

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-003			<b>Issued on Date</b>	12/02/2020
<b>Assessment Reference</b>	003	<b>Prop Type Ref</b>	GFF Det		
<b>Property</b>	Plot 003, 1 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	83 B	<b>DER</b>	19.90	<b>TER</b>	21.85
<b>Environmental</b>	87 B	<b>% DER&lt;TER</b>	8.91		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.86	<b>DFEE</b>	50.16	<b>TFEE</b>	58.02
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	13.55		
<b>Assessor Details</b>	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			<b>Assessor ID</b>	4907-0015
<b>Client</b>	TW North Thames, Taylor Wimpey				

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### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Ground-floor flat, total floor area 51 m<sup>2</sup>

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) 21.85 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 19.90 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.0 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)50.2 kWh/m<sup>2</sup>/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 ESPl 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: 3.99 m<sup>2</sup>, No overhang

Windows facing South East: 2.52 m<sup>2</sup>, No overhang

Windows facing South West: 1.27 m<sup>2</sup>, No overhang

Air change rate: 3.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K

Door U-value 1.08 W/m<sup>2</sup>K

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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	50.6200 (1b)	2.3900 (2b)	120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	120.9818 (5)

#### 2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised	0.5000 (23a)											
If mechanical ventilation:	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 (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			50.6200	0.1500	7.5930	75.0000	3796.5000 (28a)
External Wall	57.9400	7.7800	50.1600	0.2500	12.5400	52.8000	2648.4480 (29a)
External Wall to Corridor	3.2100	2.1200	1.0900	0.2200	0.2398	52.8000	57.5520 (29a)
External Wall to Stairwell	12.3200		12.3200	0.2000	2.4640	52.8000	650.4960 (29a)
Total net area of external elements Aum(A, m2)			124.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.4408		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32b)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			11804.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.2010 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3001 (36)
Total fabric heat loss						(33) + (36) =	40.7409 (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	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620 (38)
Average = Sum(39)m / 12 =	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029 (39)
HLP	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992 (40)
HLP (average)	1.1992 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy	1.7084 (42)											
Average daily hot water use (litres/day)	74.7737 (43)											
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (45)

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### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1176.4816 (45)
Distribution loss (46)m = 0.15 x (45)m													
	18.2964	16.0021	16.5128	14.3962	13.8135	11.9200	11.0457	12.6751	12.8264	14.9480	16.3169	17.7191	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	13.9973	12.6282	13.9581	13.4816	13.9119	13.4411	13.8755	13.8991	13.4632	13.9390	13.5197	13.9897	(61)
Total heat required for water heating calculated for each month	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	(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	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	(64)
Total per year (kWh/year) = Sum(64)m =												1340.5861 (64)	
Heat gains from water heating, kWh/month	44.0563	38.6285	40.0928	35.2821	34.0980	29.7830	27.9534	31.5712	31.7977	36.6194	39.5490	42.7747	(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	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9565	12.3961	10.0812	7.6321	5.7051	4.8165	5.2044	6.7648	9.0797	11.5288	13.4558	14.3444	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.8441	150.3886	146.4965	138.2105	127.7509	117.9204	111.3530	109.8084	113.7006	121.9866	132.4462	142.2767	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	(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)	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	(71)
Water heating gains (Table 5)	59.2155	57.4828	53.8882	49.0029	45.8306	41.3653	37.5718	42.4343	44.1635	49.2197	54.9292	57.4929	(72)
Total internal gains	273.6417	271.8931	262.0914	246.4709	230.9121	215.7276	205.7546	210.6331	218.5694	234.3606	252.4567	265.7396	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)							
Southwest	1.2700	36.7938	0.4300	0.0000	0.7700	15.4717 (79)							
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (77)							
Solar gains	61.0772	108.9882	162.2734	223.1076	270.0191	276.9165	263.2940	226.9430	183.1273	124.0010	74.0581	51.6859	(83)
Total gains	334.7189	380.8812	424.3647	469.5786	500.9311	492.6441	469.0487	437.5761	401.6966	358.3616	326.5148	317.4255	(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	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	
alpha	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	
util living area	0.9959	0.9920	0.9816	0.9499	0.8668	0.7126	0.5502	0.6063	0.8382	0.9667	0.9922	0.9968	(86)
MIT	19.6793	19.8364	20.1001	20.4401	20.7470	20.9273	20.9825	20.9730	20.8405	20.4470	19.9910	19.6347	(87)
Th 2	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	(88)
util rest of house	0.9946	0.9894	0.9755	0.9322	0.8199	0.6199	0.4247	0.4790	0.7651	0.9514	0.9892	0.9958	(89)
MIT 2	18.1714	18.3999	18.7815	19.2632	19.6696	19.8706	19.9139	19.9089	19.7899	19.2814	18.6264	18.1063	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	18.9134	19.1068	19.4304	19.8423	20.1998	20.3906	20.4398	20.4326	20.3069	19.8550	19.2979	18.8584	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9134	19.1068	19.4304	19.8423	20.1998	20.3906	20.4398	20.4326	20.3069	19.8550	19.2979	18.8584	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	332.3574	375.8793	412.4779	437.0061	417.4718	326.4131	228.2930	237.0395	319.0261	340.5289	322.2526	315.6405	(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	887.0780	862.3906	784.9117	664.2309	515.9624	351.5079	233.0843	244.7879	376.7776	561.8055	740.4502	889.8067	(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	412.7121	326.9356	277.0908	163.6019	73.2770	0.0000	0.0000	0.0000	0.0000	164.6298	301.1022	427.1797	(98)
Space heating												2146.5291 (98)	
Space heating per m <sup>2</sup>												(98) / (4) =	
												42.4048 (99)	

