

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-002			Issued on Date	12/02/2020
Assessment Reference	002	Prop Type Ref	GFF Semi		
Property	Plot 002, 1 Bed, K, Ba, Welwyn Garden City				
SAP Rating	83 B	DER	18.82	TER	20.93
Environmental	89 B	% DER<TER	10.07		
CO ₂ Emissions (t/year)	0.74	DFEE	43.63	TFEE	50.34
General Requirements Compliance	Pass	% DFEE<TFEE	13.32		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client	TW North Thames, Taylor Wimpey				

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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 46 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 20.93 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.82 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 43.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof (no roof)			
Openings	1.35 (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: 4.00 (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 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1900 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (East Anglia): Medium OK
Based on:
Overshading: Average
Windows facing South West: 3.99 m², No overhang
Windows facing North West: 2.52 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.08 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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	109.3186 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate					0.2000 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (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	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m ²)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10994.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							240.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss							(33) + (36) = 32.0162 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)

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Energy content (annual)												Total = Sum(45)m =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m													
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	(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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	(61)
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	(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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	(72)
Total internal gains	255.3980	253.7060	244.5604	230.0374	215.6466	201.5626	192.2927	196.9727	204.3375	219.0235	235.8366	248.1051	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Southwest		3.9900	36.7938	0.4300		0.0000	0.7700	48.6079	(79)				
Northwest		2.5200	11.2829	0.4300		0.0000	0.7700	9.4142	(81)				
Solar gains	58.0221	101.9601	147.8122	197.0684	233.4403	237.3417	226.4966	198.5070	164.7353	114.9271	70.0666	49.2863	(83)
Total gains	313.4200	355.6661	392.3725	427.1058	449.0869	438.9043	418.7893	395.4797	369.0728	333.9506	305.9031	297.3914	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	
util living area	0.9957	0.9911	0.9792	0.9429	0.8498	0.6830	0.5161	0.5659	0.8063	0.9595	0.9912	0.9967	(86)
MIT	19.8789	20.0297	20.2690	20.5657	20.8205	20.9559	20.9912	20.9862	20.8977	20.5717	20.1599	19.8347	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9943	0.9883	0.9723	0.9236	0.8014	0.5949	0.4045	0.4516	0.7310	0.9417	0.9880	0.9956	(89)
MIT 2	18.5182	18.7373	19.0824	19.4996	19.8304	19.9759	20.0021	19.9997	19.9246	19.5156	18.9280	18.4538	(90)
Living area fraction												fLA = Living area / (4) = 0.4368 (91)	
MIT	19.1126	19.3018	19.6007	19.9653	20.2629	20.4040	20.4342	20.4306	20.3496	19.9769	19.4661	19.0570	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1126	19.3018	19.6007	19.9653	20.2629	20.4040	20.4342	20.4306	20.3496	19.9769	19.4661	19.0570	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9926	0.9857	0.9689	0.9227	0.8151	0.6318	0.4535	0.5017	0.7594	0.9411	0.9856	0.9942	(94)
Useful gains	311.1034	350.5737	380.1553	394.0946	366.0513	277.2951	189.9044	198.4285	280.2557	314.2890	301.4926	295.6692	(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	741.4241	720.8661	655.7397	553.8599	428.6064	290.5111	191.9152	201.7467	312.8183	469.3492	618.9704	743.6466	(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	320.1586	248.8365	205.0347	115.0310	46.5410	0.0000	0.0000	0.0000	0.0000	115.3647	228.5840	333.2952	(98)
Space heating												1612.8458 (98)	
Space heating per m ²												(98) / (4) = 35.2612 (99)	

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1724.9687 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	320.1586	248.8365	205.0347	115.0310	46.5410	0.0000	0.0000	0.0000	0.0000	115.3647	228.5840	333.2952	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	342.4156	266.1353	219.2885	123.0278	49.7764	0.0000	0.0000	0.0000	0.0000	123.3848	244.4749	356.4655	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.5498	89.4668	89.2977	88.9434	88.2792	87.3000	87.3000	87.3000	87.3000	88.9161	89.3885	87.3000	(216)
Fuel for water heating, kWh/month	145.6517	127.9385	133.3098	118.1620	115.3386	102.2906	96.4142	108.3185	108.9221	122.6609	131.2886	141.4690	(219)
Water heating fuel used													1451.7645 (219)
Annual totals kWh/year													
Space heating fuel - main system													1724.9687 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													32.2816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.2816 (231)
Electricity for lighting (calculated in Appendix L)													229.2145 (232)
Total delivered energy for all uses													3513.2294 (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	1724.9687	0.2160	372.5932	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1451.7645	0.2160	313.5811	(264)
Space and water heating			686.1744	(265)
Pumps and fans	107.2816	0.5190	55.6791	(267)
Energy for lighting	229.2145	0.5190	118.9623	(268)
Total CO2, kg/year			860.8159	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.8200	(273)

