

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-012		Issued on Date	12/02/2020	
Assessment Reference	003	Prop Type Ref	3FF Det		
Property	Plot 012, 1 Bed, K, Ba, Welwyn Garden City				
SAP Rating	83 B	DER	18.74	TER	20.87
Environmental	88 B	% DER<TER	10.19		
CO₂ Emissions (t/year)	0.83	DFEE	46.79	TFEE	53.66
General Requirements Compliance	Pass	% DFEE<TFEE	12.82		
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

Top-floor flat, total floor area 51 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) 20.87 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.74 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 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	(no floor)		
Roof	0.11 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.34 (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: 3.99 m², No overhang

Windows facing South East: 2.52 m², No overhang

Windows facing South West: 2.54 m², No overhang

Air change rate: 6.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.08 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	50.6200 (1b)	2.3600 (2b)	119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	119.4632 (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				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (25)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.5300	1.3258	8.6572		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	44.4100	9.0500	35.3600	0.2500	8.8400	52.8000	1867.0080 (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)
Plane Ceiling	41.1800		41.1800	0.0800	3.2944	9.0000	370.6200 (30)
Sloping Ceiling	11.0100		11.0100	0.2000	2.2020	9.0000	99.0900 (30)
Dormer Roof	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5299		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32d)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7705.4960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2224 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6663 (36)
Total fabric heat loss						(33) + (36) =	39.1962 (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)	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114 (38)
Heat transfer coeff	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077 (39)
Average = Sum(39)m / 12 =												58.9077 (39)
HLP	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637 (40)
HLP (average)												1.1637 (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												

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												1176.4816 (45)
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	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)
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)
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	13.5678	12.0508	9.8003	7.4195	5.5462	4.6823	5.0594	6.5764	8.8268	11.2077	13.0810	13.9448 (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	273.2529	271.5478	261.8105	246.2583	230.7532	215.5935	205.6097	210.4447	218.3164	234.0394	252.0819	265.3400 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m ²	Table 6a	W/m ²	or Table 6b	or Table 6c	factor	W					
						Table 6d						
Northeast	3.9900	11.2829	0.4300		0.0000	0.7700	14.9058 (75)					
Southwest	2.5400	36.7938	0.4300		0.0000	0.7700	30.9434 (79)					
Southeast	2.5200	36.7938	0.4300		0.0000	0.7700	30.6997 (77)					
Solar gains	76.5489	135.3422	198.3321	267.7862	320.0627	326.5982	311.1926	270.8389	222.1712	153.1278	92.5896	64.9265 (83)
Total gains	349.8018	406.8899	460.1426	514.0445	550.8159	542.1917	516.8022	481.2836	440.4877	387.1672	344.6715	330.2665 (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	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351
alpha	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223
util living area	0.9811	0.9677	0.9406	0.8808	0.7718	0.6189	0.4768	0.5256	0.7418	0.9119	0.9694	0.9843 (86)
MIT	19.2858	19.5157	19.8725	20.3042	20.6716	20.8891	20.9658	20.9518	20.7867	20.3054	19.7029	19.2216 (87)
Th 2	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491 (88)
util rest of house	0.9772	0.9611	0.9282	0.8553	0.7232	0.5394	0.3729	0.4199	0.6713	0.8874	0.9619	0.9810 (89)
MIT 2	17.6757	18.0073	18.5180	19.1213	19.6058	19.8603	19.9312	19.9217	19.7576	19.1371	18.2820	17.5828 (90)
Living area fraction									fLA = Living area / (4) =			0.4921 (91)
MIT	18.4680	18.7496	19.1845	19.7034	20.1302	20.3666	20.4403	20.4286	20.2640	19.7120	18.9812	18.3892 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4680	18.7496	19.1845	19.7034	20.1302	20.3666	20.4403	20.4286	20.2640	19.7120	18.9812	18.3892 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9697	0.9514	0.9172	0.8485	0.7322	0.5725	0.4228	0.4698	0.6942	0.8808	0.9530	0.9744 (94)
Ext temp.	339.2139	387.1177	422.0376	436.1557	403.3301	310.3795	218.4969	226.1277	305.7801	341.0095	328.4745	321.8015 (95)
Heat loss rate W	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)
Month fracti	834.6063	815.8458	747.2155	636.4046	496.6057	339.6974	226.2234	237.3178	363.1084	536.7676	699.8946	835.8556 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m ²	368.5719	288.1052	241.9324	144.1793	69.3971	0.0000	0.0000	0.0000	0.0000	145.6440	267.4225	382.4562 (98)
												1907.7086 (98)
												(98) / (4) = 37.6869 (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													2040.3300 (211)
Space heating requirement	368.5719	288.1052	241.9324	144.1793	69.3971	0.0000	0.0000	0.0000	0.0000	145.6440	267.4225	382.4562	(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)	394.1946	308.1340	258.7512	154.2024	74.2215	0.0000	0.0000	0.0000	0.0000	155.7690	286.0133	409.0441	(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	89.6147	89.5389	89.3894	89.0907	88.5386	87.3000	87.3000	87.3000	87.3000	89.0694	89.4708	89.6562	(217)
Fuel for water heating, kWh/month	151.7310	133.2485	138.7673	122.8596	119.7242	106.4239	100.2443	112.7142	113.3709	127.5322	136.6914	147.3595	(219)
Water heating fuel used													1510.6668 (219)
Annual totals kWh/year													
Space heating fuel - main system													2040.3300 (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)													35.2773 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.2773 (231)
Electricity for lighting (calculated in Appendix L)													239.6109 (232)
Total delivered energy for all uses													3900.8850 (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	2040.3300	0.2160	440.7113	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1510.6668	0.2160	326.3040	(264)
Space and water heating			767.0153	(265)
Pumps and fans	110.2773	0.5190	57.2339	(267)
Energy for lighting	239.6109	0.5190	124.3580	(268)
Total CO2, kg/year			948.6073	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.7400	(273)