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### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2295.7530 (211)
Space heating requirement	412.7121	326.9356	277.0908	163.6019	73.2770	0.0000	0.0000	0.0000	0.0000	164.6298	301.1022	427.1797	(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)	441.4033	349.6637	296.3538	174.9753	78.3711	0.0000	0.0000	0.0000	0.0000	176.0746	322.0345	456.8766	(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	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	(64)
Efficiency of water heater (217)m	89.6853	89.6217	89.4857	89.1895	88.5802	87.3000	87.3000	87.3000	87.3000	89.1656	89.5518	89.7231	(217)
Fuel for water heating, kWh/month	151.6116	133.1253	138.6180	122.7236	119.6680	106.4239	100.2443	112.7142	113.3709	127.3946	136.5678	147.2496	(219)
Water heating fuel used													1509.7117 (219)
Annual totals kWh/year													
Space heating fuel - main system													2295.7530 (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)													35.7257 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.7257 (231)
Electricity for lighting (calculated in Appendix L)													246.4768 (232)
Total delivered energy for all uses													4162.6672 (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	2295.7530	0.2160	495.8827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1509.7117	0.2160	326.0977 (264)
Space and water heating			821.9804 (265)
Pumps and fans	110.7257	0.5190	57.4666 (267)
Energy for lighting	246.4768	0.5190	127.9214 (268)
Total CO2, kg/year			1007.3685 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.9000 (273)

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

DER			19.9000 ZC1
Total Floor Area		TFA	50.6200
Assumed number of occupants		N	1.7084
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			17.4243 ZC2
CO2 emissions from cooking, equation (L16)			3.1608 ZC3
Total CO2 emissions			40.4851 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			40.4851 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	50.6200 (1b)	2.3900 (2b)	120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	120.9818 (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) =	0.1653 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4153 (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) =	0.3530 (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	0.4501	0.4413	0.4324	0.3883	0.3795	0.3354	0.3354	0.3265	0.3530	0.3795	0.3971	0.4148 (22b)
	0.6013	0.5974	0.5935	0.5754	0.5720	0.5562	0.5562	0.5533	0.5623	0.5720	0.5789	0.5860 (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)			7.7800	1.3258	10.3144		(27)					
Jetfloor Grey			50.6200	0.1300	6.5806		(28a)					
External Wall	57.9400	7.7800	50.1600	0.1800	9.0288		(29a)					
External Wall to Corridor	3.2100	2.1200	1.0900	0.1800	0.1962		(29a)					
External Wall to Stairwell	12.3200		12.3200	0.1800	2.2176		(29a)					
Total net area of external elements Aum(A, m2)			124.0900				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	30.4576	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6978 (36)					
Total fabric heat loss						(33) + (36) =	39.1554 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	24.0060	23.8490	23.6951	22.9721	22.8368	22.2071	22.2071	22.0905	22.4497	22.8368	23.1105	23.3966 (38)
Heat transfer coeff	63.1614	63.0044	62.8505	62.1275	61.9922	61.3625	61.3625	61.2459	61.6051	61.9922	62.2659	62.5519 (39)
Average = Sum(39)m / 12 =												62.1268 (39)
HLP	1.2478	1.2447	1.2416	1.2273	1.2247	1.2122	1.2122	1.2099	1.2170	1.2247	1.2301	1.2357 (40)
HLP (average)												1.2273 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (45)
Energy content (annual)												Total = Sum(45)m = 1176.4816 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	18.2964	16.0021	16.5128	14.3962	13.8135	11.9200	11.0457	12.6751	12.8264	14.9480	16.3169	17.7191 (46)
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												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	41.9142	36.4814	38.8659	36.1372	35.8176	33.1872	34.2935	35.8176	36.1372	38.8659	39.0872	41.9142	41.9142	41.9142	41.9142	41.9142	41.9142	41.9142	(61)
Solar input	163.8902	143.1623	148.9511	132.1122	127.9079	112.6541	107.9312	120.3180	121.6468	138.5191	147.8664	160.0415	160.0415	160.0415	160.0415	160.0415	160.0415	160.0415	(62)
Output from w/h	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	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Heat gains from water heating, kWh/month	163.8902	143.1623	148.9511	132.1122	127.9079	112.6541	107.9312	120.3180	121.6468	138.5191	147.8664	160.0415	160.0415	160.0415	160.0415	160.0415	160.0415	160.0415	(64)
	51.0356	44.5918	46.3198	40.9460	39.5744	34.7195	33.0579	37.0508	37.4662	42.8512	45.9409	49.7559	49.7559	49.7559	49.7559	49.7559	49.7559	49.7559	(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)
(66)m	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9565	12.3961	10.0812	7.6321	5.7051	4.8165	5.2044	6.7648	9.0797	11.5288	13.4558	14.3444	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.8441	150.3886	146.4965	138.2105	127.7509	117.9204	111.3530	109.8084	113.7006	121.9866	132.4462	142.2767	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	(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)	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	(71)
Water heating gains (Table 5)	68.5962	66.3568	62.2578	56.8694	53.1914	48.2216	44.4327	49.7994	52.0364	57.5957	63.8068	66.8762	(72)
Total internal gains	283.0223	280.7670	270.4609	254.3375	238.2729	222.5839	212.6155	217.9982	226.4423	242.7366	261.3343	275.1228	(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	3.9900	11.2829	0.6300	0.7000	0.7700	13.7584	(75)						
Southeast	2.5200	36.7938	0.6300	0.7000	0.7700	28.3366	(77)						
Southwest	1.2700	36.7938	0.6300	0.7000	0.7700	14.2807	(79)						
Solar gains	56.3757	100.5986	149.7821	205.9335	249.2339	255.6004	243.0265	209.4737	169.0307	114.4558	68.3573	47.7073	(83)
Total gains	339.3980	381.3656	420.2430	460.2710	487.5068	478.1843	455.6420	427.4719	395.4730	357.1924	329.6916	322.8301	(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	55.6554	55.7942	55.9308	56.5817	56.7051	57.2870	57.2870	57.3961	57.0615	56.7051	56.4559	56.1977	56.1977	(86)
alpha	4.7104	4.7196	4.7287	4.7721	4.7803	4.8191	4.8191	4.8264	4.8041	4.7803	4.7637	4.7465	4.7465	
util living area	0.9967	0.9938	0.9860	0.9604	0.8884	0.7379	0.5722	0.6261	0.8562	0.9726	0.9937	0.9974	0.9974	(86)
MIT	19.6939	19.8412	20.0931	20.4334	20.7375	20.9269	20.9830	20.9742	20.8415	20.4558	20.0164	19.6685	19.6685	(87)
Th 2	19.8820	19.8844	19.8869	19.8982	19.9003	19.9102	19.9102	19.9121	19.9064	19.9003	19.8960	19.8915	19.8915	(88)
util rest of house	0.9956	0.9917	0.9809	0.9448	0.8438	0.6431	0.4407	0.4939	0.7837	0.9588	0.9912	0.9966	0.9966	(89)
MIT 2	18.1566	18.3728	18.7398	19.2325	19.6403	19.8610	19.9040	19.9014	19.7782	19.2728	18.6373	18.1261	18.1261	(90)
Living area fraction									fLA = Living area / (4) =			0.4921	0.4921	(91)
MIT	18.9131	19.0954	19.4057	19.8235	20.1802	20.3855	20.4350	20.4293	20.3014	19.8550	19.3160	18.8851	18.8851	(92)
Temperature adjustment												0.0000	0.0000	
adjusted MIT	18.9131	19.0954	19.4057	19.8235	20.1802	20.3855	20.4350	20.4293	20.3014	19.8550	19.3160	18.8851	18.8851	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9943	0.9897	0.9780	0.9436	0.8566	0.6871	0.5059	0.5594	0.8131	0.9581	0.9894	0.9955	(94)
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	922.9840	894.3705	811.1311	678.6471	525.7092	355.0156	235.3237	246.7796	382.0391	573.7356	760.6375	918.5836	(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	435.6269	347.3912	297.7027	175.9379	80.4166	0.0000	0.0000	0.0000	0.0000	172.2377	312.8083	444.3320	(98)
Space heating												2266.4533	(98)
Space heating per m2										(98) / (4) =		44.7739	(99)

