

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-013			Issued on Date	30/04/2020
Assessment Reference	013	Prop Type Ref	GFF Semi		
Property	Plot 013, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	18.23	TER	19.52
Environmental	88 B	% DER<TER	6.61		
CO₂ Emissions (t/year)	0.95	DFEE	44.29	TFEE	49.48
General Requirements Compliance	Pass	% DFEE<TFEE	10.49		
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) 19.52 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 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	1.32 (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:

6.51 m², No overhang

Air change rate:

2.00 ach

Blinds/curtains:

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

10 Key features

Party wall U-value 0.00 W/m²K

Door U-value 1.08 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	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)

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (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)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) =	14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss						(33) + (36) =	36.7697 (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 =	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)												0.9868 (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)



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	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	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	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	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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (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	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	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547	18.6547	(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	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-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)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584	63.0584	(72)
Total internal gains	317.8119	315.7154	304.0741	285.5741	267.0454	249.1909	237.6439	243.1995	252.7789	271.4677	292.8008	308.5538	308.5538	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast		3.9900	11.2829	0.2800	0.0000	0.7700	9.7061 (75)							
Northeast		2.5200	11.2829	0.2800	0.0000	0.7700	6.1302 (75)							
Solar gains	15.8362	32.2351	58.0774	95.3798	128.2092	136.6846	127.8656	101.9360	70.7683	39.3939	19.9261	12.9327	12.9327	(83)
Total gains	333.6482	347.9505	362.1516	380.9539	395.2547	385.8755	365.5095	345.1355	323.5472	310.8616	312.7268	321.4864	321.4864	(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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	
util living area	0.9984	0.9976	0.9953	0.9863	0.9527	0.8500	0.6935	0.7471	0.9321	0.9892	0.9971	0.9987	0.9987	(86)
MIT	19.8647	19.9483	20.1315	20.3987	20.6823	20.8947	20.9737	20.9607	20.8008	20.4577	20.1120	19.8348	19.8348	(87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(88)
util rest of house	0.9979	0.9969	0.9936	0.9808	0.9311	0.7805	0.5715	0.6307	0.8915	0.9838	0.9960	0.9983	0.9983	(89)
MIT 2	18.5649	18.6871	18.9546	19.3423	19.7421	20.0092	20.0820	20.0736	19.9047	19.4297	18.9266	18.5212	18.5212	(90)
Living area fraction													fLA = Living area / (4) = 0.3896 (91)	
MIT	19.0713	19.1785	19.4131	19.7539	20.1084	20.3542	20.4294	20.4193	20.2538	19.8303	19.3885	19.0330	19.0330	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.0713	19.1785	19.4131	19.7539	20.1084	20.3542	20.4294	20.4193	20.2538	19.8303	19.3885	19.0330	19.0330	(93)

8. Space heating requirement

Utilisation	0.9971	0.9958	0.9919	0.9781	0.9315	0.8028	0.6193	0.6758	0.9001	0.9817	0.9948	0.9976	0.9976	(94)
Useful gains	332.6715	346.4862	359.2140	372.6191	368.1766	309.7940	226.3533	233.2395	291.2383	305.1604	311.1116	320.7156	320.7156	(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	904.6430	874.4575	790.8410	664.7243	514.9583	352.4056	234.5246	246.1520	376.8794	565.2895	752.5834	908.4197	908.4197	(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	425.5468	354.7967	321.1305	210.3158	109.2056	0.0000	0.0000	0.0000	0.0000	193.5361	317.8597	437.2519	437.2519	(98)
Space heating													2369.6429 (98)	
Space heating per m ²													(98) / (4) = 38.1831 (99)	

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2534.3775	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	425.5468	354.7967	321.1305	210.3158	109.2056	0.0000	0.0000	0.0000	0.0000	193.5361	317.8597	437.2519	(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)	455.1303	379.4617	343.4551	224.9366	116.7974	0.0000	0.0000	0.0000	0.0000	206.9904	339.9569	467.6491	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.6485	89.6163	89.5254	89.3133	88.8249	87.3000	87.3000	87.3000	87.3000	89.2222	89.5280	87.3000	(216)
Fuel for water heating, kWh/month	166.0324	145.6939	151.5291	133.8884	130.2726	116.0228	109.1391	122.9226	123.7028	139.0970	149.4245	161.2154	(219)
Water heating fuel used												1648.9406	(219)
Annual totals kWh/year													
Space heating fuel - main system												2534.3775	(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)		320.5396 (232)
Total delivered energy for all uses		4622.6573 (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	2534.3775	0.2160	547.4255	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1648.9406	0.2160	356.1712	(264)
Space and water heating			903.5967	(265)
Pumps and fans	118.7996	0.5190	61.6570	(267)
Energy for lighting	320.5396	0.5190	166.3601	(268)
Total CO2, kg/year			1131.6138	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2300	(273)

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

DER		18.2300	ZC1
Total Floor Area		62.0600	
Assumed number of occupants		2.0392	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		17.0069	ZC2
CO2 emissions from cooking, equation (L16)		2.7061	ZC3
Total CO2 emissions		37.9430	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		37.9430	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)
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)			6.5100	1.3258	8.6307		(27)					
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)					
External Wall	43.6300	6.5100	37.1200	0.1800	6.6816		(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)			119.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.5467		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6119 (36)					
Total fabric heat loss							(33) + (36) = 35.1586 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	63.8890	63.7237	63.5617	62.8006	62.6582	61.9954	61.9954	61.8726	62.2507	62.6582	62.9463	63.2474 (39)
Average = Sum(39)m / 12 =												62.7999 (39)
HLP	1.0295	1.0268	1.0242	1.0119	1.0096	0.9990	0.9990	0.9970	1.0031	1.0096	1.0143	1.0191 (40)
HLP (average)												1.0119 (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)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	46.3192	40.3153	42.9505	39.9350	39.5818	36.6750	37.8975	39.5818	39.9350	42.9505	43.1950	46.3192 (61)
Total heat required for water heating calculated for each month	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (64)
Heat gains from water heating, kWh/month	56.3991	49.2781	51.1877	45.2491	43.7334	38.3683	36.5321	40.9446	41.4037	47.3545	50.7690	54.9849 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547 (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	328.6549	325.9990	313.8012	294.7463	275.6595	257.2483	245.7070	251.8189	261.9590	281.2026	303.0888	319.3998 (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	6.5100	11.2829	0.6300	0.7000	0.7700	22.4479 (75)						
Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321 (83)
Total gains	351.1027	371.6923	396.1260	429.9473	457.3961	450.9987	426.9565	396.3131	362.2730	337.0434	331.3340	337.7319 (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	67.4564	67.6314	67.8038	68.6255	68.7814	69.5169	69.5169	69.6548	69.2317	68.7814	68.4667	68.1407
alpha	5.4971	5.5088	5.5203	5.5750	5.5854	5.6345	5.6345	5.6437	5.6154	5.5854	5.5644	5.5427
util living area	0.9985	0.9976	0.9946	0.9814	0.9302	0.7900	0.6194	0.6830	0.9110	0.9877	0.9972	0.9988 (86)
MIT	19.8916	19.9858	20.1828	20.4754	20.7558	20.9370	20.9871	20.9783	20.8453	20.5050	20.1550	19.8757 (87)
Th 2	20.0588	20.0611	20.0632	20.0734	20.0753	20.0842	20.0842	20.0859	20.0808	20.0753	20.0714	20.0674 (88)
util rest of house	0.9980	0.9968	0.9926	0.9737	0.8999	0.7093	0.5005	0.5644	0.8602	0.9813	0.9961	0.9984 (89)
MIT 2	18.5713	18.7106	18.9995	19.4298	19.8179	20.0383	20.0789	20.0758	19.9426	19.4771	18.9659	18.5544 (90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)
MIT	19.0857	19.2074	19.4605	19.8372	20.1833	20.3885	20.4327	20.4275	20.2943	19.8776	19.4292	19.0692 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0857	19.2074	19.4605	19.8372	20.1833	20.3885	20.4327	20.4275	20.2943	19.8776	19.4292	19.0692 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	350.1445	370.1170	392.4831	417.5737	413.5115	332.9400	233.6527	242.1215	316.6292	330.1079	329.6619	336.9893 (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	944.6438	911.7238	823.7929	686.8644	531.5507	358.8590	237.6125	249.1897	385.5982	581.3180	776.0771	940.4378 (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	442.3075	363.9598	320.8945	193.8893	87.8212	0.0000	0.0000	0.0000	0.0000	186.9003	321.4189	448.9657 (98)
Space heating												2366.1571 (98)
Space heating per m ²												38.1269 (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												2533.3587 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	442.3075	363.9598	320.8945	193.8893	87.8212	0.0000	0.0000	0.0000	0.0000	186.9003	321.4189	448.9657 (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)	473.5626	389.6786	343.5701	207.5902	94.0270	0.0000	0.0000	0.0000	0.0000	200.1074	344.1316	480.6913 (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	87.2132	87.0814	86.7026	85.7663	83.8918	80.3000	80.3000	80.3000	80.3000	85.5548	86.7236	80.3000 (216)
Fuel for water heating, kWh/month	207.6682	181.6779	189.8500	170.2258	168.4910	155.0353	148.5356	165.5824	167.4111	178.9222	188.4219	202.5966 (219)
Water heating fuel used												2124.4179 (219)
Annual totals kWh/year												
Space heating fuel - main system												2533.3587 (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)												320.5396 (232)
Total delivered energy for all uses												5053.3163 (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	2533.3587	0.2160	547.2055 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2124.4179	0.2160	458.8743 (264)
Space and water heating			1006.0798 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total CO2, kg/m2/year			1211.3648 (272)
Emissions per m2 for space and water heating			16.2114 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6806 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2114 * 1.00) + 2.6806 + 0.6272, rounded to 2 d.p.			19.5200 (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)	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				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 (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (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)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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)...(32c) = 12032.2960 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 193.8817 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.7591 (36)
 Total fabric heat loss (33) + (36) = 36.7697 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	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)
Heat transfer coeff	64.4659	64.3407	64.2180	63.6419	63.5341	63.0323	63.0323	62.9393	63.2256	63.5341	63.7522	63.9801 (39)
Average = Sum(39)m / 12 =	63.6414 (39)											
HLP	1.0388	1.0368	1.0348	1.0255	1.0238	1.0157	1.0157	1.0142	1.0188	1.0238	1.0273	1.0309 (40)
HLP (average)	1.0255 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	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	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547	(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	288.3495	286.9485	276.7473	260.2031	242.9449	226.8776	216.8473	220.4571	229.3433	246.0081	265.0553	279.7805	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W			
Northeast			3.9900	11.2829	0.2800		0.0000		0.7700	9.7061	(75)		
Northeast			2.5200	11.2829	0.2800		0.0000		0.7700	6.1302	(75)		
Solar gains	15.8362	32.2351	58.0774	95.3798	128.2092	136.6846	127.8656	101.9360	70.7683	39.3939	19.9261	12.9327	(83)
Total gains	304.1858	319.1836	334.8247	355.5830	371.1542	363.5622	344.7130	322.3931	300.1116	285.4019	284.9814	292.7131	(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	51.8461	51.9470	52.0462	52.5174	52.6065	53.0253	53.0253	53.1036	52.8632	52.6065	52.4265	52.2397		
alpha	4.4564	4.4631	4.4697	4.5012	4.5071	4.5350	4.5350	4.5402	4.5242	4.5071	4.4951	4.4826		
util living area	0.9974	0.9964	0.9934	0.9831	0.9504	0.8592	0.7208	0.7729	0.9342	0.9870	0.9959	0.9979		(86)
MIT	19.5416	19.6453	19.8699	20.2045	20.5493	20.8274	20.9452	20.9234	20.7046	20.2825	19.8608	19.5209		(87)
Th 2	20.0512	20.0528	20.0545	20.0621	20.0636	20.0703	20.0703	20.0715	20.0677	20.0636	20.0607	20.0576		(88)
util rest of house	0.9967	0.9954	0.9914	0.9773	0.9305	0.7970	0.6025	0.6636	0.8988	0.9814	0.9945	0.9973		(89)
MIT 2	18.7077	18.8125	19.0378	19.3756	19.7116	19.9659	20.0493	20.0390	19.8639	19.4557	19.0340	18.6921		(90)
Living area fraction									fLA = Living area / (4) =			0.3896		(91)
MIT	19.0326	19.1370	19.3620	19.6986	20.0380	20.3015	20.3984	20.3836	20.1914	19.7779	19.3562	19.0150		(92)
Temperature adjustment												0.0000		
adjusted MIT	19.0326	19.1370	19.3620	19.6986	20.0380	20.3015	20.3984	20.3836	20.1914	19.7779	19.3562	19.0150		(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9957	0.9941	0.9894	0.9745	0.9299	0.8146	0.6477	0.7043	0.9045	0.9792	0.9932	0.9964	(94)
Useful gains	302.8893	317.2963	331.2816	346.5013	345.1318	296.1440	223.2702	227.0457	271.4532	279.4651	283.0294	291.6679	(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	949.7513	916.0196	825.9725	687.2415	529.7453	359.3816	239.4216	250.7264	385.1353	583.1071	781.3576	947.8659	(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	481.2654	402.3421	368.0500	245.3330	137.3524	0.0000	0.0000	0.0000	0.0000	225.9097	358.7963	488.2113	(98)
Space heating												2707.2602	(98)
Space heating per m2											(98) / (4) =	43.6233	(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	592.5034	466.4388	478.3390	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7456	0.8297	0.7975	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	441.7855	386.9927	381.4553	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	502.0056	478.5534	453.9895	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.3585	68.1212	53.9654	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													165.4450 (104)
Cooled fraction													1.0000 (105)
Intermittency factor (Table 10b)													
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	10.8396	17.0303	13.4914	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													41.3613 (107)
Space cooling per m2													0.6665 (108)
Energy for space heating													43.6233 (99)
Energy for space cooling													0.6665 (108)
Total													44.2897 (109)
Dwelling Fabric Energy Efficiency (DFEE)													44.3 (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)
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 infiltr 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)			6.5100	1.3258	8.6307		(27)					
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)					
External Wall	43.6300	6.5100	37.1200	0.1800	6.6816		(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)			119.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)					27.5467		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6119 (36)					
Total fabric heat loss							(33) + (36) = 35.1586 (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 =	63.8890	63.7237	63.5617	62.8006	62.6582	61.9954	61.9954	61.8726	62.2507	62.6582	62.9463	63.2474 (39)
												62.7999 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0295	1.0268	1.0242	1.0119	1.0096	0.9990	0.9990	0.9970	1.0031	1.0096	1.0143	1.0191 (40)
Days in month												1.0119 (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	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														
	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547		(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														
	288.3495	286.9485	276.7473	260.2031	242.9449	226.8776	216.8473	220.4571	229.3433	246.0081	265.0553	279.7805		(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			6.5100	11.2829	0.6300	0.7000	0.7700	22.4479 (75)						
Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321		(83)
Total gains	310.7974	332.6418	359.0720	395.4041	424.6815	420.6280	398.0969	364.9513	329.6573	301.8489	293.3005	298.1125		(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	67.4564	67.6314	67.8038	68.6255	68.7814	69.5169	69.5169	69.6548	69.2317	68.7814	68.4667	68.1407		
alpha	5.4971	5.5088	5.5203	5.5750	5.5854	5.6345	5.6345	5.6437	5.6154	5.5854	5.5644	5.5427		
util living area														
	0.9992	0.9986	0.9966	0.9873	0.9471	0.8234	0.6573	0.7277	0.9363	0.9927	0.9985	0.9994		(86)
MIT														
	19.8296	19.9260	20.1268	20.4264	20.7197	20.9215	20.9827	20.9703	20.8121	20.4533	20.0968	19.8146		(87)
Th 2														
	20.0588	20.0611	20.0632	20.0734	20.0753	20.0842	20.0842	20.0859	20.0808	20.0753	20.0714	20.0674		(88)
util rest of house														
	0.9989	0.9982	0.9953	0.9817	0.9222	0.7465	0.5345	0.6076	0.8954	0.9886	0.9978	0.9992		(89)
MIT 2														
	18.9814	19.0795	19.2815	19.5867	19.8685	20.0438	20.0792	20.0760	19.9608	19.6167	19.2586	18.9734		(90)
Living area fraction														
	19.3119	19.4093	19.6109	19.9139	20.2002	20.3858	20.4312	20.4245	20.2925	19.9427	19.5852	19.3011		(91)
MIT														
	19.3119	19.4093	19.6109	19.9139	20.2002	20.3858	20.4312	20.4245	20.2925	19.9427	19.5852	19.3011		(92)
Temperature adjustment														
												0.0000		(93)
adjusted MIT														
	19.3119	19.4093	19.6109	19.9139	20.2002	20.3858	20.4312	20.4245	20.2925	19.9427	19.5852	19.3011		(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9977	0.9945	0.9805	0.9262	0.7743	0.5831	0.6551	0.9067	0.9879	0.9974	0.9989	
Useful gains	310.3684	331.8777	357.1054	387.7129	393.3308	325.6950	232.1238	239.0759	298.8994	298.1859	292.5363	297.7894	
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	959.0950	924.5863	833.3497	691.6780	532.6048	358.6909	237.5188	249.0052	385.4866	585.3957	785.8965	955.1090	
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	
Space heating kWh	482.6526	398.3002	354.3258	218.8549	103.6199	0.0000	0.0000	0.0000	0.0000	213.6841	355.2194	489.0457	
Space heating												2615.7026	
Space heating per m2												42.1480	

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	582.7564	458.7657	470.2318	0.0000	0.0000	0.0000	0.0000	
Utilisation													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8387	0.9097	0.8771	0.0000	0.0000	0.0000	0.0000	
Useful loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	488.7670	417.3428	412.4388	0.0000	0.0000	0.0000	0.0000	
Total gains													
	0.0000	0.0000	0.0000	0.0000	0.0000	568.7059	540.9502	503.7329	0.0000	0.0000	0.0000	0.0000	
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	
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	57.5560	91.9639	67.9228	0.0000	0.0000	0.0000	0.0000	
Space cooling													
												217.4427	
Cooled fraction													
												1.0000	
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	

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	14.3890	22.9910	16.9807	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													54.3607 (107)
Space cooling per m2													0.8759 (108)
Energy for space heating													42.1480 (99)
Energy for space cooling													0.8759 (108)
Total													43.0239 (109)
Target Fabric Energy Efficiency (TFEE)													49.5 (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)	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)

	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 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)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (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)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) =	14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss						(33) + (36) =	36.7697 (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 =	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)	0.9868 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	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	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	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	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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (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	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	122.3544	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368	46.6368	(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	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	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	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	-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	63.0584	(72)
Total internal gains	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622	456.8622	(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	3.9900	12.9465	0.2800	0.0000	0.7700	11.1372 (75)								
Northeast	2.5200	12.9465	0.2800	0.0000	0.7700	7.0340 (75)								
Solar gains	18.1712	34.5956	61.3784	105.6938	136.5956	151.4533	140.4138	113.1903	79.2444	44.2323	23.4518	14.6772	14.6772	(83)
Total gains	487.4056	499.5998	507.9316	524.0858	526.5352	516.0109	490.3104	470.7763	453.2195	446.5572	457.0336	471.5394	471.5394	(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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	(86)
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	(86)
util living area	0.9891	0.9861	0.9749	0.9387	0.8386	0.6380	0.4223	0.4392	0.7437	0.9340	0.9800	0.9907	0.9907	(86)
MIT	20.1504	20.2181	20.4037	20.6504	20.8700	20.9774	20.9980	20.9976	20.9499	20.7188	20.3965	20.1257	20.1257	(87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(88)
util rest of house	0.9860	0.9820	0.9669	0.9183	0.7868	0.5463	0.3112	0.3240	0.6568	0.9074	0.9731	0.9879	0.9879	(89)
MIT 2	18.9799	19.0779	19.3450	19.6903	19.9718	20.0809	20.0938	20.0937	20.0598	19.7875	19.3365	18.9444	18.9444	(90)
Living area fraction	19.4359	19.5221	19.7575	20.0644	20.3218	20.4302	20.4461	20.4459	20.4066	20.1503	19.7495	19.4046	19.4046	(91)
MIT	19.4359	19.5221	19.7575	20.0644	20.3218	20.4302	20.4461	20.4459	20.4066	20.1503	19.7495	19.4046	19.4046	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.4359	19.5221	19.7575	20.0644	20.3218	20.4302	20.4461	20.4459	20.4066	20.1503	19.7495	19.4046	19.4046	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9830	0.9787	0.9633	0.9175	0.8010	0.5815	0.3546	0.3691	0.6887	0.9093	0.9698	0.9852	0.9852	(94)
Ext temp.	479.1383	488.9507	489.2857	480.8411	421.7674	300.0630	173.8791	173.7730	312.1279	406.0677	443.2291	464.5531	464.5531	(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	4.7000	(96)
Month fracti	902.4746	877.1320	781.3069	646.9959	479.0288	308.0634	174.3064	174.2927	331.1181	535.8975	737.9469	900.5576	900.5576	(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	1.0000	(97a)
Space heating	314.9623	260.8578	217.2638	119.6314	42.6025	0.0000	0.0000	0.0000	0.0000	96.5934	212.1968	324.3873	324.3873	(98)
RHI space heating demand													1588.4953 (98)	
													1588 (98)	

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



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)
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)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (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)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.7697 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	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	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
Average = Sum(39)m / 12 =												61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)												0.9868 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)	
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)	
Solar input (sum of months) = Sum(63)m =	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)	
Total per year (kWh/year) = Sum(64)m =	1464.6982 (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	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368	(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	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622	(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		3.9900	11.2829	0.2800	0.0000	0.7700	9.7061 (75)					
Northeast		2.5200	11.2829	0.2800	0.0000	0.7700	6.1302 (75)					
Solar gains	15.8362	32.2351	58.0774	95.3798	128.2092	136.6846	127.8656	101.9360	70.7683	39.3939	19.9261	12.9327 (83)
Total gains	485.0707	497.2393	504.6306	513.7719	518.1488	501.2422	477.7623	459.5219	444.7434	441.7189	453.5079	469.7949 (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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	
util living area	0.9905	0.9875	0.9789	0.9529	0.8805	0.7248	0.5525	0.5953	0.8211	0.9528	0.9840	0.9920	(86)
MIT	20.1073	20.1851	20.3514	20.5860	20.8134	20.9528	20.9909	20.9866	20.9055	20.6443	20.3333	20.0735	(87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(88)
util rest of house	0.9878	0.9838	0.9724	0.9371	0.8401	0.6434	0.4446	0.4868	0.7529	0.9340	0.9786	0.9897	(89)
MIT 2	18.9174	19.0302	19.2700	19.6022	19.9044	20.0605	20.0905	20.0882	20.0165	19.6871	19.2457	18.8684	(90)
Living area fraction	fLA = Living area / (4) =												0.3896 (91)
MIT	19.3810	19.4802	19.6913	19.9855	20.2586	20.4082	20.4414	20.4382	20.3629	20.0600	19.6694	19.3379	(92)
Temperature adjustment													0.0000
adjusted MIT	19.3810	19.4802	19.6913	19.9855	20.2586	20.4082	20.4414	20.4382	20.3629	20.0600	19.6694	19.3379	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9850	0.9806	0.9687	0.9349	0.8483	0.6731	0.4869	0.5292	0.7750	0.9331	0.9754	0.9872	(94)
Useful gains	477.7880	487.6146	488.8505	480.3005	439.5441	337.3964	232.6030	243.1803	344.6955	412.1671	442.3645	463.7224	(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	923.6065	892.9360	807.8788	678.9105	524.1536	355.7114	235.2562	247.3121	383.5600	579.3620	769.7906	927.0939	(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	331.6890	272.3760	237.3570	142.9991	62.9494	0.0000	0.0000	0.0000	0.0000	124.3930	235.7468	344.7112	(98)
Space heating													1752.2215 (98)
Space heating per m ²													(98) / (4) = 28.2343 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1874.0337 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	331.6890	272.3760	237.3570	142.9991	62.9494	0.0000	0.0000	0.0000	0.0000	124.3930	235.7468	344.7112	(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)	354.7476	291.3112	253.8578	152.9403	67.3256	0.0000	0.0000	0.0000	0.0000	133.0406	252.1356	368.6750	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.4840	89.4377	89.3094	89.0141	88.4013	87.3000	87.3000	87.3000	87.3000	88.8731	89.3148	87.3000	(216)
Fuel for water heating, kWh/month	166.3375	145.9849	151.8956	134.3385	130.8969	116.0228	109.1391	122.9226	123.7028	139.6435	149.7812	161.4906	(219)
Water heating fuel used													1652.1558 (219)
Annual totals kWh/year													
Space heating fuel - main system													1874.0337 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3965.5287 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1874.0337	3.4800	65.2164 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1652.1558	3.4800	57.4950 (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	320.5396	13.1900	42.2792 (250)
Additional standing charges			120.0000 (251)
Total energy cost			300.6602 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1795 (257)
SAP value		83.5460
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	1874.0337	0.2160	404.7913 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1652.1558	0.2160	356.8657 (264)
Space and water heating			761.6569 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			989.6740 (272)
CO2 emissions per m2			15.9500 (273)
EI value			87.6129
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	$3.48 / 0.8855 = 3.930$, stars = 4
Water heating environmental impact	$0.216 / 0.8855 = 0.2439$, stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				2	2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (solar film) (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (solar film) (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (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)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.7697 (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 =	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)												0.9868 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)													Total = Sum(45)m =	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	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	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	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	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	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (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	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	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368	46.6368 (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	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	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	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	-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	63.0584 (72)
Total internal gains	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622	456.8622 (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		3.9900	12.9465	0.2800	0.0000	0.0000	0.7700	11.1372 (75)				
Northeast		2.5200	12.9465	0.2800	0.0000	0.0000	0.7700	7.0340 (75)				
Solar gains	18.1712	34.5956	61.3784	105.6938	136.5956	151.4533	140.4138	113.1903	79.2444	44.2323	23.4518	14.6772 (83)
Total gains	487.4056	499.5998	507.9316	524.0858	526.5352	516.0109	490.3104	470.7763	453.2195	446.5572	457.0336	471.5394 (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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889
util living area	0.9891	0.9861	0.9749	0.9387	0.8386	0.6380	0.4223	0.4392	0.7437	0.9340	0.9800	0.9907	0.9907 (86)
MIT	20.1504	20.2181	20.4037	20.6504	20.8700	20.9774	20.9980	20.9976	20.9499	20.7188	20.3965	20.1257	20.1257 (87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943 (88)
util rest of house	0.9860	0.9820	0.9669	0.9183	0.7868	0.5463	0.3112	0.3240	0.6568	0.9074	0.9731	0.9879	0.9879 (89)
MIT 2	18.9799	19.0779	19.3450	19.6903	19.9718	20.0809	20.0938	20.0937	20.0598	19.7875	19.3365	18.9444	18.9444 (90)
Living area fraction													fLA = Living area / (4) = 0.3896 (91)
MIT	19.4359	19.5221	19.7575	20.0644	20.3218	20.4302	20.4461	20.4459	20.4066	20.1503	19.7495	19.4046	19.4046 (92)
Temperature adjustment													0.0000
adjusted MIT	19.4359	19.5221	19.7575	20.0644	20.3218	20.4302	20.4461	20.4459	20.4066	20.1503	19.7495	19.4046	19.4046 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9830	0.9787	0.9633	0.9175	0.8010	0.5815	0.3546	0.3691	0.6887	0.9093	0.9698	0.9852	0.9852 (94)
Useful gains	479.1383	488.9507	489.2857	480.8411	421.7674	300.0630	173.8791	173.7730	312.1279	406.0677	443.2291	464.5531	464.5531 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000	4.7000 (96)
Heat loss rate W	902.4746	877.1320	781.3069	646.9959	479.0288	308.0634	174.3064	174.2927	331.1181	535.8975	737.9469	900.5576	900.5576 (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	314.9623	260.8578	217.2638	119.6314	42.6025	0.0000	0.0000	0.0000	0.0000	96.5934	212.1968	324.3873	324.3873 (98)
Space heating													1588.4953 (98)
Space heating per m ²													(98) / (4) = 25.961 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1698.9255 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	314.9623	260.8578	217.2638	119.6314	42.6025	0.0000	0.0000	0.0000	0.0000	96.5934	212.1968	324.3873	(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)	336.8580	278.9923	232.3677	127.9481	45.5642	0.0000	0.0000	0.0000	0.0000	103.3085	226.9484	346.9383	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.4478	89.4068	89.2426	88.8715	88.1386	87.3000	87.3000	87.3000	87.3000	88.6723	89.2352	87.3000	(216)
Fuel for water heating, kWh/month	166.4048	146.0353	152.0093	134.5540	131.2870	116.0228	109.1391	122.9226	123.7028	139.9597	149.9147	161.5656	(219)
Water heating fuel used													1653.5177 (219)
Annual totals kWh/year													
Space heating fuel - main system													1698.9255 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3791.7824 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1698.9255	3.9300	66.7678 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1653.5177	3.9300	64.9832 (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	320.5396	17.5600	56.2868 (250)
Additional standing charges			88.0000 (251)
Total energy cost			296.8990 (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	1698.9255	0.2160	366.9679 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1653.5177	0.2160	357.1598 (264)
Space and water heating			724.1277 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			952.1448 (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	1698.9255	1.2200	2072.6891 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1653.5177	1.2200	2017.2916 (264)
Space and water heating			4089.9807 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	320.5396	3.0700	984.0566 (268)
Primary energy kWh/year			5438.7521 (272)
Primary energy kWh/m2/year			87.6370 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current environmental impact rating:

B 88

(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	£77	£77	£0
Mains gas	£220	£220	£0
Space heating	£176	£176	£0
Water heating	£65	£65	£0
Lighting	£56	£56	£0
Total cost of fuels	£297	£297	£0
Total cost of uses	£297	£297	£0
Delivered energy	61 kWh/m ²	61 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	88 kWh/m ²	88 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	South East
Overshading	Average or unknown
Thermal mass parameter	233.9 (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	36.77 (37)
Summer heat loss coefficient	134.66 (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	3.9900	100.0415	0.2800	0.0000	0.7650	85.5012
North East	2.5200	100.0415	0.2800	0.0000	0.7650	54.0008
total:						139.5020

	Jun	Jul	Aug	
Solar gains	150	140	112	(P4)
Internal gains	362	347	355	
Total summer gains	512	486	467	(P5)
Summer gain/loss ratio	3.80	3.61	3.47	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 233.9)	0.36	0.36	0.36	
Threshold temperature	19.57	21.57	21.43	(P7)
Likelihood of high internal temperature	Not significant		Slight	
Assessment of likelihood of high internal temperature:	Slight			