83)
Total gains	341.7455	379.9770	412.6065	443.4599	462.5110	450.7867	430.1501	408.2584	383.9125	353.3381	330.6718	325.6662 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.8167	60.0015	60.1837	61.0544	61.2202	62.0036	62.0036	62.1509	61.6995	61.2202	60.8858	60.5402
alpha	4.9878	5.0001	5.0122	5.0703	5.0813	5.1336	5.1336	5.1434	5.1133	5.0813	5.0591	5.0360
util living area	0.9970	0.9943	0.9873	0.9643	0.8976	0.7479	0.5776	0.6264	0.8564	0.9732	0.9941	0.9976 (86)
MIT	19.7976	19.9346	20.1658	20.4795	20.7592	20.9361	20.9863	20.9796	20.8645	20.5125	20.1039	19.7770 (87)
Th 2	19.9514	19.9542	19.9571	19.9704	19.9729	19.9845	19.9845	19.9867	19.9800	19.9729	19.9678	19.9626 (88)
util rest of house	0.9960	0.9924	0.9827	0.9504	0.8567	0.6582	0.4532	0.5019	0.7870	0.9601	0.9917	0.9968 (89)
MIT 2	18.3565	18.5581	18.8957	19.3531	19.7307	19.9405	19.9793	19.9780	19.8693	19.4072	18.8155	18.3343 (90)
Living area fraction									fLA = Living area / (4) =			0.4476 (91)
MIT	19.0016	19.1743	19.4643	19.8573	20.1911	20.3862	20.4301	20.4264	20.3148	19.9020	19.3922	18.9801 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0016	19.1743	19.4643	19.8573	20.1911	20.3862	20.4301	20.4264	20.3148	19.9020	19.3922	18.9801 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9947	0.9904	0.9799	0.9485	0.8665	0.6960	0.5093	0.5580	0.8125	0.9590	0.9899	0.9958 (94)
Ext temp.	339.9307	376.3450	404.3135	420.6435	400.7777	313.7585	219.0748	227.8153	311.9377	338.8405	327.3172	324.2930 (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	886.5060	858.0863	776.9792	647.3314	500.2734	336.5999	222.8085	233.6715	363.3170	548.0497	728.2036	880.5892 (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	406.6520	323.7301	277.2633	163.2153	74.0248	0.0000	0.0000	0.0000	0.0000	155.6517	288.6382	413.8844 (98)
Space heating per m2										(98) / (4) =		40.4902 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													2251.6701 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	406.6520	323.7301	277.2633	163.2153	74.0248	0.0000	0.0000	0.0000	0.0000	155.6517	288.6382	413.8844	(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)	435.3876	346.6061	296.8558	174.7487	79.2557	0.0000	0.0000	0.0000	0.0000	166.6506	309.0345	443.1311	(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	165.9170	144.9328	150.7931	133.7459	129.4896	114.0472	109.2659	121.8059	123.1511	140.2321	149.6950	162.0206	(64)
Efficiency of water heater	87.2210	87.0154	86.5645	85.5535	83.7015	80.3000	80.3000	80.3000	80.3000	85.3143	86.6768	87.3105	(216)
(217)m	87.2210	87.0154	86.5645	85.5535	83.7015	80.3000	80.3000	80.3000	80.3000	85.3143	86.6768	87.3105	(217)
Fuel for water heating, kWh/month	190.2259	166.5599	174.1975	156.3301	154.7041	142.0265	136.0722	151.6886	153.3638	164.3712	172.7047	185.5684	(219)
Water heating fuel used												1947.8129	(219)
Annual totals kWh/year													
Space heating fuel - main system												2251.6701	(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)												261.7838	(232)
Total delivered energy for all uses												4536.2668	(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	2251.6701	0.2160	486.3607 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1947.8129	0.2160	420.7276 (264)
Space and water heating			907.0883 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	261.7838	0.5190	135.8658 (268)
Total CO2, kg/m2/year			1081.8791 (272)
Emissions per m2 for space and water heating			17.4642 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6158 (272b)
Emissions per m2 for pumps and fans			0.7494 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.4642 * 1.00) + 2.6158 + 0.7494, rounded to 2 d.p.			20.8300 (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	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3852 (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) = 0.3563 (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												
	0.4543	0.4454	0.4365	0.3919	0.3830	0.3385	0.3385	0.3296	0.3563	0.3830	0.4008	0.4187 (22b)
Effective ac	0.6032	0.5992	0.5953	0.5768	0.5734	0.5573	0.5573	0.5543	0.5635	0.5734	0.5803	0.5876 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			6.7100	1.3258	8.8958		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.2500	10.3250	60.0000	2478.0000 (29a)
APT Wall to Stairwell	16.4700		16.4700	0.2400	3.9528	110.0000	1811.7000 (29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522	9.0000	467.4600 (30)
Total net area of external elements Aum (A, m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4310		(33)
E-FC-4			51.9400			70.0000	3635.8000 (32d)
2F - Timber			82.1400			9.0000	739.2600 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	9132.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							175.8225 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1660 (36)
Total fabric heat loss						(33) + (36) =	39.5970 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	23.8825	23.7239	23.5684	22.8380	22.7013	22.0651	22.0651	21.9473	22.3102	22.7013	22.9778	23.2668 (38)
Heat transfer coeff	63.4796	63.3209	63.1654	62.4350	62.2983	61.6622	61.6622	61.5444	61.9072	62.2983	62.5748	62.8638 (39)
Average = Sum(39)m / 12 =												62.4343 (39)
HLP	1.2222	1.2191	1.2161	1.2021	1.1994	1.1872	1.1872	1.1849	1.1919	1.1994	1.2048	1.2103 (40)
HLP (average)												1.2020 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)												Total = Sum(45)m = 1191.0305 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (56)
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 (57)
Heat gains from water heating, kWh/month	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)
	26.2404	22.9500	23.6824	20.6469	19.8112	17.0955	15.8415	18.1784	18.3955	21.4382	23.4014	25.4125 (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	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8233	13.1659	10.7072	8.1061	6.0594	5.1156	5.5276	7.1849	9.6436	12.2448	14.2915	15.2353	(67)
Appliances gains (calculated in Appendix L13, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	35.2694	34.1519	31.8312	28.6762	26.6279	23.7438	21.2924	24.4333	25.5493	28.8148	32.5020	34.1565	(72)
Total internal gains	251.5725	250.3777	241.6165	227.3837	212.5884	198.7036	189.9456	193.1639	200.7203	215.0636	231.4979	244.1530	(73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	W
Northeast					2.8800	11.2829		0.6200		0.7000	0.7700	9.7732
Southwest					3.8300	36.7938		0.6200		0.7000	0.7700	42.3835 (75)
Solar gains	52.1567	92.0885	134.6221	181.2562	216.2141	220.4532	210.1256	183.1584	150.6320	104.1023	63.0629	44.2527 (83)
Total gains	303.7292	342.4661	376.2387	408.6399	428.8024	419.1568	400.0712	376.3222	351.3523	319.1659	294.5608	288.4058 (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	39.9613	40.0615	40.1601	40.6299	40.7190	41.1391	41.1391	41.2179	40.9763	40.7190	40.5391	40.3528	
alpha	3.6641	3.6708	3.6773	3.7087	3.7146	3.7426	3.7426	3.7479	3.7318	3.7146	3.7026	3.6902	
util living area	0.9927	0.9878	0.9773	0.9502	0.8879	0.7647	0.6175	0.6658	0.8581	0.9621	0.9879	0.9939	(86)
MIT	19.2382	19.4169	19.7251	20.1433	20.5362	20.8265	20.9432	20.9237	20.7061	20.2042	19.6503	19.2081	(87)
Th 2	19.9023	19.9047	19.9071	19.9184	19.9205	19.9303	19.9303	19.9321	19.9265	19.9205	19.9162	19.9118	(88)
util rest of house	0.9908	0.9848	0.9712	0.9356	0.8516	0.6846	0.4918	0.5440	0.7989	0.9481	0.9843	0.9924	(89)
MIT 2	18.3011	18.4804	18.7874	19.2053	19.5774	19.8326	19.9101	19.9024	19.7394	19.2713	18.7222	18.2781	(90)
Living area fraction	18.7206	18.8996	19.2071	19.6252	20.0066	20.2775	20.3726	20.3596	20.1721	19.6889	19.1377	18.6944	(91)
MIT	18.7206	18.8996	19.2071	19.6252	20.0066	20.2775	20.3726	20.3596	20.1721	19.6889	19.1377	18.6944	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7206	18.8996	19.2071	19.6252	20.0066	20.2775	20.3726	20.3596	20.1721	19.6889	19.1377	18.6944	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9882	0.9811	0.9663	0.9308	0.8550	0.7131	0.5468	0.5963	0.8144	0.9444	0.9809	0.9902	(94)
Ext temp.	300.1453	335.9872	363.5498	380.3707	366.6161	298.8841	218.7697	224.3860	286.1567	301.4189	288.9473	285.5672	(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	915.4117	886.4693	802.6516	669.6258	517.4871	350.0862	232.6246	243.6891	375.9059	566.2236	753.2555	911.1736	(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	457.7582	369.9240	326.6917	208.2637	112.2480	0.0000	0.0000	0.0000	0.0000	197.0147	334.3019	465.4512	(98)