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2426.6095 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	435.6269	347.3912	297.7027	175.9379	80.4166	0.0000	0.0000	0.0000	0.0000	172.2377	312.8083	444.3320	(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)	466.4100	371.9392	318.7395	188.3703	86.0992	0.0000	0.0000	0.0000	0.0000	184.4087	334.9125	475.7301	(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	163.8902	143.1623	148.9511	132.1122	127.9079	112.6541	107.9312	120.3180	121.6468	138.5191	147.8664	160.0415	(64)
Efficiency of water heater (217)m	87.3950	87.1992	86.7608	85.7732	83.9193	80.3000	80.3000	80.3000	80.3000	85.6008	86.8920	80.3000	(216)
Fuel for water heating, kWh/month	187.5281	164.1785	171.6802	154.0249	152.4178	140.2915	134.4100	149.8356	151.4904	161.8200	170.1727	182.9336	(219)
Water heating fuel used												1920.7834	(219)
Annual totals kWh/year													
Space heating fuel - main system													2426.6095 (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)													246.4768 (232)
Total delivered energy for all uses													4668.8696 (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	2426.6095	0.2160	524.1477 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.7834	0.2160	414.8892 (264)
Space and water heating			939.0369 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	246.4768	0.5190	127.9214 (268)
Total CO2, kg/m2/year			1105.8833 (272)
Emissions per m2 for space and water heating			18.5507 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5271 (272b)
Emissions per m2 for pumps and fans			0.7690 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.5507 * 1.00) + 2.5271 + 0.7690, rounded to 2 d.p.			21.8500 (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	50.6200 (1b)	x 2.3900 (2b)	= 120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.9818 (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) =	0.1653 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3653	(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) =		0.3105 (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	0.3959	0.3881	0.3804	0.3416	0.3338	0.2950	0.2950	0.2872	0.3105	0.3338	0.3493	0.3649 (22b)
Effective ac	0.5784	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5413	0.5482	0.5557	0.5610	0.5666 (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)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			50.6200	0.1500	7.5930	75.0000	3796.5000 (28a)
External Wall	57.9400	7.7800	50.1600	0.2500	12.5400	52.8000	2648.4480 (29a)
External Wall to Corridor	3.2100	2.1200	1.0900	0.2200	0.2398	52.8000	57.5520 (29a)
External Wall to Stairwell	12.3200		12.3200	0.2000	2.4640	52.8000	650.4960 (29a)
Total net area of external elements Aum(A, m2)			124.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.4408		(33)
E-FC-4			50.6200			30.0000	1518.6000 (32b)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9779.8360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.2010 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3001 (36)
Total fabric heat loss						(33) + (36) =	40.7409 (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	23.0909	22.9694	22.8503	22.2909	22.1863	21.6991	21.6991	21.6089	21.8867	22.1863	22.3980	22.6194 (38)
Heat transfer coeff	63.8318	63.7103	63.5912	63.0318	62.9271	62.4399	62.4399	62.3497	62.6276	62.9271	63.1389	63.3602 (39)
Average = Sum(39)m / 12 =												63.0313 (39)
HLP	1.2610	1.2586	1.2562	1.2452	1.2431	1.2335	1.2335	1.2317	1.2372	1.2431	1.2473	1.2517 (40)
HLP (average)												1.2452 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (45)
Energy content (annual)										Total = Sum(45)m =		1176.4816 (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	25.9199	22.6697	23.3931	20.3947	19.5692	16.8867	15.6480	17.9563	18.1708	21.1763	23.1156	25.1020	(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	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	85.4183	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.9565	12.3961	10.0812	7.6321	5.7051	4.8165	5.2044	6.7648	9.0797	11.5288	13.4558	14.3444	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.8441	150.3886	146.4965	138.2105	127.7509	117.9204	111.3530	109.8084	113.7006	121.9866	132.4462	142.2767	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	31.5418	(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)	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	(71)
Water heating gains (Table 5)	34.8386	33.7347	31.4423	28.3259	26.3027	23.4538	21.0323	24.1349	25.2372	28.4628	32.1050	33.7393	(72)
Total internal gains	246.2647	245.1449	236.6455	222.7940	208.3841	194.8161	186.2151	189.3336	196.6431	210.6037	226.6325	238.9859	(73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058	(75)						
Southwest	1.2700	36.7938	0.4300	0.0000	0.7700	15.4717	(79)						
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997	(77)						
Solar gains	61.0772	108.9882	162.2734	223.1076	270.0191	276.9165	263.2940	226.9430	183.1273	124.0010	74.0581	51.6859	(83)
Total gains	307.3419	354.1331	398.9188	445.9016	478.4032	471.7326	449.5092	416.2766	379.7703	334.6047	300.6905	290.6719	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (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)	42.5591	42.6402	42.7201	43.0992	43.1709	43.5077	43.5077	43.5707	43.3774	43.1709	43.0261	42.8758	(85)
tau	3.8373	3.8427	3.8480	3.8733	3.8781	3.9005	3.9005	3.9047	3.8918	3.8781	3.8684	3.8584	
alpha	0.9940	0.9889	0.9770	0.9440	0.8665	0.7253	0.5729	0.6294	0.8435	0.9623	0.9895	0.9951	(86)
util living area	19.3215	19.5083	19.8239	20.2431	20.6218	20.8724	20.9618	20.9449	20.7520	20.2634	19.7159	19.2856	(87)
MIT	19.8715	19.8734	19.8753	19.8840	19.8857	19.8933	19.8933	19.8947	19.8903	19.8857	19.8823	19.8789	(88)
Th 2	0.9923	0.9859	0.9704	0.9267	0.8233	0.6372	0.4455	0.5026	0.7768	0.9473	0.9861	0.9938	(89)
util rest of house	18.3509	18.5378	18.8514	19.2658	19.6170	19.8268	19.8813	19.8755	19.7403	19.2933	18.7522	18.3207	(90)
MIT 2	18.8285	19.0154	19.3300	19.7467	20.1115	20.3413	20.4130	20.4017	20.2382	19.7707	19.2264	18.7955	(92)
Living area fraction	18.8285	19.0154	19.3300	19.7467	20.1115	20.3413	20.4130	20.4017	20.2382	19.7707	19.2264	18.7955	(91)
MIT	18.8285	19.0154	19.3300	19.7467	20.1115	20.3413	20.4130	20.4017	20.2382	19.7707	19.2264	18.7955	(92)
Temperature adjustment	18.8285	19.0154	19.3300	19.7467	20.1115	20.3413	20.4130	20.4017	20.2382	19.7707	19.2264	18.7955	(93)
adjusted MIT	18.8285	19.0154	19.3300	19.7467	20.1115	20.3413	20.4130	20.4017	20.2382	19.7707	19.2264	18.7955	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	304.3609	348.0893	385.5105	412.0644	398.5704	318.6031	228.2607	234.7635	303.9635	316.3433	295.7258	288.3718	(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	927.3808	899.2954	815.8721	683.6879	529.3112	358.4889	238.0851	249.5067	384.4184	577.0861	765.6470	924.7767	(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	463.5268	370.4105	320.1890	195.5689	97.2712	0.0000	0.0000	0.0000	0.0000	193.9927	338.3432	473.4853	(98)
Space heating												2452.7875	(98)
Space heating per m2												48.4549	(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	586.9354	462.0556	473.8578	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8149	0.8799	0.8516	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	478.2874	406.5410	403.5296	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	616.2900	589.1138	551.3241	0.0000	0.0000	0.0000	0.0000	(103)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	99.3618	135.8342	109.9591	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												345.1551 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
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												
Space cooling per m2	0.0000	0.0000	0.0000	0.0000	0.0000	24.8405	33.9586	27.4898	0.0000	0.0000	0.0000	0.0000 (107)
Energy for space heating												86.2888 (107)
Energy for space cooling												1.7046 (108)
Total												48.4549 (99)
Dwelling Fabric Energy Efficiency (DFEE)												1.7046 (108)
												50.1595 (109)
												50.2 (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	50.6200 (1b)	2.3900 (2b)	120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	120.9818 (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) =	0.1653 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4153 (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) =	0.3530 (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	0.4501	0.4413	0.4324	0.3883	0.3795	0.3354	0.3354	0.3265	0.3530	0.3795	0.3971	0.4148 (22b)
Effective ac	0.6013	0.5974	0.5935	0.5754	0.5720	0.5562	0.5562	0.5533	0.5623	0.5720	0.5789	0.5860 (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)			7.7800	1.3258	10.3144		(27)					
Jetfloor Grey			50.6200	0.1300	6.5806		(28a)					
External Wall	57.9400	7.7800	50.1600	0.1800	9.0288		(29a)					
External Wall to Corridor	3.2100	2.1200	1.0900	0.1800	0.1962		(29a)					
External Wall to Stairwell	12.3200		12.3200	0.1800	2.2176		(29a)					
Total net area of external elements Aum(A, m2)			124.0900				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	30.4576	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6978 (36)					
Total fabric heat loss							(33) + (36) =					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.0060	23.8490	23.6951	22.9721	22.8368	22.2071	22.2071	22.0905	22.4497	22.8368	23.1105	23.3966 (38)
Heat transfer coeff	63.1614	63.0044	62.8505	62.1275	61.9922	61.3625	61.3625	61.2459	61.6051	61.9922	62.2659	62.5519 (39)
Average = Sum(39)m / 12 =												62.1268 (39)
HLP	1.2478	1.2447	1.2416	1.2273	1.2247	1.2122	1.2122	1.2099	1.2170	1.2247	1.2301	1.2357 (40)
HLP (average)												1.2273 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m												1176.4816 (45)
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 (46)
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 (56)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	19.4092	28.7281	22.7365	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											70.8737 (107)	
Space cooling per m2											1.4001 (108)	
Energy for space heating											49.0520 (99)	
Energy for space cooling											1.4001 (108)	
Total											50.4521 (109)	
Target Fabric Energy Efficiency (TFEE)											58.0 (109)	