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

DER			18.7400	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			39.3251	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			39.3251	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)	2.3600 (2b)	119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	119.4632 (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) =	0.1674 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4174 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3861 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4923	0.4826	0.4730	0.4247	0.4151	0.3668	0.3668	0.3572	0.3861	0.4151	0.4344	0.4537 (22b)
Effective ac	0.6212	0.6165	0.6119	0.5902	0.5861	0.5673	0.5673	0.5638	0.5745	0.5861	0.5943	0.6029 (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)			9.0500	1.3258	11.9981		(27)
External Wall	44.4100	9.0500	35.3600	0.1800	6.3648		(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)
Plane Ceiling	41.1800		41.1800	0.1300	5.3534		(30)
Sloping Ceiling	11.0100		11.0100	0.1300	1.4313		(30)
Dormer Roof	1.0100		1.0100	0.1300	0.1313		(30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.8127	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												250.0000 (35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												7.2156 (36)	
Total fabric heat loss												(33) + (36) =	37.0283 (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	24.4885	24.3030	24.1211	23.2671	23.1073	22.3635	22.3635	22.2258	22.6500	23.1073	23.4306	23.7685 (38)
Heat transfer coeff	61.5168	61.3313	61.1495	60.2954	60.1356	59.3918	59.3918	59.2541	59.6783	60.1356	60.4589	60.7968 (39)
Average = Sum(39)m / 12 =												60.2947 (39)
HLP	1.2153	1.2116	1.2080	1.1911	1.1880	1.1733	1.1733	1.1706	1.1789	1.1880	1.1944	1.2010 (40)
HLP (average)												1.1911 (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													

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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	0.0000	(56)
Combi loss	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	(61)
Total heat required for water heating calculated for each 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	(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	0.0000	(63)
Output from w/h	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	(64)
Heat gains from water heating, kWh/month	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	(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	13.5678	12.0508	9.8003	7.4195	5.5462	4.6823	5.0594	6.5764	8.8268	11.2077	13.0810	13.9448	(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	282.6336	280.4217	270.1801	254.1249	238.1140	222.4498	212.4705	217.8098	226.1894	242.4154	260.9595	274.7232	(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	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	2.5400	36.7938	0.6300	0.7000	0.7700	28.5615 (79)							
Solar gains	70.6564	124.9240	183.0651	247.1728	295.4253	301.4578	287.2380	249.9906	205.0692	141.3405	85.4623	59.9287	(83)
Total gains	353.2900	405.3457	453.2453	501.2977	533.5393	523.9075	499.7085	467.8004	431.2586	383.7559	346.4218	334.6519	(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	57.1434	57.3162	57.4867	58.3009	58.4558	59.1879	59.1879	59.3255	58.9038	58.4558	58.1433	57.8201	
alpha	4.8096	4.8211	4.8324	4.8867	4.8971	4.9459	4.9459	4.9550	4.9269	4.8971	4.8762	4.8547	
util living area	0.9961	0.9919	0.9805	0.9438	0.8494	0.6777	0.5126	0.5652	0.8115	0.9626	0.9921	0.9970	(86)
MIT	19.7616	19.9260	20.1881	20.5278	20.8045	20.9537	20.9905	20.9849	20.8859	20.5283	20.0859	19.7358	(87)
Th 2	19.9078	19.9107	19.9136	19.9271	19.9296	19.9414	19.9414	19.9436	19.9369	19.9296	19.9245	19.9192	(88)
util rest of house	0.9948	0.9892	0.9737	0.9236	0.7978	0.5845	0.3946	0.4441	0.7322	0.9449	0.9890	0.9960	(89)
MIT 2	18.2732	18.5143	18.8947	19.3826	19.7427	19.9116	19.9381	19.9377	19.8488	19.3942	18.7580	18.2436	(90)
Living area fraction	fLA = Living area / (4) =												0.4921 (91)
MIT	19.0057	19.2090	19.5312	19.9461	20.2652	20.4244	20.4559	20.4530	20.3592	19.9522	19.4115	18.9779	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0057	19.2090	19.5312	19.9461	20.2652	20.4244	20.4559	20.4530	20.3592	19.9522	19.4115	18.9779	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9933	0.9869	0.9707	0.9240	0.8155	0.6288	0.4530	0.5040	0.7665	0.9454	0.9870	0.9948	(94)
Useful gains	350.9406	400.0214	439.9611	463.2195	435.0871	329.4429	226.3698	235.7807	330.5733	362.8004	341.9261	332.9085	(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	904.6450	877.5880	796.8496	666.0317	515.0753	345.9224	229.0115	240.1576	373.5370	562.4032	744.3376	898.4482	(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	411.9561	320.9248	265.5250	146.0248	59.5112	0.0000	0.0000	0.0000	0.0000	148.5045	289.7363	420.7615	(98)
Space heating													2062.9442 (98)
Space heating per m2													(98) / (4) = 40.7535 (99)

