

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-016		Issued on Date	30/04/2020	
Assessment Reference	016	Prop Type Ref	GFF Semi		
Property	Plot 016, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	16.67	TER	17.75
Environmental	89 B	% DER<TER	6.07		
CO₂ Emissions (t/year)	0.87	DFEE	37.90	TFEE	40.74
General Requirements Compliance	Pass	% DFEE<TFEE	6.96		
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 62 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.75 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.67 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)40.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (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	1.33 (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): Slight OK

Based on:

Overshading:

Average

Windows facing South West:

6.93 m², No overhang

Air change rate:

2.00 ach

Blinds/curtains:

Dark-coloured curtain or roller blind, closed 100% of daylight hours

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.2001		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)										Total = Sum(45)m =		1300.1221 (45)

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Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	317.5679	315.4987	303.8979	285.4406	266.9457	249.1067	237.5529	243.0812	252.6202	271.2661	292.5655	308.3030 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
Southwest	6.9300	36.7938	0.2800	0.0000	0.7700	54.9740 (79)						
Solar gains	54.9740	93.6410	128.1237	158.7515	177.8149	176.5290	170.1928	155.9706	138.7309	103.4932	65.8461	47.0463 (83)
Total gains	372.5419	409.1397	432.0216	444.1921	444.7606	425.6357	407.7457	399.0519	391.3510	374.7594	358.4116	355.3492 (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	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055
alpha	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
util living area	0.9972	0.9946	0.9885	0.9709	0.9190	0.7879	0.6112	0.6467	0.8602	0.9731	0.9942	0.9978 (86)
MIT	19.9972	20.1144	20.3032	20.5431	20.7773	20.9367	20.9876	20.9829	20.8904	20.5974	20.2438	19.9594 (87)
Th 2	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9963	0.9930	0.9848	0.9605	0.8878	0.7120	0.5000	0.5373	0.8001	0.9614	0.9921	0.9972 (89)
MIT 2	18.7873	18.9581	19.2322	19.5763	19.8969	20.0854	20.1281	20.1253	20.0389	19.6563	19.1473	18.7321 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.2587	19.4086	19.6495	19.9530	20.2400	20.4171	20.4630	20.4595	20.3707	20.0230	19.5745	19.2103 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2587	19.4086	19.6495	19.9530	20.2400	20.4171	20.4630	20.4595	20.3707	20.0230	19.5745	19.2103 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9951	0.9911	0.9821	0.9578	0.8922	0.7387	0.5436	0.5801	0.8185	0.9595	0.9903	0.9962 (94)
Useful gains	370.7194	405.5044	424.2728	425.4512	396.8236	314.4272	221.6447	231.4717	320.3064	359.5961	354.9345	353.9937 (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	872.6728	846.4154	767.1266	644.8197	498.2116	339.3645	225.3608	236.8243	365.8234	549.7250	727.7492	875.6811 (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	373.4533	296.2922	255.0832	157.9453	75.4327	0.0000	0.0000	0.0000	0.0000	141.4559	268.4266	388.1354 (98)
Space heating												1956.2246 (98)
Space heating per m ²										(98) / (4) =		31.5215 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2092.2188 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	373.4533	296.2922	255.0832	157.9453	75.4327	0.0000	0.0000	0.0000	0.0000	141.4559	268.4266	388.1354	(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)	399.4153	316.8900	272.8163	168.9255	80.6767	0.0000	0.0000	0.0000	0.0000	151.2898	287.0873	415.1181	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.5644	89.4966	89.3628	89.0929	88.5354	87.3000	87.3000	87.3000	87.3000	88.9758	89.4099	87.3000	(216)
Fuel for water heating, kWh/month	166.1882	145.8889	151.8049	134.2197	130.6987	116.0228	109.1391	122.9226	123.7028	139.4822	149.6218	161.3495	(219)
Water heating fuel used													1651.0411 (219)
Annual totals kWh/year													
Space heating fuel - main system													2092.2188 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													316.2303 (232)
Total delivered energy for all uses													4178.2898 (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	2092.2188	0.2160	451.9193 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1651.0411	0.2160	356.6249 (264)
Space and water heating			808.5441 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total CO2, kg/year			1034.3246 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6700 (273)

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

	TFA	N	EF	
DER				16.6700 ZC1
Total Floor Area				62.0600
Assumed number of occupants				2.0392
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				17.0069 ZC2
CO2 emissions from cooking, equation (L16)				2.7061 ZC3
Total CO2 emissions				36.3830 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				36.3830 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3848 (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) =		0.3271 (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	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (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)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)
External Wall	31.4900	6.9300	24.5600	0.1800	4.4208		(29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m ²)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.8427	(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)	6.8425 (36)
Total fabric heat loss	(33) + (36) = 32.6852 (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	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Average = Sum(39)m / 12 =	61.4157	61.2503	61.0883	60.3272	60.1848	59.5220	59.5220	59.3992	59.7773	60.1848	60.4729	60.7741 (39)
												60.3266 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9896	0.9870	0.9843	0.9721	0.9698	0.9591	0.9591	0.9571	0.9632	0.9698	0.9744	0.9793 (40)
HLP (average)												0.9721 (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)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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 EMISSIONS 09 Jan 2014

Combi loss	46.3192	40.3153	42.9505	39.9350	39.5818	36.6750	37.8975	39.5818	39.9350	42.9505	43.1950	46.3192 (61)
Total heat required for water heating calculated for each month	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (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	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (64)
Heat gains from water heating, kWh/month	56.3991	49.2781	51.1877	45.2491	43.7334	38.3683	36.5321	40.9446	41.4037	47.3545	50.7690	54.9849 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	75.8052	73.3305	68.8007	62.8460	58.7815	53.2894	49.1023	55.0330	57.5051	63.6486	70.5125	73.9044 (72)
Total internal gains	328.4109	325.7823	313.6250	294.6129	275.5598	257.1641	245.6160	251.7006	261.8002	281.0011	302.8535	319.1490 (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	6.9300	36.7938	0.6300		0.7000	0.7700	77.9256 (79)					
Solar gains	77.9256	132.7361	181.6153	225.0302	252.0526	250.2299	241.2483	221.0884	196.6510	146.7017	93.3369	66.6881 (83)
Total gains	406.3364	458.5184	495.2403	519.6431	527.6124	507.3940	486.8643	472.7890	458.4512	427.7027	396.1904	385.8371 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	70.1730	70.3624	70.5490	71.4391	71.6081	72.4056	72.4056	72.5552	72.0963	71.6081	71.2670	70.9138 (85)
tau	5.6782	5.6908	5.7033	5.7626	5.7739	5.8270	5.8270	5.8370	5.8064	5.7739	5.7511	5.7276
alpha	0.9968	0.9931	0.9837	0.9548	0.8763	0.7098	0.5311	0.5677	0.8045	0.9620	0.9930	0.9976 (86)
util living area	20.0326	20.1722	20.3780	20.6343	20.8477	20.9674	20.9948	20.9925	20.9316	20.6644	20.3009	20.0065 (87)
MIT	20.0920	20.0942	20.0964	20.1067	20.1086	20.1176	20.1176	20.1192	20.1141	20.1086	20.1047	20.1006 (88)
Th 2	0.9958	0.9909	0.9782	0.9389	0.8340	0.6282	0.4282	0.4643	0.7332	0.9454	0.9903	0.9969 (89)
util rest of house	18.8015	19.0062	19.3053	19.6756	19.9573	20.0953	20.1155	20.1160	20.0605	19.7237	19.2024	18.7699 (90)
MIT 2	19.2812	19.4605	19.7232	20.0492	20.3042	20.4351	20.4581	20.4575	20.3999	20.0902	19.6304	19.2517 (92)
Living area fraction	19.2812	19.4605	19.7232	20.0492	20.3042	20.4351	20.4581	20.4575	20.3999	20.0902	19.6304	19.2517 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT	19.2812	19.4605	19.7232	20.0492	20.3042	20.4351	20.4581	20.4575	20.3999	20.0902	19.6304	19.2517 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9946	0.9888	0.9753	0.9377	0.8443	0.6589	0.4685	0.5048	0.7580	0.9450	0.9884	0.9959 (94)
Useful gains	404.1373	453.4047	483.0148	487.2697	445.4584	334.3025	228.1126	238.6746	347.5038	404.1643	391.5942	384.2430 (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	920.0772	891.8349	807.7853	672.5982	517.8424	347.3165	229.6431	241.0120	376.5894	571.1691	757.7490	914.7540 (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	383.8593	294.6251	241.6292	133.4366	53.8537	0.0000	0.0000	0.0000	0.0000	124.2515	263.6315	394.7002 (98)
Space heating												1889.9871 (98)
Space heating per m2										(98) / (4) =		30.4542 (99)