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# 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	50.6200 (1b)	2.3900 (2b)	120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	120.9818 (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)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			50.6200	0.1500	7.5930	75.0000	3796.5000 (28a)
External Wall	57.9400	7.7800	50.1600	0.2500	12.5400	52.8000	2648.4480 (29a)
External Wall to Corridor	3.2100	2.1200	1.0900	0.2200	0.2398	52.8000	57.5520 (29a)
External Wall to Stairwell	12.3200		12.3200	0.2000	2.4640	52.8000	650.4960 (29a)
Total net area of external elements Aum(A, m2)			124.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.4408		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32b)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11804.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.2010 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3001 (36)
Total fabric heat loss						(33) + (36) =	40.7409 (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	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620 (38)
Average = Sum(39)m / 12 =	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029 (39)
HLP	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992 (40)
HLP (average)												1.1992 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (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 =	1176.4816 (45)
Distribution loss (46)m = 0.15 x (45)m														
	18.2964	16.0021	16.5128	14.3962	13.8135	11.9200	11.0457	12.6751	12.8264	14.9480	16.3169	17.7191	17.7191	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	13.9973	12.6282	13.9581	13.4816	13.9119	13.4411	13.8755	13.8991	13.4632	13.9390	13.5197	13.9897	13.9897	(61)
Total heat required for water heating calculated for each month	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	132.1170	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	132.1170	(64)
RHI water heating demand													Total per year (kWh/year) = Sum(64)m =	1340.5861 (64)
Heat gains from water heating, kWh/month	44.0563	38.6285	40.0928	35.2821	34.0980	29.7830	27.9534	31.5712	31.7977	36.6194	39.5490	42.7747	42.7747	(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	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.8913	30.9902	25.2029	19.0802	14.2627	12.0412	13.0109	16.9121	22.6993	28.8220	33.6395	35.8611	35.8611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.1554	224.4607	218.6514	206.2843	190.6730	176.0005	166.1985	163.8932	169.7024	182.0696	197.6809	212.3533	212.3533	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	(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)	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	(71)
Water heating gains (Table 5)	59.2155	57.4828	53.8882	49.0029	45.8306	41.3653	37.5718	42.4343	44.1635	49.2197	54.9292	57.4929	57.4929	(72)
Total internal gains	400.3881	397.0596	381.8685	358.4933	334.8922	313.5329	300.9071	307.3655	320.6912	344.2371	370.3755	389.8332	389.8332	(73)