8c. Space cooling requirement

Not applicable

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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													2208.7197 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	411.9561	320.9248	265.5250	146.0248	59.5112	0.0000	0.0000	0.0000	0.0000	148.5045	289.7363	420.7615	(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)	441.0665	343.6025	284.2880	156.3435	63.7165	0.0000	0.0000	0.0000	0.0000	158.9984	310.2102	450.4941	(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	87.2757	87.0235	86.4905	85.3037	83.2535	80.3000	80.3000	80.3000	80.3000	85.2266	86.7146	80.3000	(216)
Fuel for water heating, kWh/month	187.7844	164.5100	172.2167	154.8728	153.6366	140.2915	134.4100	149.8356	151.4904	162.5303	170.5208	183.1729	(219)
Water heating fuel used													1925.2721 (219)
Annual totals kWh/year													
Space heating fuel - main system													2208.7197 (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)													239.6109 (232)
Total delivered energy for all uses													4448.6027 (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	2208.7197	0.2160	477.0835 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1925.2721	0.2160	415.8588 (264)
Space and water heating			892.9422 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	239.6109	0.5190	124.3580 (268)
Total CO2, kg/m2/year			1056.2253 (272)
Emissions per m2 for space and water heating			17.6401 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4567 (272b)
Emissions per m2 for pumps and fans			0.7690 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.6401 * 1.00) + 2.4567 + 0.7690, rounded to 2 d.p.			20.8700 (273)