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

DER			18.8200	ZC1
Total Floor Area		TFA	45.7400	
Assumed number of occupants		N	1.5659	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.6439	ZC2
CO2 emissions from cooking, equation (L16)			3.4233	ZC3
Total CO2 emissions			39.8872	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			39.8872	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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	109.3186 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1830 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4330 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			6.5100	1.3258	8.6307		(27)
Jetfloor Grey			45.7400	0.1300	5.9462		(28a)
External Wall	38.8100	8.6300	30.1800	0.1800	5.4324		(29a)
External Wall to Corridor	10.0200		10.0200	0.1800	1.8036		(29a)
Total net area of external elements Aum(A, m ²)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	23.9329	(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)							6.7523 (36)
Total fabric heat loss							(33) + (36) = 30.6852 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	22.0087	21.8545	21.7033	20.9934	20.8606	20.2422	20.2422	20.1277	20.4804	20.8606	21.1293	21.4102 (38)
Average = Sum(39)m / 12 =	52.6939	52.5397	52.3885	51.6786	51.5458	50.9274	50.9274	50.8129	51.1656	51.5458	51.8145	52.0954 (39)
												51.6779 (39)
HLP	1.1520	1.1487	1.1454	1.1298	1.1269	1.1134	1.1134	1.1109	1.1186	1.1269	1.1328	1.1389 (40)
HLP (average)												1.1298 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)												Total = Sum(45)m = 1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Combi loss	40.0170	34.8301	37.1067	34.5015	34.1964	31.6850	32.7412	34.1964	34.5015	37.1067	37.3179	40.0170 (61)
Total heat required for water heating calculated for each month	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973 (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	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973 (64)
Heat gains from water heating, kWh/month	48.7255	42.5734	44.2232	39.0926	37.7831	33.1480	31.5616	35.3737	35.7704	40.9116	43.8614	47.5037 (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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	65.4913	63.3532	59.4398	54.2953	50.7838	46.0389	42.4215	47.5453	49.6811	54.9886	60.9186	63.8491 (72)
Total internal gains	264.1483	261.9723	252.3448	237.3412	222.4673	207.9012	198.6355	203.7973	211.6471	226.8138	244.1062	256.8578 (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						
Southwest	3.9900	36.7938	0.6300	0.7000	0.7700	44.8662 (79)						
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)						
Solar gains	53.5557	94.1115	136.4341	181.8987	215.4708	219.0719	209.0616	183.2266	152.0545	106.0804	64.6731	45.4924 (83)
Total gains	317.7040	356.0838	388.7788	419.2399	437.9381	426.9731	407.6971	387.0238	363.7016	332.8942	308.7792	302.3502 (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	60.2800	60.4569	60.6314	61.4643	61.6227	62.3709	62.3709	62.5115	62.0806	61.6227	61.3031	60.9726	
alpha	5.0187	5.0305	5.0421	5.0976	5.1082	5.1581	5.1581	5.1674	5.1387	5.1082	5.0869	5.0648	
util living area	0.9961	0.9925	0.9830	0.9530	0.8716	0.7080	0.5380	0.5855	0.8244	0.9648	0.9923	0.9970 (86)	
MIT	19.8434	19.9886	20.2243	20.5347	20.7986	20.9511	20.9902	20.9852	20.8901	20.5569	20.1476	19.8195 (87)	
Th 2	19.9586	19.9613	19.9640	19.9765	19.9789	19.9899	19.9899	19.9919	19.9857	19.9789	19.9741	19.9692 (88)	
util rest of house	0.9949	0.9900	0.9771	0.9357	0.8253	0.6177	0.4205	0.4664	0.7493	0.9484	0.9892	0.9960 (89)	
MIT 2	18.4283	18.6414	18.9843	19.4328	19.7816	19.9574	19.9863	19.9859	19.8991	19.4724	18.8832	18.4011 (90)	
Living area fraction	fLA = Living area / (4) = 0.4368 (91)												
MIT	19.0464	19.2299	19.5260	19.9141	20.2259	20.3915	20.4248	20.4224	20.3320	19.9461	19.4355	19.0207 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.0464	19.2299	19.5260	19.9141	20.2259	20.3915	20.4248	20.4224	20.3320	19.9461	19.4355	19.0207 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9933	0.9877	0.9739	0.9344	0.8377	0.6555	0.4722	0.5187	0.7775	0.9478	0.9871	0.9947 (94)
Useful gains	315.5840	351.6947	378.6349	391.7395	366.8801	279.8687	192.5113	200.7585	282.7818	315.5049	304.7889	300.7507 (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	777.0475	752.8870	682.4123	569.1933	439.4725	294.9440	194.7889	204.3896	318.8634	481.7534	639.1597	772.0905 (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	343.3288	269.6012	226.0103	127.7667	54.0088	0.0000	0.0000	0.0000	0.0000	123.6889	240.7470	350.6768 (98)
Space heating	1735.8285 (98)											
Space heating per m2	(98) / (4) = 37.9499 (99)											

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1858.4888 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	343.3288	269.6012	226.0103	127.7667	54.0088	0.0000	0.0000	0.0000	0.0000	123.6889	240.7470	350.6768	(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)	367.5897	288.6523	241.9811	136.7952	57.8253	0.0000	0.0000	0.0000	0.0000	132.4292	257.7591	375.4570	(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	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973	(64)
Efficiency of water heater (217)m	86.9752	86.7301	86.2121	85.0836	83.1487	80.3000	80.3000	80.3000	80.3000	84.8832	86.3838	87.0761	(217)
Fuel for water heating, kWh/month	179.9041	157.5950	164.9525	148.2450	146.8673	133.9414	128.3260	143.0535	144.6333	155.8013	163.4258	175.4756	(219)
Water heating fuel used													1842.2208 (219)
Annual totals kWh/year													
Space heating fuel - main system													1858.4888 (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)													229.2145 (232)
Total delivered energy for all uses													4004.9241 (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	1858.4888	0.2160	401.4336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1842.2208	0.2160	397.9197 (264)
Space and water heating			799.3533 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total CO2, kg/m2/year			957.2406 (272)
Emissions per m2 for space and water heating			17.4760 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6008 (272b)
Emissions per m2 for pumps and fans			0.8510 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.4760 * 1.00) + 2.6008 + 0.8510, rounded to 2 d.p.			20.9300 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1830 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3830	(18)
Number of sides sheltered				2	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3255 (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	0.4150	0.4069	0.3987	0.3581	0.3499	0.3092	0.3092	0.3011	0.3255	0.3499	0.3662	0.3825 (22b)
Effective ac	0.5861	0.5828	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5671	0.5731 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m2)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			30.0000	1372.2000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9164.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							200.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss						(33) + (36) =	32.0162 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	21.1444	21.0238	20.9055	20.3501	20.2462	19.7624	19.7624	19.6728	19.9488	20.2462	20.4564	20.6762 (38)
Heat transfer coeff	53.1606	53.0400	52.9217	52.3663	52.2624	51.7786	51.7786	51.6890	51.9649	52.2624	52.4726	52.6924 (39)
Average = Sum(39)m / 12 =	52.3658 (39)											
HLP	1.1622	1.1596	1.1570	1.1449	1.1426	1.1320	1.1320	1.1301	1.1361	1.1426	1.1472	1.1520 (40)
HLP (average)	1.1449 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy	1.5659 (42)											
Average daily hot water use (litres/day)	71.3891 (43)											
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)	Total = Sum(45)m = 1123.2292 (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	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	24.7467	21.6436	22.3342	19.4715	18.6834	16.1224	14.9397	17.1436	17.3483	20.2178	22.0693	23.9658	(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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	33.2616	32.2077	30.0191	27.0438	25.1121	22.3922	20.0803	23.0424	24.0949	27.1744	30.6518	32.2121	(72)
Total internal gains	228.9187	227.8268	219.9242	207.0897	193.7956	181.2545	173.2943	176.2944	183.0609	195.9996	210.8393	222.2208	(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			
Southwest			3.9900	36.7938	0.4300		0.0000		0.7700	48.6079	(79)		
Northwest			2.5200	11.2829	0.4300		0.0000		0.7700	9.4142	(81)		
Solar gains	58.0221	101.9601	147.8122	197.0684	233.4403	237.3417	226.4966	198.5070	164.7353	114.9271	70.0666	49.2863	(83)
Total gains	286.9408	329.7869	367.7363	404.1581	427.2359	418.5962	399.7909	374.8014	347.7962	310.9267	280.9059	271.5071	(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	47.8886	47.9976	48.1048	48.6150	48.7117	49.1668	49.1668	49.2520	48.9905	48.7117	48.5165	48.3142		
alpha	4.1926	4.1998	4.2070	4.2410	4.2474	4.2778	4.2778	4.2835	4.2660	4.2474	4.2344	4.2209		
util living area	0.9940	0.9886	0.9759	0.9406	0.8577	0.7060	0.5466	0.5981	0.8222	0.9578	0.9891	0.9953		(86)
MIT	19.5364	19.7169	20.0066	20.3819	20.7083	20.9123	20.9772	20.9667	20.8227	20.4006	19.8997	19.5028		(87)
Th 2	19.9503	19.9525	19.9545	19.9644	19.9662	19.9748	19.9748	19.9764	19.9715	19.9662	19.9625	19.9586		(88)
util rest of house	0.9924	0.9855	0.9690	0.9226	0.8139	0.6209	0.4299	0.4808	0.7536	0.9415	0.9856	0.9940		(89)
MIT 2	18.6211	18.8020	19.0896	19.4608	19.7606	19.9298	19.9677	19.9650	19.8664	19.4862	18.9924	18.5941		(90)
Living area fraction									fLA = Living area / (4) =			0.4368		(91)
MIT	19.0209	19.2016	19.4901	19.8632	20.1746	20.3590	20.4087	20.4026	20.2841	19.8856	19.3887	18.9910		(92)
Temperature adjustment												0.0000		
adjusted MIT	19.0209	19.2016	19.4901	19.8632	20.1746	20.3590	20.4087	20.4026	20.2841	19.8856	19.3887	18.9910		(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9905	0.9827	0.9652	0.9206	0.8237	0.6547	0.4808	0.5317	0.7768	0.9400	0.9831	0.9924	(94)	
Ext temp.	284.2183	324.0734	354.9419	372.0568	351.9201	274.0613	192.2264	199.2882	270.1608	292.2600	276.1454	269.4346	(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	782.5723	758.5588	687.4606	574.1019	442.9002	298.1909	197.2079	206.8885	321.3585	485.2899	644.8199	779.3752	(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	370.7754	291.9742	247.3939	145.4725	67.6892	0.0000	0.0000	0.0000	0.0000	143.6142	265.4457	379.3958	(98)	
												1911.7608	(98)	
												(98) / (4) =	41.7963	(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	486.7187	383.1615	392.8364	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8561	0.9139	0.8930	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	416.6787	350.1748	350.8076	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	549.3184	526.2635	498.0291	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	95.5006	131.0100	109.5328	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													336.0433 (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 kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.8751	32.7525	27.3832	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													84.0108 (107)
Space cooling per m2													1.8367 (108)
Energy for space heating													41.7963 (99)
Energy for space cooling													1.8367 (108)
Total													43.6330 (109)
Dwelling Fabric Energy Efficiency (DFEE)													43.6 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1830 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4330 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3680 (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	0.4692	0.4600	0.4508	0.4048	0.3956	0.3496	0.3496	0.3404	0.3680	0.3956	0.4140	0.4324 (22b)
Effective ac	0.6101	0.6058	0.6016	0.5819	0.5783	0.5611	0.5611	0.5579	0.5677	0.5783	0.5857	0.5935 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			6.5100	1.3258	8.6307		(27)
Jetfloor Grey			45.7400	0.1300	5.9462		(28a)
External Wall	38.8100	8.6300	30.1800	0.1800	5.4324		(29a)
External Wall to Corridor	10.0200		10.0200	0.1800	1.8036		(29a)
Total net area of external elements Aum(A, m2)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 23.9329		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7523 (36)
Total fabric heat loss							(33) + (36) = 30.6852 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	22.0087	21.8545	21.7033	20.9934	20.8606	20.2422	20.2422	20.1277	20.4804	20.8606	21.1293	21.4102 (38)
Average = Sum(39)m / 12 =	52.6939	52.5397	52.3885	51.6786	51.5458	50.9274	50.9274	50.8129	51.1656	51.5458	51.8145	52.0954 (39)
HLP	1.1520	1.1487	1.1454	1.1298	1.1269	1.1134	1.1134	1.1109	1.1186	1.1269	1.1328	1.1389 (40)
HLP (average)												1.1298 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy content (annual)	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As 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	24.7467	21.6436	22.3342	19.4715	18.6834	16.1224	14.9397	17.1436	17.3483	20.2178	22.0693	23.9658 (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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.9791	11.5279	9.3751	7.0976	5.3055	4.4791	4.8399	6.2910	8.4438	10.7214	12.5134	13.3398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	33.2616	32.2077	30.0191	27.0438	25.1121	22.3922	20.0803	23.0424	24.0949	27.1744	30.6518	32.2121 (72)
Total internal gains	228.9187	227.8268	219.9242	207.0897	193.7956	181.2545	173.2943	176.2944	183.0609	195.9996	210.8393	222.2208 (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						
Southwest	3.9900	36.7938	0.6300	0.7000	0.7700	44.8662 (79)						
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)						
Solar gains	53.5557	94.1115	136.4341	181.8987	215.4708	219.0719	209.0616	183.2266	152.0545	106.0804	64.6731	45.4924 (83)
Total gains	282.4744	321.9383	356.3582	388.9884	409.2664	400.3264	382.3559	359.5209	335.1154	302.0800	275.5124	267.7132 (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	60.2800	60.4569	60.6314	61.4643	61.6227	62.3709	62.3709	62.5115	62.0806	61.6227	61.3031	60.9726
alpha	5.0187	5.0305	5.0421	5.0976	5.1082	5.1581	5.1581	5.1674	5.1387	5.1082	5.0869	5.0648
util living area	0.9977	0.9952	0.9882	0.9644	0.8947	0.7412	0.5700	0.6237	0.8581	0.9760	0.9953	0.9983 (86)
MIT	19.7723	19.9207	20.1626	20.4845	20.7666	20.9396	20.9873	20.9803	20.8648	20.5026	20.0814	19.7492 (87)
Th 2	19.9586	19.9613	19.9640	19.9765	19.9789	19.9899	19.9899	19.9919	19.9857	19.9789	19.9741	19.9692 (88)
util rest of house	0.9970	0.9935	0.9839	0.9506	0.8533	0.6516	0.4474	0.5000	0.7893	0.9640	0.9934	0.9977 (89)
MIT 2	18.8430	18.9930	19.2350	19.5589	19.8190	19.9617	19.9866	19.9863	19.9100	19.5825	19.1639	18.8285 (90)
Living area fraction										fLA = Living area / (4) =		0.4368 (91)
MIT	19.2490	19.3983	19.6402	19.9632	20.2329	20.3889	20.4238	20.4205	20.3271	19.9844	19.5647	19.2307 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2490	19.3983	19.6402	19.9632	20.2329	20.3889	20.4238	20.4205	20.3271	19.9844	19.5647	19.2307 (93)

8. Space heating requirement

Utilisation	0.9963	0.9924	0.9822	0.9504	0.8649	0.6892	0.5015	0.5546	0.8152	0.9641	0.9924	0.9971 (94)
Useful gains	281.4182	319.4831	350.0246	369.6870	353.9589	275.9016	191.7442	199.3887	273.2028	291.2298	273.4281	266.9444 (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	787.7186	761.7347	688.3957	571.7310	439.8369	294.8113	194.7343	204.2927	318.6117	483.7263	645.8509	783.0297 (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	376.6874	297.1930	251.7481	145.4716	63.8932	0.0000	0.0000	0.0000	0.0000	143.2174	268.1444	383.9675 (98)
Space heating per m2												1930.3227 (98)
										(98) / (4) =		42.2021 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	478.7177	376.8628	386.1781	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8757	0.9333	0.9141	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	419.2095	351.7096	352.9947	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	527.9641	505.8849	480.1689	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	78.3033	114.7064	94.6176	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												287.6273 (104)
Intermittency factor (Table 10b)												fC = cooled area / (4) = 1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	19.5758	28.6766	23.6544	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												71.9068 (107)
Energy for space heating												1.5721 (108)
Energy for space cooling												42.2021 (99)
Total												1.5721 (108)
Target Fabric Energy Efficiency (TFEE)												43.7741 (109)
												50.3 (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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate					0.2000 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m ²)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10994.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							240.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss							(33) + (36) = 32.0162 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m														
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	16.9170	(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)
Combi loss	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	13.9691	(61)
Total heat required for water heating calculated for each month														
	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(64)
													Total per year (kWh/year) = Sum(64)m =	1287.1451 (64)
RHI water heating demand													1287 (64)	
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	40.9917	(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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4477	28.8197	23.4378	17.7439	13.2638	11.1978	12.0997	15.7276	21.1096	26.8034	31.2836	33.3495	33.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000	194.3000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	(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	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	55.0964	(72)
Total internal gains	372.7356	369.5629	355.4340	333.7606	311.9679	292.2141	280.5256	286.6863	299.0343	320.8708	345.0857	363.0241	363.0241	(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	Specific data	Access	Gains							
		m2	Table 6a	g	FF	factor	W							
			W/m2	or Table 6b	or Table 6c	Table 6d								
Southwest		3.9900	40.9830	0.4300	0.0000	0.7700	54.1422 (79)							
Northwest		2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)							
Solar gains	64.9444	106.4681	152.0404	213.6268	244.6720	259.4209	245.0604	216.1389	179.8222	125.4974	80.3653	54.6222	54.6222	(83)
Total gains	437.6800	476.0310	507.4744	547.3874	556.6400	551.6350	525.5859	502.8252	478.8565	446.3682	425.4510	417.6464	417.6464	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	
util living area	0.9798	0.9681	0.9374	0.8555	0.7070	0.4999	0.3231	0.3375	0.6038	0.8644	0.9600	0.9833	0.9833	(86)
MIT	20.1717	20.2938	20.5184	20.7702	20.9316	20.9903	20.9992	20.9990	20.9761	20.7974	20.4494	20.1328	20.1328	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9740	0.9593	0.9199	0.8180	0.6420	0.4150	0.2290	0.2393	0.5137	0.8200	0.9470	0.9784	0.9784	(89)
MIT 2	18.9404	19.1139	19.4283	19.7607	19.9480	20.0004	20.0053	20.0053	19.9911	19.8026	19.3377	18.8850	18.8850	(90)
Living area fraction	19.4782	19.6293	19.9045	20.2017	20.3777	20.4328	20.4395	20.4394	20.4214	20.2371	19.8233	19.4301	19.4301	(92)
Temperature adjustment												0.0000	0.0000	
adjusted MIT	19.4782	19.6293	19.9045	20.2017	20.3777	20.4328	20.4395	20.4394	20.4214	20.2371	19.8233	19.4301	19.4301	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	424.6308	454.7079	465.7970	452.1509	371.4481	249.3104	141.9881	141.9514	264.5298	371.0986	401.6602	407.1507	407.1507	(95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000	4.7000	(96)
Heat loss rate W	739.7057	722.2406	645.9168	535.6597	394.3069	251.9107	142.1254	142.1203	271.3601	442.3302	606.8158	737.2953	737.2953	(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	1.0000	(97a)
Space heating kWh	234.4158	179.7820	134.0091	60.1264	17.0069	0.0000	0.0000	0.0000	0.0000	52.9964	147.7120	245.6276	245.6276	(98)
Space heating													1071.6761 (98)	