#### 6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast		3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)							
Southwest		1.2700	40.9830	0.4300	0.0000	0.7700	17.2332 (79)							
Southeast		2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (77)							
Solar gains	68.5319	114.1591	167.5327	242.7200	283.8459	303.4504	285.6526	247.9292	200.6497	135.8634	85.1682	57.4113	57.4113	(83)
Total gains	468.9200	511.2187	549.4012	601.2133	618.7381	616.9833	586.5596	555.2946	521.3409	480.1006	455.5437	447.2445	447.2445	(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	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	
alpha	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	
util living area	0.9828	0.9734	0.9480	0.8769	0.7399	0.5344	0.3500	0.3692	0.6519	0.8909	0.9674	0.9856	0.9856	(86)
MIT	19.9740	20.1042	20.3614	20.6683	20.8870	20.9802	20.9979	20.9973	20.9528	20.6991	20.2883	19.9351	19.9351	(87)
Th 2	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	(88)
util rest of house	0.9778	0.9657	0.9326	0.8417	0.6727	0.4388	0.2399	0.2533	0.5532	0.8506	0.9562	0.9814	0.9814	(89)
MIT 2	18.5974	18.7838	19.1475	19.5609	19.8234	19.9101	19.9202	19.9201	19.8914	19.6112	19.0501	18.5418	18.5418	(90)
Living area fraction													fLA = Living area / (4) =	0.4921 (91)
MIT	19.2748	19.4336	19.7449	20.1059	20.3468	20.4367	20.4505	20.4502	20.4137	20.1466	19.6594	19.2274	19.2274	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.2748	19.4336	19.7449	20.1059	20.3468	20.4367	20.4505	20.4502	20.4137	20.1466	19.6594	19.2274	19.2274	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9739	0.9615	0.9297	0.8484	0.7007	0.4855	0.2942	0.3106	0.6002	0.8602	0.9529	0.9778	0.9778	(94)
Useful gains	456.6979	491.5163	510.7520	510.0577	433.5352	299.5231	172.5913	172.4583	312.9094	412.9694	434.0857	437.3278	437.3278	(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	884.7332	864.0194	773.6489	643.8070	476.3230	305.7430	173.0353	173.0160	328.6264	530.9423	725.9687	881.8551	881.8551	(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	318.4583	250.3220	195.5953	96.2995	31.8341	0.0000	0.0000	0.0000	0.0000	87.7719	210.1558	330.7283	330.7283	(98)
Space heating													1521.1651 (98)	
RHI space heating demand													1521 (98)	