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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 2.3600 (2b)	= 119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.4632 (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) =	0.1674 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3674	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3399 (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	0.4333	0.4248	0.4163	0.3738	0.3653	0.3229	0.3229	0.3144	0.3399	0.3653	0.3823	0.3993 (22b)
Effective ac	0.5939	0.5902	0.5867	0.5699	0.5667	0.5521	0.5521	0.5494	0.5578	0.5667	0.5731	0.5797 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.5300	1.3258	8.6572		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	44.4100	9.0500	35.3600	0.2500	8.8400	52.8000	1867.0080 (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 (30)
Plane Ceiling	41.1800		41.1800	0.0800	3.2944	9.0000	370.6200 (30)
Sloping Ceiling	11.0100		11.0100	0.2000	2.2020	9.0000	99.0900 (30)
Dormer Roof	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5299		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32d)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7705.4960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2224 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6663 (36)
Total fabric heat loss						(33) + (36) =	39.1962 (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	23.4126	23.2689	23.1280	22.4663	22.3425	21.7662	21.7662	21.6595	21.9882	22.3425	22.5929	22.8548 (38)
Heat transfer coeff	62.6088	62.4651	62.3242	61.6625	61.5387	60.9624	60.9624	60.8557	61.1844	61.5387	61.7892	62.0510 (39)
Average = Sum(39)m / 12 =												61.6619 (39)
HLP	1.2368	1.2340	1.2312	1.2181	1.2157	1.2043	1.2043	1.2022	1.2087	1.2157	1.2206	1.2258 (40)
HLP (average)												1.2181 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	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	0.0000	(56)
If cylinder contains dedicated solar storage														
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	(57)
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	13.5678	12.0508	9.8003	7.4195	5.5462	4.6823	5.0594	6.5764	8.8268	11.2077	13.0810	13.9448	(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	245.8759	244.7996	236.3646	222.5814	208.2252	194.6819	186.0701	189.1452	196.3901	210.2825	226.2577	238.5864	(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	0.4300		0.0000	0.7700	14.9058	(75)					
Southwest	2.5400	36.7938	0.4300		0.0000	0.7700	30.9434	(79)					
Southeast	2.5200	36.7938	0.4300		0.0000	0.7700	30.6997	(77)					
Solar gains	76.5489	135.3422	198.3321	267.7862	320.0627	326.5982	311.1926	270.8389	222.1712	153.1278	92.5896	64.9265	(83)
Total gains	322.4248	380.1418	434.6967	490.3675	528.2879	521.2802	497.2627	459.9841	418.5614	363.4103	318.8472	303.5128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000	(85)
tau	34.1871	34.2658	34.3432	34.7118	34.7816	35.1104	35.1104	35.1720	34.9830	34.7816	34.6406	34.4945		
alpha	3.2791	3.2844	3.2895	3.3141	3.3188	3.3407	3.3407	3.3448	3.3322	3.3188	3.3094	3.2996		
util living area	0.9853	0.9741	0.9512	0.8980	0.7982	0.6485	0.5055	0.5574	0.7725	0.9277	0.9760	0.9879	(86)	
MIT	19.0889	19.3305	19.7110	20.1933	20.6023	20.8621	20.9553	20.9377	20.7386	20.2004	19.5560	19.0446	(87)	
Th 2	19.8906	19.8929	19.8951	19.9055	19.9075	19.9165	19.9165	19.9182	19.9130	19.9075	19.9035	19.8994	(88)	
util rest of house	0.9821	0.9686	0.9404	0.8746	0.7509	0.5667	0.3944	0.4455	0.7031	0.9061	0.9699	0.9852	(89)	
MIT 2	18.1592	18.3996	18.7748	19.2466	19.6213	19.8405	19.9005	19.8939	19.7507	19.2646	18.6330	18.1217	(90)	
Living area fraction									fLA = Living area / (4) =			0.4921	(91)	
MIT	18.6167	18.8577	19.2355	19.7125	20.1041	20.3432	20.4196	20.4075	20.2368	19.7251	19.0872	18.5759	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6167	18.8577	19.2355	19.7125	20.1041	20.3432	20.4196	20.4075	20.2368	19.7251	19.0872	18.5759	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9620	0.9325	0.8699	0.7602	0.6007	0.4478	0.4983	0.7258	0.9018	0.9640	0.9810	(94)
Useful gains	315.1100	365.6956	405.3472	426.5550	401.6146	313.1323	222.6554	229.2291	303.7827	327.7063	307.3829	297.7467	(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	896.3514	871.8698	793.7294	666.7265	517.1767	350.1212	232.8512	243.8803	375.4785	561.5490	740.6804	892.0373	(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	432.4436	340.1491	288.9564	172.9235	85.9782	0.0000	0.0000	0.0000	0.0000	173.9790	311.9741	442.1522	(98)
Space heating												2248.5560	(98)
Space heating per m2												44.4203	(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	573.0469	451.1220	462.5034	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8277	0.8844	0.8594	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	474.3216	398.9607	397.4569	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	674.0242	644.7367	602.1598	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	143.7859	182.8573	152.2990	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												478.9422 (104)
