

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0012-5828-089				Issued on Date	15/12/2022
Assessment Reference	088	Prop Type Ref	1F Apartment-Det-As			
Property	FOG, Plot 089, 2 Bed, K, B					
SAP Rating	84 B	DER	17.75	TER	21.71	
Environmental	88 B	% DER<TER	18.24			
CO ₂ Emissions (t/year)	0.89	DFEE	49.83	TFEE	62.80	
General Requirements Compliance	Pass	% DFEE<TFEE	20.66			
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 62 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) 21.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 62.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 49.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	(no roof)		
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: 4.01 (design value)
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: Programmer, room thermostat and TRVs 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 (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing South East: 1.68 m², No overhang
Windows facing South West: 3.06 m², No overhang
Windows facing North West: 5.95 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 1.00 W/m²K
Window U-value 0.90 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (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					4.0100
Number of sides sheltered					0.2005 (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) =	0.1855 (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	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.8900	1.1450	7.8893		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
E-FC-14			48.9800	0.1900	9.3062	117.0000	5730.6600 (28b)
E-FC-14 over bin store			15.6900	0.1900	2.9811	117.0000	1835.7300 (28b)
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.2600	12.6672	52.8000	2572.4160 (29a)
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1900	2.8804	52.8000	800.4480 (29a)
Total net area of external elements Aum(A, m ²)			141.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7421		(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			118.6300			9.0000	1067.6700 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15559.4240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							252.3423 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0473 (36)
Total fabric heat loss							(33) + (36) = 50.7894 (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	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017 (38)
Heat transfer coeff	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911 (39)
Average = Sum(39)m / 12 =												74.2911 (39)
HLP	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049 (40)
HLP (average)												1.2049 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy conte	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1295.9816 (45)										
Distribution loss (46)m = 0.15 x (45)m											
20.1548	17.6275	18.1901	15.8585	15.2166	13.1308	12.1676	13.9625	14.1293	16.4663	17.9743	19.5189 (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	14.5821	13.1489	14.5226	14.0143	14.4525	13.9530	14.3973	14.4331	13.9864	14.4936	14.0722 (61)
Total heat required for water heating calculated for each month											
148.9477	130.6659	135.7896	119.7378	115.8968	101.4916	95.5147	107.5166	108.1816	124.2690	133.9006	144.6965 (62)
WWHRS	-42.0986	-37.0362	-37.8031	-31.1385	-28.9310	-23.8795	-20.2333	-24.4900	-25.1939	-31.1195	-40.6824 eq. (G10)
Total of WWHRS savings											
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-378.6190
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h											
106.8491	93.6297	97.9865	88.5994	86.9658	77.6122	75.2814	83.0266	82.9876	93.1495	97.8874	104.0141 (64)
Heat gains from water heating, kWh/month											
48.3221	42.3616	43.9519	38.6566	37.3433	32.5948	30.5709	34.5585	34.8165	40.1237	43.3610	46.9095 (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	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2284	14.4139	11.7222	8.8745	6.6338	5.6005	6.0515	7.8660	10.5578	13.4055	15.6462	16.6795 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.1132	178.9511	174.3197	164.4600	152.0139	140.3163	132.5016	130.6637	135.2951	145.1548	157.6009	169.2985 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408 (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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264 (71)
Water heating gains (Table 5)	64.9490	63.0381	59.0752	53.6898	50.1927	45.2706	41.0899	46.4496	48.3562	53.9297	60.2236	63.0504 (72)
Total internal gains	314.7131	312.8256	301.5395	283.4466	265.2627	247.6098	236.0654	241.4018	250.6315	268.9124	289.8931	305.4508 (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
Southeast					1.6800	36.7938	0.4600	0.0000			0.7700	21.8944 (77)
Southwest					3.0600	36.7938	0.4600	0.0000			0.7700	39.8791 (79)
Northwest					2.1500	11.2829	0.4600	0.0000			0.7700	8.5923 (81)
Northwest					3.8000	11.2829	0.4300	0.0000			0.7700	14.1960 (81)

Solar gains	84.5617	151.6092	227.5439	315.6379	384.3005	395.0516	375.2413	321.9474	257.7251	172.9815	102.6639	71.4753 (83)
Total gains	399.2748	464.4348	529.0834	599.0845	649.5632	642.6614	611.3067	563.3491	508.3566	441.8939	392.5570	376.9260 (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	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774
alpha	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785
util living area	0.9973	0.9939	0.9839	0.9493	0.8544	0.6865	0.5227	0.5846	0.8333	0.9709	0.9944	0.9980 (86)
MIT	19.7388	19.9004	20.1666	20.5056	20.7966	20.9487	20.9890	20.9815	20.8668	20.4856	20.0385	19.6947 (87)
Th 2	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161 (88)
util rest of house	0.9964	0.9918	0.9781	0.9304	0.8031	0.5912	0.4001	0.4578	0.7562	0.9564	0.9922	0.9973 (89)
MIT 2	18.7749	18.9356	19.1987	19.5253	19.7833	19.8936	19.9135	19.9111	19.8448	19.5127	19.0738	18.7309 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1615	19.3226	19.5869	19.9185	20.1897	20.3168	20.3448	20.3404	20.2547	19.9029	19.4607	19.1174 (92)
Temperature adjustment	~0.1500											
adjusted MIT	19.0115	19.1726	19.4369	19.7685	20.0397	20.1668	20.1948	20.1904	20.1047	19.7529	19.3107	18.9674 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9953	0.9899	0.9748	0.9272	0.8097	0.6146	0.4325	0.4912	0.7715	0.9535	0.9904	0.9964 (94)
Useful gains	397.4062	459.7462	515.7564	555.5009	525.9428	395.0080	264.3974	276.7296	392.2123	421.3667	388.7884	375.5749 (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	1092.9311	1060.3264	961.0984	807.4324	619.5633	413.5631	267.0646	281.5933	446.0934	679.9776	907.1460	1097.0897 (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	517.4705	403.5899	331.3344	181.3907	69.6537	0.0000	0.0000	0.0000	0.0000	192.4065	373.2175	536.8070 (98)
Space heating												2605.8702 (98)
Space heating per m2												42.2619 (99)
	(98) / (4) =											

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2879.4146 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	517.4705	403.5899	331.3344	181.3907	69.6537	0.0000	0.0000	0.0000	0.0000	192.4065	373.2175	536.8070	(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)	571.7906	445.9557	366.1154	200.4317	76.9654	0.0000	0.0000	0.0000	0.0000	212.6039	412.3950	593.1569	(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	106.8491	93.6297	97.9865	88.5994	86.9658	77.6122	75.2814	83.0266	82.9876	93.1495	97.8874	104.0141	(64)
Efficiency of water heater (217)m	89.9358	89.8796	89.7492	89.4243	88.6948	87.3000	87.3000	87.3000	87.3000	89.4307	89.8159	87.3000	(216)
Fuel for water heating, kWh/month	118.8060	104.1723	109.1782	99.0775	98.0507	88.9028	86.2330	95.1049	95.0603	104.1583	108.9867	115.6165	(219)
Water heating fuel used												1223.3472	(219)
Annual totals kWh/year													
Space heating fuel - main system												2879.4146	(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)													39.2638 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.2638 (231)
Electricity for lighting (calculated in Appendix L)													286.5989 (232)
Total delivered energy for all uses													4503.6245 (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	2879.4146	0.2160	621.9536 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1223.3472	0.2160	264.2430 (264)
Space and water heating			886.1965 (265)
Pumps and fans	114.2638	0.5190	59.3029 (267)
Energy for lighting	286.5989	0.5190	148.7448 (268)
Total CO2, kg/year			1094.2443 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7500 (273)

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

DER			17.7500 ZC1
Total Floor Area		TFA	61.6600
Assumed number of occupants		N	2.0282
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			17.0213 ZC2
CO2 emissions from cooking, equation (L16)			2.7194 ZC3
Total CO2 emissions			37.4907 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			37.4907 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1404 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3904 (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) =				0.3611 (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	0.4604	0.4514	0.4424	0.3972	0.3882	0.3431	0.3431	0.3340	0.3611	0.3882	0.4063	0.4243 (22b)
Effective ac	0.6060	0.6019	0.5979	0.5789	0.5754	0.5589	0.5589	0.5558	0.5652	0.5754	0.5825	0.5900 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			10.6900	1.3258	14.1723		(27)					
E-FC-14			48.9800	0.1300	6.3674		(28b)					
E-FC-14 over bin store			15.6900	0.1300	2.0397		(28b)					
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.1800	8.7696		(29a)					
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1800	2.7288		(29a)					
Total net area of external elements Aum(A, m2)			141.2200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	36.0578		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.3336 (36)					
Total fabric heat loss						(33) + (36) =	53.3914 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.4843	28.2908	28.1012	27.2104	27.0437	26.2679	26.2679	26.1242	26.5668	27.0437	27.3809	27.7334 (38)
Heat transfer coeff	81.8758	81.6823	81.4926	80.6019	80.4352	79.6594	79.6594	79.5157	79.9582	80.4352	80.7724	81.1248 (39)
Average = Sum(39)m / 12 =												80.6011 (39)
HLP	1.3279	1.3247	1.3216	1.3072	1.3045	1.2919	1.2919	1.2896	1.2968	1.3045	1.3100	1.3157 (40)
HLP (average)												1.3072 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy content (annual)	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)
Distribution loss	Total = Sum(45)m = 1295.9816 (45)											
	m = 0.15 x (45)m											
Water storage loss:	20.1548	17.6275	18.1901	15.8585	15.2166	13.1308	12.1676	13.9625	14.1293	16.4663	17.9743	19.5189 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	46.1716	40.1869	42.8137	39.8078	39.4558	36.5582	37.7768	39.4558	39.8078	42.8137	43.0574	46.1716 (61)
Solar input	180.5372	157.7039	164.0807	145.5313	140.9000	124.0969	118.8942	132.5392	134.0030	152.5891	162.8858	176.2975 (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	180.5372	157.7039	164.0807	145.5313	140.9000	124.0969	118.8942	132.5392	134.0030	152.5891	162.8858	176.2975 (64)
	56.2195	49.1211	51.0247	45.1050	43.5941	38.2462	36.4157	40.8142	41.2718	47.2037	50.6073	54.8098 (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	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2284	14.4139	11.7222	8.8745	6.6338	5.6005	6.0515	7.8660	10.5578	13.4055	15.6462	16.6795	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.1132	178.9511	174.3197	164.4600	152.0139	140.3163	132.5016	130.6637	135.2951	145.1548	157.6009	169.2985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	(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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	(71)
Water heating gains (Table 5)	75.5638	73.0969	68.5816	62.6459	58.5943	53.1197	48.9459	54.8578	57.3220	63.4459	70.2879	73.6690	(72)
Total internal gains	325.3278	322.8844	311.0459	292.4027	273.6643	255.4589	243.9214	249.8099	259.5973	278.4286	299.9574	316.0694	(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	
Southeast					1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (77)		
Southwest					3.0600	36.7938	0.6300	0.7000	0.7700	34.4087 (79)		
Northwest					5.9500	11.2829	0.6300	0.7000	0.7700	20.5169 (81)		
Solar gains	73.8166	132.5519	199.4648	277.4875	338.5029	348.2366	330.6678	283.2853	226.1907	151.3787	89.6564	62.3686 (83)
Total gains	399.1445	455.4362	510.5107	569.8902	612.1673	603.6955	574.5893	533.0952	485.7880	429.8073	389.6138	378.4380 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.2981	52.4219	52.5439	53.1246	53.2347	53.7532	53.7532	53.8503	53.5523	53.2347	53.0125	52.7822	
alpha	4.4865	4.4948	4.5029	4.5416	4.5490	4.5835	4.5835	4.5900	4.5702	4.5490	4.5342	4.5188	
util living area	0.9972	0.9944	0.9869	0.9618	0.8913	0.7454	0.5836	0.6426	0.8685	0.9759	0.9946	0.9978	(86)
MIT	19.5699	19.7273	19.9989	20.3675	20.7001	20.9112	20.9775	20.9655	20.8074	20.3821	19.9119	19.5432	(87)
Th 2	19.8191	19.8215	19.8239	19.8352	19.8373	19.8472	19.8472	19.8490	19.8434	19.8373	19.8330	19.8286	(88)
util rest of house	0.9962	0.9925	0.9820	0.9464	0.8461	0.6471	0.4437	0.5023	0.7967	0.9633	0.9923	0.9970	(89)
MIT 2	17.9326	18.1636	18.5596	19.0934	19.5410	19.7877	19.8391	19.8350	19.6865	19.1235	18.4417	17.9001	(90)
Living area fraction	18.5893	18.7908	19.1368	19.6044	20.0059	20.2383	20.2957	20.2884	20.1360	19.6283	19.0314	18.5591	(91)
MIT	18.5893	18.7908	19.1368	19.6044	20.0059	20.2383	20.2957	20.2884	20.1360	19.6283	19.0314	18.5591	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5893	18.7908	19.1368	19.6044	20.0059	20.2383	20.2957	20.2884	20.1360	19.6283	19.0314	18.5591	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9947	0.9900	0.9781	0.9426	0.8537	0.6832	0.5004	0.5590	0.8178	0.9603	0.9901	0.9958	(94)
Ext temp.	397.0275	450.9010	499.3518	537.1902	522.5883	412.4606	287.5357	298.0007	397.2708	412.7371	385.7660	376.8466	(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	1169.9484	1134.6290	1029.8091	862.7967	668.0832	449.1424	294.3962	309.1886	482.6305	726.1930	963.7232	1164.8796	(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	575.0532	459.4652	394.6602	234.4367	108.2482	0.0000	0.0000	0.0000	0.0000	233.2112	416.1292	586.2965	(98)
Space heating per m2												3007.5004	(98)
												48.7755	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3220.0219 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	575.0532	459.4652	394.6602	234.4367	108.2482	0.0000	0.0000	0.0000	0.0000	233.2112	416.1292	586.2965	(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)	615.6886	491.9328	422.5484	251.0029	115.8974	0.0000	0.0000	0.0000	0.0000	249.6908	445.5345	627.7265	(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	180.5372	157.7039	164.0807	145.5313	140.9000	124.0969	118.8942	132.5392	134.0030	152.5891	162.8858	176.2975	(64)
Efficiency of water heater (217)m	87.7625	87.5850	87.1799	86.2452	84.3968	80.3000	80.3000	80.3000	80.3000	86.1160	87.3107	80.3000	(216)
Fuel for water heating, kWh/month	205.7112	180.0581	188.2093	168.7414	166.9495	154.5415	148.0626	165.0551	166.8779	177.1902	186.5589	200.6901	(219)
Water heating fuel used												2108.6457	(219)
Annual totals kWh/year													
Space heating fuel - main system												3220.0219	(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)												286.5989	(232)
Total delivered energy for all uses												5690.2665	(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	3220.0219	0.2160	695.5247 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2108.6457	0.2160	455.4675 (264)
Space and water heating			1150.9922 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	286.5989	0.5190	148.7448 (268)
Total CO2, kg/m2/year			1338.6620 (272)
Emissions per m2 for space and water heating			18.6668 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4123 (272b)
Emissions per m2 for pumps and fans			0.6313 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.6668 * 1.00) + 2.4123 + 0.6313, rounded to 2 d.p.			21.7100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1404 (8)
Measured/design AP50					Yes
Infiltration rate					4.0100
Number of sides sheltered					0.3409 (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) =				0.3153 (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	0.4021	0.3942	0.3863	0.3469	0.3390	0.2996	0.2996	0.2917	0.3153	0.3390	0.3548	0.3705 (22b)
Effective ac	0.5808	0.5777	0.5746	0.5602	0.5575	0.5449	0.5449	0.5425	0.5497	0.5575	0.5629	0.5686 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.8900	1.1450	7.8893		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
E-FC-14			48.9800	0.1900	9.3062	117.0000	5730.6600 (28b)
E-FC-14 over bin store			15.6900	0.1900	2.9811	117.0000	1835.7300 (28b)
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.2600	12.6672	52.8000	2572.4160 (29a)
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1900	2.8804	52.8000	800.4480 (29a)
Total net area of external elements Aum(A, m ²)			141.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7421		(33)
E-FC-4			50.7500			30.0000	1522.5000 (32b)
Timber partition			118.6300			9.0000	1067.6700 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 13529.4240 (34)
219.4198 (35)
8.0473 (36)
(33) + (36) = 50.7894 (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	27.3009	27.1534	27.0088	26.3296	26.2025	25.6109	25.6109	25.5014	25.8388	26.2025	26.4596	26.7284 (38)
Heat transfer coeff	78.0903	77.9428	77.7982	77.1190	76.9919	76.4003	76.4003	76.2908	76.6282	76.9919	77.2490	77.5177 (39)
Average = Sum(39)m / 12 =												77.1184 (39)
HLP	1.2665	1.2641	1.2617	1.2507	1.2487	1.2391	1.2391	1.2373	1.2428	1.2487	1.2528	1.2572 (40)
HLP (average)												1.2507 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy conte	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)
Energy content (annual)										Total = Sum(45)m =		1295.9816 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	28.5527	24.9724	25.7692	22.4662	21.5569	18.6020	17.2375	19.7802	20.0165	23.3273	25.4635	27.6517 (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	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2284	14.4139	11.7222	8.8745	6.6338	5.6005	6.0515	7.8660	10.5578	13.4055	15.6462	16.6795	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.1132	178.9511	174.3197	164.4600	152.0139	140.3163	132.5016	130.6637	135.2951	145.1548	157.6009	169.2985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	(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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	(71)
Water heating gains (Table 5)	38.3773	37.1612	34.6361	31.2031	28.9743	25.8361	23.1686	26.5863	27.8007	31.3539	35.3660	37.1663	(72)
Total internal gains	285.1413	283.9487	274.1004	257.9600	241.0444	225.1753	215.1442	218.5385	227.0759	243.3366	262.0355	276.5667	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast	1.6800	36.7938	0.4600	0.0000	0.7700	21.8944	(77)
Southwest	3.0600	36.7938	0.4600	0.0000	0.7700	39.8791	(79)
Northwest	2.1500	11.2829	0.4600	0.0000	0.7700	8.5923	(81)
Northwest	3.8000	11.2829	0.4300	0.0000	0.7700	14.1960	(81)

Solar gains	84.5617	151.6092	227.5439	315.6379	384.3005	395.0516	375.2413	321.9474	257.7251	172.9815	102.6639	71.4753	(83)
Total gains	369.7030	435.5579	501.6443	573.5979	625.3449	620.2269	590.3854	540.4858	484.8010	416.3181	364.6995	348.0420	(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	48.1260	48.2171	48.3067	48.7322	48.8126	49.1906	49.1906	49.2612	49.0443	48.8126	48.6501	48.4815	
alpha	4.2084	4.2145	4.2204	4.2488	4.2542	4.2794	4.2794	4.2841	4.2696	4.2542	4.2433	4.2321	
util living area	0.9964	0.9924	0.9816	0.9472	0.8602	0.7040	0.5462	0.6094	0.8436	0.9693	0.9932	0.9972	(86)
MIT	19.4584	19.6441	19.9518	20.3557	20.7055	20.9134	20.9773	20.9643	20.8018	20.3433	19.8246	19.4234	(87)
Th 2	19.8672	19.8691	19.8709	19.8796	19.8813	19.8889	19.8889	19.8903	19.8859	19.8813	19.8780	19.8745	(88)
util rest of house	0.9953	0.9901	0.9756	0.9292	0.8126	0.6110	0.4192	0.4803	0.7724	0.9555	0.9907	0.9964	(89)
MIT 2	18.4707	18.6568	18.9626	19.3611	19.6800	19.8473	19.8826	19.8792	19.7719	19.3575	18.8443	18.4414	(90)
Living area fraction									fLA = Living area / (4) =			0.4011	(91)
MIT	18.8668	19.0528	19.3593	19.7600	20.0913	20.2748	20.3217	20.3144	20.1850	19.7529	19.2374	18.8353	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8668	19.0528	19.3593	19.7600	20.0913	20.2748	20.3217	20.3144	20.1850	19.7529	19.2374	18.8353	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9940	0.9879	0.9722	0.9269	0.8226	0.6455	0.4704	0.5322	0.7941	0.9535	0.9888	0.9953	(94)
Useful gains	367.4938	430.2674	487.6852	531.6504	514.4286	400.3532	277.7315	287.6329	384.9929	396.9443	360.6167	346.4141	(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	1137.5280	1103.1067	1000.4323	837.5131	646.0623	433.5597	284.3370	298.6344	466.2789	704.6992	937.6045	1134.4940	(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	572.9055	452.1480	381.4838	220.2212	97.9355	0.0000	0.0000	0.0000	0.0000	228.9696	415.4312	586.3315	(98)
Space heating												2955.4263	(98)
Space heating per m2												(98) / (4) =	47.9310 (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	718.1629	565.3623	579.8097	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8519	0.9101	0.8817	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	611.8187	514.5314	511.2135	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	800.7736	764.4150	707.3343	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	136.0475	185.9134	145.9139	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												467.8748 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	34.0119	46.4784	36.4785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												116.9687 (107)
Space cooling per m2												1.8970 (108)
Energy for space heating												47.9310 (99)
Energy for space cooling												1.8970 (108)
Total												49.8280 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1404 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3904 (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) =	0.3611 (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	0.4604	0.4514	0.4424	0.3972	0.3882	0.3431	0.3431	0.3340	0.3611	0.3882	0.4063	0.4243 (22b)
	0.6060	0.6019	0.5979	0.5789	0.5754	0.5589	0.5589	0.5558	0.5652	0.5754	0.5825	0.5900 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9800	1.0000	1.9800		(26)					
TER Opening Type (Uw = 1.40)			10.6900	1.3258	14.1723		(27)					
E-FC-14			48.9800	0.1300	6.3674		(28b)					
E-FC-14 over bin store			15.6900	0.1300	2.0397		(28b)					
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.1800	8.7696		(29a)					
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1800	2.7288		(29a)					
Total net area of external elements Aum(A, m2)			141.2200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0578		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.3336 (36)					
Total fabric heat loss						(33) + (36) =	53.3914 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.4843	28.2908	28.1012	27.2104	27.0437	26.2679	26.2679	26.1242	26.5668	27.0437	27.3809	27.7334 (38)
Heat transfer coeff	81.8758	81.6823	81.4926	80.6019	80.4352	79.6594	79.6594	79.5157	79.9582	80.4352	80.7724	81.1248 (39)
Average = Sum(39)m / 12 =												80.6011 (39)
HLP	1.3279	1.3247	1.3216	1.3072	1.3045	1.2919	1.2919	1.2896	1.2968	1.3045	1.3100	1.3157 (40)
HLP (average)												1.3072 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy conte	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)
Energy content (annual)										Total = Sum(45)m =		1295.9816 (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 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (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)
	28.5527	24.9724	25.7692	22.4662	21.5569	18.6020	17.2375	19.7802	20.0165	23.3273	25.4635	27.6517 (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	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	101.4080	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2284	14.4139	11.7222	8.8745	6.6338	5.6005	6.0515	7.8660	10.5578	13.4055	15.6462	16.6795	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.1132	178.9511	174.3197	164.4600	152.0139	140.3163	132.5016	130.6637	135.2951	145.1548	157.6009	169.2985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	33.1408	(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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	(71)
Water heating gains (Table 5)	38.3773	37.1612	34.6361	31.2031	28.9743	25.8361	23.1686	26.5863	27.8007	31.3539	35.3660	37.1663	(72)
Total internal gains	285.1413	283.9487	274.1004	257.9600	241.0444	225.1753	215.1442	218.5385	227.0759	243.3366	262.0355	276.5667	(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			
Southeast				1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (77)			
Southwest				3.0600	36.7938	0.6300	0.7000	0.7700	34.4087 (79)			
Northwest				5.9500	11.2829	0.6300	0.7000	0.7700	20.5169 (81)			
Solar gains	73.8166	132.5519	199.4648	277.4875	338.5029	348.2366	330.6678	283.2853	226.1907	151.3787	89.6564	62.3686 (83)
Total gains	358.9579	416.5006	473.5652	535.4475	579.5473	573.4119	545.8120	501.8237	453.2667	394.7153	351.6919	338.9353 (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	52.2981	52.4219	52.5439	53.1246	53.2347	53.7532	53.7532	53.8503	53.5523	53.2347	53.0125	52.7822		
alpha	4.4865	4.4948	4.5029	4.5416	4.5490	4.5835	4.5835	4.5900	4.5702	4.5490	4.5342	4.5188		
util living area	0.9982	0.9961	0.9902	0.9693	0.9069	0.7696	0.6092	0.6731	0.8908	0.9824	0.9964	0.9986	(86)	
MIT	19.5114	19.6712	19.9473	20.3244	20.6704	20.8982	20.9733	20.9584	20.7805	20.3352	19.8570	19.4854	(87)	
Th 2	19.8191	19.8215	19.8239	19.8352	19.8373	19.8472	19.8472	19.8490	19.8434	19.8373	19.8330	19.8286	(88)	
util rest of house	0.9975	0.9947	0.9864	0.9564	0.8658	0.6730	0.4657	0.5305	0.8258	0.9728	0.9949	0.9981	(89)	
MIT 2	18.4727	18.6339	18.9102	19.2884	19.6110	19.7995	19.8405	19.8371	19.7174	19.3054	18.8287	18.4542	(90)	
Living area fraction									fLA = Living area / (4) =			0.4011	(91)	
MIT	18.8893	19.0499	19.3261	19.7039	20.0359	20.2402	20.2948	20.2868	20.1438	19.7184	19.2411	18.8678	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.8893	19.0499	19.3261	19.7039	20.0359	20.2402	20.2948	20.2868	20.1438	19.7184	19.2411	18.8678	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9968	0.9935	0.9843	0.9546	0.8740	0.7090	0.5241	0.5885	0.8457	0.9715	0.9938	0.9975	(94)
Ext temp.	357.8156	413.7794	466.1410	511.1564	506.5204	406.5517	286.0670	295.3143	383.3317	383.4719	349.5270	338.1028	(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	1194.5097	1155.7981	1045.2365	870.8142	670.5016	449.2932	294.3267	309.0611	483.2496	733.4437	980.6689	1189.9199	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	622.5004	498.6366	430.8471	258.9536	122.0020	0.0000	0.0000	0.0000	0.0000	260.3790	454.4221	633.7519	(98)
												3281.4928	(98)
												53.2191	(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	748.7980	589.4793	604.3192	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8194	0.8890	0.8565	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	613.5595	524.0480	517.5808	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	746.0548	712.3163	662.1448	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	95.3966	140.0716	107.5556	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												343.0238	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.8491	35.0179	26.8889	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												85.7559 (107)
Space cooling per m2												1.3908 (108)
Energy for space heating												53.2191 (99)
Energy for space cooling												1.3908 (108)
Total												54.6099 (109)
Target Fabric Energy Efficiency (TFEE)												62.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (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					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					4.0100
Infiltration rate					0.2005 (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) =				0.1855 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (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
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.8900	1.1450	7.8893		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
E-FC-14			48.9800	0.1900	9.3062	117.0000	5730.6600 (28b)
E-FC-14 over bin store			15.6900	0.1900	2.9811	117.0000	1835.7300 (28b)
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.2600	12.6672	52.8000	2572.4160 (29a)
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1900	2.8804	52.8000	800.4480 (29a)
Total net area of external elements Aum(A, m2)			141.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			42.7421	(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			118.6300			9.0000	1067.6700 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =			15559.4240	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						252.3423	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						8.0473	(36)
Total fabric heat loss			(33) + (36) =			50.7894	(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	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017 (38)
Heat transfer coeff	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911 (39)
Average = Sum(39)m / 12 =												74.2911 (39)
HLP	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049 (40)
HLP (average)												1.2049 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy conte	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1295.9816 (45)
Distribution loss (46)m = 0.15 x (45)m													
	20.1548	17.6275	18.1901	15.8585	15.2166	13.1308	12.1676	13.9625	14.1293	16.4663	17.9743	19.5189 (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	14.5821	13.1489	14.5226	14.0143	14.4525	13.9530	14.3973	14.4331	13.9864	14.4936	14.0722	14.5706 (61)	
Total heat required for water heating calculated for each month	148.9477	130.6659	135.7896	119.7378	115.8968	101.4916	95.5147	107.5166	108.1816	124.2690	133.9006	144.6965 (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	148.9477	130.6659	135.7896	119.7378	115.8968	101.4916	95.5147	107.5166	108.1816	124.2690	133.9006	144.6965 (64)	
	Total per year (kWh/year) = Sum(64)m =											1466.6083 (64)	
RHI water heating demand	1467 (64)												
Heat gains from water heating, kWh/month	48.3221	42.3616	43.9519	38.6566	37.3433	32.5948	30.5709	34.5585	34.8165	40.1237	43.3610	46.9095 (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	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.5710	36.0348	29.3055	22.1861	16.5844	14.0013	15.1288	19.6651	26.3944	33.5137	39.1155	41.6986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.3481	267.0912	260.1787	245.4627	226.8864	209.4273	197.7636	195.0205	201.9330	216.6490	235.2253	252.6844	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	(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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	(71)
Water heating gains (Table 5)	64.9490	63.0381	59.0752	53.6898	50.1927	45.2706	41.0899	46.4496	48.3562	53.9297	60.2236	63.0504	(72)
Total internal gains	462.6285	458.9245	441.3196	414.0989	386.4238	361.4595	346.7426	353.8955	369.4440	396.8528	427.3247	450.1937	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c		Access factor Table 6d	Gains W		
Southeast				1.6800	40.4699	0.4600	0.0000		0.7700	24.0819 (77)		
Southwest				3.0600	40.4699	0.4600	0.0000		0.7700	43.8634 (79)		
Northwest				2.1500	12.9236	0.4600	0.0000		0.7700	9.8417 (81)		
Northwest				3.8000	12.9236	0.4300	0.0000		0.7700	16.2602 (81)		
Solar gains	94.0471	152.1767	226.7937	325.9636	387.7474	426.8769	400.9774	351.1527	279.0853	185.7266	117.0645	78.6711 (83)
Total gains	556.6756	611.1012	668.1134	740.0625	774.1711	788.3364	747.7200	705.0482	648.5293	582.5794	544.3892	528.8648 (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	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	
alpha	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	
util living area	0.9864	0.9776	0.9506	0.8715	0.7054	0.4648	0.3073	0.3361	0.6311	0.8955	0.9724	0.9889 (86)	
MIT	20.0536	20.1816	20.4382	20.7310	20.9278	20.9924	20.9992	20.9988	20.9676	20.7356	20.3467	20.0146 (87)	
Th 2	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161 (88)	
util rest of house	0.9819	0.9704	0.9345	0.8321	0.6305	0.3672	0.2003	0.2229	0.5276	0.8533	0.9619	0.9853 (89)	
MIT 2	19.0866	19.2116	19.4588	19.7241	19.8777	19.9140	19.9161	19.9160	19.9038	19.7354	19.3747	19.0484 (90)	
Living area fraction	19.4744	19.6006	19.8516	20.1279	20.2988	20.3465	20.3505	20.3503	fLA = Living area / (4) =				0.4011 (91)
MIT	19.4744	19.6006	19.8516	20.1279	20.2988	20.3465	20.3505	20.3503	20.3305	20.1366	19.7646	19.4359 (92)	
Temperature adjustment	19.3244	19.4506	19.7016	19.9779	20.1488	20.1965	20.2005	20.2003	20.1805	19.9866	19.6146	-0.1500	
adjusted MIT	19.3244	19.4506	19.7016	19.9779	20.1488	20.1965	20.2005	20.2003	20.1805	19.9866	19.6146	19.2859 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9788	0.9665	0.9307	0.8347	0.6476	0.3929	0.2284	0.2527	0.5541	0.8565	0.9582	0.9825	(94)
Ext temp.	544.8509	590.6096	621.7919	617.7057	501.3226	309.7146	170.8071	178.1571	359.3277	498.9782	521.6292	519.5863	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1056.7489	1028.9797	913.9004	748.7000	531.0956	311.7640	170.9055	178.3201	370.0056	623.0466	862.8580	1053.8852	(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)
RHI space heating demand	380.8521	294.5847	217.3288	94.3159	22.1511	0.0000	0.0000	0.0000	0.0000	92.3069	245.6847	397.5184	(98)
												1744.7426	(98)
												1745	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (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					4.0100
Number of sides sheltered					0.2005 (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) =	0.1855 (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	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (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
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.8900	1.1450	7.8893		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
E-FC-14			48.9800	0.1900	9.3062	117.0000	5730.6600 (28b)
E-FC-14 over bin store			15.6900	0.1900	2.9811	117.0000	1835.7300 (28b)
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.2600	12.6672	52.8000	2572.4160 (29a)
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1900	2.8804	52.8000	800.4480 (29a)
Total net area of external elements Aum(A, m ²)			141.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7421		(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			118.6300			9.0000	1067.6700 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15559.4240 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							252.3423 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0473 (36)
Total fabric heat loss							(33) + (36) = 50.7894 (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	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017 (38)
Heat transfer coeff	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911 (39)
Average = Sum(39)m / 12 =												74.2911 (39)
HLP	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049 (40)
HLP (average)												1.2049 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy conte	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1295.9816 (45)										
Distribution loss (46)m = 0.15 x (45)m											
20.1548	17.6275	18.1901	15.8585	15.2166	13.1308	12.1676	13.9625	14.1293	16.4663	17.9743	19.5189 (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	14.5821	13.1489	14.5226	14.0143	14.4525	13.9530	14.3973	14.4331	13.9864	14.4936	14.0722 (61)
Total heat required for water heating calculated for each month											
148.9477	130.6659	135.7896	119.7378	115.8968	101.4916	95.5147	107.5166	108.1816	124.2690	133.9006	144.6965 (62)
WWHRS	-42.0986	-37.0362	-37.8031	-31.1385	-28.9310	-23.8795	-20.2333	-24.4900	-25.1939	-31.1195	-40.6824 eq. (G10)
Total of WWHRS savings											
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-378.6190
Solar input (sum of months) = Sum(63)m =											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h											
106.8491	93.6297	97.9865	88.5994	86.9658	77.6122	75.2814	83.0266	82.9876	93.1495	97.8874	104.0141 (64)
Heat gains from water heating, kWh/month											
48.3221	42.3616	43.9519	38.6566	37.3433	32.5948	30.5709	34.5585	34.8165	40.1237	43.3610	46.9095 (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	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.5710	36.0348	29.3055	22.1861	16.5844	14.0013	15.1288	19.6651	26.3944	33.5137	39.1155	41.6986 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.3481	267.0912	260.1787	245.4627	226.8864	209.4273	197.7636	195.0205	201.9330	216.6490	235.2253	252.6844 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971 (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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264 (71)
Water heating gains (Table 5)	64.9490	63.0381	59.0752	53.6898	50.1927	45.2706	41.0899	46.4496	48.3562	53.9297	60.2236	63.0504 (72)
Total internal gains	462.6285	458.9245	441.3196	414.0989	386.4238	361.4595	346.7426	353.8955	369.4440	396.8528	427.3247	450.1937 (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			
Southeast				1.6800	36.7938	0.4600	0.0000	0.7700	21.8944 (77)			
Southwest				3.0600	36.7938	0.4600	0.0000	0.7700	39.8791 (79)			
Northwest				2.1500	11.2829	0.4600	0.0000	0.7700	8.5923 (81)			
Northwest				3.8000	11.2829	0.4300	0.0000	0.7700	14.1960 (81)			

Solar gains	84.5617	151.6092	227.5439	315.6379	384.3005	395.0516	375.2413	321.9474	257.7251	172.9815	102.6639	71.4753 (83)
Total gains	547.1902	610.5337	668.8636	729.7368	770.7243	756.5111	721.9839	675.8428	627.1690	569.8343	529.9886	521.6690 (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	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774
alpha	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785
util living area	0.9896	0.9812	0.9605	0.9037	0.7816	0.6026	0.4475	0.4965	0.7370	0.9286	0.9808	0.9917 (86)
MIT	19.9533	20.1062	20.3491	20.6415	20.8675	20.9706	20.9943	20.9907	20.9245	20.6355	20.2323	19.9060 (87)
Th 2	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161 (88)
util rest of house	0.9863	0.9754	0.9480	0.8737	0.7212	0.5113	0.3400	0.3842	0.6498	0.8995	0.9737	0.9890 (89)
MIT 2	18.9873	19.1375	19.3733	19.6454	19.8345	19.9040	19.9148	19.9138	19.8793	19.6473	19.2633	18.9406 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.3747	19.5260	19.7647	20.0449	20.2488	20.3318	20.3478	20.3457	20.2985	20.0437	19.6519	19.3278 (92)
Temperature adjustment	-0.1500											
adjusted MIT	19.2247	19.3760	19.6147	19.8949	20.0988	20.1818	20.1978	20.1957	20.1485	19.8937	19.5019	19.1778 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9836	0.9717	0.9438	0.8731	0.7322	0.5346	0.3684	0.4138	0.6700	0.8988	0.9702	0.9867 (94)
Useful gains	538.2088	593.2419	631.2766	637.1009	564.3403	404.4031	265.9593	279.6641	420.1967	512.1619	514.2136	514.7068 (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												
	1108.7741	1075.4414	974.3029	816.8243	623.9536	414.6779	267.2839	281.9886	449.3522	690.4375	921.3522	1112.7165 (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												
	424.5006	324.0380	255.2116	129.4009	44.3523	0.0000	0.0000	0.0000	0.0000	132.6371	293.1398	444.9192 (98)
Space heating												2048.1994 (99)
Space heating per m2											(98) / (4) =	33.2176 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 2263.2038 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	424.5006	324.0380	255.2116	129.4009	44.3523	0.0000	0.0000	0.0000	0.0000	132.6371	293.1398	444.9192	(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)	469.0614	358.0531	282.0017	142.9844	49.0081	0.0000	0.0000	0.0000	0.0000	146.5603	323.9114	491.6234	(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	106.8491	93.6297	97.9865	88.5994	86.9658	77.6122	75.2814	83.0266	82.9876	93.1495	97.8874	104.0141	(64)
Efficiency of water heater (217)m	89.8378	89.7624	89.5890	89.1716	88.3552	87.3000	87.3000	87.3000	87.3000	89.1518	89.6771	87.3000	(216)
Fuel for water heating, kWh/month	118.9356	104.3083	109.3734	99.3583	98.4275	88.9028	86.2330	95.1049	95.0603	104.4841	109.1554	115.7310	(219)
Water heating fuel used												1225.0747	(219)
Annual totals kWh/year													
Space heating fuel - main system												2263.2038	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)
 mechanical ventilation fans (SFP = 0.2260) 39.2638 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 114.2638 (231)
 Electricity for lighting (calculated in Appendix L) 286.5989 (232)
 Total delivered energy for all uses 3889.1412 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2263.2038	3.4800	78.7595	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1225.0747	3.4800	42.6326	(247)
Mechanical ventilation fans	39.2638	13.1900	5.1789	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	286.5989	13.1900	37.8024	(250)
Additional standing charges			120.0000	(251)
Total energy cost			294.2659	(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] = 1.1587 (257)
 SAP value 83.8355
 SAP rating (Section 12) 84 (258)
 SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2263.2038	0.2160	488.8520	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1225.0747	0.2160	264.6161	(264)
Space and water heating			753.4681	(265)
Pumps and fans	114.2638	0.5190	59.3029	(267)
Energy for lighting	286.5989	0.5190	148.7448	(268)
Total kg/year			961.5159	(272)
CO2 emissions per m2			15.5900	(273)
EI value			87.9202	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
 Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8872 = 3.923$, stars = 5
 $0.216 / 0.8872 = 0.2435$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	61.6600 (1b)	x 2.3100 (2b)	= 142.4346 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.6600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.4346 (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					4.0100
Infiltration rate					0.2005 (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) =				0.1855 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (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
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			6.8900	1.1450	7.8893		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
E-FC-14			48.9800	0.1900	9.3062	117.0000	5730.6600 (28b)
E-FC-14 over bin store			15.6900	0.1900	2.9811	117.0000	1835.7300 (28b)
100mm Knauf Supafil 34	59.4100	10.6900	48.7200	0.2600	12.6672	52.8000	2572.4160 (29a)
E-WM-30 WTS	17.1400	1.9800	15.1600	0.1900	2.8804	52.8000	800.4480 (29a)
Total net area of external elements Aum(A, m2)			141.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7421		(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			118.6300			9.0000	1067.6700 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =		15559.4240	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						252.3423	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0473 (36)
Total fabric heat loss						(33) + (36) =	50.7894 (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	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017	23.5017 (38)
Heat transfer coeff	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911	74.2911 (39)
Average = Sum(39)m / 12 =												74.2911 (39)
HLP	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049	1.2049 (40)
HLP (average)												1.2049 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0282 (42)
Average daily hot water use (litres/day)												82.3688 (43)
Daily hot water use	90.6057	87.3109	84.0162	80.7214	77.4267	74.1319	74.1319	77.4267	80.7214	84.0162	87.3109	90.6057 (44)
Energy conte	134.3656	117.5170	121.2670	105.7235	101.4442	87.5387	81.1174	93.0834	94.1951	109.7754	119.8284	130.1259 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1295.9816 (45)
Distribution loss (46)m = 0.15 x (45)m													
	20.1548	17.6275	18.1901	15.8585	15.2166	13.1308	12.1676	13.9625	14.1293	16.4663	17.9743	19.5189	(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	14.5821	13.1489	14.5226	14.0143	14.4525	13.9530	14.3973	14.4331	13.9864	14.4936	14.0722	14.5706	(61)
Total heat required for water heating calculated for each month	148.9477	130.6659	135.7896	119.7378	115.8968	101.4916	95.5147	107.5166	108.1816	124.2690	133.9006	144.6965	(62)
WWHRS	-42.0986	-37.0362	-37.8031	-31.1385	-28.9310	-23.8795	-20.2333	-24.4900	-25.1939	-31.1195	-36.0131	-40.6824	eq. (G10)
Total of WWHRS savings												-378.6190	
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	106.8491	93.6297	97.9865	88.5994	86.9658	77.6122	75.2814	83.0266	82.9876	93.1495	97.8874	104.0141	(64)
Heat gains from water heating, kWh/month	48.3221	42.3616	43.9519	38.6566	37.3433	32.5948	30.5709	34.5585	34.8165	40.1237	43.3610	46.9095	(65)
Total per year (kWh/year) = Sum(64)m =												1087.9893	(64)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	121.6895	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.5710	36.0348	29.3055	22.1861	16.5844	14.0013	15.1288	19.6651	26.3944	33.5137	39.1155	41.6986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.3481	267.0912	260.1787	245.4627	226.8864	209.4273	197.7636	195.0205	201.9330	216.6490	235.2253	252.6844	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	49.1971	(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)	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	-81.1264	(71)
Water heating gains (Table 5)	64.9490	63.0381	59.0752	53.6898	50.1927	45.2706	41.0899	46.4496	48.3562	53.9297	60.2236	63.0504	(72)
Total internal gains	462.6285	458.9245	441.3196	414.0989	386.4238	361.4595	346.7426	353.8955	369.4440	396.8528	427.3247	450.1937	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W							
Southeast	1.6800	40.4699	0.4600	0.0000	0.7700	24.0819	(77)						
Southwest	3.0600	40.4699	0.4600	0.0000	0.7700	43.8634	(79)						
Northwest	2.1500	12.9236	0.4600	0.0000	0.7700	9.8417	(81)						
Northwest	3.8000	12.9236	0.4300	0.0000	0.7700	16.2602	(81)						
Solar gains	94.0471	152.1767	226.7937	325.9636	387.7474	426.8769	400.9774	351.1527	279.0853	185.7266	117.0645	78.6711	(83)
Total gains	556.6756	611.1012	668.1134	740.0625	774.1711	788.3364	747.7200	705.0482	648.5293	582.5794	544.3892	528.8648	(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	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	58.1774	
alpha	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	4.8785	
util living area	0.9864	0.9776	0.9506	0.8715	0.7054	0.4648	0.3073	0.3361	0.6311	0.8955	0.9724	0.9889	(86)
MIT	20.0536	20.1816	20.4382	20.7310	20.9278	20.9924	20.9992	20.9988	20.9676	20.7356	20.3467	20.0146	(87)
Th 2	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	19.9161	(88)
util rest of house	0.9819	0.9704	0.9345	0.8321	0.6305	0.3672	0.2003	0.2229	0.5276	0.8533	0.9619	0.9853	(89)
MIT 2	19.0866	19.2116	19.4588	19.7241	19.8777	19.9140	19.9161	19.9160	19.9038	19.7354	19.3747	19.0484	(90)
Living area fraction									fLA = Living area / (4) =			0.4011	(91)
MIT	19.4744	19.6006	19.8516	20.1279	20.2988	20.3465	20.3505	20.3503	20.3305	20.1366	19.7646	19.4359	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3244	19.4506	19.7016	19.9779	20.1488	20.1965	20.2005	20.2003	20.1805	19.9866	19.6146	19.2859	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9788	0.9665	0.9307	0.8347	0.6476	0.3929	0.2284	0.2527	0.5541	0.8565	0.9582	0.9825	(94)
Useful gains	544.8509	590.6096	621.7919	617.7057	501.3226	309.7146	170.8071	178.1571	359.3277	498.9782	521.6292	519.5863	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1056.7489	1028.9797	913.9004	748.7000	531.0956	311.7640	170.9055	178.3201	370.0056	623.0466	862.8580	1053.8852	(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	380.8521	294.5847	217.3288	94.3159	22.1511	0.0000	0.0000	0.0000	0.0000	92.3069	245.6847	397.5184	(98)
Space heating												1744.7426	(98)
Space heating per m2												(98) / (4) =	28.2962 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													1927.8924 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	380.8521	294.5847	217.3288	94.3159	22.1511	0.0000	0.0000	0.0000	0.0000	92.3069	245.6847	397.5184	(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)	420.8311	325.5079	240.1423	104.2164	24.4763	0.0000	0.0000	0.0000	0.0000	101.9966	271.4749	439.2468	(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	106.8491	93.6297	97.9865	88.5994	86.9658	77.6122	75.2814	83.0266	82.9876	93.1495	97.8874	104.0141	(64)
Efficiency of water heater (217)m	89.7790	89.7069	89.4807	88.9212	87.9312	87.3000	87.3000	87.3000	87.3000	88.8639	89.5646	87.3000	(216)
Fuel for water heating, kWh/month	119.0134	104.3728	109.5057	99.6380	98.9021	88.9028	86.2330	95.1049	95.0603	104.8226	109.2925	115.8064	(219)
Water heating fuel used												1226.6547	(219)
Annual totals kWh/year													
Space heating fuel - main system												1927.8924	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													39.2638 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													114.2638 (231)
Electricity for lighting (calculated in Appendix L)													286.5989 (232)
Total delivered energy for all uses													3555.4098 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1927.8924	3.9200	75.5734 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1226.6547	3.9200	48.0849 (247)
Mechanical ventilation fans	39.2638	16.9600	6.6591 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	286.5989	16.9600	48.6072 (250)
Additional standing charges			88.0000 (251)
Total energy cost			279.6446 (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	1927.8924	0.2160	416.4248 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.6547	0.2160	264.9574 (264)
Space and water heating			681.3822 (265)
Pumps and fans	114.2638	0.5190	59.3029 (267)
Energy for lighting	286.5989	0.5190	148.7448 (268)
Total kg/year			889.4299 (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	1927.8924	1.2200	2352.0287 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.6547	1.2200	1496.5187 (264)
Space and water heating			3848.5474 (265)
Pumps and fans	114.2638	3.0700	350.7898 (267)
Energy for lighting	286.5989	3.0700	879.8586 (268)
Primary energy kWh/year			5079.1959 (272)
Primary energy kWh/m2/year			82.3742 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 84
Current environmental impact rating: B 88

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

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

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

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£68	£68	£0
Mains gas	£212	£212	£0
Space heating	£183	£183	£0
Water heating	£48	£48	£0
Lighting	£49	£49	£0
Total cost of fuels	£280	£280	£0
Total cost of uses	£280	£280	£0
Delivered energy	58 kWh/m²	58 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	82 kWh/m²	82 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	252.3 (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	282.02 (P1)
Transmission heat loss coefficient	50.79 (37)
Summer heat loss coefficient	332.81 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North 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
South East	1.6800	119.9223	0.4600	0.0000	0.9000	83.4084
South West	3.0600	119.9223	0.4600	0.0000	0.9000	151.9224
North West	2.1500	98.8453	0.4600	0.0000	0.9000	87.9822
North West	3.8000	98.8453	0.4300	0.0000	0.9000	145.3619
total:						468.6748

Solar gains	Jun	Jul	Aug	
	499	469	410	(P3/P4)
Internal gains	358	344	351	
Total summer gains	857	812	761	(P5)
Summer gain/loss ratio	2.58	2.44	2.29	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 252.3)	0.23	0.23	0.23	
Threshold temperature	18.81	20.57	20.32	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			