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



**CALCULATION OF HEAT DEMAND 09 Jan 2014**

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.6200 (1b)	2.3900 (2b)	120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	120.9818 (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 (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			50.6200	0.1500	7.5930	75.0000	3796.5000 (28a)
External Wall	57.9400	7.7800	50.1600	0.2500	12.5400	52.8000	2648.4480 (29a)
External Wall to Corridor	3.2100	2.1200	1.0900	0.2200	0.2398	52.8000	57.5520 (29a)
External Wall to Stairwell	12.3200		12.3200	0.2000	2.4640	52.8000	650.4960 (29a)
Total net area of external elements Aum(A, m2)			124.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.4408		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32b)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11804.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.2010 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3001 (36)
Total fabric heat loss						(33) + (36) =	40.7409 (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	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620 (38)
Average = Sum(39)m / 12 =	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029 (39)
HLP	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992 (40)
HLP (average)												1.1992 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (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 =	1176.4816 (45)
Distribution loss (46)m = 0.15 x (45)m														
	18.2964	16.0021	16.5128	14.3962	13.8135	11.9200	11.0457	12.6751	12.8264	14.9480	16.3169	17.7191	17.7191	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	13.9973	12.6282	13.9581	13.4816	13.9119	13.4411	13.8755	13.8991	13.4632	13.9390	13.5197	13.9897	13.9897	(61)
Total heat required for water heating calculated for each month	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	132.1170	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	132.1170	(64)
Heat gains from water heating, kWh/month	44.0563	38.6285	40.0928	35.2821	34.0980	29.7830	27.9534	31.5712	31.7977	36.6194	39.5490	42.7747	42.7747	(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	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.8913	30.9902	25.2029	19.0802	14.2627	12.0412	13.0109	16.9121	22.6993	28.8220	33.6395	35.8611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.1554	224.4607	218.6514	206.2843	190.6730	176.0005	166.1985	163.8932	169.7024	182.0696	197.6809	212.3533	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	(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)	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	(71)
Water heating gains (Table 5)	59.2155	57.4828	53.8882	49.0029	45.8306	41.3653	37.5718	42.4343	44.1635	49.2197	54.9292	57.4929	(72)
Total internal gains	400.3881	397.0596	381.8685	358.4933	334.8922	313.5329	300.9071	307.3655	320.6912	344.2371	370.3755	389.8332	(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	11.2829	0.4300	0.0000	0.7700	14.9058 (75)							
Southwest	1.2700	36.7938	0.4300	0.0000	0.7700	15.4717 (79)							
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (77)							
Solar gains	61.0772	108.9882	162.2734	223.1076	270.0191	276.9165	263.2940	226.9430	183.1273	124.0010	74.0581	51.6859	(83)
Total gains	461.4653	506.0478	544.1418	581.6009	604.9112	590.4494	564.2011	534.3085	503.8184	468.2381	444.4336	441.5191	(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	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	
alpha	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	
util living area	0.9852	0.9761	0.9552	0.9025	0.7920	0.6217	0.4653	0.5097	0.7384	0.9196	0.9745	0.9878	(86)
MIT	19.9148	20.0617	20.3004	20.5931	20.8341	20.9584	20.9911	20.9866	20.9091	20.6104	20.2029	19.8671	(87)
Th 2	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	(88)
util rest of house	0.9810	0.9692	0.9421	0.8738	0.7346	0.5310	0.3553	0.3964	0.6539	0.8896	0.9660	0.9843	(89)
MIT 2	18.5119	18.7229	19.0620	19.4635	19.7654	19.8938	19.9174	19.9152	19.8527	19.4963	18.9286	18.4432	(90)
Living area fraction													fLA = Living area / (4) =
MIT	19.2023	19.3817	19.6714	20.0194	20.2913	20.4177	20.4458	20.4424	20.3725	20.0446	19.5557	19.1439	(91)
Temperature adjustment													0.0000
adjusted MIT	19.2023	19.3817	19.6714	20.0194	20.2913	20.4177	20.4458	20.4424	20.3725	20.0446	19.5557	19.1439	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	451.0107	488.3254	510.6789	509.9109	457.1365	339.0233	231.0729	241.6425	348.3765	418.3930	427.6912	433.1214	(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	904.6102	879.0820	799.5426	674.9795	521.5157	353.1519	233.4498	245.3879	380.7612	573.3111	756.0955	907.1366	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	337.4781	262.5884	214.9145	118.8494	47.8981	0.0000	0.0000	0.0000	0.0000	115.2591	236.4511	352.6673	(98)
Space heating													1686.1060 (98)
Space heating per m2													(98) / (4) =
													33.3091 (99)

# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1803.3220 (211)
Space heating requirement	337.4781	262.5884	214.9145	118.8494	47.8981	0.0000	0.0000	0.0000	0.0000	115.2591	236.4511	352.6673	(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)	360.9391	280.8432	229.8551	127.1117	51.2280	0.0000	0.0000	0.0000	0.0000	123.2717	252.8889	377.1843	(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	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	(64)
Efficiency of water heater (217)m	89.5572	89.4754	89.3021	88.9371	88.2714	87.3000	87.3000	87.3000	87.3000	88.8829	89.3831	89.6049	(216)
Fuel for water heating, kWh/month	151.8284	133.3430	138.9030	123.0719	120.0866	106.4239	100.2443	112.7142	113.3709	127.7999	136.8256	147.4439	(219)
Water heating fuel used													1512.0556 (219)
Annual totals kWh/year													
Space heating fuel - main system													1803.3220 (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)													35.7257 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.7257 (231)
Electricity for lighting (calculated in Appendix L)													246.4768 (232)
Total delivered energy for all uses													3672.5800 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1803.3220	3.4800	62.7556 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1512.0556	3.4800	52.6195 (247)
Mechanical ventilation fans	35.7257	13.1900	4.7122 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	246.4768	13.1900	32.5103 (250)
Additional standing charges			120.0000 (251)
Total energy cost			282.4901 (255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2408 (257)
SAP value		82.6908
SAP rating (Section 12)		83 (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	1803.3220	0.2160	389.5175 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1512.0556	0.2160	326.6040 (264)
Space and water heating			716.1216 (265)
Pumps and fans	110.7257	0.5190	57.4666 (267)
Energy for lighting	246.4768	0.5190	127.9214 (268)
Total kg/year			901.5096 (272)
CO2 emissions per m2			17.8100 (273)
EI value			87.3664
EI rating			87 (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

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# 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	50.6200 (1b)	x 2.3900 (2b)	= 120.9818 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.9818 (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:												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 (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			50.6200	0.1500	7.5930	75.0000	3796.5000 (28a)
External Wall	57.9400	7.7800	50.1600	0.2500	12.5400	52.8000	2648.4480 (29a)
External Wall to Corridor	3.2100	2.1200	1.0900	0.2200	0.2398	52.8000	57.5520 (29a)
External Wall to Stairwell	12.3200		12.3200	0.2000	2.4640	52.8000	650.4960 (29a)
Total net area of external elements Aum(A, m2)			124.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.4408		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32b)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11804.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.2010 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3001 (36)
Total fabric heat loss						(33) + (36) =	40.7409 (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	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620	19.9620 (38)
Average = Sum(39)m / 12 =	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029	60.7029 (39)
HLP	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992	1.1992 (40)
HLP (average)												1.1992 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	82.2511	79.2601	76.2692	73.2782	70.2873	67.2963	67.2963	70.2873	73.2782	76.2692	79.2601	82.2511 (44)
Energy conte	121.9760	106.6810	110.0852	95.9749	92.0902	79.4669	73.6377	84.5004	85.5096	99.6532	108.7792	118.1272 (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 =	1176.4816 (45)
Distribution loss (46)m = 0.15 x (45)m														
	18.2964	16.0021	16.5128	14.3962	13.8135	11.9200	11.0457	12.6751	12.8264	14.9480	16.3169	17.7191	17.7191	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	13.9973	12.6282	13.9581	13.4816	13.9119	13.4411	13.8755	13.8991	13.4632	13.9390	13.5197	13.9897	13.9897	(61)
Total heat required for water heating calculated for each month	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	132.1170	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	132.1170	(64)
Heat gains from water heating, kWh/month	44.0563	38.6285	40.0928	35.2821	34.0980	29.7830	27.9534	31.5712	31.7977	36.6194	39.5490	42.7747	42.7747	(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	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	102.5020	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.8913	30.9902	25.2029	19.0802	14.2627	12.0412	13.0109	16.9121	22.6993	28.8220	33.6395	35.8611	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	222.1554	224.4607	218.6514	206.2843	190.6730	176.0005	166.1985	163.8932	169.7024	182.0696	197.6809	212.3533	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	46.9586	(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)	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	-68.3347	(71)
Water heating gains (Table 5)	59.2155	57.4828	53.8882	49.0029	45.8306	41.3653	37.5718	42.4343	44.1635	49.2197	54.9292	57.4929	(72)
Total internal gains	400.3881	397.0596	381.8685	358.4933	334.8922	313.5329	300.9071	307.3655	320.6912	344.2371	370.3755	389.8332	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	Specific data	Specific data	Access	Gains							
	m <sup>2</sup>	Table 6a	g	Table 6c	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)							
Southwest	1.2700	40.9830	0.4300	0.0000	0.7700	17.2332 (79)							
Southeast	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (77)							
Solar gains	68.5319	114.1591	167.5327	242.7200	283.8459	303.4504	285.6526	247.9292	200.6497	135.8634	85.1682	57.4113	(83)
Total gains	468.9200	511.2187	549.4012	601.2133	618.7381	616.9833	586.5596	555.2946	521.3409	480.1006	455.5437	447.2445	(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	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183	54.0183
alpha	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012	4.6012
util living area	0.9828	0.9734	0.9480	0.8769	0.7399	0.5344	0.3500	0.3692	0.6519	0.8909	0.9674	0.9856	(86)
MIT	19.9740	20.1042	20.3614	20.6683	20.8870	20.9802	20.9979	20.9973	20.9528	20.6991	20.2883	19.9351	(87)
Th 2	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	19.9207	(88)
util rest of house	0.9778	0.9657	0.9326	0.8417	0.6727	0.4388	0.2399	0.2533	0.5532	0.8506	0.9562	0.9814	(89)
MIT 2	18.5974	18.7838	19.1475	19.5609	19.8234	19.9101	19.9202	19.9201	19.8914	19.6112	19.0501	18.5418	(90)
Living area fraction	19.2748	19.4336	19.7449	20.1059	20.3468	20.4367	20.4505	20.4502	20.4137	20.1466	19.6594	19.2274	(92)
MIT	19.2748	19.4336	19.7449	20.1059	20.3468	20.4367	20.4505	20.4502	20.4137	20.1466	19.6594	19.2274	(93)
Temperature adjustment													0.0000
adjusted MIT	19.2748	19.4336	19.7449	20.1059	20.3468	20.4367	20.4505	20.4502	20.4137	20.1466	19.6594	19.2274	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	456.6979	491.5163	510.7520	510.0577	433.5352	299.5231	172.5913	172.4583	312.9094	412.9694	434.0857	437.3278	(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	884.7332	864.0194	773.6489	643.8070	476.3230	305.7430	173.0353	173.0160	328.6264	530.9423	725.9687	881.8551	(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	318.4583	250.3220	195.5953	96.2995	31.8341	0.0000	0.0000	0.0000	0.0000	87.7719	210.1558	330.7283	(98)
Space heating												1521.1651	(98)
Space heating per m2												30.0507	(99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