Intermittency factor (Table 10b)												FC = cooled area / (4) = 1.0000 (105)
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	35.9465	45.7143	38.0747	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												119.7355 (107)
Energy for space heating												2.3654 (108)
Energy for space cooling												44.4203 (99)
Total												2.3654 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.7857 (109)
												46.8 (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)	2.3600 (2b)	119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	119.4632 (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) =	0.1674 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4174 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3861 (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	0.4923	0.4826	0.4730	0.4247	0.4151	0.3668	0.3668	0.3572	0.3861	0.4151	0.4344	0.4537 (22b)
Effective ac	0.6212	0.6165	0.6119	0.5902	0.5861	0.5673	0.5673	0.5638	0.5745	0.5861	0.5943	0.6029 (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)			9.0500	1.3258	11.9981		(27)
External Wall	44.4100	9.0500	35.3600	0.1800	6.3648		(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)
Plane Ceiling	41.1800		41.1800	0.1300	5.3534		(30)
Sloping Ceiling	11.0100		11.0100	0.1300	1.4313		(30)
Dormer Roof	1.0100		1.0100	0.1300	0.1313		(30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.8127	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.2156 (36)
 Total fabric heat loss (33) + (36) = 37.0283 (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	24.4885	24.3030	24.1211	23.2671	23.1073	22.3635	22.3635	22.2258	22.6500	23.1073	23.4306	23.7685 (38)
Heat transfer coeff	61.5168	61.3313	61.1495	60.2954	60.1356	59.3918	59.3918	59.2541	59.6783	60.1356	60.4589	60.7968 (39)
Average = Sum(39)m / 12 =												60.2947 (39)
HLP	1.2153	1.2116	1.2080	1.1911	1.1880	1.1733	1.1733	1.1706	1.1789	1.1880	1.1944	1.2010 (40)
HLP (average)												1.1911 (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:	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)
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(56)
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	(57)
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	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	13.5678	12.0508	9.8003	7.4195	5.5462	4.6823	5.0594	6.5764	8.8268	11.2077	13.0810	13.9448	(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	245.8759	244.7996	236.3646	222.5814	208.2252	194.6819	186.0701	189.1452	196.3901	210.2825	226.2577	238.5864	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	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	2.5400	36.7938	0.6300	0.7000	0.7700	28.5615 (79)							
Solar gains	70.6564	124.9240	183.0651	247.1728	295.4253	301.4578	287.2380	249.9906	205.0692	141.3405	85.4623	59.9287	(83)
Total gains	316.5324	369.7236	419.4298	469.7542	503.6505	496.1397	473.3081	439.1358	401.4594	351.6231	311.7200	298.5150	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	57.1434	57.3162	57.4867	58.3009	58.4558	59.1879	59.1879	59.3255	58.9038	58.4558	58.1433	57.8201	
alpha	4.8096	4.8211	4.8324	4.8867	4.8971	4.9459	4.9459	4.9550	4.9269	4.8971	4.8762	4.8547	
util living area	0.9976	0.9945	0.9857	0.9552	0.8708	0.7058	0.5386	0.5972	0.8417	0.9730	0.9950	0.9982	(86)
MIT	19.6953	19.8629	20.1312	20.4828	20.7776	20.9447	20.9882	20.9809	20.8636	20.4780	20.0242	19.6702	(87)
Th 2	19.9078	19.9107	19.9136	19.9271	19.9296	19.9414	19.9414	19.9436	19.9369	19.9296	19.9245	19.9192	(88)
util rest of house	0.9968	0.9926	0.9805	0.9383	0.8231	0.6123	0.4160	0.4716	0.7674	0.9596	0.9929	0.9976	(89)
MIT 2	18.7259	18.8950	19.1627	19.5144	19.7816	19.9165	19.9385	19.9383	19.8626	19.5176	19.0672	18.7098	(90)
Living area fraction										fLA = Living area / (4) =			0.4921 (91)
MIT	19.2029	19.3713	19.6393	19.9909	20.2717	20.4225	20.4551	20.4514	20.3552	19.9902	19.5381	19.1824	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2029	19.3713	19.6393	19.9909	20.2717	20.4225	20.4551	20.4514	20.3552	19.9902	19.5381	19.1824	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9914	0.9789	0.9395	0.8399	0.6569	0.4768	0.5339	0.7997	0.9605	0.9920	0.9970	(94)
Useful gains	315.2847	366.5393	410.5633	441.3158	423.0185	325.9047	225.6586	234.4469	321.0402	337.7319	309.2149	297.6215	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	916.7809	887.5431	803.4605	668.7324	515.4658	345.8079	228.9593	240.0602	373.2989	564.6860	751.9936	910.8841	(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	447.5132	350.1145	292.3155	163.7400	68.7808	0.0000	0.0000	0.0000	0.0000	168.8538	318.8007	456.2673	(98)
Space heating per m2												2266.3859	(98)
												(98) / (4) =	44.7725 (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	558.2830	439.4994	450.3309	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8856	0.9379	0.9170	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	494.3985	412.2194	412.9670	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	644.6392	616.7378	577.7917	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	108.1733	152.1617	122.6296	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												382.9646 (104)
Intermittency factor (Table 10b)												FC = cooled area / (4) =
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	1.0000 (105)
Space cooling kWh												0.0000 (106)
	0.0000	0.0000	0.0000	0.0000	0.0000	27.0433	38.0404	30.6574	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												95.7411 (107)
Space cooling per m2												1.8914 (108)
Energy for space heating												44.7725 (99)
Energy for space cooling												1.8914 (108)
Total												46.6639 (109)
Target Fabric Energy Efficiency (TFEE)												53.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.6200 (1b)	2.3600 (2b)	119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		119.4632 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	119.4632 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				1	1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1850 (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	0.2266	0.2220	0.2174	0.1943	0.1943	0.1711	0.1758	0.1758	0.1850	0.1943	0.1989	0.2081 (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)			6.5300	1.3258	8.6572		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	44.4100	9.0500	35.3600	0.2500	8.8400	52.8000	1867.0080 (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)
Plane Ceiling	41.1800		41.1800	0.0800	3.2944	9.0000	370.6200 (30)
Sloping Ceiling	11.0100		11.0100	0.2000	2.2020	9.0000	99.0900 (30)
Dormer Roof	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5299		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32d)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7705.4960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2224 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6663 (36)
Total fabric heat loss					(33) + (36) =		39.1962 (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)	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114 (38)
Heat transfer coeff	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077 (39)
Average = Sum(39)m / 12 =												58.9077 (39)
HLP	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637 (40)
HLP (average)												1.1637 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1176.4816 (45)
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	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)
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)
RHI water heating demand												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)
												1341 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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	33.9194	30.1269	24.5009	18.5487	13.8654	11.7057	12.6485	16.4410	22.0670	28.0191	32.7025	34.8621 (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	399.4162	396.1963	381.1664	357.9618	334.4949	313.1975	300.5446	306.8944	320.0588	343.4343	369.4385	388.8342 (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	2.5400	40.9830	0.4300	0.0000	0.7700	34.4665 (79)						
Southeast	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (77)						
Solar gains	85.7651	141.5013	204.3126	290.7174	335.8777	357.3654	337.0855	295.3077	242.8920	167.4392	106.3107	72.0202 (83)
Total gains	485.1813	537.6977	585.4791	648.6792	670.3726	670.5629	637.6301	602.2021	562.9508	510.8735	475.7491	460.8544 (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	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351
alpha	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223
util living area	0.9497	0.9292	0.8849	0.7904	0.6509	0.4689	0.3100	0.3274	0.5734	0.8115	0.9199	0.9561 (86)
MIT	19.6636	19.8463	20.1795	20.5591	20.8277	20.9586	20.9930	20.9917	20.9180	20.5960	20.0746	19.6096 (87)
Th 2	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491 (88)
util rest of house	0.9402	0.9162	0.8637	0.7532	0.5919	0.3891	0.2161	0.2286	0.4901	0.7683	0.9027	0.9477 (89)
MIT 2	18.2163	18.4746	18.9413	19.4515	19.7845	19.9213	19.9469	19.9464	19.8878	19.5137	18.8042	18.1401 (90)
Living area fraction									FLA = Living area / (4) =			0.4921 (91)
MIT	18.9285	19.1496	19.5506	19.9966	20.2979	20.4318	20.4616	20.4608	20.3948	20.0463	19.4294	18.8633 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9285	19.1496	19.5506	19.9966	20.2979	20.4318	20.4616	20.4608	20.3948	20.0463	19.4294	18.8633 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	450.6415	486.2870	500.2943	489.7444	410.5206	286.0106	167.2628	166.9629	296.5424	394.7549	424.6157	431.6823 (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	838.1668	821.7397	739.3282	618.3274	459.3538	296.4106	168.5728	168.5217	317.7927	509.3335	690.9498	834.3243 (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	288.3189	225.4242	177.8412	92.5798	36.3319	0.0000	0.0000	0.0000	0.0000	85.2465	191.7605	299.5656 (98)
Space heating												1397.0687 (98)
RHI space heating demand												1397 (98)

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



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	50.6200 (1b)	2.3600 (2b)	119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		119.4632 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	119.4632 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2000 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (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)			6.5300	1.3258	8.6572		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	44.4100	9.0500	35.3600	0.2500	8.8400	52.8000	1867.0080 (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)
Plane Ceiling	41.1800		41.1800	0.0800	3.2944	9.0000	370.6200 (30)
Sloping Ceiling	11.0100		11.0100	0.2000	2.2020	9.0000	99.0900 (30)
Dormer Roof	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5299		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32d)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7705.4960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2224 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6663 (36)
Total fabric heat loss							(33) + (36) = 39.1962 (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)	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114 (38)
Heat transfer coeff	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077 (39)
Average = Sum(39)m / 12 =												58.9077 (39)
HLP	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637 (40)
HLP (average)												1.1637 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1176.4816 (45)
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	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)
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)
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)
										Total per year (kWh/year) = Sum(64)m =		1340.5861 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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	33.9194	30.1269	24.5009	18.5487	13.8654	11.7057	12.6485	16.4410	22.0670	28.0191	32.7025	34.8621 (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	399.4162	396.1963	381.1664	357.9618	334.4949	313.1975	300.5446	306.8944	320.0588	343.4343	369.4385	388.8342 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Southwest	2.5400	36.7938	0.4300	0.0000	0.7700	30.9434 (79)						
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (77)						
Solar gains	76.5489	135.3422	198.3321	267.7862	320.0627	326.5982	311.1926	270.8389	222.1712	153.1278	92.5896	64.9265 (83)
Total gains	475.9651	531.5385	579.4985	625.7479	654.5576	639.7957	611.7372	577.7333	542.2301	496.5621	462.0280	453.7607 (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	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351
alpha	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223
util living area	0.9552	0.9343	0.8961	0.8214	0.7008	0.5454	0.4105	0.4497	0.6524	0.8474	0.9332	0.9612 (86)
MIT	19.5840	19.7910	20.1038	20.4680	20.7614	20.9249	20.9784	20.9701	20.8590	20.4866	19.9626	19.5189 (87)
Th 2	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491 (88)
util rest of house	0.9468	0.9224	0.8771	0.7889	0.6481	0.4694	0.3179	0.3547	0.5787	0.8122	0.9189	0.9539 (89)
MIT 2	18.1022	18.3961	18.8360	19.3328	19.7073	19.8911	19.9382	19.9328	19.8286	19.3712	18.6465	18.0093 (90)
Living area fraction	18.8314	19.0826	19.4599	19.8914	20.2261	20.3998	20.4500	20.4433	20.3357	19.9201	19.2942	18.7522 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8314	19.0826	19.4599	19.8914	20.2261	20.3998	20.4500	20.4433	20.3357	19.9201	19.2942	18.7522 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9356	0.9105	0.8669	0.7869	0.6628	0.5030	0.3628	0.4004	0.6073	0.8111	0.9082	0.9432 (94)
Ext temp.	445.3292	483.9593	502.3475	492.4006	433.8342	321.8163	221.9539	231.2955	329.2804	402.7409	419.5934	428.0022 (95)
Heat loss rate W	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)
Month fracti	856.0122	835.4616	763.4384	647.4801	502.2497	341.6552	226.7969	238.1789	367.3283	549.0251	718.3315	857.2339 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	305.5482	236.2095	194.2517	111.6573	50.9012	0.0000	0.0000	0.0000	0.0000	108.8355	215.0914	319.3484 (98)
												1541.8431 (98)
												30.4592 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
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	1649.0301	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	305.5482	236.2095	194.2517	111.6573	50.9012	0.0000	0.0000	0.0000	0.0000	108.8355	215.0914	319.3484	(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)	326.7895	252.6305	207.7558	119.4196	54.4398	0.0000	0.0000	0.0000	0.0000	116.4016	230.0443	341.5491	(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	89.4898	89.4003	89.2254	88.8871	88.3130	87.3000	87.3000	87.3000	87.3000	88.8370	89.3133	89.5395	(216)	
Fuel for water heating, kWh/month	151.9428	133.4551	139.0223	123.1410	120.0300	106.4239	100.2443	112.7142	113.3709	127.8658	136.9325	147.5516	(219)	
Water heating fuel used												1512.6944	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1649.0301	(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)		35.2773 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		110.2773 (231)
Electricity for lighting (calculated in Appendix L)		239.6109 (232)
Total delivered energy for all uses		3511.6125 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1649.0301	3.4800	57.3862	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1512.6944	3.4800	52.6418	(247)
Mechanical ventilation fans	35.2773	13.1900	4.6531	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	239.6109	13.1900	31.6047	(250)
Additional standing charges			120.0000	(251)
Total energy cost			276.1783	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		1.2131	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	83.0775	
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	1649.0301	0.2160	356.1905	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1512.6944	0.2160	326.7420	(264)
Space and water heating			682.9325	(265)
Pumps and fans	110.2773	0.5190	57.2339	(267)
Energy for lighting	239.6109	0.5190	124.3580	(268)
Total kg/year			864.5244	(272)
CO2 emissions per m2			17.0800	(273)
EI value			87.8847	
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	$3.48 / 0.8852 = 3.931$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8852 = 0.2440$, stars = 4

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 2.3600 (2b)	= 119.4632 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 119.4632 (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				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1850 (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	0.2266	0.2220	0.2174	0.1943	0.1943	0.1711	0.1758	0.1758	0.1850	0.1943	0.1989	0.2081 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.5300	1.3258	8.6572		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	44.4100	9.0500	35.3600	0.2500	8.8400	52.8000	1867.0080 (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)
Plane Ceiling	41.1800		41.1800	0.0800	3.2944	9.0000	370.6200 (30)
Sloping Ceiling	11.0100		11.0100	0.2000	2.2020	9.0000	99.0900 (30)
Dormer Roof	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m2)			113.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.5299		(33)
E-FC-4			50.6200			70.0000	3543.4000 (32d)
Metal			79.1600			14.0000	1108.2400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7705.4960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.2224 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6663 (36)
Total fabric heat loss						(33) + (36) =	39.1962 (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	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114	19.7114 (38)
Average = Sum(39)m / 12 =	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077	58.9077 (39)
HLP	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637	1.1637 (40)
HLP (average)												1.1637 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7084 (42)
Average daily hot water use (litres/day)												74.7737 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1176.4816 (45)
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	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)
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)
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	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	33.9194	30.1269	24.5009	18.5487	13.8654	11.7057	12.6485	16.4410	22.0670	28.0191	32.7025	34.8621 (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	399.4162	396.1963	381.1664	357.9618	334.4949	313.1975	300.5446	306.8944	320.0588	343.4343	369.4385	388.8342 (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	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Southwest	2.5400	40.9830	0.4300	0.0000	0.7700	34.4665 (79)						
Southeast	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (77)						
Solar gains	85.7651	141.5013	204.3126	290.7174	335.8777	357.3654	337.0855	295.3077	242.8920	167.4392	106.3107	72.0202 (83)
Total gains	485.1813	537.6977	585.4791	648.6792	670.3726	670.5629	637.6301	602.2021	562.9508	510.8735	475.7491	460.8544 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351	36.3351 (85)
tau	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223	3.4223
alpha	0.9497	0.9292	0.8849	0.7904	0.6509	0.4689	0.3100	0.3274	0.5734	0.8115	0.9199	0.9561 (86)
MIT	19.6636	19.8463	20.1795	20.5591	20.8277	20.9586	20.9930	20.9917	20.9180	20.5960	20.0746	19.6096 (87)
Th 2	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491	19.9491 (88)
util rest of house	0.9402	0.9162	0.8637	0.7532	0.5919	0.3891	0.2161	0.2286	0.4901	0.7683	0.9027	0.9477 (89)
MIT 2	18.2163	18.4746	18.9413	19.4515	19.7845	19.9213	19.9469	19.9464	19.8878	19.5137	18.8042	18.1401 (90)
Living area fraction	18.9285	19.1496	19.5506	19.9966	20.2979	20.4318	20.4616	20.4608	20.3948	20.0463	19.4294	18.8633 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (91)
adjusted MIT	18.9285	19.1496	19.5506	19.9966	20.2979	20.4318	20.4616	20.4608	20.3948	20.0463	19.4294	18.8633 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	450.6415	486.2870	500.2943	489.7444	410.5206	286.0106	167.2628	166.9629	296.5424	394.7549	424.6157	431.6823 (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	838.1668	821.7397	739.3282	618.3274	459.3538	296.4106	168.5728	168.5217	317.7927	509.3335	690.9498	834.3243 (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	288.3189	225.4242	177.8412	92.5798	36.3319	0.0000	0.0000	0.0000	0.0000	85.2465	191.7605	299.5656 (98)
Space heating per m2												1397.0687 (98)
												(98) / (4) = 27.5991 (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													1494.1911 (211)
Space heating requirement	288.3189	225.4242	177.8412	92.5798	36.3319	0.0000	0.0000	0.0000	0.0000	85.2465	191.7605	299.5656	(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)	308.3624	241.0954	190.2045	99.0158	38.8576	0.0000	0.0000	0.0000	0.0000	91.1727	205.0915	320.3910	(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	89.4492	89.3663	89.1572	88.7378	88.0951	87.3000	87.3000	87.3000	87.3000	88.6438	89.2264	89.4960	(216)
Fuel for water heating, kWh/month	152.0117	133.5058	139.1288	123.3483	120.3269	106.4239	100.2443	112.7142	113.3709	128.1445	137.0659	147.6233	(219)
Water heating fuel used													1513.9084 (219)
Annual totals kWh/year													
Space heating fuel - main system													1494.1911 (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)													35.2773 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													110.2773 (231)
Electricity for lighting (calculated in Appendix L)													239.6109 (232)
Total delivered energy for all uses													3357.9876 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1494.1911	3.9200	58.5723	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1513.9084	3.9200	59.3452	(247)
Mechanical ventilation fans	35.2773	16.9600	5.9830	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	239.6109	16.9600	40.6380	(250)
Additional standing charges			88.0000	(251)
Total energy cost			265.2585	(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	1494.1911	0.2160	322.7453	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1513.9084	0.2160	327.0042	(264)
Space and water heating			649.7495	(265)
Pumps and fans	110.2773	0.5190	57.2339	(267)
Energy for lighting	239.6109	0.5190	124.3580	(268)
Total kg/year			831.3414	(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	1494.1911	1.2200	1822.9131	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1513.9084	1.2200	1846.9683	(264)
Space and water heating			3669.8814	(265)
Pumps and fans	110.2773	3.0700	338.5512	(267)
Energy for lighting	239.6109	3.0700	735.6054	(268)
Primary energy kWh/year			4744.0380	(272)
Primary energy kWh/m2/year			93.7186	(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 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: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0	0.00 kg/m ²	

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 88

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 2019)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, East Anglia):			
	Current	Potential	Saving
Electricity	£59	£59	£0
Mains gas	£206	£206	£0
Space heating	£165	£165	£0
Water heating	£59	£59	£0
Lighting	£41	£41	£0
Total cost of fuels	£265	£265	£0
Total cost of uses	£265	£265	£0
Delivered energy	66 kWh/m ²	66 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	16 kg/m ²	16 kg/m ²	0 kg/m ²
Primary energy	94 kWh/m ²	94 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	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	152.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	236.54 (P1)
Transmission heat loss coefficient	39.20 (37)
Summer heat loss coefficient	275.73 (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	2.5400	122.3147	0.4300	0.0000	0.9000	120.2329
South East	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862
total:						393.9961

	Jun	Jul	Aug	
Solar gains	418	394	345	(P4)
Internal gains	310	298	304	
Total summer gains	728	692	649	(P5)

	2.64	2.51	2.35	
Summer gain/loss ratio	2.64	2.51	2.35	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 152.2)	0.93	0.93	0.93	
Threshold temperature	18.97	21.04	20.89	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight