

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0012-5828-087				Issued on Date	15/12/2022
Assessment Reference	087	Prop Type Ref	GF Apartment-Det-As			
Property	Plot 087, 1 Bed, K, B					
SAP Rating	84 B	DER	17.29	TER	21.16	
Environmental	89 B	% DER<TER	18.29			
CO ₂ Emissions (t/year)	0.72	DFEE	46.66	TFEE	56.14	
General Requirements Compliance	Pass	% DFEE<TFEE	16.89			
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

Ground-floor flat, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.16 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 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	0.11 (max. 0.25)	0.11 (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): Medium OK

Based on:

Overshading: Average
Windows facing North East: 1.84 m², No overhang
Windows facing South East: 6.71 m², No overhang
Windows facing South West: 2.15 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.11 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	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (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	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)			6.9000	1.1450	7.9008		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Slab on ground			50.7500	0.1100	5.5825	110.0000	5582.5000 (28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.2600	11.9132	52.8000	2419.2960 (29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1900	3.1027	52.8000	862.2240 (29a)
Total net area of external elements Aum(A, m ²)			125.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5170		(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			111.6800			9.0000	1005.1200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13421.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							264.4658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9957 (36)
Total fabric heat loss						(33) + (36) =	43.5128 (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	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271 (38)
Heat transfer coeff	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399 (39)
Average = Sum(39)m / 12 =												62.9399 (39)
HLP	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402 (40)
HLP (average)												1.2402 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy content (annual)	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
	Total = Sum(45)m =											1177.9137 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	18.3187	16.0216	16.5329	14.4138	13.8304	11.9345	11.0591	12.6905	12.8421	14.9662	16.3367	17.7407 (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	14.5186	13.954	14.4694	13.9698	14.4116	13.9191	14.3659	14.3955	13.9467	14.4455	14.0176	14.5091 (61)
Total heat required for water heating calculated for each month	136.6431	119.9062	124.6886	110.0616	106.6139	93.4827	88.0933	98.9988	99.5604	114.2200	122.9292	132.7801 (62)
WWHRS	-36.6891	-32.2740	-32.9440	-27.1578	-25.2437	-20.8440	-17.6757	-21.3895	-21.9978	-27.1561	-31.4052	-35.4500 eq. (G10)
Total of WWHRS savings												-330.2268
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	99.9540	87.6322	91.7446	82.9038	81.3702	72.6388	70.4176	77.6093	77.5626	87.0638	91.5240	97.3301 (64)
Heat gains from water heating, kWh/month	44.2360	38.7884	40.2652	35.4430	34.2602	29.9347	28.1058	31.7295	31.9532	36.7864	39.7175	42.9524 (65)
Solar input (sum of months) = Sum(63)m =												
Total per year (kWh/year) = Sum(64)m =												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.3325	11.8418	9.6304	7.2908	5.4500	4.6011	4.9717	6.4623	8.6737	11.0133	12.8542	13.7030 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.1817	150.7297	146.8287	138.5239	128.0406	118.1878	111.6055	110.0575	113.9585	122.2633	132.7466	142.5994 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880 (71)
Water heating gains (Table 5)	59.4570	57.7209	54.1199	49.2263	46.0486	41.5759	37.7767	42.6471	44.3795	49.4441	55.1632	57.7317 (72)
Total internal gains	273.6542	271.9754	262.2620	246.7241	231.2222	216.0478	206.0368	210.8499	218.6947	234.4036	252.4469	265.7171 (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				1.8400	11.2829	0.4600	0.0000	0.7700	7.3534 (75)			
Southeast				2.9100	36.7938	0.4600	0.0000	0.7700	37.9242 (77)			
Southwest				2.1500	36.7938	0.4600	0.0000	0.7700	28.0196 (79)			
Southeast				3.8000	36.7938	0.4300	0.0000	0.7700	46.2933 (77)			
Solar gains	119.5905	206.1494	288.5503	368.4022	422.5668	423.8770	406.8458	365.7691	316.0992	229.5882	143.6867	102.0567 (83)
Total gains	393.2447	478.1248	550.8123	615.1263	653.7891	639.9249	612.8826	576.6190	534.7939	463.9919	396.1336	367.7738 (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	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348
alpha	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490
util living area	0.9952	0.9870	0.9657	0.9071	0.7828	0.6043	0.4470	0.4937	0.7354	0.9391	0.9891	0.9965 (86)
MIT	19.8505	20.0567	20.3367	20.6453	20.8719	20.9719	20.9948	20.9916	20.9285	20.6187	20.1584	19.7963 (87)
Th 2	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880 (88)
util rest of house	0.9935	0.9826	0.9541	0.8766	0.7204	0.5101	0.3366	0.3787	0.6450	0.9120	0.9846	0.9953 (89)
MIT 2	18.8593	19.0630	19.3355	19.6226	19.8106	19.8768	19.8869	19.8860	19.8543	19.6067	19.1652	18.8054 (90)
Living area fraction									fLA = Living area / (4) =			0.4179 (91)
MIT	19.2736	19.4783	19.7539	20.0500	20.2542	20.3345	20.3499	20.3480	20.3032	20.0297	19.5803	19.2195 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1236	19.3283	19.6039	19.9000	20.1042	20.1845	20.1999	20.1980	20.1532	19.8797	19.4303	19.0695 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	390.0635	468.4478	523.5289	539.4812	479.5582	343.0824	225.5365	237.2459	357.3950	423.0376	389.0495	365.5711 (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	932.9943	908.1151	824.7608	692.3385	528.9567	351.4862	226.5768	239.0479	380.9905	584.0616	776.0664	935.8854 (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	403.9405	295.4564	224.1165	110.0572	36.7525	0.0000	0.0000	0.0000	0.0000	119.8019	278.6522	424.3138 (98)
Space heating												1893.0910 (98)
Space heating per m2												37.3023 (99)