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)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												2023.5408 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	383.8593	294.6251	241.6292	133.4366	53.8537	0.0000	0.0000	0.0000	0.0000	124.2515	263.6315	394.7002 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	410.9842	315.4445	258.7037	142.8657	57.6592	0.0000	0.0000	0.0000	0.0000	133.0316	282.2607	422.5912 (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	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (64)
Efficiency of water heater	86.8963	86.5947	86.0162	84.8256	82.8538	80.3000	80.3000	80.3000	80.3000	84.5313	86.2489	80.3000 (216)
Fuel for water heating, kWh/month	208.4255	182.6991	191.3651	172.1134	170.6018	155.0353	148.5356	165.5824	167.4111	181.0885	189.4589	203.2569 (219)
Water heating fuel used												2135.5735 (219)
Annual totals kWh/year												
Space heating fuel - main system												2023.5408 (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)												316.2303 (232)
Total delivered energy for all uses												4550.3446 (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	2023.5408	0.2160	437.0848 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2135.5735	0.2160	461.2839 (264)
Space and water heating			898.3687 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total CO2, kg/m2/year			1101.4172 (272)
Emissions per m2 for space and water heating			14.4758 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6446 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4758 * 1.00) + 2.6446 + 0.6272, rounded to 2 d.p.			17.7500 (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	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3348	(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) =		0.2846 (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	0.3629	0.3558	0.3487	0.3131	0.3060	0.2704	0.2704	0.2633	0.2846	0.3060	0.3202	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5366	0.5366	0.5347	0.5405	0.5468	0.5513	0.5559 (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
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.2001		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			30.0000	1861.8000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12010.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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	27.6961	27.5710	27.4483	26.8722	26.7644	26.2625	26.2625	26.1696	26.4558	26.7644	26.9824	27.2104 (38)
Average = Sum(39)m / 12 =	61.5616	61.4365	61.3138	60.7376	60.6298	60.1280	60.1280	60.0351	60.3213	60.6298	60.8479	61.0759 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9920	0.9900	0.9880	0.9787	0.9770	0.9689	0.9689	0.9674	0.9720	0.9770	0.9805	0.9841 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

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	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)
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	0.0000	(59)
Heat gains from water heating, kWh/month	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	27.7401	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	(72)
Total internal gains	288.1055	286.7318	276.5710	260.0697	242.8452	226.7934	216.7563	220.3388	229.1845	245.8065	264.8200	279.5297	(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	6.9300	36.7938	0.2800	0.0000	0.7700	54.9740 (79)							
Solar gains	54.9740	93.6410	128.1237	158.7515	177.8149	176.5290	170.1928	155.9706	138.7309	103.4932	65.8461	47.0463	(83)
Total gains	343.0795	380.3728	404.6947	418.8211	420.6601	403.3224	386.9491	376.3095	367.9154	349.2997	330.6662	326.5759	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	54.1920	54.3023	54.4110	54.9271	55.0248	55.4840	55.4840	55.5699	55.3062	55.0248	54.8276	54.6229	21.0000 (85)
tau	4.6128	4.6202	4.6274	4.6618	4.6683	4.6989	4.6989	4.7047	4.6871	4.6683	4.6552	4.6415	
util living area	0.9958	0.9925	0.9856	0.9674	0.9201	0.8046	0.6428	0.6789	0.8709	0.9707	0.9923	0.9966	(86)
MIT	19.6894	19.8318	20.0632	20.3685	20.6613	20.8843	20.9696	20.9603	20.8162	20.4415	20.0090	19.6600	(87)
Th 2	20.0900	20.0917	20.0934	20.1011	20.1026	20.1094	20.1094	20.1106	20.1067	20.1026	20.0996	20.0966	(88)
util rest of house	0.9947	0.9906	0.9815	0.9572	0.8924	0.7350	0.5305	0.5704	0.8178	0.9596	0.9899	0.9958	(89)
MIT 2	18.8857	19.0287	19.2597	19.5660	19.8457	20.0425	20.0983	20.0950	19.9889	19.6409	19.2120	18.8616	(90)
Living area fraction	19.1988	19.3416	19.5728	19.8787	20.1635	20.3705	20.4378	20.4321	20.3112	19.9529	19.5226	19.1726	(91)
MIT	19.1988	19.3416	19.5728	19.8787	20.1635	20.3705	20.4378	20.4321	20.3112	19.9529	19.5226	19.1726	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1988	19.3416	19.5728	19.8787	20.1635	20.3705	20.4378	20.4321	20.3112	19.9529	19.5226	19.1726	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9933	0.9885	0.9786	0.9542	0.8945	0.7574	0.5740	0.6120	0.8316	0.9573	0.9879	0.9946	(94)
Useful gains	340.7690	375.9939	396.0291	399.6228	376.2973	305.4627	222.0960	230.2835	305.9493	334.3726	326.6659	324.8066	(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	917.1963	887.2395	801.5417	666.8181	513.1406	346.9685	230.7602	242.0704	374.6702	567.0627	755.8868	914.4679	(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	428.8619	343.5570	301.7014	192.3806	101.8114	0.0000	0.0000	0.0000	0.0000	173.1215	309.0391	438.7080	(98)
Space heating												2289.1809	(98)
Space heating per m2										(98) / (4) =		36.8866	(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	565.2035	444.9474	456.2668	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8118	0.8869	0.8719	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	458.8509	394.6203	397.8169	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	548.3664	527.7992	516.8512	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	64.4512	99.0851	88.5615	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												252.0979 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	16.1128	24.7713	22.1404	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												63.0245 (107)
Space cooling per m2												1.0155 (108)
Energy for space heating												36.8866 (99)
Energy for space cooling												1.0155 (108)
Total												37.9021 (109)
Dwelling Fabric Energy Efficiency (DFEE)												37.9 (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	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3848	0.3848 (18)
Number of sides sheltered				2	2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3271 (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 infiltr rate	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
Effective ac	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (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)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)
External Wall	31.4900	6.9300	24.5600	0.1800	4.4208		(29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.8427	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8425 (36)
Total fabric heat loss							(33) + (36) =

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	61.4157	61.2503	61.0883	60.3272	60.1848	59.5220	59.5220	59.3992	59.7773	60.1848	60.4729	60.7741 (39)
Average = Sum(39)m / 12 =												60.3266 (39)
HLP	0.9896	0.9870	0.9843	0.9721	0.9698	0.9591	0.9591	0.9571	0.9632	0.9698	0.9744	0.9793 (40)
HLP (average)												0.9721 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m =
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	0.0000	(59)
Heat gains from water heating, kWh/month	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	27.7401	(65)

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

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039	18.4039	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521	170.2521	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	(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	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)														
	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)														
	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	37.2851	(72)
Total internal gains														
	288.1055	286.7318	276.5710	260.0697	242.8452	226.7934	216.7563	220.3388	229.1845	245.8065	264.8200	279.5297	279.5297	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains							
		m2	Table 6a	Specific data	Specific data	factor	W							
			W/m2	or Table 6b	or Table 6c	Table 6d								
Southwest		6.9300	36.7938	0.6300	0.7000	0.7700	77.9256 (79)							
Solar gains	77.9256	132.7361	181.6153	225.0302	252.0526	250.2299	241.2483	221.0884	196.6510	146.7017	93.3369	66.6881	66.6881	(83)
Total gains	366.0311	419.4679	458.1863	485.0999	494.8978	477.0232	458.0046	441.4272	425.8355	392.5082	358.1569	346.2177	346.2177	(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	70.1730	70.3624	70.5490	71.4391	71.6081	72.4056	72.4056	72.5552	72.0963	71.6081	71.2670	70.9138	70.9138	
alpha	5.6782	5.6908	5.7033	5.7626	5.7739	5.8270	5.8270	5.8370	5.8064	5.7739	5.7511	5.7276	5.7276	
util living area														
	0.9981	0.9956	0.9886	0.9660	0.8994	0.7433	0.5622	0.6041	0.8391	0.9737	0.9957	0.9987	0.9987	(86)
MIT														
	19.9707	20.1133	20.3246	20.5913	20.8207	20.9587	20.9931	20.9897	20.9136	20.6186	20.2435	19.9453	19.9453	(87)
Th 2														
	20.0920	20.0942	20.0964	20.1067	20.1086	20.1176	20.1176	20.1192	20.1141	20.1086	20.1047	20.1006	20.1006	(88)
util rest of house														
	0.9975	0.9941	0.9846	0.9533	0.8617	0.6620	0.4545	0.4960	0.7723	0.9614	0.9941	0.9982	0.9982	(89)
MIT 2														
	19.1493	19.2931	19.5043	19.7726	19.9840	20.0978	20.1157	20.1161	20.0661	19.8036	19.4319	19.1311	19.1311	(90)
Living area fraction														
										fLA = Living area / (4) =			0.3896	(91)
MIT														
	19.4693	19.6127	19.8240	20.0916	20.3100	20.4332	20.4575	20.4565	20.3963	20.1212	19.7481	19.4483	19.4483	(92)
Temperature adjustment														
													0.0000	
adjusted MIT														
	19.4693	19.6127	19.8240	20.0916	20.3100	20.4332	20.4575	20.4565	20.3963	20.1212	19.7481	19.4483	19.4483	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	0.9970	0.9931	0.9831	0.9531	0.8712	0.6927	0.4968	0.5385	0.7957	0.9616	0.9932	0.9978	0.9978	(94)	
Useful gains	364.9249	416.5615	450.4653	462.3455	431.1750	330.4448	227.5414	237.7062	338.8275	377.4345	355.7174	345.4456	345.4456	(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	4.2000	(96)	
Heat loss rate W															
	931.6345	901.1559	813.9376	675.1564	518.1918	347.2037	229.6081	240.9526	376.3777	573.0291	764.8655	926.7039	926.7039	(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															
	421.6319	325.6474	270.4234	153.2238	64.7405	0.0000	0.0000	0.0000	0.0000	145.5224	294.5866	432.4562	432.4562	(98)	
Space heating													2108.2324	(98)	
Space heating per m2													(98) / (4) =	33.9709	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b														
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	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	559.5066	440.4626	451.4341	0.0000	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9015	0.9535	0.9425	0.0000	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	504.3728	419.9940	425.4775	0.0000	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	634.5103	610.8511	592.9629	0.0000	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	0.0000	(103a)
Space cooling kWh														
	0.0000	0.0000	0.0000	0.0000	0.0000	93.6990	141.9977	124.6091	0.0000	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling														
Cooled fraction													360.3058	(104)
Intermittency factor (Table 10b)													1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	(106)

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	23.4247	35.4994	31.1523	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													90.0764 (107)
Space cooling per m2													1.4514 (108)
Energy for space heating													33.9709 (99)
Energy for space cooling													1.4514 (108)
Total													35.4223 (109)
Target Fabric Energy Efficiency (TFEE)													40.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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	0.2000 (18)
Number of sides sheltered				2	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.2001		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)										Total = Sum(45)m =		1300.1221 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
RHI water heating demand												1465 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (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	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.7657	39.7605	32.3354	24.4800	18.2991	15.4488	16.6930	21.6982	29.1233	36.9787	43.1596	46.0098 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	468.6244	464.4624	446.1125	418.0584	389.6902	364.3471	349.6691	357.2903	373.5782	401.8211	432.9937	456.2352 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Southwest	6.9300	40.9830	0.2800	0.0000	0.7700	61.2331 (79)						
Solar gains	61.2331	97.1524	130.6864	170.5442	184.8792	191.5705	182.7513	168.3451	150.0949	112.1949	75.1232	51.9081 (83)
Total gains	529.8575	561.6148	576.7989	588.6026	574.5694	555.9176	532.4205	525.6354	523.6731	514.0160	508.1169	508.1433 (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	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055
alpha	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
util living area	0.9829	0.9747	0.9534	0.8981	0.7797	0.5749	0.3716	0.3764	0.6435	0.8824	0.9657	0.9858 (86)
MIT	20.2844	20.3772	20.5561	20.7633	20.9204	20.9882	20.9992	20.9991	20.9782	20.8228	20.5255	20.2514 (87)
Th 2	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9782	0.9678	0.9405	0.8699	0.7237	0.4917	0.2775	0.2810	0.5609	0.8447	0.9549	0.9819 (89)
MIT 2	19.2027	19.3352	19.5884	19.8696	20.0616	20.1268	20.1334	20.1334	20.1196	19.9501	19.5484	19.1555 (90)
Living area fraction	19.6242	19.7412	19.9655	20.2178	20.3962	20.4624	20.4707	20.4707	20.4541	20.2901	19.9291	19.5825 (91)
MIT	19.6242	19.7412	19.9655	20.2178	20.3962	20.4624	20.4707	20.4707	20.4541	20.2901	19.9291	19.5825 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6242	19.7412	19.9655	20.2178	20.3962	20.4624	20.4707	20.4707	20.4541	20.2901	19.9291	19.5825 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9748	0.9641	0.9375	0.8729	0.7417	0.5239	0.3142	0.3183	0.5924	0.8523	0.9519	0.9787 (94)
Ext temp.	516.5048	541.4450	540.7668	513.7917	426.1303	291.2666	167.2983	167.2846	310.2242	438.0790	483.6553	497.3367 (95)
Heat loss rate W	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)
Month fracti	870.6579	848.3174	756.3910	625.2645	460.6555	295.3367	167.4749	167.4732	318.1882	518.6411	713.4321	868.2266 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
RHI space heating demand	263.4899	206.2182	160.4244	80.2604	25.6867	0.0000	0.0000	0.0000	0.0000	59.9382	165.4393	275.9421 (98)
												1237.3993 (98)