RHI space heating demand													1072 (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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		109.3186 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2000 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (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	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m ²)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10994.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							240.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss							(33) + (36) = 32.0162 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m														
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	16.9170	(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)
Combi loss	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	13.9691	(61)
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(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	0.0000	(63)
Output from w/h	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	40.9917	(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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4477	28.8197	23.4378	17.7439	13.2638	11.1978	12.0997	15.7276	21.1096	26.8034	31.2836	33.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	(72)
Total internal gains	372.7356	369.5629	355.4340	333.7606	311.9679	292.2141	280.5256	286.6863	299.0343	320.8708	345.0857	363.0241	(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	g	Specific data	FF	Access	Gains				
		m ²	Table 6a	or Table 6b	W/m ²	or Table 6c		factor	W				
								Table 6d					
Southwest		3.9900	36.7938	0.4300		0.0000		0.7700	48.6079 (79)				
Northwest		2.5200	11.2829	0.4300		0.0000		0.7700	9.4142 (81)				
Solar gains	58.0221	101.9601	147.8122	197.0684	233.4403	237.3417	226.4966	198.5070	164.7353	114.9271	70.0666	49.2863	(83)
Total gains	430.7577	471.5230	503.2462	530.8289	545.4082	529.5558	507.0222	485.1933	463.7696	435.7980	415.1523	412.3105	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676
util living area	0.9829	0.9715	0.9462	0.8850	0.7628	0.5853	0.4308	0.4688	0.6934	0.8997	0.9692	0.9861	(86)
MIT	20.1171	20.2557	20.4658	20.7092	20.8941	20.9777	20.9961	20.9940	20.9491	20.7251	20.3721	20.0704	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9780	0.9635	0.9313	0.8538	0.7055	0.5025	0.3353	0.3704	0.6121	0.8657	0.9592	0.9820	(89)
MIT 2	18.8619	19.0596	19.3555	19.6838	19.9086	19.9914	20.0041	20.0031	19.9688	19.7123	19.2289	18.7949	(90)
Living area fraction													fLA = Living area / (4) = 0.4368 (91)
MIT	19.4102	19.5821	19.8405	20.1317	20.3391	20.4223	20.4374	20.4360	20.3970	20.1547	19.7283	19.3521	(92)
Temperature adjustment													0.0000
adjusted MIT	19.4102	19.5821	19.8405	20.1317	20.3391	20.4223	20.4374	20.4360	20.3970	20.1547	19.7283	19.3521	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9743	0.9594	0.9284	0.8582	0.7258	0.5380	0.3771	0.4135	0.6456	0.8714	0.9558	0.9787	(94)
Useful gains	419.6973	452.3958	467.1933	455.5559	395.8515	284.8995	191.2017	200.6173	299.4115	379.7717	396.7940	403.5182	(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	756.3212	734.8920	667.7433	562.1889	432.4173	291.4266	192.0759	202.0145	315.1901	478.2497	632.0915	758.4169	(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	250.4482	189.8375	149.2092	76.7757	27.2049	0.0000	0.0000	0.0000	0.0000	73.2676	169.4142	264.0446	(98)
Space heating													1200.2019 (98)
Space heating per m2													(98) / (4) = 26.2397 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1283.6384 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	250.4482	189.8375	149.2092	76.7757	27.2049	0.0000	0.0000	0.0000	0.0000	73.2676	169.4142	264.0446	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	267.8590	203.0347	159.5821	82.1131	29.0961	0.0000	0.0000	0.0000	0.0000	78.3610	181.1917	282.4006	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.3781	89.2692	89.0514	88.6228	87.9558	87.3000	87.3000	87.3000	87.3000	88.5583	89.1625	87.3000	(216)
Fuel for water heating, kWh/month	145.9316	128.2217	133.6784	118.5895	115.7628	102.2906	96.4142	108.3185	108.9221	123.1565	131.6213	141.7197	(219)
Water heating fuel used													1454.6268 (219)
Annual totals kWh/year													
Space heating fuel - main system													1283.6384 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													32.2816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.2816 (231)
Electricity for lighting (calculated in Appendix L)													229.2145 (232)
Total delivered energy for all uses													3074.7613 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1283.6384	3.4800	44.6706 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1454.6268	3.4800	50.6210 (247)
Mechanical ventilation fans	32.2816	13.1900	4.2579 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	229.2145	13.1900	30.2334 (250)
Additional standing charges			120.0000 (251)
Total energy cost			259.6755 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2019 (257)
SAP value		83.2330
SAP rating (Section 12)		B (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	1283.6384	0.2160	277.2659 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1454.6268	0.2160	314.1994 (264)
Space and water heating			591.4653 (265)
Pumps and fans	107.2816	0.5190	55.6791 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total kg/year			766.1068 (272)
CO2 emissions per m2			16.7500 (273)
EI value			88.6865
EI rating			B (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
Water heating energy efficiency	$3.48 / 0.8839 = 3.937$, stars = 4
Water heating environmental impact	$0.216 / 0.8839 = 0.2444$, stars = 4