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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													2091.8132 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	403.9405	295.4564	224.1165	110.0572	36.7525	0.0000	0.0000	0.0000	0.0000	119.8019	278.6522	424.3138	(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)	446.3431	326.4711	247.6425	121.6102	40.6105	0.0000	0.0000	0.0000	0.0000	132.3778	307.9030	468.8551	(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	99.9540	87.6322	91.7446	82.9038	81.3702	72.6388	70.4176	77.6093	77.5626	87.0638	91.5240	97.3301	(64)
Efficiency of water heater (217)m	89.8467	89.7475	89.5466	89.0969	88.2711	87.3000	87.3000	87.3000	87.3000	89.1251	89.6872	89.8853	(216)
Fuel for water heating, kWh/month	111.2495	97.6431	102.4546	93.0491	92.1821	83.2059	80.6617	88.8995	88.8461	97.6873	102.0481	108.2826	(219)
Water heating fuel used												1146.2095	(219)
Annual totals kWh/year													
Space heating fuel - main system												2091.8132	(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)													32.4564 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.4564 (231)
Electricity for lighting (calculated in Appendix L)													235.4560 (232)
Total delivered energy for all uses													3580.9351 (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	2091.8132	0.2160	451.8317 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1146.2095	0.2160	247.5812 (264)
Space and water heating			699.4129 (265)
Pumps and fans	107.4564	0.5190	55.7699 (267)
Energy for lighting	235.4560	0.5190	122.2016 (268)
Total CO2, kg/year			877.3844 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2900 (273)

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

DER		17.2900	ZC1
Total Floor Area	TFA	50.7500	
Assumed number of occupants	N	1.7122	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4191	ZC2
CO2 emissions from cooking, equation (L16)		3.1545	ZC3
Total CO2 emissions		37.8636	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		37.8636	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1699 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4199 (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) = 0.3884 (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	0.4952	0.4855	0.4758	0.4272	0.4175	0.3690	0.3690	0.3592	0.3884	0.4175	0.4369	0.4563 (22b)
Effective ac	0.6226	0.6178	0.6132	0.5913	0.5872	0.5681	0.5681	0.5645	0.5754	0.5872	0.5955	0.6041 (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			1.9800	1.0000	1.9800		(26)
TER Opening Type (Uw = 1.40)			10.7000	1.3258	14.1856		(27)
Slab on ground			50.7500	0.1300	6.5975		(28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.1800	8.2476		(29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1800	2.9394		(29a)
Total net area of external elements Aum, m ²			125.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.9501		(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)							9.2986 (36)
Total fabric heat loss							(33) + (36) = 43.2487 (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	24.1907	24.0057	23.8244	22.9728	22.8134	22.0717	22.0717	21.9343	22.3574	22.8134	23.1358	23.4727 (38)
Heat transfer coeff	67.4394	67.2544	67.0731	66.2215	66.0621	65.3204	65.3204	65.1830	65.6061	66.0621	66.3845	66.7215 (39)
Average = Sum(39)m / 12 =												66.2207 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3289	1.3252	1.3216	1.3049	1.3017	1.2871	1.2871	1.2844	1.2927	1.3017	1.3081	1.3147 (40)
HLP (average)												1.3048 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy conte	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
Energy content (annual)												Total = Sum(45)m = 1177.9137 (45)
Distribution loss (46)m = 0.15 x (45)m	18.3187	16.0216	16.5329	14.4138	13.8304	11.9345	11.0591	12.6905	12.8421	14.9662	16.3367	17.7407 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	41.9653	36.5258	38.9132	36.1812	35.8612	33.2276	34.3352	35.8612	36.1812	38.9132	39.1348	41.9653 (61)
Total heat required for water heating calculated for each month	164.0897	143.3366	149.1325	132.2730	128.0636	112.7912	108.0626	120.4645	121.7949	138.6877	148.0464	160.2363 (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	164.0897	143.3366	149.1325	132.2730	128.0636	112.7912	108.0626	120.4645	121.7949	138.6877	148.0464	160.2363 (64)
Heat gains from water heating, kWh/month	51.0977	44.6460	46.3762	40.9958	39.6226	34.7618	33.0982	37.0959	37.5118	42.9033	45.9968	49.8164 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.3325	11.8418	9.6304	7.2908	5.4500	4.6011	4.9717	6.4623	8.6737	11.0133	12.8542	13.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.1817	150.7297	146.8287	138.5239	128.0406	118.1878	111.6055	110.0575	113.9585	122.2633	132.7466	142.5994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	(71)
Water heating gains (Table 5)	68.6797	66.4376	62.3336	56.9386	53.2562	48.2803	44.4868	49.8601	52.0998	57.6658	63.8845	66.9576	(72)
Total internal gains	282.8769	280.6921	270.4757	254.4364	238.4298	222.7522	212.7469	218.0629	226.4150	242.6253	261.1682	274.9430	(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	1.8400	11.2829	0.6300	0.7000	0.7700	6.3447 (75)
Southeast	6.7100	36.7938	0.6300	0.7000	0.7700	75.4518 (77)
Southwest	2.1500	36.7938	0.6300	0.7000	0.7700	24.1760 (79)

Solar gains	105.9725	182.6179	255.4635	325.9144	373.6154	374.6807	359.6645	323.5015	279.7711	203.3410	127.3144	90.4421 (83)
Total gains	388.8494	463.3099	525.9392	580.3508	612.0452	597.4329	572.4114	541.5644	506.1861	445.9663	388.4826	365.3850 (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	52.2589	52.4026	52.5443	53.2200	53.3483	53.9541	53.9541	54.0678	53.7192	53.3483	53.0893	52.8212
alpha	4.4839	4.4935	4.5030	4.5480	4.5566	4.5969	4.5969	4.6045	4.5813	4.5566	4.5393	4.5214
util living area	0.9944	0.9873	0.9702	0.9237	0.8216	0.6527	0.4913	0.5368	0.7722	0.9461	0.9885	0.9957 (86)
MIT	19.6746	19.8785	20.1704	20.5226	20.7992	20.9492	20.9889	20.9835	20.8885	20.5226	20.0309	19.6398 (87)
Th 2	19.8183	19.8211	19.8239	19.8370	19.8395	19.8510	19.8510	19.8531	19.8465	19.8395	19.8345	19.8293 (88)
util rest of house	0.9925	0.9831	0.9600	0.8974	0.7633	0.5541	0.3685	0.4113	0.6837	0.9219	0.9839	0.9943 (89)
MIT 2	18.0843	18.3816	18.8022	19.3008	19.6534	19.8194	19.8472	19.8469	19.7649	19.3140	18.6144	18.0412 (90)
Living area fraction	18.7489	19.0072	19.3740	19.8114	20.1322	20.2916	20.3244	20.3219	20.2345	fLA = Living area / (4) =		0.4179 (91)
MIT	18.7489	19.0072	19.3740	19.8114	20.1322	20.2916	20.3244	20.3219	20.2345	19.8191	19.2064	18.7093 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7489	19.0072	19.3740	19.8114	20.1322	20.2916	20.3244	20.3219	20.2345	19.8191	19.2064	18.7093 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9902	0.9792	0.9551	0.8968	0.7794	0.5937	0.4202	0.4641	0.7161	0.9214	0.9806	0.9924 (94)
Useful gains	385.0255	453.6576	502.3474	520.4371	477.0394	354.7120	240.5155	251.3228	362.5034	410.8951	380.9446	362.5947 (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	974.4270	948.7716	863.4983	722.5706	557.0510	371.7767	243.2770	255.6440	402.4580	609.0328	803.6768	968.0823 (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	438.5147	332.7166	268.6963	145.5361	59.5286	0.0000	0.0000	0.0000	0.0000	147.4144	304.3672	450.4828 (98)
Space heating												2147.2567 (98)
Space heating per m2												42.3105 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

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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													2298.9900 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	438.5147	332.7166	268.6963	145.5361	59.5286	0.0000	0.0000	0.0000	0.0000	147.4144	304.3672	450.4828	(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)	469.5018	356.2276	287.6834	155.8202	63.7352	0.0000	0.0000	0.0000	0.0000	157.8313	325.8750	482.3156	(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	164.0897	143.3366	149.1325	132.2730	128.0636	112.7912	108.0626	120.4645	121.7949	138.6877	148.0464	160.2363	(64)
Efficiency of water heater	87.4064	87.1014	86.5160	85.2921	83.2516	80.3000	80.3000	80.3000	80.3000	85.2050	86.8263	87.5120	(217)
Fuel for water heating, kWh/month	187.7320	164.5630	172.3755	155.0823	153.8272	140.4623	134.5736	150.0180	151.6748	162.7695	170.5088	183.1020	(219)
Water heating fuel used												1926.6890	(219)
Annual totals kWh/year													
Space heating fuel - main system												2298.9900	(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)												235.4560	(232)
Total delivered energy for all uses												4536.1350	(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	2298.9900	0.2160	496.5818 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1926.6890	0.2160	416.1648 (264)
Space and water heating			912.7467 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	235.4560	0.5190	122.2016 (268)
Total CO2, kg/m2/year			1073.8733 (272)
Emissions per m2 for space and water heating			17.9852 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4079 (272b)
Emissions per m2 for pumps and fans			0.7670 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9852 * 1.00) + 2.4079 + 0.7670, rounded to 2 d.p.			21.1600 (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	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (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) = 0.1699 (8)
Measured/design AP50					Yes
Infiltration rate					4.0100
Number of sides sheltered					0.3704 (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) =				0.3426 (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	0.4368	0.4282	0.4197	0.3768	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025 (22b)
	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810 (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)			6.9000	1.1450	7.9008		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Slab on ground			50.7500	0.1100	5.5825	110.0000	5582.5000 (28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.2600	11.9132	52.8000	2419.2960 (29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1900	3.1027	52.8000	862.2240 (29a)
Total net area of external elements Aum(A, m ²)				125.5800			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5170		(33)
E-FC-4				50.7500		30.0000	1522.5000 (32b)
Timber partition				111.6800		9.0000	1005.1200 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			11391.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							224.4658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9957 (36)
Total fabric heat loss						(33) + (36) =	43.5128 (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	23.1337	22.9898	22.8487	22.1860	22.0620	21.4849	21.4849	21.3780	21.7072	22.0620	22.3128	22.5751 (38)
Heat transfer coeff	66.6465	66.5025	66.3614	65.6988	65.5748	64.9977	64.9977	64.8908	65.2200	65.5748	65.8256	66.0878 (39)
Average = Sum(39)m / 12 =												65.6982 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3132	1.3104	1.3076	1.2946	1.2921	1.2807	1.2807	1.2786	1.2851	1.2921	1.2971	1.3022 (40)
HLP (average)												1.2945 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy content (annual)	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1177.9137 (45)
	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:												

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Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	25.9514	22.6973	23.4216	20.4195	19.5930	16.9073	15.6671	17.9782	18.1929	21.2021	23.1437	25.1326 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.3325	11.8418	9.6304	7.2908	5.4500	4.6011	4.9717	6.4623	8.6737	11.0133	12.8542	13.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.1817	150.7297	146.8287	138.5239	128.0406	118.1878	111.6055	110.0575	113.9585	122.2633	132.7466	142.5994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	(71)
Water heating gains (Table 5)	34.8810	33.7757	31.4806	28.3604	26.3347	23.4823	21.0579	24.1642	25.2679	28.4974	32.1441	33.7804	(72)
Total internal gains	246.0781	245.0303	236.6227	222.8582	208.5083	194.9542	186.3180	189.3670	196.5831	210.4570	226.4278	238.7658	(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	1.8400	11.2829	0.4600	0.0000	0.7700	7.3534	(75)
Southeast	2.9100	36.7938	0.4600	0.0000	0.7700	37.9242	(77)
Southwest	2.1500	36.7938	0.4600	0.0000	0.7700	28.0196	(79)
Southeast	3.8000	36.7938	0.4300	0.0000	0.7700	46.2933	(77)

Solar gains	119.5905	206.1494	288.5503	368.4022	422.5668	423.8770	406.8458	365.7691	316.0992	229.5882	143.6867	102.0567	(83)
Total gains	365.6686	451.1796	525.1730	591.2604	631.0751	618.8313	593.1638	555.1361	512.6823	440.0452	370.1144	340.8225	(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	47.4796	47.5823	47.6835	48.1644	48.2555	48.6840	48.6840	48.7642	48.5180	48.2555	48.0716	47.8809	
alpha	4.1653	4.1722	4.1789	4.2110	4.2170	4.2456	4.2456	4.2509	4.2345	4.2170	4.2048	4.1921	
util living area	0.9935	0.9841	0.9622	0.9063	0.7942	0.6256	0.4706	0.5192	0.7529	0.9378	0.9866	0.9951	(86)
MIT	19.5380	19.7773	20.1080	20.4929	20.7873	20.9434	20.9866	20.9798	20.8745	20.4727	19.9245	19.4931	(87)
Th 2	19.8305	19.8327	19.8349	19.8451	19.8470	19.8559	19.8559	19.8576	19.8525	19.8470	19.8431	19.8391	(88)
util rest of house	0.9915	0.9794	0.9508	0.8781	0.7357	0.5313	0.3539	0.3990	0.6668	0.9126	0.9818	0.9936	(89)
MIT 2	18.5191	18.7573	19.0821	19.4538	19.7101	19.8307	19.8526	19.8520	19.7872	19.4461	18.9131	18.4811	(90)
Living area fraction									fLA = Living area / (4) =			0.4179	(91)
MIT	18.9449	19.1836	19.5109	19.8881	20.1603	20.2957	20.3265	20.3233	20.2416	19.8751	19.3358	18.9040	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9449	19.1836	19.5109	19.8881	20.1603	20.2957	20.3265	20.3233	20.2416	19.8751	19.3358	18.9040	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9895	0.9760	0.9469	0.8793	0.7530	0.5691	0.4029	0.4494	0.6984	0.9134	0.9791	0.9919	(94)
Ext temp.	361.8142	440.3428	497.2852	519.8728	475.1914	352.2012	238.9873	249.4905	358.0778	401.9230	362.3725	338.0725	(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	976.0329	949.8923	863.4203	721.9058	554.7824	370.2103	242.2144	254.5892	400.5542	608.2144	805.4306	971.7582	(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	456.9787	342.4173	272.4045	145.4638	59.2157	0.0000	0.0000	0.0000	0.0000	153.4808	319.0018	471.4622	(98)
												2220.4248	(98)
												43.7522	(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	610.9780	480.9827	493.1699	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8965	0.9414	0.9249	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	547.7396	452.7824	456.1403	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	788.0549	756.8258	713.3366	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	173.0270	226.2083	191.3541	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												590.5893 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												147.6473 (107)
Energy for space heating												2.9093 (108)
Energy for space cooling												43.7522 (99)
Total												2.9093 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.6615 (109)
												46.7 (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	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1699 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4199 (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) =		0.3884 (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	0.4952	0.4855	0.4758	0.4272	0.4175	0.3690	0.3690	0.3592	0.3884	0.4175	0.4369	0.4563 (22b)
Effective ac	0.6226	0.6178	0.6132	0.5913	0.5872	0.5681	0.5681	0.5645	0.5754	0.5872	0.5955	0.6041 (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			1.9800	1.0000	1.9800		(26)
TER Opening Type (Uw = 1.40)			10.7000	1.3258	14.1856		(27)
Slab on ground			50.7500	0.1300	6.5975		(28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.1800	8.2476		(29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1800	2.9394		(29a)
Total net area of external elements Aum, m ²			125.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.9501		(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)							9.2986 (36)
Total fabric heat loss						(33) + (36) =	43.2487 (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	24.1907	24.0057	23.8244	22.9728	22.8134	22.0717	22.0717	21.9343	22.3574	22.8134	23.1358	23.4727 (38)
Heat transfer coeff	67.4394	67.2544	67.0731	66.2215	66.0621	65.3204	65.3204	65.1830	65.6061	66.0621	66.3845	66.7215 (39)
Average = Sum(39)m / 12 =												66.2207 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3289	1.3252	1.3216	1.3049	1.3017	1.2871	1.2871	1.2844	1.2927	1.3017	1.3081	1.3147 (40)
HLP (average)												1.3048 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy conte	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
Energy content (annual)												Total = Sum(45)m = 1177.9137 (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	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	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	0.0000 (57)

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 (59)
Heat gains from water heating, kWh/month	25.9514	22.6973	23.4216	20.4195	19.5930	16.9073	15.6671	17.9782	18.1929	21.2021	23.1437	25.1326 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	85.6100	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.3325	11.8418	9.6304	7.2908	5.4500	4.6011	4.9717	6.4623	8.6737	11.0133	12.8542	13.7030	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	149.1817	150.7297	146.8287	138.5239	128.0406	118.1878	111.6055	110.0575	113.9585	122.2633	132.7466	142.5994	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	31.5610	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	(71)
Water heating gains (Table 5)	34.8810	33.7757	31.4806	28.3604	26.3347	23.4823	21.0579	24.1642	25.2679	28.4974	32.1441	33.7804	(72)
Total internal gains	246.0781	245.0303	236.6227	222.8582	208.5083	194.9542	186.3180	189.3670	196.5831	210.4570	226.4278	238.7658	(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				1.8400	11.2829	0.6300		0.7000	0.7700		6.3447 (75)	
Southeast				6.7100	36.7938	0.6300		0.7000	0.7700		75.4518 (77)	
Southwest				2.1500	36.7938	0.6300		0.7000	0.7700		24.1760 (79)	

Solar gains	105.9725	182.6179	255.4635	325.9144	373.6154	374.6807	359.6645	323.5015	279.7711	203.3410	127.3144	90.4421 (83)
Total gains	352.0507	427.6481	492.0862	548.7726	582.1237	569.6349	545.9826	512.8685	476.3543	413.7979	353.7422	329.2078 (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	52.2589	52.4026	52.5443	53.2200	53.3483	53.9541	53.9541	54.0678	53.7192	53.3483	53.0893	52.8212	
alpha	4.4839	4.4935	4.5030	4.5480	4.5566	4.5969	4.5969	4.6045	4.5813	4.5566	4.5393	4.5214	
util living area	0.9963	0.9906	0.9765	0.9358	0.8414	0.6767	0.5130	0.5631	0.7993	0.9580	0.9920	0.9972	(86)
MIT	19.6102	19.8179	20.1170	20.4821	20.7757	20.9411	20.9868	20.9800	20.8703	20.4767	19.9714	19.5759	(87)
Th 2	19.8183	19.8211	19.8239	19.8370	19.8395	19.8510	19.8510	19.8531	19.8465	19.8395	19.8345	19.8293	(88)
util rest of house	0.9950	0.9875	0.9682	0.9127	0.7860	0.5774	0.3858	0.4333	0.7139	0.9381	0.9888	0.9963	(89)
MIT 2	18.5705	18.7788	19.0752	19.4349	19.6952	19.8255	19.8479	19.8479	19.7799	19.4393	18.9430	18.5450	(90)
Living area fraction	19.0050	19.2131	19.5106	19.8726	20.1468	20.2918	20.3239	20.3210	20.2356	19.8729	19.3728	18.9759	(91)
MIT	19.0050	19.2131	19.5106	19.8726	20.1468	20.2918	20.3239	20.3210	20.2356	19.8729	19.3728	18.9759	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0050	19.2131	19.5106	19.8726	20.1468	20.2918	20.3239	20.3210	20.2356	19.8729	19.3728	18.9759	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9938	0.9853	0.9655	0.9135	0.8023	0.6176	0.4394	0.4880	0.7457	0.9388	0.9870	0.9953	(94)
Ext temp.	349.8583	421.3724	475.0940	501.3039	467.0169	351.7892	239.9289	250.2876	355.1954	388.4597	349.1612	327.6653	(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	991.6952	962.6180	872.6623	726.6205	558.0105	371.7897	243.2440	255.5850	402.5324	612.5849	814.7251	985.8670	(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	477.5266	363.7170	295.7908	162.2280	67.6993	0.0000	0.0000	0.0000	0.0000	166.7491	335.2060	489.7021	(98)
Space heating per m2												2358.6190	(98)
												46.4753	(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	614.0118	483.3710	495.3912	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8846	0.9360	0.9182	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	543.1669	452.4145	454.8891	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	730.5527	701.6789	663.9330	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	134.9177	185.4527	155.5286	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												475.8991	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	33.7294	46.3632	38.8822	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											118.9748 (107)
Space cooling per m2											2.3443 (108)
Energy for space heating											46.4753 (99)
Energy for space cooling											2.3443 (108)
Total											48.8196 (109)
Target Fabric Energy Efficiency (TFEE)											56.1 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (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 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)			6.9000	1.1450	7.9008		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Slab on ground			50.7500	0.1100	5.5825	110.0000	5582.5000 (28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.2600	11.9132	52.8000	2419.2960 (29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1900	3.1027	52.8000	862.2240 (29a)
Total net area of external elements Aum(A, m ²)			125.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5170		(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			111.6800			9.0000	1005.1200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13421.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							264.4658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9957 (36)
Total fabric heat loss						(33) + (36) =	43.5128 (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	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271 (38)
Heat transfer coeff	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399 (39)
Average = Sum(39)m / 12 =												62.9399 (39)
HLP	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402 (40)
HLP (average)												1.2402 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy content (annual)	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
	Total = Sum(45)m =											1177.9137 (45)

Distribution loss	(46)m = 0.15 x (45)m												
	18.3187	16.0216	16.5329	14.4138	13.8304	11.9345	11.0591	12.6905	12.8421	14.9662	16.3367	17.7407	(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	14.5186	13.0954	14.4694	13.9698	14.4116	13.9191	14.3659	14.3955	13.9467	14.4455	14.0176	14.5091	(61)
Total heat required for water heating calculated for each month	136.6431	119.9062	124.6886	110.0616	106.6139	93.4827	88.0933	98.9988	99.5604	114.2200	122.9292	132.7801	(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								Solar input	(sum of months) = Sum(63)m =			0.0000	(63)
	136.6431	119.9062	124.6886	110.0616	106.6139	93.4827	88.0933	98.9988	99.5604	114.2200	122.9292	132.7801	(64)
								Total per year (kWh/year) = Sum(64)m =				1347.9779	(64)
RHI water heating demand												1348	(64)
Heat gains from water heating, kWh/month	44.2360	38.7884	40.2652	35.4430	34.2602	29.9347	28.1058	31.7295	31.9532	36.7864	39.7175	42.9524	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.3312	29.6045	24.0760	18.2271	13.6250	11.5028	12.4291	16.1559	21.6844	27.5333	32.1354	34.2576 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.6592	224.9697	219.1473	206.7521	191.1054	176.3997	166.5754	164.2649	170.0873	182.4825	198.1292	212.8349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880 (71)
Water heating gains (Table 5)	59.4570	57.7209	54.1199	49.2263	46.0486	41.5759	37.7767	42.6471	44.3795	49.4441	55.1632	57.7317 (72)
Total internal gains	399.6769	396.5245	381.5726	358.4349	335.0084	313.7078	301.0106	307.2973	320.3805	343.6892	369.6572	389.0536 (73)

[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				1,8400	12,9236	0,4600	0,0000	0,7700	8,4226 (75)			
Southeast				2,9100	40,4699	0,4600	0,0000	0,7700	41,7132 (77)			
Southwest				2,1500	40,4699	0,4600	0,0000	0,7700	30,8191 (79)			
Southeast				3,8000	40,4699	0,4300	0,0000	0,7700	50,9184 (77)			
Solar gains	131.8734	204.6766	283.7874	375.4269	421.6053	453.5619	430.2352	393.9624	337.6354	243.5628	162.3344	111.4520 (83)
Total gains	531.5502	601.2011	665.3601	733.8618	756.6136	767.2697	731.2458	701.2597	658.0160	587.2520	531.9916	500.5055 (84)

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	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348
alpha	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490
util living area	0.9790	0.9621	0.9176	0.8108	0.6329	0.4072	0.2665	0.2868	0.5410	0.8350	0.9550	0.9835 (86)
MIT	20.1631	20.3190	20.5723	20.8195	20.9571	20.9961	20.9996	20.9995	20.9842	20.8235	20.4596	20.1141 (87)
Th 2	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880 (88)
util rest of house	0.9722	0.9503	0.8930	0.7617	0.5569	0.3182	0.1711	0.1874	0.4437	0.7791	0.9385	0.9780 (89)
MIT 2	19.1667	19.3166	19.5538	19.7667	19.8667	19.8870	19.8880	19.8879	19.8826	19.7763	19.4542	19.1192 (90)
Living area fraction									fLA = Living area / (4) =			0.4179 (91)
MIT	19.5832	19.7355	19.9795	20.2067	20.3224	20.3505	20.3526	20.3525	20.3430	20.2140	19.8744	19.5350 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.4332	19.5855	19.8295	20.0567	20.1724	20.2005	20.2026	20.2025	20.1930	20.0640	19.7244	19.3850 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9687	0.9464	0.8915	0.7698	0.5771	0.3434	0.1981	0.2155	0.4711	0.7889	0.9355	0.9748 (94)
Useful gains	514.9031	568.9857	593.1804	564.9342	436.6090	263.4878	144.8842	151.1521	309.9688	463.3094	497.6979	487.8976 (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	902.1270	880.2466	782.3090	639.2588	451.4307	264.3780	144.9228	151.2119	314.2573	532.7206	737.9321	899.0959 (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	288.0946	209.1673	140.7117	53.5137	11.0274	0.0000	0.0000	0.0000	0.0000	51.6419	172.9686	305.9315 (98)
Space heating RHI space heating demand												1233.0567 (98) 1233 (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	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour			
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Mechanical extract ventilation - decentralised	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)
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)			6.9000	1.1450	7.9008		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Slab on ground			50.7500	0.1100	5.5825	110.0000	5582.5000 (28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.2600	11.9132	52.8000	2419.2960 (29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1900	3.1027	52.8000	862.2240 (29a)
Total net area of external elements Aum(A, m ²)			125.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5170		(33)
E-FC-4			50.7500			70.0000	3552.5000 (32b)
Timber partition			111.6800			9.0000	1005.1200 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13421.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							264.4658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9957 (36)
Total fabric heat loss						(33) + (36) =	43.5128 (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	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271 (38)
Heat transfer coeff	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399 (39)
Average = Sum(39)m / 12 =												62.9399 (39)
HLP	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402 (40)
HLP (average)												1.2402 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
Daily hot water use	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy conte	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
Energy content (annual)										Total = Sum(45)m =		1177.9137 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	18.3187	16.0216	16.5329	14.4138	13.8304	11.9345	11.0591	12.6905	12.8421	14.9662	16.3367	17.7407 (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	14.5186	13.9554	14.4694	13.9698	14.4116	13.9191	14.3659	14.3955	13.9467	14.4455	14.0176	14.5091 (61)
Total heat required for water heating calculated for each month	136.6431	119.9062	124.6886	110.0616	106.6139	93.4827	88.0933	98.9988	99.5604	114.2200	122.9292	132.7801 (62)
WWHRS	-36.6891	-32.2740	-32.9440	-27.1578	-25.2437	-20.8440	-17.6757	-21.3895	-21.9978	-27.1561	-31.4052	-35.4500 eq. (G10)
Total of WWHRS savings												-330.2268
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	99.9540	87.6322	91.7446	82.9038	81.3702	72.6388	70.4176	77.6093	77.5626	87.0638	91.5240	97.3301 (64)
Heat gains from water heating, kWh/month	44.2360	38.7884	40.2652	35.4430	34.2602	29.9347	28.1058	31.7295	31.9532	36.7864	39.7175	42.9524 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.3312	29.6045	24.0760	18.2271	13.6250	11.5028	12.4291	16.1559	21.6844	27.5333	32.1354	34.2576 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.6592	224.9697	219.1473	206.7521	191.1054	176.3997	166.5754	164.2649	170.0873	182.4825	198.1292	212.8349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880 (71)
Water heating gains (Table 5)	59.4570	57.7209	54.1199	49.2263	46.0486	41.5759	37.7767	42.6471	44.3795	49.4441	55.1632	57.7317 (72)
Total internal gains	399.6769	396.5245	381.5726	358.4349	335.0084	313.7078	301.0106	307.2973	320.3805	343.6892	369.6572	389.0536 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF		Access factor Table 6d	Gains W
Northeast				1.8400	11.2829		0.4600		0.0000		0.7700	7.3534 (75)
Southeast				2.9100	36.7938		0.4600		0.0000		0.7700	37.9242 (77)
Southwest				2.1500	36.7938		0.4600		0.0000		0.7700	28.0196 (79)
Southeast				3.8000	36.7938		0.4300		0.0000		0.7700	46.2933 (77)
Solar gains	119.5905	206.1494	288.5503	368.4022	422.5668	423.8770	406.8458	365.7691	316.0992	229.5882	143.6867	102.0567 (83)
Total gains	519.2674	602.6739	670.1229	726.8371	757.5752	737.5848	707.8564	673.0663	636.4797	573.2774	513.3439	491.1103 (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	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348
alpha	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490
util living area	0.9843	0.9676	0.9315	0.8507	0.7102	0.5334	0.3889	0.4264	0.6459	0.8819	0.9692	0.9878 (86)
MIT	20.0592	20.2505	20.4975	20.7504	20.9175	20.9836	20.9972	20.9956	20.9596	20.7404	20.3426	20.0030 (87)
Th 2	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880 (88)
util rest of house	0.9793	0.9577	0.9114	0.8106	0.6443	0.4464	0.2919	0.3253	0.5563	0.8399	0.9580	0.9839 (89)
MIT 2	19.0646	19.2501	19.4840	19.7095	19.8405	19.8817	19.8874	19.8870	19.8702	19.7084	19.3425	19.0095 (90)
Living area fraction	19.4803	19.6682	19.9076	20.1445	20.2906	20.3422	20.3512	20.3503	20.3255	20.1397	19.7605	19.4247 (92)
MIT	19.4803	19.6682	19.9076	20.1445	20.2906	20.3422	20.3512	20.3503	20.3255	20.1397	19.7605	19.4247 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3303	19.5182	19.7576	19.9945	20.1406	20.1922	20.2012	20.2003	20.1755	19.9897	19.6105	19.2747 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9762	0.9538	0.9087	0.8148	0.6601	0.4707	0.3194	0.3540	0.5805	0.8443	0.9545	0.9811 (94)
Ext temp.	506.8835	574.8063	608.9512	592.2339	500.0713	347.1869	226.1090	238.2659	369.5048	484.0190	490.0052	481.8226 (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	946.0066	920.0658	834.4304	698.2895	531.2531	351.9742	226.6593	239.1892	382.3900	590.9875	787.4066	948.8020 (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	326.7076	232.0144	167.7565	76.3600	23.1992	0.0000	0.0000	0.0000	0.0000	79.5845	214.1290	347.4326 (98)
Space heating per m ²												28.9100 (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												1621.1976	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	326.7076	232.0144	167.7565	76.3600	23.1992	0.0000	0.0000	0.0000	0.0000	79.5845	214.1290	347.4326	(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)	361.0029	256.3695	185.3663	84.3757	25.6345	0.0000	0.0000	0.0000	0.0000	87.9387	236.6066	383.9034	(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	99.9540	87.6322	91.7446	82.9038	81.3702	72.6388	70.4176	77.6093	77.5626	87.0638	91.5240	97.3301	(64)
Efficiency of water heater	89.7295	89.5996	89.3422	88.8055	87.9902	87.3000	87.3000	87.3000	87.3000	88.7995	89.5175	89.7798	(216)
(217)m	89.7295	89.5996	89.3422	88.8055	87.9902	87.3000	87.3000	87.3000	87.3000	88.7995	89.5175	89.7798	(217)
Fuel for water heating, kWh/month	111.3948	97.8043	102.6890	93.3543	92.4764	83.2059	80.6617	88.8995	88.8461	98.0454	102.2415	108.4098	(219)
Water heating fuel used												1148.0287	(219)
Annual totals kWh/year													
Space heating fuel - main system												1621.1976	(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)												32.4564	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												107.4564	(231)
Electricity for lighting (calculated in Appendix L)												235.4560	(232)
Total delivered energy for all uses												3112.1387	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1621.1976	3.4800	56.4177 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1148.0287	3.4800	39.9514 (247)
Mechanical ventilation fans	32.4564	13.1900	4.2810 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	235.4560	13.1900	31.0566 (250)
Additional standing charges			120.0000 (251)
Total energy cost			261.5992 (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] =	1.1475 (257)
SAP value	83.9926	
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	1621.1976	0.2160	350.1787 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1148.0287	0.2160	247.9742 (264)
Space and water heating			598.1529 (265)
Pumps and fans	107.4564	0.5190	55.7699 (267)
Energy for lighting	235.4560	0.5190	122.2016 (268)
Total kg/year			776.1244 (272)
CO2 emissions per m2			15.2900 (273)
EI value			89.1383
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 x (1 + 0.29 x 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 x (1 + 0.29 x 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8856 = 3.929, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8856 = 0.2439$, 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	50.7500 (1b)	x 2.3200 (2b)	= 117.7400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.7500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 117.7400 (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:												
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)			6.9000	1.1450	7.9008		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Slab on ground			50.7500	0.1100	5.5825	110.0000	5582.5000 (28a)
100mm Knauf Supafil 34	56.5200	10.7000	45.8200	0.2600	11.9132	52.8000	2419.2960 (29a)
E-WM-30 WTS	18.3100	1.9800	16.3300	0.1900	3.1027	52.8000	862.2240 (29a)
Total net area of external elements Aum(A, m ²)					125.5800		(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5170		(33)
E-FC-4					50.7500	70.0000	3552.5000 (32b)
Timber partition					111.6800	9.0000	1005.1200 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			13421.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							264.4658 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9957 (36)
Total fabric heat loss				(33) + (36) =			43.5128 (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	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271	19.4271 (38)
Heat transfer coeff	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399	62.9399 (39)
Average = Sum(39)m / 12 =												62.9399 (39)
HLP	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402	1.2402 (40)
HLP (average)												1.2402 (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												1.7122 (42)
Average daily hot water use (litres/day)												74.8647 (43)
Daily hot water use	82.3512	79.3566	76.3620	73.3674	70.3728	67.3783	67.3783	70.3728	73.3674	76.3620	79.3566	82.3512 (44)
Energy conte	122.1245	106.8108	110.2192	96.0918	92.2023	79.5636	73.7274	84.6032	85.6137	99.7745	108.9117	118.2710 (45)
Energy content (annual)												Total = Sum(45)m = 1177.9137 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	18.3187	16.0216	16.5329	14.4138	13.8304	11.9345	11.0591	12.6905	12.8421	14.9662	16.3367	17.7407 (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	14.5186	13.9544	14.4694	13.9698	14.4116	13.9191	14.3659	14.3955	13.9467	14.4455	14.0176	14.5091 (61)
Total heat required for water heating calculated for each month	136.6431	119.9062	124.6886	110.0616	106.6139	93.4827	88.0933	98.9988	99.5604	114.2200	122.9292	132.7801 (62)
WWHRS	-36.6891	-32.2740	-32.9440	-27.1578	-25.2437	-20.8440	-17.6757	-21.3895	-21.9978	-27.1561	-31.4052	-35.4500 eq. (G10)
Total of WWHRS savings												-330.2268
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	99.9540	87.6322	91.7446	82.9038	81.3702	72.6388	70.4176	77.6093	77.5626	87.0638	91.5240	97.3301 (64)
Heat gains from water heating, kWh/month	44.2360	38.7884	40.2652	35.4430	34.2602	29.9347	28.1058	31.7295	31.9532	36.7864	39.7175	42.9524 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319	102.7319 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.3312	29.6045	24.0760	18.2271	13.6250	11.5028	12.4291	16.1559	21.6844	27.5333	32.1354	34.2576 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.6592	224.9697	219.1473	206.7521	191.1054	176.3997	166.5754	164.2649	170.0873	182.4825	198.1292	212.8349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854	46.9854 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880	-68.4880 (71)
Water heating gains (Table 5)	59.4570	57.7209	54.1199	49.2263	46.0486	41.5759	37.7767	42.6471	44.3795	49.4441	55.1632	57.7317 (72)
Total internal gains	399.6769	396.5245	381.5726	358.4349	335.0084	313.7078	301.0106	307.2973	320.3805	343.6892	369.6572	389.0536 (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				1.8400	12.9236	0.4600	0.0000	0.7700			8.4226 (75)	
Southeast				2.9100	40.4699	0.4600	0.0000	0.7700			41.7132 (77)	
Southwest				2.1500	40.4699	0.4600	0.0000	0.7700			30.8191 (79)	
Southeast				3.8000	40.4699	0.4300	0.0000	0.7700			50.9184 (77)	
Solar gains	131.8734	204.6766	283.7874	375.4269	421.6053	453.5619	430.2352	393.9624	337.6354	243.5628	162.3344	111.4520 (83)
Total gains	531.5502	601.2011	665.3601	733.8618	756.6136	767.2697	731.2458	701.2597	658.0160	587.2520	531.9916	500.5055 (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	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348	59.2348
alpha	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490	4.9490
util living area	0.9790	0.9621	0.9176	0.8108	0.6329	0.4072	0.2665	0.2868	0.5410	0.8350	0.9550	0.9835 (86)
MIT	20.1631	20.3190	20.5723	20.8195	20.9571	20.9961	20.9996	20.9995	20.9842	20.8235	20.4596	20.1141 (87)
Th 2	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880	19.8880 (88)
util rest of house	0.9722	0.9503	0.8930	0.7617	0.5569	0.3182	0.1711	0.1874	0.4437	0.7791	0.9385	0.9780 (89)
MIT 2	19.1667	19.3166	19.5538	19.7667	19.8667	19.8870	19.8880	19.8879	19.8826	19.7763	19.4542	19.1192 (90)
Living area fraction	19.5832	19.7355	19.9795	20.2067	20.3224	20.3505	20.3526	20.3525	20.3430	20.2140	19.8744	19.5350 (92)
MIT	19.5832	19.7355	19.9795	20.2067	20.3224	20.3505	20.3526	20.3525	20.3430	20.2140	19.8744	19.5350 (92)
Temperature adjustment	19.4332	19.5855	19.8295	20.0567	20.1724	20.2005	20.2026	20.2025	20.1930	20.0640	19.7244	-0.1500
adjusted MIT	19.4332	19.5855	19.8295	20.0567	20.1724	20.2005	20.2026	20.2025	20.1930	20.0640	19.7244	19.3850 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	514.9031	568.9857	593.1804	564.9342	436.6090	263.4878	144.8842	151.1521	309.9688	463.3094	497.6979	487.8976 (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	902.1270	880.2466	782.3090	639.2588	451.4307	264.3780	144.9228	151.2119	314.2573	532.7206	737.9321	899.0959 (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	288.0946	209.1673	140.7117	53.5137	11.0274	0.0000	0.0000	0.0000	0.0000	51.6419	172.9686	305.9315 (98)
Space heating												1233.0567 (98)
Space heating per m ²												24.2967 (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													1362.4936 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	288.0946	209.1673	140.7117	53.5137	11.0274	0.0000	0.0000	0.0000	0.0000	51.6419	172.9686	305.9315	(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)	318.3366	231.1241	155.4825	59.1312	12.1849	0.0000	0.0000	0.0000	0.0000	57.0629	191.1255	338.0459	(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	99.9540	87.6322	91.7446	82.9038	81.3702	72.6388	70.4176	77.6093	77.5626	87.0638	91.5240	97.3301	(64)
Efficiency of water heater (217)m	89.6535	89.5310	89.2094	88.5279	87.6700	87.3000	87.3000	87.3000	87.3000	88.4646	89.3665	89.7064	(216)
Fuel for water heating, kWh/month	111.4892	97.8792	102.8418	93.6470	92.8142	83.2059	80.6617	88.8995	88.8461	98.4166	102.4143	108.4986	(219)
Water heating fuel used												1149.6140	(219)
Annual totals kWh/year													
Space heating fuel - main system												1362.4936	(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)													32.4564 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.4564 (231)
Electricity for lighting (calculated in Appendix L)													235.4560 (232)
Total delivered energy for all uses													2855.0201 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1362.4936	3.9200	53.4098 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1149.6140	3.9200	45.0649 (247)
Mechanical ventilation fans	32.4564	16.9600	5.5046 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	235.4560	16.9600	39.9333 (250)
Additional standing charges			88.0000 (251)
Total energy cost			244.6326 (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	1362.4936	0.2160	294.2986 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.6140	0.2160	248.3166 (264)
Space and water heating			542.6153 (265)
Pumps and fans	107.4564	0.5190	55.7699 (267)
Energy for lighting	235.4560	0.5190	122.2016 (268)
Total kg/year			720.5868 (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	1362.4936	1.2200	1662.2422 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.6140	1.2200	1402.5291 (264)
Space and water heating			3064.7714 (265)
Pumps and fans	107.4564	3.0700	329.8912 (267)
Energy for lighting	235.4560	3.0700	722.8498 (268)
Primary energy kWh/year			4117.5124 (272)
Primary energy kWh/m2/year			81.1332 (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 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: (none)			
	SAP change	Cost change	CO2 change

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 89

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	£58	£58	£0
Mains gas	£186	£186	£0
Space heating	£160	£160	£0
Water heating	£45	£45	£0
Lighting	£40	£40	£0
Total cost of fuels	£244	£244	£0
Total cost of uses	£245	£245	£0
Delivered energy	56 kWh/m²	56 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	81 kWh/m²	81 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 West
Overshading	Average or unknown
Thermal mass parameter	264.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	116.56 (P1)
Transmission heat loss coefficient	43.51 (37)
Summer heat loss coefficient	160.08 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South 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 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	1.8400	98.8453	0.4600	0.0000	0.9000	75.2964
South East	2.9100	119.9223	0.4600	0.0000	0.9000	144.4752
South West	2.1500	119.9223	0.4600	0.0000	0.9000	106.7429
South East	3.8000	119.9223	0.4300	0.0000	0.9000	176.3578
total:						502.8723

Solar gains	Jun	Jul	Aug	
	530	503	460	(P3/P4)
Internal gains	311	298	304	
Total summer gains	841	801	765	(P5)
Summer gain/loss ratio	5.25	5.00	4.78	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 264.5)	0.15	0.15	0.15	
Threshold temperature	21.40	23.05	22.73	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			