#### 8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1626.9146 (211)
Space heating requirement	318.4583	250.3220	195.5953	96.2995	31.8341	0.0000	0.0000	0.0000	0.0000	87.7719	210.1558	330.7283	(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)	340.5971	267.7241	209.1928	102.9941	34.0471	0.0000	0.0000	0.0000	0.0000	93.8737	224.7655	353.7201	(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	135.9733	119.3092	124.0433	109.4565	106.0022	92.9080	87.5132	98.3995	98.9728	113.5922	122.2990	132.1170	(64)
Efficiency of water heater (217)m	89.5182	89.4418	89.2307	88.7690	88.0188	87.3000	87.3000	87.3000	87.3000	88.6666	89.2959	89.5629	(216)
Fuel for water heating, kWh/month	151.8946	133.3931	139.0141	123.3048	120.4313	106.4239	100.2443	112.7142	113.3709	128.1116	136.9592	147.5130	(219)
Water heating fuel used													1513.3750 (219)
Annual totals kWh/year													
Space heating fuel - main system													1626.9146 (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)													35.7257 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.7257 (231)
Electricity for lighting (calculated in Appendix L)													246.4768 (232)
Total delivered energy for all uses													3497.4921 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1626.9146	3.9200	63.7751 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1513.3750	3.9200	59.3243 (247)
Mechanical ventilation fans	35.7257	16.9600	6.0591 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	246.4768	16.9600	41.8025 (250)
Additional standing charges			88.0000 (251)
Total energy cost			271.6809 (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	1626.9146	0.2160	351.4136 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1513.3750	0.2160	326.8890 (264)
Space and water heating			678.3026 (265)
Pumps and fans	110.7257	0.5190	57.4666 (267)
Energy for lighting	246.4768	0.5190	127.9214 (268)
Total kg/year			863.6906 (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	1626.9146	1.2200	1984.8358 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1513.3750	1.2200	1846.3175 (264)
Space and water heating			3831.1533 (265)
Pumps and fans	110.7257	3.0700	339.9279 (267)
Energy for lighting	246.4768	3.0700	756.6837 (268)
Primary energy kWh/year			4927.7649 (272)
Primary energy kWh/m2/year			97.3482 (273)

#### SAP 2012 EPC IMPROVEMENTS



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 83  
 Current environmental impact rating: B 87

(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 <sup>2</sup>

Potential energy efficiency rating: B 83  
 Potential environmental impact rating: B 87

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	£61	£61	£0
Mains gas	£211	£211	£0
Space heating	£171	£171	£0
Water heating	£59	£59	£0
Lighting	£42	£42	£0
Total cost of fuels	£272	£272	£0
Total cost of uses	£272	£272	£0
Delivered energy	69 kWh/m <sup>2</sup>	69 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	17 kg/m <sup>2</sup>	17 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	97 kWh/m <sup>2</sup>	97 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014  
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No improvements selected / applicable  
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# 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	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	233.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

#### Overheating Calculation

Summer ventilation heat loss coefficient	119.77 (P1)
Transmission heat loss coefficient	40.74 (37)
Summer heat loss coefficient	160.51 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South East	0.000	1.000	None
South West	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)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
South West	1.2700	122.3147	0.4300	0.0000	0.9000	60.1164
South East	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862

total: 333.8796

	Jun	Jul	Aug	
Solar gains	355	334	290	(P4)
Internal gains	311	298	304	
Total summer gains	665	632	594	(P5)

	4.14	3.94	3.70	
Summer gain/loss ratio	4.14	3.94	3.70	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 233.2)	0.37	0.37	0.37	
Threshold temperature	19.91	21.90	21.67	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight