

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-015			Issued on Date	30/04/2020
Assessment Reference	015	Prop Type Ref	GFF Semi		
Property	Plot 015, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	17.57	TER	18.93
Environmental	88 B	% DER<TER	7.17		
CO₂ Emissions (t/year)	0.92	DFEE	41.64	TFEE	46.67
General Requirements Compliance	Pass	% DFEE<TFEE	10.78		
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) 18.93 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.57 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)46.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.6 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	1.33 (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 North East:

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 (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				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:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
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 Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (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) =	29.4275			(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/m ² K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7310 (36)
Total fabric heat loss			(33) + (36) =				34.1585 (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	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319 (39)
Average = Sum(39)m / 12 =												58.6319 (39)
HLP	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448 (40)
HLP (average)												0.9448 (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 m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast		6.9300	11.2829	0.2800	0.0000	0.7700	16.8579 (75)
Solar gains	16.8579	34.3148	61.8244	101.5334	136.4808	145.5030	136.1150
Total gains	334.4259	349.8135	365.7223	386.9740	403.4265	394.6096	373.6679

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	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606
alpha	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774
util living area	0.9984	0.9975	0.9948	0.9842	0.9438	0.8258	0.6607	0.7178	0.9216	0.9880	0.9970	0.9987 (86)
MIT	19.9275	20.0110	20.1917	20.4539	20.7266	20.9180	20.9816	20.9712	20.8299	20.5009	20.1654	19.8975 (87)
Th 2	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296 (88)
util rest of house	0.9978	0.9967	0.9930	0.9781	0.9196	0.7541	0.5445	0.6046	0.8779	0.9822	0.9959	0.9983 (89)
MIT 2	18.6826	18.8047	19.0684	19.4482	19.8296	20.0648	20.1211	20.1147	19.9699	19.5183	19.0306	18.6387 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.1677	19.2747	19.5060	19.8400	20.1791	20.3972	20.4564	20.4484	20.3050	19.9011	19.4728	19.1291 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1677	19.2747	19.5060	19.8400	20.1791	20.3972	20.4564	20.4484	20.3050	19.9011	19.4728	19.1291 (93)

8. Space heating requirement

Utilisation	0.9970	0.9957	0.9913	0.9754	0.9213	0.7783	0.5900	0.6486	0.8883	0.9802	0.9947	0.9976 (94)
Useful gains	333.4389	348.2919	362.5375	377.4678	371.6667	307.1166	220.4801	228.0421	291.3189	306.9917	312.1089	321.2982 (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	871.7196	842.8166	762.5686	641.4349	497.1450	339.8994	226.1063	237.3661	363.8095	545.3434	725.4377	875.3229 (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	400.4808	332.3206	297.6231	190.0563	93.3559	0.0000	0.0000	0.0000	0.0000	177.3337	297.5967	412.1944 (98)
Space heating												2200.9617 (98)
Space heating per m2												(98) / (4) = 35.4651 (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													2353.9697 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	400.4808	332.3206	297.6231	190.0563	93.3559	0.0000	0.0000	0.0000	0.0000	177.3337	297.5967	412.1944	(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)	428.3217	355.4231	318.3135	203.2688	99.8459	0.0000	0.0000	0.0000	0.0000	189.6617	318.2853	440.8496	(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	89.6100	89.5739	89.4732	89.2368	88.7005	87.3000	87.3000	87.3000	87.3000	89.1545	89.4828	87.3000	(216)
Fuel for water heating, kWh/month	166.1037	145.7630	151.6176	134.0033	130.4554	116.0228	109.1391	122.9226	123.7028	139.2026	149.4999	161.2808	(219)
Water heating fuel used													1649.7136 (219)
Annual totals kWh/year													
Space heating fuel - main system													2353.9697 (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													4438.7132 (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	2353.9697	0.2160	508.4575	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1649.7136	0.2160	356.3381	(264)
Space and water heating			864.7956	(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			1090.5761	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5700	(273)

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

DER			17.5700	ZC1
Total Floor Area		TFA	62.0600	
Assumed number of occupants		N	2.0392	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.0069	ZC2
CO2 emissions from cooking, equation (L16)			2.7061	ZC3
Total CO2 emissions			37.2830	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			37.2830	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 (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)
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	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 Corridor	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)							7.0475 (36)					
Total fabric heat loss						(33) + (36) =	32.8902 (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 =	61.6207	61.4553	61.2933	60.5322	60.3898	59.7270	59.7270	59.6042	59.9823	60.3898	60.6779	60.9791 (39)
	60.5316 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9929	0.9903	0.9876	0.9754	0.9731	0.9624	0.9624	0.9604	0.9665	0.9731	0.9777	0.9826 (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	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)

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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	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							
Northeast	6.9300	11.2829	0.6300	0.7000	0.7700	23.8961 (75)						
Solar gains	23.8961	48.6412	87.6361	143.9236	193.4615	206.2505	192.9431	153.8165	106.7859	59.4435	30.0675	19.5148 (83)
Total gains	352.3070	374.4235	401.2610	438.5365	469.0213	463.4146	438.5590	405.5170	368.5861	340.4445	332.9210	338.6638 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	69.9396	70.1277	70.3131	71.1971	71.3650	72.1570	72.1570	72.3057	71.8499	71.3650	71.0262	70.6754
alpha	5.6626	5.6752	5.6875	5.7465	5.7577	5.8105	5.8105	5.8204	5.7900	5.7577	5.7351	5.7117
util living area	0.9985	0.9975	0.9940	0.9783	0.9170	0.7603	0.5866	0.6520	0.8973	0.9863	0.9971	0.9988 (86)
MIT	19.9449	20.0399	20.2360	20.5257	20.7943	20.9531	20.9913	20.9847	20.8698	20.5430	20.2009	19.9289 (87)
Th 2	20.0892	20.0915	20.0936	20.1039	20.1058	20.1148	20.1148	20.1164	20.1113	20.1058	20.1019	20.0979 (88)
util rest of house	0.9980	0.9966	0.9918	0.9695	0.8835	0.6794	0.4752	0.5388	0.8432	0.9793	0.9959	0.9984 (89)
MIT 2	18.6715	18.8121	19.0996	19.5247	19.8923	20.0814	20.1113	20.1095	19.9972	19.5547	19.0553	18.6546 (90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)
MIT	19.1676	19.2905	19.5424	19.9147	20.2437	20.4211	20.4542	20.4505	20.3372	19.9397	19.5017	19.1511 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1676	19.2905	19.5424	19.9147	20.2437	20.4211	20.4542	20.4505	20.3372	19.9397	19.5017	19.1511 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	351.3374	372.7743	397.2568	424.1718	417.1616	328.6326	227.5805	236.5079	316.6163	332.8172	331.1862	337.9188 (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	916.1520	884.3716	799.4106	666.7448	515.9552	347.6743	230.1975	241.4259	374.1202	564.0245	752.5074	911.7032 (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	420.2221	343.7934	299.2025	174.6525	73.5024	0.0000	0.0000	0.0000	0.0000	172.0183	303.3513	426.8956 (98)
Space heating												2213.6380 (98)
Space heating per m2												(98) / (4) = 35.6693 (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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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												2370.0621 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	420.2221	343.7934	299.2025	174.6525	73.5024	0.0000	0.0000	0.0000	0.0000	172.0183	303.3513	426.8956 (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)	449.9166	368.0871	320.3453	186.9941	78.6964	0.0000	0.0000	0.0000	0.0000	184.1737	324.7872	457.0617 (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	87.1004	86.9532	86.5371	85.5033	83.4912	80.3000	80.3000	80.3000	80.3000	85.3454	86.5873	80.3000 (216)
Fuel for water heating, kWh/month	207.9370	181.9458	190.2131	170.7492	169.2994	155.0353	148.5356	165.5824	167.4111	179.3612	188.7185	202.8508 (219)
Water heating fuel used												2127.6396 (219)
Annual totals kWh/year												
Space heating fuel - main system												2370.0621 (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												4888.9320 (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	2370.0621	0.2160	511.9334 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2127.6396	0.2160	459.5702 (264)
Space and water heating			971.5036 (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			1174.5521 (272)
Emissions per m2 for space and water heating			15.6543 (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) = (15.6543 * 1.00) + 2.6446 + 0.6272, rounded to 2 d.p.			18.9300 (273)

FULL SAP CALCULATION PRINTOUT

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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 Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	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) =	29.4275		(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)							4.7310 (36)
Total fabric heat loss						(33) + (36) =	34.1585 (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 =	61.8546	61.7295	61.6068	61.0306	60.9228	60.4210	60.4210	60.3281	60.6143	60.9228	61.1409	61.3689 (39)
HLP (average)	0.9967	0.9947	0.9927	0.9834	0.9817	0.9736	0.9736	0.9721	0.9767	0.9817	0.9852	0.9889 (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							
Northeast	6.9300	11.2829	0.2800	0.0000	0.7700	16.8579 (75)							
Solar gains	16.8579	34.3148	61.8244	101.5334	136.4808	145.5030	136.1150	108.5125	75.3340	41.9354	21.2116	13.7670	(83)
Total gains	304.9635	321.0466	338.3954	361.6031	379.3260	372.2963	352.8714	328.8513	304.5185	287.7419	286.0317	293.2967	(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)	0.9974	0.9963	0.9929	0.9811	0.9429	0.8392	0.6917	0.7478	0.9260	0.9859	0.9957	0.9979	(86)
MIT	19.6101	19.7140	19.9362	20.2660	20.6002	20.8576	20.9582	20.9394	20.7389	20.3304	19.9195	19.5894	(87)
Th 2	20.0861	20.0878	20.0894	20.0972	20.0986	20.1054	20.1054	20.1067	20.1028	20.0986	20.0957	20.0926	(88)
util rest of house	0.9967	0.9952	0.9908	0.9748	0.9212	0.7746	0.5769	0.6398	0.8882	0.9801	0.9944	0.9973	(89)
MIT 2	18.8036	18.9086	19.1313	19.4642	19.7881	20.0206	20.0896	20.0813	19.9239	19.5309	19.1202	18.7881	(90)
Living area fraction	19.1178	19.2224	19.4449	19.7766	20.1045	20.3467	20.4281	20.4157	20.2415	19.8424	19.4316	19.1003	(92)
MIT	19.1178	19.2224	19.4449	19.7766	20.1045	20.3467	20.4281	20.4157	20.2415	19.8424	19.4316	19.1003	(93)
Temperature adjustment													0.0000
adjusted MIT	19.1178	19.2224	19.4449	19.7766	20.1045	20.3467	20.4281	20.4157	20.2415	19.8424	19.4316	19.1003	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9940	0.9888	0.9720	0.9213	0.7941	0.6211	0.6805	0.8952	0.9780	0.9930	0.9965	(94)
Useful gains	303.6658	319.1098	334.6215	351.4729	349.4869	295.6324	219.1625	223.7746	272.6071	281.3999	284.0414	292.2580	(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	916.5494	884.1134	797.4934	663.8068	512.0285	347.2217	231.2962	242.2566	372.2599	563.0726	753.9671	914.4128	(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	455.9854	379.6824	344.3767	224.8804	120.9310	0.0000	0.0000	0.0000	0.0000	209.5645	338.3466	462.8832	(98)
Space heating												2536.6501	(98)
Space heating per m2												40.8742	(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	567.9577	447.1156	458.4936	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7788	0.8580	0.8267	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	442.3340	383.6109	379.0489	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	512.1022	487.9681	461.3806	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	50.2331	77.6417	61.2548	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												189.1297 (104)	
Cooled fraction												FC = cooled area / (4) =	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	12.5583	19.4104	15.3137	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													47.2824 (107)
Space cooling per m2													0.7619 (108)
Energy for space heating													40.8742 (99)
Energy for space cooling													0.7619 (108)
Total													41.6360 (109)
Dwelling Fabric Energy Efficiency (DFEE)													41.6 (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 (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	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 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 Corridor	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)							7.0475 (36)					
Total fabric heat loss							(33) + (36) = 32.8902 (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 =	61.6207	61.4553	61.2933	60.5322	60.3898	59.7270	59.7270	59.6042	59.9823	60.3898	60.6779	60.9791 (39)
												60.5316 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9929	0.9903	0.9876	0.9754	0.9731	0.9624	0.9624	0.9604	0.9665	0.9731	0.9777	0.9826 (40)
Days in month												0.9754 (40)
	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	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	(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							
Northeast	6.9300	11.2829	0.6300	0.7000	0.7700	23.8961 (75)							
Solar gains	23.8961	48.6412	87.6361	143.9236	193.4615	206.2505	192.9431	153.8165	106.7859	59.4435	30.0675	19.5148	(83)
Total gains	312.0016	335.3730	364.2071	403.9933	436.3067	433.0438	409.6994	374.1553	335.9704	305.2499	294.8876	299.0444	(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)	69.9396	70.1277	70.3131	71.1971	71.3650	72.1570	72.1570	72.3057	71.8499	71.3650	71.0262	70.6754	21.0000 (85)
alpha	5.6626	5.6752	5.6875	5.7465	5.7577	5.8105	5.8105	5.8204	5.7900	5.7577	5.7351	5.7117	
util living area	0.9992	0.9986	0.9963	0.9850	0.9363	0.7951	0.6231	0.6964	0.9257	0.9919	0.9984	0.9994	(86)
MIT	19.8825	19.9798	20.1799	20.4772	20.7606	20.9406	20.9882	20.9786	20.8389	20.4914	20.1423	19.8674	(87)
Th 2	20.0892	20.0915	20.0936	20.1039	20.1058	20.1148	20.1148	20.1164	20.1113	20.1058	20.1019	20.0979	(88)
util rest of house	0.9989	0.9981	0.9949	0.9788	0.9083	0.7167	0.5072	0.5803	0.8811	0.9875	0.9978	0.9992	(89)
MIT 2	19.0590	19.1580	19.3594	19.6619	19.9317	20.0850	20.1114	20.1095	20.0103	19.6795	19.3291	19.0511	(90)
Living area fraction	19.3799	19.4782	19.6791	19.9796	20.2547	20.4183	20.4531	20.4482	20.3331	19.9958	19.6459	19.3691	(91)
MIT	19.3799	19.4782	19.6791	19.9796	20.2547	20.4183	20.4531	20.4482	20.3331	19.9958	19.6459	19.3691	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3799	19.4782	19.6791	19.9796	20.2547	20.4183	20.4531	20.4482	20.3331	19.9958	19.6459	19.3691	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9976	0.9941	0.9777	0.9137	0.7457	0.5529	0.6261	0.8942	0.9868	0.9973	0.9989	(94)
Useful gains	311.5722	334.5774	362.0417	394.9713	398.6414	322.8997	226.5270	234.2668	300.4290	301.2159	294.1015	298.7243	(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	929.2322	895.9090	807.7894	670.6702	516.6142	347.5106	230.1321	241.2875	373.8777	567.4126	761.2593	924.9996	(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	459.5390	377.2148	331.6363	198.5032	87.7718	0.0000	0.0000	0.0000	0.0000	198.0503	336.3536	465.9488	(98)
Space heating												2455.0178	(98)
Space heating per m2												(98) / (4) =	39.5588 (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	561.4336	441.9796	452.9921	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8688	0.9309	0.9017	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	487.7864	411.4329	408.4702	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	583.1058	554.3905	514.3333	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	68.6299	106.3604	78.7621	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												253.7525	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

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	17.1575	26.5901	19.6905	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													63.4381 (107)
Space cooling per m2													1.0222 (108)
Energy for space heating													39.5588 (99)
Energy for space cooling													1.0222 (108)
Total													40.5810 (109)
Target Fabric Energy Efficiency (TFEE)													46.7 (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 (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				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:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
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 Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (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) =	29.4275			(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/m ² K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7310 (36)
Total fabric heat loss			(33) + (36) =				34.1585 (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	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319 (39)
Average = Sum(39)m / 12 =												58.6319 (39)
HLP	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448 (40)
HLP (average)												0.9448 (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 m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	6.9300	12.9465	0.2800	0.0000	0.7700	19.3435 (75)						
Solar gains	19.3435	36.8275	65.3383	112.5128	145.4083	161.2245	149.4727	120.4929	84.3569	47.0859	24.9648	15.6241 (83)
Total gains	487.9679	501.2899	511.4508	530.5712	535.0985	525.5716	499.1419	477.7832	457.9351	448.9070	457.9585	471.8594 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606
alpha	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774
util living area	0.9883	0.9848	0.9718	0.9294	0.8163	0.6069	0.3979	0.4154	0.7185	0.9259	0.9781	0.9900 (86)
MIT	20.2132	20.2808	20.4618	20.6989	20.8976	20.9844	20.9988	20.9985	20.9622	20.7553	20.4484	20.1880 (87)
Th 2	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296 (88)
util rest of house	0.9850	0.9804	0.9632	0.9072	0.7631	0.5205	0.2969	0.3101	0.6337	0.8977	0.9708	0.9871 (89)
MIT 2	19.0975	19.1952	19.4549	19.7842	20.0346	20.1205	20.1293	20.1293	20.1039	19.8646	19.4378	19.0613 (90)
Living area fraction	19.5322	19.6182	19.8472	20.1406	20.3709	20.4571	20.4681	20.4679	20.4383	20.2117	19.8316	19.5003 (91)
Temperature adjustment												0.0000
adjusted MIT	19.5322	19.6182	19.8472	20.1406	20.3709	20.4571	20.4681	20.4679	20.4383	20.2117	19.8316	19.5003 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9821	0.9772	0.9598	0.9076	0.7789	0.5538	0.3364	0.3513	0.6654	0.9007	0.9677	0.9845 (94)
Ext temp.	479.2395	489.8590	490.8921	481.5249	416.7910	291.0740	167.9034	167.8304	304.6879	404.3517	443.1462	464.5269 (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	869.6370	845.3631	753.2547	623.8799	461.4835	296.5067	168.1619	168.1527	318.8585	516.6443	711.2966	867.7676 (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	290.4557	238.8988	195.1978	102.4956	33.2512	0.0000	0.0000	0.0000	0.0000	83.5457	193.0683	300.0111 (98)
												1436.9243 (98)
												1437 (98)

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Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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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	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	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:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
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 Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (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) =	29.4275		(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/m ² K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7310 (36)
Total fabric heat loss						(33) + (36) =	34.1585 (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	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319 (39)
Average = Sum(39)m / 12 =												58.6319 (39)
HLP	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448 (40)
HLP (average)												0.9448 (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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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						
Northeast	6.9300	11.2829	0.2800	0.0000	0.7700	16.8579 (75)						
Solar gains	16.8579	34.3148	61.8244	101.5334	136.4808	145.5030	136.1150	108.5125	75.3340	41.9354	21.2116	13.7670 (83)
Total gains	485.4823	498.7772	507.9369	519.5918	526.1710	509.8501	485.7842	465.8028	448.9122	443.7565	454.2053	470.0023 (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)	0.9898	0.9864	0.9764	0.9459	0.8627	0.6954	0.5236	0.5671	0.8006	0.9472	0.9826	0.9915 (86)
MIT	20.1713	20.2488	20.4113	20.6378	20.8481	20.9656	20.9940	20.9908	20.9250	20.6851	20.3873	20.1374 (87)
Th 2	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296 (88)
util rest of house	0.9870	0.9825	0.9693	0.9287	0.8202	0.6164	0.4239	0.4658	0.7318	0.9270	0.9769	0.9891 (89)
MIT 2	19.0367	19.1488	19.3829	19.7015	19.9771	20.1054	20.1271	20.1254	20.0687	19.7709	19.3501	18.9877 (90)
Living area fraction	19.4788	19.5774	19.7836	20.0663	20.3165	20.4406	20.4649	20.4626	20.4023	20.1271	19.7542	19.4356 (91)
MIT	19.4788	19.5774	19.7836	20.0663	20.3165	20.4406	20.4649	20.4626	20.4023	20.1271	19.7542	19.4356 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4788	19.5774	19.7836	20.0663	20.3165	20.4406	20.4649	20.4626	20.4023	20.1271	19.7542	19.4356 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	477.8283	488.4825	490.6099	481.7821	436.8257	329.2677	224.8748	235.4001	338.9474	411.3510	442.3254	463.7122 (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	889.9595	860.5624	778.8408	654.6998	505.1985	342.4426	226.6056	238.1974	369.5167	558.5925	741.9400	893.2936 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	306.6256	250.0377	214.4438	124.5007	50.8693	0.0000	0.0000	0.0000	0.0000	109.5477	215.7225	319.6085 (98)
Space heating												1591.3560 (98)
Space heating per m2												(98) / (4) = 25.6422 (99)

8c. Space cooling requirement

Not applicable

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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													1701.9850 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	306.6256	250.0377	214.4438	124.5007	50.8693	0.0000	0.0000	0.0000	0.0000	109.5477	215.7225	319.6085	(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)	327.9419	267.4200	229.3516	133.1558	54.4057	0.0000	0.0000	0.0000	0.0000	117.1634	230.7193	341.8273	(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	89.4288	89.3761	89.2326	88.9035	88.2529	87.3000	87.3000	87.3000	87.3000	88.7717	89.2478	87.3000	(216)
Fuel for water heating, kWh/month	166.4403	146.0855	152.0263	134.5057	131.1170	116.0228	109.1391	122.9226	123.7028	139.8030	149.8936	161.5842	(219)
Water heating fuel used													1653.2427 (219)
Annual totals kWh/year													
Space heating fuel - main system													1701.9850 (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													3790.2576 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1701.9850	3.4800	59.2291 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1653.2427	3.4800	57.5328 (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			294.1424 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1539 (257)
SAP value		83.9027
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	1701.9850	0.2160	367.6288 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1653.2427	0.2160	357.1004 (264)
Space and water heating			724.7292 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			950.5097 (272)
CO2 emissions per m2			15.3200 (273)
EI value			88.1031
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8849 = 3.933$, stars = 4
Water heating environmental impact	$0.216 / 0.8849 = 0.2441$, 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)
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 Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	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) =	29.4275		(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)							4.7310 (36)
Total fabric heat loss						(33) + (36) =	34.1585 (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	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319	58.6319 (39)
Average = Sum(39)m / 12 =												58.6319 (39)
HLP	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448	0.9448 (40)
HLP (average)												0.9448 (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)	
										Solar input (sum of months) = Sum(63)m =			0.0000 (63)
										Total per year (kWh/year) = Sum(64)m =			1464.6982 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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	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							
Northeast	6.9300	12.9465	0.2800	0.0000	0.7700	19.3435 (75)						
Solar gains	19.3435	36.8275	65.3383	112.5128	145.4083	161.2245	149.4727	120.4929	84.3569	47.0859	24.9648	15.6241 (83)
Total gains	487.9679	501.2899	511.4508	530.5712	535.0985	525.5716	499.1419	477.7832	457.9351	448.9070	457.9585	471.8594 (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	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606	68.6606
alpha	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774	5.5774
util living area	0.9883	0.9848	0.9718	0.9294	0.8163	0.6069	0.3979	0.4154	0.7185	0.9259	0.9781	0.9900 (86)
MIT	20.2132	20.2808	20.4618	20.6989	20.8976	20.9844	20.9988	20.9985	20.9622	20.7553	20.4484	20.1880 (87)
Th 2	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296	20.1296 (88)
util rest of house	0.9850	0.9804	0.9632	0.9072	0.7631	0.5205	0.2969	0.3101	0.6337	0.8977	0.9708	0.9871 (89)
MIT 2	19.0975	19.1952	19.4549	19.7842	20.0346	20.1205	20.1293	20.1293	20.1039	19.8646	19.4378	19.0613 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.5322	19.6182	19.8472	20.1406	20.3709	20.4571	20.4681	20.4679	20.4383	20.2117	19.8316	19.5003 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5322	19.6182	19.8472	20.1406	20.3709	20.4571	20.4681	20.4679	20.4383	20.2117	19.8316	19.5003 (93)

8. Space heating requirement

Utilisation	0.9821	0.9772	0.9598	0.9076	0.7789	0.5538	0.3364	0.3513	0.6654	0.9007	0.9677	0.9845 (94)
Useful gains	479.2395	489.8590	490.8921	481.5249	416.7910	291.0740	167.9034	167.8304	304.6879	404.3517	443.1462	464.5269 (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	869.6370	845.3631	753.2547	623.8799	461.4835	296.5067	168.1619	168.1527	318.8585	516.6443	711.2966	867.7676 (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	290.4557	238.8988	195.1978	102.4956	33.2512	0.0000	0.0000	0.0000	0.0000	83.5457	193.0683	300.0111 (98)
Space heating												1436.9243 (98)
Space heating per m ²												(98) / (4) = 23.1538 (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

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													1536.8174 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	290.4557	238.8988	195.1978	102.4956	33.2512	0.0000	0.0000	0.0000	0.0000	83.5457	193.0683	300.0111	(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)	310.6479	255.5067	208.7677	109.6210	35.5628	0.0000	0.0000	0.0000	0.0000	89.3537	206.4902	320.8675	(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	89.3898	89.3427	89.1600	88.7483	87.9945	87.3000	87.3000	87.3000	87.3000	88.5599	89.1623	87.3000	(216)
Fuel for water heating, kWh/month	166.5128	146.1402	152.1502	134.7408	131.5021	116.0228	109.1391	122.9226	123.7028	140.1373	150.0373	161.6646	(219)
Water heating fuel used													1654.6724 (219)
Annual totals kWh/year													
Space heating fuel - main system													1536.8174 (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													3626.5197 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1536.8174	3.9300	60.3969 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1654.6724	3.9300	65.0286 (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			289.8168 (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	1536.8174	0.2160	331.9526 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.6724	0.2160	357.4092 (264)
Space and water heating			689.3618 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			915.1423 (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	1536.8174	1.2200	1874.9172 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.6724	1.2200	2018.7003 (264)
Space and water heating			3893.6175 (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			5229.1592 (272)
Primary energy kWh/m2/year			84.2597 (273)

SAP 2012 EPC IMPROVEMENTS

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

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 88

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	£213	£213	£0
Space heating	£169	£169	£0
Water heating	£65	£65	£0
Lighting	£56	£56	£0
Total cost of fuels	£289	£289	£0
Total cost of uses	£290	£290	£0
Delivered energy	58 kWh/m ²	58 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	84 kWh/m ²	84 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	34.16 (37)
Summer heat loss coefficient	132.05 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type	
North East	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	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
North East	6.9300	100.0415	0.2800	0.0000	0.7650	148.5021
total:						148.5021

	Jun	Jul	Aug	
Solar gains	160	149	120	(P4)
Internal gains	361	347	354	
Total summer gains	522	495	474	(P5)
Summer gain/loss ratio	3.95	3.75	3.59	(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	19.71	21.72	21.55	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			