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	45.7400 (1b)	2.3900 (2b)	109.3186 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 109.3186 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	(18)
Number of sides sheltered				2	(19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (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
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Solid Door			2.1200	1.2000	2.5440		(26)
Jetfloor Grey			45.7400	0.1500	6.8610	75.0000	3430.5000 (28a)
External Wall	38.8100	8.6300	30.1800	0.2500	7.5450	52.8000	1593.5040 (29a)
External Wall to Corridor	10.0200		10.0200	0.2200	2.2044	52.8000	529.0560 (29a)
Total net area of external elements Aum(A, m ²)			94.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.7851		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10994.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							240.3682 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.2311 (36)
Total fabric heat loss							(33) + (36) = 32.0162 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376	18.0376 (38)
Average = Sum(39)m / 12 =	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537	50.0537 (39)
HLP	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943	1.0943 (40)
HLP (average)												1.0943 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (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 =	1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m														
	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170	16.9170	(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)
Combi loss	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691	13.9691	(61)
Total heat required for water heating calculated for each month														
	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(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	0.0000	(63)
Output from w/h	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	126.7494	(64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917	40.9917	(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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4477	28.8197	23.4378	17.7439	13.2638	11.1978	12.0997	15.7276	21.1096	26.8034	31.2836	33.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964	(72)
Total internal gains	372.7356	369.5629	355.4340	333.7606	311.9679	292.2141	280.5256	286.6863	299.0343	320.8708	345.0857	363.0241	(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	FF	Access	Gains						
		m ²	Table 6a	g	Specific data	factor	W						
			W/m ²	or Table 6b	or Table 6c	Table 6d							
Southwest		3.9900	40.9830	0.4300	0.0000	0.7700	54.1422 (79)						
Northwest		2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)						
Solar gains	64.9444	106.4681	152.0404	213.6268	244.6720	259.4209	245.0604	216.1389	179.8222	125.4974	80.3653	54.6222	(83)
Total gains	437.6800	476.0310	507.4744	547.3874	556.6400	551.6350	525.5859	502.8252	478.8565	446.3682	425.4510	417.6464	(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	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146	61.0146
alpha	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676	5.0676
util living area	0.9798	0.9681	0.9374	0.8555	0.7070	0.4999	0.3231	0.3375	0.6038	0.8644	0.9600	0.9833	(86)
MIT	20.1717	20.2938	20.5184	20.7702	20.9316	20.9903	20.9992	20.9990	20.9761	20.7974	20.4494	20.1328	(87)
Th 2	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	20.0055	(88)
util rest of house	0.9740	0.9593	0.9199	0.8180	0.6420	0.4150	0.2290	0.2393	0.5137	0.8200	0.9470	0.9784	(89)
MIT 2	18.9404	19.1139	19.4283	19.7607	19.9480	20.0004	20.0053	20.0053	19.9911	19.8026	19.3377	18.8850	(90)
Living area fraction													fLA = Living area / (4) = 0.4368 (91)
MIT	19.4782	19.6293	19.9045	20.2017	20.3777	20.4328	20.4395	20.4394	20.4214	20.2371	19.8233	19.4301	(92)
Temperature adjustment													0.0000
adjusted MIT	19.4782	19.6293	19.9045	20.2017	20.3777	20.4328	20.4395	20.4394	20.4214	20.2371	19.8233	19.4301	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9702	0.9552	0.9179	0.8260	0.6673	0.4519	0.2702	0.2823	0.5524	0.8314	0.9441	0.9749	(94)