Space heating per m2										(98) / (4) =		47.5867	(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	579.6243	456.3000	467.7371	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7727	0.8456	0.8195	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	447.9005	385.8680	383.2964	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	556.4343	532.9139	506.3198	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	78.1444	109.4021	91.5294	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												279.0759 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	19.5361	27.3505	22.8823	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												69.7690 (107)
Space cooling per m2												1.3433 (108)
Energy for space heating												47.5867 (99)
Energy for space cooling												1.3433 (108)
Total												48.9300 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.9 (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	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4167 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3854 (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												
	0.4914	0.4818	0.4722	0.4240	0.4143	0.3662	0.3662	0.3565	0.3854	0.4143	0.4336	0.4529 (22b)
Effective ac	0.6208	0.6161	0.6115	0.5899	0.5858	0.5670	0.5670	0.5636	0.5743	0.5858	0.5940	0.6026 (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)			6.7100	1.3258	8.8958		(27)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.1800	7.4340		(29a)
APT Wall to Stairwell	16.4700		16.4700	0.1800	2.9646		(29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522		(30)
Total net area of external elements Aum(A, m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.1666	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5552 (36)
Total fabric heat loss						(33) + (36) =	35.7218 (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	24.5781	24.3924	24.2104	23.3557	23.1958	22.4513	22.4513	22.3134	22.7381	23.1958	23.5193	23.8575 (38)
Heat transfer coeff	60.2999	60.1143	59.9323	59.0775	58.9176	58.1731	58.1731	58.0353	58.4599	58.9176	59.2411	59.5793 (39)
Average = Sum(39)m / 12 =												59.0768 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1610	1.1574	1.1539	1.1374	1.1343	1.1200	1.1200	1.1174	1.1255	1.1343	1.1406	1.1471 (40)
HLP (average)												1.1374 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)												Total = Sum(45)m = 1191.0305 (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	(59)
Heat gains from water heating, kWh/month	26.2404	22.9500	23.6824	20.6469	19.8112	17.0955	15.8415	18.1784	18.3955	21.4382	23.4014	25.4125 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.8233	13.1659	10.7072	8.1061	6.0594	5.1156	5.5276	7.1849	9.6436	12.2448	14.2915	15.2353 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	35.2694	34.1519	31.8312	28.6762	26.6279	23.7438	21.2924	24.4333	25.5493	28.8148	32.5020	34.1565 (72)
Total internal gains	251.5725	250.3777	241.6165	227.3837	212.5884	198.7036	189.9456	193.1639	200.7203	215.0636	231.4979	244.1530 (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												2.8800	11.2829	0.6300	0.7000	0.7700	9.9309 (75)
Southwest												3.8300	36.7938	0.6300	0.7000	0.7700	43.0671 (79)
Solar gains	52.9980	93.5737	136.7934	184.1797	219.7014	224.0089	213.5147	186.1125	153.0616	105.7813	64.0800	44.9665 (83)					
Total gains	304.5705	343.9514	378.4100	411.5634	432.2897	422.7125	403.4603	379.2764	353.7818	320.8450	295.5780	289.1195 (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	59.8167	60.0015	60.1837	61.0544	61.2202	62.0036	62.0036	62.1509	61.6995	61.2202	60.8858	60.5402
alpha	4.9878	5.0001	5.0122	5.0703	5.0813	5.1336	5.1336	5.1434	5.1133	5.0813	5.0591	5.0360
util living area	0.9982	0.9963	0.9912	0.9732	0.9171	0.7796	0.6105	0.6652	0.8860	0.9819	0.9964	0.9986 (86)
MIT	19.7314	19.8711	20.1075	20.4304	20.7253	20.9223	20.9825	20.9733	20.8367	20.4601	20.0419	19.7115 (87)
Th 2	19.9514	19.9542	19.9571	19.9704	19.9729	19.9845	19.9845	19.9867	19.9800	19.9729	19.9678	19.9626 (88)
util rest of house	0.9976	0.9951	0.9879	0.9623	0.8814	0.6920	0.4816	0.5372	0.8242	0.9724	0.9949	0.9982 (89)
MIT 2	18.7966	18.9381	19.1753	19.5029	19.7799	19.9469	19.9799	19.9787	19.8853	19.5373	19.1197	18.7857 (90)
Living area fraction									fLA = Living area / (4) =			0.4476 (91)
MIT	19.2150	19.3558	19.5926	19.9181	20.2031	20.3835	20.4287	20.4239	20.3112	19.9504	19.5326	19.2001 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2150	19.3558	19.5926	19.9181	20.2031	20.3835	20.4287	20.4239	20.3112	19.9504	19.5326	19.2001 (93)

8. Space heating requirement

Utilisation	0.9970	0.9941	0.9864	0.9616	0.8906	0.7291	0.5400	0.5951	0.8471	0.9722	0.9941	0.9977 (94)
Useful gains	303.6600	341.9251	373.2810	395.7787	384.9763	308.2093	217.8736	225.7233	299.6894	311.9203	293.8256	288.4533 (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	899.3752	868.9983	784.6677	650.9210	500.9831	336.4438	222.7252	233.5280	363.1038	550.9019	736.5182	893.6969 (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	443.2121	354.1932	306.0717	183.7025	86.3091	0.0000	0.0000	0.0000	0.0000	177.8023	318.7387	450.3012 (98)
Space heating												2320.3308 (98)
Space heating per m2												(98) / (4) = 44.6733 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	546.8274	430.4811	441.0680	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8472	0.9140	0.8913	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	463.2636	393.4809	393.1420	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	560.5903	536.8752	509.7727	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	70.0752	106.6853	86.7733	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												263.5338 (104)
Cooled fraction												fC = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b)												

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	17.5188	26.6713	21.6933	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												65.8835 (107)
Energy for space heating												1.2685 (108)
Energy for space cooling												44.6733 (99)
Total												1.2685 (108)
Target Fabric Energy Efficiency (TFEE)												45.9417 (109)
												52.8 (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	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3852 (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) =		0.3563 (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												
	0.3741	0.3474	0.3563	0.3385	0.3385	0.3296	0.3207	0.3118	0.3029	0.3296	0.3118	0.3296 (22b)
Effective ac	0.5700	0.5603	0.5635	0.5573	0.5573	0.5543	0.5514	0.5486	0.5459	0.5543	0.5486	0.5543 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			6.7100	1.3258	8.8958		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.2500	10.3250	60.0000	2478.0000 (29a)
APT Wall to Stairwell	16.4700		16.4700	0.2400	3.9528	110.0000	1811.7000 (29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522	9.0000	467.4600 (30)
Total net area of external elements Aum(A, m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4310		(33)
E-FC-4			51.9400			70.0000	3635.8000 (32d)
2F - Timber			82.1400			9.0000	739.2600 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	9132.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							175.8225 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1660 (36)
Total fabric heat loss						(33) + (36) =	39.5970 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	22.5678	22.1861	22.3102	22.0651	22.0651	21.9473	21.8327	21.7211	21.6128	21.9473	21.7211	21.9473 (38)
Heat transfer coeff	62.1648	61.7831	61.9072	61.6622	61.6622	61.5444	61.4297	61.3182	61.2098	61.5444	61.3182	61.5444 (39)
Average = Sum(39)m / 12 =												61.5907 (39)
HLP	1.1969	1.1895	1.1919	1.1872	1.1872	1.1849	1.1827	1.1806	1.1785	1.1849	1.1806	1.1849 (40)
HLP (average)												1.1858 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)												Total = Sum(45)m = 1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	(61)
Total heat required for water heating calculated for each month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	(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)
Output from w/h	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	(64)
RHI water heating demand												(64)
Heat gains from water heating, kWh/month	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	(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	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0582	32.9148	26.7681	20.2652	15.1484	12.7890	13.8189	17.9624	24.1090	30.6120	35.7287	38.0882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.2691	229.6275	223.6845	211.0327	195.0620	180.0518	170.0241	167.6658	173.6087	186.2606	202.2312	217.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	411.9495	408.4056	392.6701	368.5617	344.2573	322.3605	309.5183	316.2330	330.0769	354.3582	381.2349	401.2056	(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					2.8800				14.6176				0.6200				0.7000		0.7700		12.6617 (75)	
Southwest					3.8300				45.1778				0.6200				0.7000		0.7700		52.0412 (79)	

Solar gains	64.7029	97.5036	144.5135	197.1332	224.4697	248.9648	235.3087	209.5220	171.2686	119.1490	78.0327	53.9330	(83)									
Total gains	476.6524	505.9092	537.1837	565.6949	568.7270	571.3253	544.8270	525.7550	501.3455	473.5072	459.2676	455.1386	(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	40.8065	41.0586	40.9763	41.1391	41.1391	41.2179	41.2948	41.3699	41.4432	41.2179	41.3699	41.2179	
alpha	3.7204	3.7372	3.7318	3.7426	3.7426	3.7479	3.7530	3.7580	3.7629	3.7479	3.7580	3.7479	
util living area	0.9658	0.9560	0.9288	0.8680	0.7558	0.5717	0.4282	0.4417	0.6765	0.8668	0.9437	0.9694 (86)	
MIT	19.7373	19.8618	20.1398	20.4893	20.7792	20.9434	20.9853	20.9838	20.8910	20.5774	20.1326	19.7267 (87)	
Th 2	19.9225	19.9284	19.9265	19.9303	19.9303	19.9321	19.9339	19.9356	19.9373	19.9321	19.9356	19.9321 (88)	
util rest of house	0.9581	0.9462	0.9124	0.8366	0.6969	0.4798	0.3165	0.3272	0.5908	0.8281	0.9290	0.9624 (89)	
MIT 2	18.2898	18.4713	18.8642	19.3476	19.7182	19.8945	19.9282	19.9293	19.8535	19.4758	18.8662	18.2818 (90)	
Living area fraction									fLA = Living area / (4) =			0.4476 (91)	
MIT	18.9377	19.0938	19.4352	19.8586	20.1931	20.3640	20.4014	20.4013	20.3179	19.9689	19.4331	18.9286 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.7877	18.9438	19.2852	19.7086	20.0431	20.2140	20.2514	20.2513	20.1679	19.8189	19.2831	18.7786 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9477	0.9349	0.9006	0.8291	0.7036	0.5052	0.3506	0.3621	0.6108	0.8234	0.9178	0.9526	(94)
Useful gains	451.7218	472.9637	483.7742	469.0236	400.1842	288.6374	191.0017	190.3675	306.2133	389.8764	421.5366	433.5427	(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	863.3283	842.9539	760.5427	629.4870	465.1254	302.4310	193.5894	193.2333	334.6879	518.1372	697.9895	847.9922	(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	306.2353	248.6334	205.9158	115.5336	48.3162	0.0000	0.0000	0.0000	0.0000	95.4261	199.0461	308.3505	(98)
Space heating												1527.4569	(98)
RHI space heating demand												1527	(98)

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	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					4.3700
Number of sides sheltered					0.3852 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3563 (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	0.4543	0.4454	0.4365	0.3919	0.3830	0.3385	0.3385	0.3296	0.3563	0.3830	0.4008	0.4187 (22b)
	0.6032	0.5992	0.5953	0.5768	0.5734	0.5573	0.5573	0.5543	0.5635	0.5734	0.5803	0.5876 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			6.7100	1.3258	8.8958		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.2500	10.3250	60.0000	2478.0000 (29a)
APT Wall to Stairwell	16.4700		16.4700	0.2400	3.9528	110.0000	1811.7000 (29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522	9.0000	467.4600 (30)
Total net area of external elements Aum (A, m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4310		(33)
E-FC-4			51.9400			70.0000	3635.8000 (32d)
2F - Timber			82.1400			9.0000	739.2600 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	9132.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							175.8225 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1660 (36)
Total fabric heat loss						(33) + (36) =	39.5970 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	23.8825	23.7239	23.5684	22.8380	22.7013	22.0651	22.0651	21.9473	22.3102	22.7013	22.9778	23.2668 (38)
Heat transfer coeff	63.4796	63.3209	63.1654	62.4350	62.2983	61.6622	61.6622	61.5444	61.9072	62.2983	62.5748	62.8638 (39)
Average = Sum(39)m / 12 =												62.4343 (39)
HLP	1.2222	1.2191	1.2161	1.2021	1.1994	1.1872	1.1872	1.1849	1.1919	1.1994	1.2048	1.2103 (40)
HLP (average)												1.2020 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)												1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 (56)
Combi 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 (57)