												1237 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.2001	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss							(33) + (36) = 33.8655 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (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	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (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	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.7657	39.7605	32.3354	24.4800	18.2991	15.4488	16.6930	21.6982	29.1233	36.9787	43.1596	46.0098 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	468.6244	464.4624	446.1125	418.0584	389.6902	364.3471	349.6691	357.2903	373.5782	401.8211	432.9937	456.2352 (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	6.9300	36.7938	0.2800	0.0000	0.7700	54.9740 (79)						
Solar gains	54.9740	93.6410	128.1237	158.7515	177.8149	176.5290	170.1928	155.9706	138.7309	103.4932	65.8461	47.0463 (83)
Total gains	523.5984	558.1034	574.2362	576.8099	567.5051	540.8761	519.8619	513.2609	512.3091	505.3143	498.8398	503.2815 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055 (85)
tau	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
alpha	0.9855	0.9773	0.9602	0.9199	0.8288	0.6609	0.4889	0.5162	0.7310	0.9144	0.9736	0.9882 (86)
util living area	20.2376	20.3448	20.5100	20.7083	20.8799	20.9736	20.9958	20.9943	20.9533	20.7593	20.4589	20.1969 (87)
MIT	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9815	0.9712	0.9492	0.8970	0.7820	0.5830	0.3952	0.4224	0.6584	0.8860	0.9654	0.9850 (89)
MIT 2	19.1351	19.2889	19.5238	19.7975	20.0161	20.1154	20.1319	20.1311	20.0978	19.8694	19.4543	19.0765 (90)
Living area fraction	19.5647	19.7003	19.9080	20.1524	20.3526	20.4497	20.4685	20.4674	20.4311	20.2161	19.8457	19.5131 (92)
MIT	19.5647	19.7003	19.9080	20.1524	20.3526	20.4497	20.4685	20.4674	20.4311	20.2161	19.8457	19.5131 (93)
Temperature adjustment												0.0000
adjusted MIT	19.5647	19.7003	19.9080	20.1524	20.3526	20.4497	20.4685	20.4674	20.4311	20.2161	19.8457	19.5131 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	512.2361	539.9484	543.1538	517.7389	451.0078	331.2357	224.4853	235.5814	350.7044	449.2746	479.9265	494.2405 (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	890.5243	863.4316	782.2098	656.4512	504.7856	341.2677	225.6834	237.2875	369.3504	560.9926	743.5719	893.3464 (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	281.4464	217.3807	177.8577	99.8729	40.0106	0.0000	0.0000	0.0000	0.0000	83.1182	189.8247	296.9349 (98)
Space heating												1386.4461 (98)
Space heating per m2												(98) / (4) = 22.3404 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1482.8300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	281.4464	217.3807	177.8577	99.8729	40.0106	0.0000	0.0000	0.0000	0.0000	83.1182	189.8247	296.9349	(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)	301.0122	232.4927	190.2221	106.8159	42.7921	0.0000	0.0000	0.0000	0.0000	88.8965	203.0211	317.5774	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.3669	89.2721	89.0870	88.7278	88.1004	87.3000	87.3000	87.3000	87.3000	88.5560	89.1491	87.3000	(216)
Fuel for water heating, kWh/month	166.5555	146.2557	152.2748	134.7720	131.3440	116.0228	109.1391	122.9226	123.7028	140.1435	150.0595	161.6778	(219)
Water heating fuel used													1654.8702 (219)
Annual totals kWh/year													
Space heating fuel - main system													1482.8300 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													316.2303 (232)
Total delivered energy for all uses													3572.7301 (238)

 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1482.8300	3.4800	51.6025 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1654.8702	3.4800	57.5895 (247)
Mechanical ventilation fans	43.7996	13.1900	5.7772 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	316.2303	13.1900	41.7108 (250)
Additional standing charges			120.0000 (251)
Total energy cost			286.5724 (255)

 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1242 (257)
SAP value		84.3169
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	1482.8300	0.2160	320.2913 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.8702	0.2160	357.4520 (264)
Space and water heating			677.7432 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			903.5237 (272)
CO2 emissions per m2			14.5600 (273)
EI value			88.6912
EI rating			89 (274)
EI band			B

 Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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	$3.48 / 0.8841 = 3.936$, stars = 4
Water heating environmental impact	$0.216 / 0.8841 = 0.2443$, 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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	0.2000 (18)
Number of sides sheltered				2	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.2001	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)										Total = Sum(45)m =		1300.1221 (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	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (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	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.7657	39.7605	32.3354	24.4800	18.2991	15.4488	16.6930	21.6982	29.1233	36.9787	43.1596	46.0098 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	468.6244	464.4624	446.1125	418.0584	389.6902	364.3471	349.6691	357.2903	373.5782	401.8211	432.9937	456.2352 (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	6.9300	40.9830	0.2800	0.0000	0.7700	61.2331 (79)						
Solar gains	61.2331	97.1524	130.6864	170.5442	184.8792	191.5705	182.7513	168.3451	150.0949	112.1949	75.1232	51.9081 (83)
Total gains	529.8575	561.6148	576.7989	588.6026	574.5694	555.9176	532.4205	525.6354	523.6731	514.0160	508.1169	508.1433 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055 (85)
tau	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
alpha	0.9829	0.9747	0.9534	0.8981	0.7797	0.5749	0.3716	0.3764	0.6435	0.8824	0.9657	0.9858 (86)
util living area	20.2844	20.3772	20.5561	20.7633	20.9204	20.9882	20.9992	20.9991	20.9782	20.8228	20.5255	20.2514 (87)
MIT	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9782	0.9678	0.9405	0.8699	0.7237	0.4917	0.2775	0.2810	0.5609	0.8447	0.9549	0.9819 (89)
MIT 2	19.2027	19.3352	19.5884	19.8696	20.0616	20.1268	20.1334	20.1334	20.1196	19.9501	19.5484	19.1555 (90)
Living area fraction	19.6242	19.7412	19.9655	20.2178	20.3962	20.4624	20.4707	20.4707	fLA = Living area / (4) =	20.4541	20.2901	19.9291
MIT	19.6242	19.7412	19.9655	20.2178	20.3962	20.4624	20.4707	20.4707	20.4541	20.2901	19.9291	19.5825 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6242	19.7412	19.9655	20.2178	20.3962	20.4624	20.4707	20.4707	20.4541	20.2901	19.9291	19.5825 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	516.5048	541.4450	540.7668	513.7917	426.1303	291.2666	167.2983	167.2846	310.2242	438.0790	483.6553	497.3367 (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	870.6579	848.3174	756.3910	625.2645	460.6555	295.3367	167.4749	167.4732	318.1882	518.6411	713.4321	868.2266 (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	263.4899	206.2182	160.4244	80.2604	25.6867	0.0000	0.0000	0.0000	0.0000	59.9382	165.4393	275.9421 (98)
Space heating												1237.3993 (98)
Space heating per m2												(98) / (4) = 19.9388 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													1323.4217 (211)
Space heating requirement	263.4899	206.2182	160.4244	80.2604	25.6867	0.0000	0.0000	0.0000	0.0000	59.9382	165.4393	275.9421	(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)	281.8074	220.5543	171.5769	85.8400	27.4724	0.0000	0.0000	0.0000	0.0000	64.1050	176.9404	295.1253	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.3182	89.2320	89.0052	88.5576	87.8644	87.3000	87.3000	87.3000	87.3000	88.3170	89.0408	87.3000	(216)
Fuel for water heating, kWh/month	166.6464	146.3215	152.4148	135.0310	131.6968	116.0228	109.1391	122.9226	123.7028	140.5226	150.2421	161.7736	(219)
Water heating fuel used													1656.4360 (219)
Annual totals kWh/year													
Space heating fuel - main system													1323.4217 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													316.2303 (232)
Total delivered energy for all uses													3414.8875 (238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1323.4217	3.9300	52.0105 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1656.4360	3.9300	65.0979 (247)
Mechanical ventilation fans	43.7996	17.5600	7.6912 (249)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	316.2303	17.5600	55.5300 (250)
Additional standing charges			88.0000 (251)
Total energy cost			281.4997 (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	1323.4217	0.2160	285.8591 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.4360	0.2160	357.7902 (264)
Space and water heating			643.6493 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			869.4298 (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	1323.4217	1.2200	1614.5744 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.4360	1.2200	2020.8519 (264)
Space and water heating			3635.4264 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	316.2303	3.0700	970.8269 (268)
Primary energy kWh/year			4970.9680 (272)
Primary energy kWh/m2/year			80.0994 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 89

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

(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 84
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 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	£76	£76	£0
Mains gas	£205	£205	£0
Space heating	£161	£161	£0
Water heating	£65	£65	£0
Lighting	£56	£56	£0
Total cost of fuels	£281	£281	£0
Total cost of uses	£282	£282	£0
Delivered energy	55 kWh/m ²	55 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	14 kg/m ²	14 kg/m ²	0 kg/m ²
Primary energy	80 kWh/m ²	80 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	233.5 (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	97.89 (P1)
Transmission heat loss coefficient	33.87 (37)
Summer heat loss coefficient	131.76 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type	
South West	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	0.850	0.90	1.000	0.765 (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	6.9300	122.3147	0.2800	0.0000	0.7650	181.5646
total:						181.5646

	Jun	Jul	Aug	
Solar gains	190	182	167	(P4)
Internal gains	361	347	354	
Total summer gains	552	528	522	(P5)
Summer gain/loss ratio	4.19	4.01	3.96	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 233.5)	0.37	0.37	0.37	
Threshold temperature	19.95	21.97	21.92	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			