

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-015			Issued on Date	12/02/2020
Assessment Reference	015	Prop Type Ref	GFF Semi		
Property	Plot 015, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	17.14	TER	18.93
Environmental	88 B	% DER<TER	9.44		
CO₂ Emissions (t/year)	0.89	DFEE	40.16	TFEE	46.67
General Requirements Compliance	Pass	% DFEE<TFEE	13.94		
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) 17.14 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)46.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.2 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): Medium OK
Based on:
Overshading: Average
Windows facing North East: 6.93 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.08 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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				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)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (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)
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	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							
Northeast	6.9300	11.2829	0.4300	0.0000	0.7700	25.8890 (75)						
Solar gains	25.8890	52.6977	94.9446	155.9263	209.5955	223.4510	209.0338	166.6442	115.6914	64.4008	32.5750	21.1422 (83)
Total gains	343.4569	368.1964	398.8425	441.3669	476.5412	472.5576	446.5867	409.7254	368.3116	335.6669	325.1405	329.4452 (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	0.9981	0.9968	0.9922	0.9720	0.8988	0.7362	0.5659	0.6349	0.8848	0.9836	0.9964	0.9985 (86)
MIT	19.9424	20.0411	20.2447	20.5339	20.8056	20.9545	20.9913	20.9841	20.8692	20.5353	20.1839	19.9096 (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	0.9975	0.9958	0.9895	0.9618	0.8630	0.6573	0.4600	0.5261	0.8301	0.9759	0.9951	0.9981 (89)
MIT 2	18.7043	18.8485	19.1450	19.5603	19.9276	20.0965	20.1259	20.1220	20.0132	19.5669	19.0575	18.6564 (90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)
MIT	19.1867	19.3131	19.5735	19.9396	20.2697	20.4308	20.4631	20.4579	20.3468	19.9442	19.4964	19.1447 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1867	19.3131	19.5735	19.9396	20.2697	20.4308	20.4631	20.4579	20.3468	19.9442	19.4964	19.1447 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9967	0.9945	0.9873	0.9591	0.8695	0.6861	0.5014	0.5686	0.8456	0.9738	0.9937	0.9973 (94)
Useful gains	342.3075	366.1685	393.7694	423.3192	414.3443	324.2327	223.9381	232.9713	311.4384	326.8572	323.1072	328.5658 (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	872.8346	845.0689	766.5221	647.2727	502.4574	341.8727	226.4987	237.9228	366.2588	547.8672	726.8243	876.2360 (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	394.7122	321.8210	277.3280	161.2465	65.5561	0.0000	0.0000	0.0000	0.0000	164.4315	290.6764	407.4666 (98)
Space heating	(98) / (4) =											2083.2384 (98)
Space heating per m ²	(98) / (4) =											33.5681 (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													2228.0624 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	394.7122	321.8210	277.3280	161.2465	65.5561	0.0000	0.0000	0.0000	0.0000	164.4315	290.6764	407.4666	(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)	422.1521	344.1936	296.6075	172.4562	70.1135	0.0000	0.0000	0.0000	0.0000	175.8625	310.8838	435.7932	(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	89.6006	89.5526	89.4233	89.1092	88.4308	87.3000	87.3000	87.3000	87.3000	89.0953	89.4664	87.3000	(216)
Fuel for water heating, kWh/month	166.1210	145.7976	151.7022	134.1952	130.8533	116.0228	109.1391	122.9226	123.7028	139.2951	149.5273	161.2939	(219)
Water heating fuel used													1650.5727 (219)
Annual totals kWh/year													
Space heating fuel - main system													2228.0624 (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													4313.6650 (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	2228.0624	0.2160	481.2615	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1650.5727	0.2160	356.5237	(264)
Space and water heating			837.7852	(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			1063.5657	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1400	(273)

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

DER			17.1400	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			36.8530	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			36.8530	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (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				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 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	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)
HLP (average)												0.9754 (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)												2.0392 (42)
Daily hot water use												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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 content (annual)	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)
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 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	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												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

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	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 (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	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)
HLP (average)												0.9834 (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														
(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								
Northeast		6.9300	11.2829	0.4300	0.0000	0.7700	25.8890	(75)						
Solar gains	25.8890	52.6977	94.9446	155.9263	209.5955	223.4510	209.0338	166.6442	115.6914	64.4008	32.5750	21.1422	21.1422	(83)
Total gains	313.9945	339.4295	371.5156	415.9960	452.4407	450.2443	425.7902	386.9830	344.8760	310.2073	297.3951	300.6719	300.6719	(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	53.9353	54.0446	54.1522	54.6634	54.7602	55.2150	55.2150	55.3000	55.0389	54.7602	54.5648	54.3621	54.3621	
alpha	4.5957	4.6030	4.6101	4.6442	4.6507	4.6810	4.6810	4.6867	4.6693	4.6507	4.6377	4.6241	4.6241	
util living area														
	0.9971	0.9953	0.9897	0.9684	0.9017	0.7561	0.5966	0.6668	0.8928	0.9812	0.9950	0.9976	0.9976	(86)
MIT														
	19.6270	19.7483	19.9967	20.3579	20.6964	20.9113	20.9773	20.9627	20.7886	20.3700	19.9407	19.6033	19.6033	(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	20.0926	(88)
util rest of house														
	0.9963	0.9940	0.9867	0.9585	0.8696	0.6818	0.4877	0.5583	0.8449	0.9737	0.9934	0.9970	0.9970	(89)
MIT 2														
	18.8205	18.9427	19.1911	19.5526	19.8724	20.0562	20.0975	20.0922	19.9640	19.5692	19.1413	18.8019	18.8019	(90)
Living area fraction														
										fLA = Living area / (4) =		0.3896	0.3896	(91)
MIT														
	19.1347	19.2566	19.5049	19.8664	20.1934	20.3894	20.4403	20.4313	20.2853	19.8812	19.4527	19.1142	19.1142	(92)
Temperature adjustment														
												0.0000	0.0000	
adjusted MIT														
	19.1347	19.2566	19.5049	19.8664	20.1934	20.3894	20.4403	20.4313	20.2853	19.8812	19.4527	19.1142	19.1142	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9952	0.9925	0.9843	0.9554	0.8734	0.7071	0.5300	0.5999	0.8562	0.9714	0.9919	0.9961	0.9961	(94)
Useful gains	312.4957	336.8912	365.6735	397.4319	395.1808	318.3680	225.6733	232.1703	295.2698	301.3261	294.9901	299.4959	299.4959	(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														
	917.5972	886.2246	801.1926	669.2866	517.4448	349.7994	232.0343	243.2028	374.9155	565.4377	755.2583	915.2658	915.2658	(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														
	450.1955	369.1521	324.0262	195.7354	90.9645	0.0000	0.0000	0.0000	0.0000	196.4990	331.3931	458.1328	458.1328	(98)
Space heating														
												2416.0985	2416.0985	(98)
Space heating per m2														
												(98) / (4) =	38.9317	(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	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	0.0000	(100)
Utilisation														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8478	0.9091	0.8777	0.0000	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	481.5344	406.4574	402.4357	0.0000	0.0000	0.0000	0.0000	0.0000	(102)
Total gains														
	0.0000	0.0000	0.0000	0.0000	0.0000	603.2103	573.1978	529.3268	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	87.6066	124.0549	94.4069	0.0000	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												306.0684 (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	0.0000	21.9017	31.0137	23.6017	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												76.5171 (107)
Space cooling per m2												1.2330 (108)
Energy for space heating												38.9317 (99)
Energy for space cooling												1.2330 (108)
Total												40.1646 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.2 (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 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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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	61.6207	61.4553	61.2933	60.5322	60.3898	59.7270	59.7270	59.6042	59.9823	60.3898	60.6779	60.9791 (39)
Average = Sum(39)m / 12 =												60.5316 (39)
HLP	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)
HLP (average)												0.9754 (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	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)													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	0.9992	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													fLA = Living area / (4) =
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													fC = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

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 (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 (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 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 or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	6.9300	12.9465	0.4300			0.0000	0.7700	29.7061 (75)				
Solar gains	29.7061	56.5566	100.3409	172.7874	223.3055	247.5947	229.5474	185.0427	129.5481	72.3106	38.3388	23.9942 (83)
Total gains	498.3305	521.0189	546.4534	590.8459	612.9958	611.9418	579.2166	542.3330	503.1263	474.1316	471.3325	480.2294 (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	0.9872	0.9819	0.9629	0.8980	0.7486	0.5287	0.3436	0.3667	0.6676	0.9105	0.9752	0.9892 (86)
MIT	20.2292	20.3106	20.5102	20.7612	20.9344	20.9920	20.9994	20.9992	20.9736	20.7820	20.4679	20.2011 (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	0.9835	0.9768	0.9521	0.8696	0.6908	0.4501	0.2560	0.2733	0.5837	0.8784	0.9670	0.9861 (89)
MIT 2	19.1205	19.2377	19.5221	19.8633	20.0715	20.1251	20.1295	20.1294	20.1123	19.8975	19.4651	19.0801 (90)
Living area fraction	19.5525	19.6557	19.9071	20.2131	20.4077	20.4629	20.4684	20.4683	20.4479	20.2421	19.8558	19.5169 (91)
MIT	19.5525	19.6557	19.9071	20.2131	20.4077	20.4629	20.4684	20.4683	20.4479	20.2421	19.8558	19.5169 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5525	19.6557	19.9071	20.2131	20.4077	20.4629	20.4684	20.4683	20.4479	20.2421	19.8558	19.5169 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9805	0.9734	0.9488	0.8727	0.7102	0.4806	0.2902	0.3098	0.6155	0.8831	0.9639	0.9833 (94)
Ext temp.	488.6062	507.1488	518.4616	515.6053	435.3340	294.1193	168.0611	168.0054	309.6758	418.7221	454.3080	472.1941 (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	870.8282	847.5658	756.7684	628.1298	463.6436	296.8465	168.1818	168.1747	319.4202	518.4307	712.7191	868.7416 (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	284.3732	228.7602	177.3002	81.0177	21.0624	0.0000	0.0000	0.0000	0.0000	74.1832	186.0560	295.0313 (98)
												1347.7842 (98)
												1348 (98)

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)	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 (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)
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 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	0.4300	0.0000	0.7700	25.8890 (75)						
Solar gains	25.8890	52.6977	94.9446	155.9263	209.5955	223.4510	209.0338	166.6442	115.6914	64.4008	32.5750	21.1422 (83)
Total gains	494.5134	517.1601	541.0571	573.9847	599.2857	587.7981	558.7030	523.9345	489.2697	466.2219	465.5687	477.3775 (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)	0.9889	0.9839	0.9692	0.9221	0.8052	0.6185	0.4584	0.5085	0.7574	0.9364	0.9806	0.9909 (86)
MIT	20.1854	20.2768	20.4585	20.7005	20.8958	20.9805	20.9969	20.9946	20.9435	20.7122	20.4043	20.1490 (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	0.9858	0.9794	0.9603	0.8997	0.7560	0.5424	0.3695	0.4155	0.6855	0.9133	0.9743	0.9883 (89)
MIT 2	19.0570	19.1890	19.4491	19.7839	20.0294	20.1165	20.1284	20.1272	20.0854	19.8060	19.3742	19.0045 (90)
Living area fraction	19.4967	19.6128	19.8424	20.1410	20.3670	20.4532	20.4668	20.4652	20.4198	20.1591	19.7755	19.4504 (91)
MIT	19.4967	19.6128	19.8424	20.1410	20.3670	20.4532	20.4668	20.4652	20.4198	20.1591	19.7755	19.4504 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4967	19.6128	19.8424	20.1410	20.3670	20.4532	20.4668	20.4652	20.4198	20.1591	19.7755	19.4504 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	486.0896	504.7957	517.6434	516.5863	461.6463	335.8689	225.8325	236.7332	347.8055	426.2311	452.1412	470.5497 (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	891.0092	862.6395	782.2883	659.0835	508.1605	343.1824	226.7155	238.3486	370.5387	560.4665	743.1904	894.1612 (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	301.2601	240.4710	196.8958	102.5980	34.6066	0.0000	0.0000	0.0000	0.0000	99.8712	209.5554	315.1669 (98)
Space heating												1500.4250 (98)
Space heating per m2												(98) / (4) = 24.1770 (99)

8c. Space cooling requirement

Not applicable

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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													1604.7326 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	301.2601	240.4710	196.8958	102.5980	34.6066	0.0000	0.0000	0.0000	0.0000	99.8712	209.5554	315.1669	(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)	322.2034	257.1882	210.5837	109.7305	37.0124	0.0000	0.0000	0.0000	0.0000	106.8141	224.1234	337.0769	(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	89.4161	89.3475	89.1667	88.7491	88.0165	87.3000	87.3000	87.3000	87.3000	88.6985	89.2256	87.3000	(216)
Fuel for water heating, kWh/month	166.4637	146.1322	152.1387	134.7396	131.4692	116.0228	109.1391	122.9226	123.7028	139.9183	149.9308	161.6018	(219)
Water heating fuel used													1654.1817 (219)
Annual totals kWh/year													
Space heating fuel - main system													1604.7326 (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													3693.9441 (238)

 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1604.7326	3.4800	55.8447 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1654.1817	3.4800	57.5655 (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			290.7907 (255)

 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1408 (257)
SAP value		84.0861
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	1604.7326	0.2160	346.6222 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.1817	0.2160	357.3032 (264)
Space and water heating			703.9255 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			929.7060 (272)
CO2 emissions per m2			14.9800 (273)
EI value			88.3635
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	$3.48 / 0.8844 = 3.935$, stars = 4
Water heating environmental impact	$0.216 / 0.8844 = 0.2442$, 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	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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 (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)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	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)
Average = Sum(39)m / 12 =	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)
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 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						
Northeast	6.9300	12.9465	0.4300	0.0000	0.7700	29.7061 (75)						
Solar gains	29.7061	56.5566	100.3409	172.7874	223.3055	247.5947	229.5474	185.0427	129.5481	72.3106	38.3388	23.9942 (83)
Total gains	498.3305	521.0189	546.4534	590.8459	612.9958	611.9418	579.2166	542.3330	503.1263	474.1316	471.3325	480.2294 (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)	0.9872	0.9819	0.9629	0.8980	0.7486	0.5287	0.3436	0.3667	0.6676	0.9105	0.9752	0.9892 (86)
MIT	20.2292	20.3106	20.5102	20.7612	20.9344	20.9920	20.9994	20.9992	20.9736	20.7820	20.4679	20.2011 (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	0.9835	0.9768	0.9521	0.8696	0.6908	0.4501	0.2560	0.2733	0.5837	0.8784	0.9670	0.9861 (89)
MIT 2	19.1205	19.2377	19.5221	19.8633	20.0715	20.1251	20.1295	20.1294	20.1123	19.8975	19.4651	19.0801 (90)
Living area fraction	19.5525	19.6557	19.9071	20.2131	20.4077	20.4629	20.4684	20.4683	20.4479	20.2421	19.8558	19.5169 (92)
MIT	19.5525	19.6557	19.9071	20.2131	20.4077	20.4629	20.4684	20.4683	20.4479	20.2421	19.8558	19.5169 (93)
Temperature adjustment												0.0000
adjusted MIT	19.5525	19.6557	19.9071	20.2131	20.4077	20.4629	20.4684	20.4683	20.4479	20.2421	19.8558	19.5169 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	488.6062	507.1488	518.4616	515.6053	435.3340	294.1193	168.0611	168.0054	309.6758	418.7221	454.3080	472.1941 (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	870.8282	847.5658	756.7684	628.1298	463.6436	296.8465	168.1818	168.1747	319.4202	518.4307	712.7191	868.7416 (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	284.3732	228.7602	177.3002	81.0177	21.0624	0.0000	0.0000	0.0000	0.0000	74.1832	186.0560	295.0313 (98)
Space heating												1347.7842 (98)
Space heating per m2												(98) / (4) = 21.7174 (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													1441.4805 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	284.3732	228.7602	177.3002	81.0177	21.0624	0.0000	0.0000	0.0000	0.0000	74.1832	186.0560	295.0313	(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)	304.1424	244.6633	189.6259	86.6499	22.5266	0.0000	0.0000	0.0000	0.0000	79.3403	198.9904	315.5415	(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	89.3744	89.3105	89.0845	88.5648	87.7779	87.3000	87.3000	87.3000	87.3000	88.4703	89.1334	87.3000	(216)
Fuel for water heating, kWh/month	166.5415	146.1929	152.2790	135.0200	131.8265	116.0228	109.1391	122.9226	123.7028	140.2791	150.0859	161.6861	(219)
Water heating fuel used													1655.6984 (219)
Annual totals kWh/year													
Space heating fuel - main system													1441.4805 (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													3532.2087 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1441.4805	3.9200	56.5060 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1655.6984	3.9200	64.9034 (247)
Mechanical ventilation fans	43.7996	16.9600	7.4284 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	316.2303	16.9600	53.6327 (250)
Additional standing charges			88.0000 (251)
Total energy cost			283.1905 (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	1441.4805	0.2160	311.3598 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1655.6984	0.2160	357.6308 (264)
Space and water heating			668.9906 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			894.7711 (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	1441.4805	1.2200	1758.6062 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1655.6984	1.2200	2019.9520 (264)
Space and water heating			3778.5581 (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			5114.0998 (272)
Primary energy kWh/m2/year			82.4057 (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 443 TEST (28 May 2019)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£74	£74	£0
Mains gas	£209	£209	£0
Space heating	£165	£165	£0
Water heating	£65	£65	£0
Lighting	£54	£54	£0
Total cost of fuels	£283	£283	£0
Total cost of uses	£284	£284	£0
Delivered energy	57 kWh/m ²	57 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	82 kWh/m ²	82 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 (P7)
Summer heat loss coefficient	132.05 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)

[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	0.4300	0.0000	0.9000	268.3022
total:						268.3022

	Jun	Jul	Aug	
Solar gains	289	268	216	(P4)
Internal gains	361	347	354	
Total summer gains	651	615	571	(P5)
Summer gain/loss ratio	4.93	4.66	4.32	(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	20.69	22.62	22.29	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			