Useful gains	424.6308	454.7079	465.7970	452.1509	371.4481	249.3104	141.9881	141.9514	264.5298	371.0986	401.6602	407.1507	(95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000	(96)
Heat loss rate W	739.7057	722.2406	645.9168	535.6597	394.3069	251.9107	142.1254	142.1203	271.3601	442.3302	606.8158	737.2953	(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	234.4158	179.7820	134.0091	60.1264	17.0069	0.0000	0.0000	0.0000	0.0000	52.9964	147.7120	245.6276	(98)
Space heating													1071.6761 (98)
Space heating per m2													(98) / (4) = 23.4297 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1146.1776 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	234.4158	179.7820	134.0091	60.1264	17.0069	0.0000	0.0000	0.0000	0.0000	52.9964	147.7120	245.6276	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	250.7120	192.2802	143.3252	64.3063	18.1892	0.0000	0.0000	0.0000	0.0000	56.6806	157.9807	262.7033	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.3294	89.2277	88.9659	88.4380	87.7440	87.3000	87.3000	87.3000	87.3000	88.3213	89.0548	87.3000	(216)
Fuel for water heating, kWh/month	146.0111	128.2813	133.8069	118.8374	116.0421	102.2906	96.4142	108.3185	108.9221	123.4871	131.7806	141.8020	(219)
Water heating fuel used												1455.9937	(219)
Annual totals kWh/year													
Space heating fuel - main system													1146.1776 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													32.2816 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.2816 (231)
Electricity for lighting (calculated in Appendix L)													229.2145 (232)
Total delivered energy for all uses													2938.6675 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1146.1776	3.9200	44.9302 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1455.9937	3.9200	57.0750 (247)
Mechanical ventilation fans	32.2816	16.9600	5.4750 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	229.2145	16.9600	38.8748 (250)
Additional standing charges			88.0000 (251)
Total energy cost			247.0749 (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	1146.1776	0.2160	247.5744 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1455.9937	0.2160	314.4946 (264)
Space and water heating			562.0690 (265)
Pumps and fans	107.2816	0.5190	55.6791 (267)
Energy for lighting	229.2145	0.5190	118.9623 (268)
Total kg/year			736.7105 (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	1146.1776	1.2200	1398.3367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1455.9937	1.2200	1776.3124 (264)
Space and water heating			3174.6491 (265)
Pumps and fans	107.2816	3.0700	329.3544 (267)
Energy for lighting	229.2145	3.0700	703.6886 (268)
Primary energy kWh/year			4207.6921 (272)
Primary energy kWh/m2/year			91.9915 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 83

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current environmental impact rating:

B 89

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 2019)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£57	£57	£0
Mains gas	£190	£190	£0
Space heating	£151	£151	£0
Water heating	£57	£57	£0
Lighting	£39	£39	£0
Total cost of fuels	£247	£247	£0
Total cost of uses	£247	£247	£0
Delivered energy	64 kWh/m ²	64 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	16 kg/m ²	16 kg/m ²	0 kg/m ²
Primary energy	92 kWh/m ²	92 kWh/m ²	0 kWh/m ²

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	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	240.4 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	72.15 (P1)
Transmission heat loss coefficient	32.02 (37)
Summer heat loss coefficient	104.17 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
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 West	3.9900	122.3147	0.4300	0.0000	0.9000	188.8698
North West	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644
total:						286.4342

	Jun	Jul	Aug
Solar gains	303	286	253 (P4)
Internal gains	289	278	284
Total summer gains	592	564	536 (P5)

	5.69	5.41	5.15
Summer gain/loss ratio	5.69	5.41	5.15 (P6)
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 240.4)	0.32	0.32	0.32
Threshold temperature	21.40	23.33	23.07 (P7)
Likelihood of high internal temperature	Slight	Medium	Medium

Assessment of likelihood of high internal temperature: Medium