Total heat required for water heating calculated for each month	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Solar input	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (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	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0582	32.9148	26.7681	20.2652	15.1484	12.7890	13.8189	17.9624	24.1090	30.6120	35.7287	38.0882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.2691	229.6275	223.6845	211.0327	195.0620	180.0518	170.0241	167.6658	173.6087	186.2606	202.2312	217.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	411.9495	408.4056	392.6701	368.5617	344.2573	322.3605	309.5183	316.2330	330.0769	354.3582	381.2349	401.2056	(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			2.8800	11.2829	0.6200	0.7000	0.7700	9.7732 (75)				
Southwest			3.8300	36.7938	0.6200	0.7000	0.7700	42.3835 (79)				
Solar gains	52.1567	92.0885	134.6221	181.2562	216.2141	220.4532	210.1256	183.1584	150.6320	104.1023	63.0629	44.2527 (83)
Total gains	464.1062	500.4940	527.2923	549.8180	560.4714	542.8137	519.6439	499.3914	480.7089	458.4605	444.2978	445.4583 (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	39.9613	40.0615	40.1601	40.6299	40.7190	41.1391	41.1391	41.2179	40.9763	40.7190	40.5391	40.3528	
alpha	3.6641	3.6708	3.6773	3.7087	3.7146	3.7426	3.7426	3.7479	3.7318	3.7146	3.7026	3.6902	
util living area	0.9722	0.9612	0.9397	0.8920	0.8008	0.6498	0.4991	0.5355	0.7398	0.8994	0.9575	0.9757	(86)
MIT	19.5858	19.7488	20.0223	20.3817	20.6951	20.9019	20.9720	20.9633	20.8327	20.4500	19.9638	19.5526	(87)
Th 2	19.9023	19.9047	19.9071	19.9184	19.9205	19.9303	19.9303	19.9321	19.9265	19.9205	19.9162	19.9118	(88)
util rest of house	0.9660	0.9526	0.9258	0.8659	0.7510	0.5652	0.3877	0.4242	0.6640	0.8698	0.9466	0.9702	(89)
MIT 2	18.0583	18.2936	18.6853	19.1943	19.6086	19.8553	19.9169	19.9131	19.7843	19.2984	18.6136	18.0170	(90)
Living area fraction	18.7421	18.9450	19.2838	19.7258	20.0949	20.3238	20.3892	20.3832	20.2536	19.8139	19.2180	18.7044	(91)
Temperature adjustment	18.5921	18.7950	19.1338	19.5758	19.9449	20.1738	20.2392	20.2332	20.1036	19.6639	19.0680	18.5544	(92)
adjusted MIT												-0.1500	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9562	0.9414	0.9137	0.8561	0.7523	0.5857	0.4210	0.4570	0.6778	0.8613	0.9356	0.9612	(94)
Ext temp.	443.7703	471.1855	481.7626	470.7166	421.6167	317.9525	218.7943	228.2030	325.8144	394.8905	415.6952	428.1575	(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	907.2549	879.8425	798.0209	666.5428	513.6464	343.6915	224.4025	235.9107	371.6676	564.6660	748.8938	902.3712	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	344.8326	274.6175	235.2962	140.9948	68.4701	0.0000	0.0000	0.0000	0.0000	126.3130	239.9030	352.8150	(98)
												1783.2422	(98)
												34.3327	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1981.3802 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	344.8326	274.6175	235.2962	140.9948	68.4701	0.0000	0.0000	0.0000	0.0000	126.3130	239.9030	352.8150	(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)	383.1473	305.1305	261.4402	156.6609	76.0779	0.0000	0.0000	0.0000	0.0000	140.3477	266.5589	392.0166	(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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759	(64)
Efficiency of water heater (217)m	88.9968	88.9269	88.7799	88.4662	87.9050	86.7000	86.7000	86.7000	86.7000	88.3453	88.8063	89.0315	(216)
Fuel for water heating, kWh/month	163.0244	143.3588	149.7805	133.3237	130.4484	116.6762	110.6362	123.3713	123.7798	138.5224	147.4905	158.5684	(219)
Water heating fuel used												1638.9807	(219)
Annual totals kWh/year													
Space heating fuel - main system												1981.3802	(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)												261.7838	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3957.1448	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1981.3802	3.4800	68.9520 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1638.9807	3.4800	57.0365 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	261.7838	13.1900	34.5293 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			290.4103 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2582 (257)
SAP value		82.4478
SAP rating (Section 12)		82 (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	1981.3802	0.2160	427.9781 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1638.9807	0.2160	354.0198 (264)
Space and water heating			781.9980 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	261.7838	0.5190	135.8658 (268)
Energy saving/generation technologies			
PV Unit	-322.8335	0.5190	-167.5506 (269)
Total kg/year			789.2382 (272)
CO2 emissions per m2			15.2000 (273)
EI value			89.0904
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8800 = 3.954$, stars = 4
Water heating environmental impact	$0.216 / 0.8800 = 0.2454$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	51.9400 (1b)	x 2.3100 (2b)	= 119.9814 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.9814 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					4.3700
Number of sides sheltered					0.3852 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3563 (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	0.3741	0.3474	0.3563	0.3385	0.3385	0.3296	0.3207	0.3118	0.3029	0.3296	0.3118	0.3296 (22b)
	0.5700	0.5603	0.5635	0.5573	0.5573	0.5543	0.5514	0.5486	0.5459	0.5543	0.5486	0.5543 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			6.7100	1.3258	8.8958		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	50.1300	8.8300	41.3000	0.2500	10.3250	60.0000	2478.0000 (29a)
APT Wall to Stairwell	16.4700		16.4700	0.2400	3.9528	110.0000	1811.7000 (29a)
APT External Plane Ceiling	51.9400		51.9400	0.1300	6.7522	9.0000	467.4600 (30)
Total net area of external elements Aum (m ²)			118.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.4310		(33)
E-FC-4			51.9400			70.0000	3635.8000 (32d)
2F - Timber			82.1400			9.0000	739.2600 (32c)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	9132.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							175.8225 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1660 (36)
Total fabric heat loss						(33) + (36) =	39.5970 (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	22.5678	22.1861	22.3102	22.0651	22.0651	21.9473	21.8327	21.7211	21.6128	21.9473	21.7211	21.9473 (38)
Heat transfer coeff	62.1648	61.7831	61.9072	61.6622	61.6622	61.5444	61.4297	61.3182	61.2098	61.5444	61.3182	61.5444 (39)
Average = Sum(39)m / 12 =												61.5907 (39)
HLP	1.1969	1.1895	1.1919	1.1872	1.1872	1.1849	1.1827	1.1806	1.1785	1.1849	1.1806	1.1849 (40)
HLP (average)												1.1858 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 (56)
Combi 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 (57)
Total heat required for water heating calculated for each month	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Solar input	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (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	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.0582	32.9148	26.7681	20.2652	15.1484	12.7890	13.8189	17.9624	24.1090	30.6120	35.7287	38.0882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.2691	229.6275	223.6845	211.0327	195.0620	180.0518	170.0241	167.6658	173.6087	186.2606	202.2312	217.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	411.9495	408.4056	392.6701	368.5617	344.2573	322.3605	309.5183	316.2330	330.0769	354.3582	381.2349	401.2056	(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				2.8800	14.6176	0.6200	0.7000	0.7700	12.6617			
Southwest				3.8300	45.1778	0.6200	0.7000	0.7700	52.0412 (75)			
Solar gains	64.7029	97.5036	144.5135	197.1332	224.4697	248.9648	235.3087	209.5220	171.2686	119.1490	78.0327	53.9330 (83)
Total gains	476.6524	505.9092	537.1837	565.6949	568.7270	571.3253	544.8270	525.7550	501.3455	473.5072	459.2676	455.1386 (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	40.8065	41.0586	40.9763	41.1391	41.1391	41.2179	41.2948	41.3699	41.4432	41.2179	41.3699	41.2179	
alpha	3.7204	3.7372	3.7318	3.7426	3.7426	3.7479	3.7530	3.7580	3.7629	3.7479	3.7580	3.7479	
util living area	0.9658	0.9560	0.9288	0.8680	0.7558	0.5717	0.4282	0.4417	0.6765	0.8668	0.9437	0.9694	(86)
MIT	19.7373	19.8618	20.1398	20.4893	20.7792	20.9434	20.9853	20.9838	20.8910	20.5774	20.1326	19.7267	(87)
Th 2	19.9225	19.9284	19.9265	19.9303	19.9303	19.9321	19.9339	19.9356	19.9373	19.9321	19.9356	19.9321	(88)
util rest of house	0.9581	0.9462	0.9124	0.8366	0.6969	0.4798	0.3165	0.3272	0.5908	0.8281	0.9290	0.9624	(89)
MIT 2	18.2898	18.4713	18.8642	19.3476	19.7182	19.8945	19.9282	19.9293	19.8535	19.4758	18.8662	18.2818	(90)
Living area fraction	18.9377	19.0938	19.4352	19.8586	20.1931	20.3640	20.4014	20.4013	20.3179	19.9689	19.4331	18.9286	(91)
MIT	18.9377	19.0938	19.4352	19.8586	20.1931	20.3640	20.4014	20.4013	20.3179	19.9689	19.4331	18.9286	(92)
Temperature adjustment	18.7877	18.9438	19.2852	19.7086	20.0431	20.2140	20.2514	20.2513	20.1679	19.8189	19.2831	18.7786	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9477	0.9349	0.9006	0.8291	0.7036	0.5052	0.3506	0.3621	0.6108	0.8234	0.9178	0.9526	(94)
Ext temp.	451.7218	472.9637	483.7742	469.0236	400.1842	288.6374	191.0017	190.3675	306.2133	389.8764	421.5366	433.5427	(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	863.3283	842.9539	760.5427	629.4870	465.1254	302.4310	193.5894	193.2333	334.6879	518.1372	697.9895	847.9922	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	306.2353	248.6334	205.9158	115.5336	48.3162	0.0000	0.0000	0.0000	0.0000	95.4261	199.0461	308.3505	(98)
												1527.4569	(98)
												29.4081	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1697.1744 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	306.2353	248.6334	205.9158	115.5336	48.3162	0.0000	0.0000	0.0000	0.0000	95.4261	199.0461	308.3505	(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)	340.2614	276.2593	228.7953	128.3707	53.6847	0.0000	0.0000	0.0000	0.0000	106.0290	221.1623	342.6116	(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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759	(64)
Efficiency of water heater (217)m	88.9121	88.8537	88.6756	88.3021	87.6527	86.7000	86.7000	86.7000	86.7000	88.1155	88.6607	88.9369	(216)
Fuel for water heating, kWh/month	163.1798	143.4769	149.9566	133.5715	130.8239	116.6762	110.6362	123.3713	123.7798	138.8836	147.7326	158.7372	(219)
Water heating fuel used												1640.8256	(219)
Annual totals kWh/year													
Space heating fuel - main system												1697.1744	(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)													261.7838 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3674.7838 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1697.1744	3.9200	66.5292 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1640.8256	3.9200	64.3204 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	261.7838	16.9600	44.3985 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			275.9681 (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	1697.1744	0.2160	366.5897 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1640.8256	0.2160	354.4183 (264)
Space and water heating			721.0080 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	261.7838	0.5190	135.8658 (268)
Energy saving/generation technologies			
PV Unit	-322.8335	0.5190	-167.5506 (269)
Total kg/year			728.2482 (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	1697.1744	1.2200	2070.5527 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1640.8256	1.2200	2001.8073 (264)
Space and water heating			4072.3600 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	261.7838	3.0700	803.6763 (268)
Energy saving/generation technologies			
PV Unit	-322.8335	3.0700	-991.0989 (269)
Primary energy kWh/year			4115.1875 (272)
Primary energy kWh/m2/year			79.2296 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Current energy efficiency rating: B 82
Current environmental impact rating: B 89

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

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

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

Potential energy efficiency rating: B 82
Potential environmental impact rating: B 89

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	£57	£57	£0
Mains gas	£219	£219	£0
Space heating	£167	£167	£0
Water heating	£64	£64	£0
Lighting	£44	£44	£0
Total cost of fuels	£276	£276	£0
Total cost of uses	£275	£275	£0
Delivered energy	71 kWh/m²	71 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	79 kWh/m²	79 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	175.8 (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	237.56 (P1)
Transmission heat loss coefficient	39.60 (37)
Summer heat loss coefficient	277.16 (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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.8800	106.0502	0.6200	0.7000	0.9000	107.3690
South West	3.8300	127.3119	0.6200	0.7000	0.9000	171.4125
total:						278.7814

	Jun	Jul	Aug	
Solar gains	300	279	247	(P3)
Internal gains	319	307	313	
Total summer gains	619	585	561	(P5)
Summer gain/loss ratio	2.23	2.11	2.02	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 175.8)	0.77	0.77	0.77	
Threshold temperature	18.40	20.18	20.09	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			