

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-011			Issued on Date	12/02/2020
Assessment Reference	011	Prop Type Ref	3FF Semi		
Property	Plot 011, 1 Bed, K, Ba, Welwyn Garden City				
SAP Rating	83 B	DER	17.89	TER	20.32
Environmental	89 B	% DER<TER	11.96		
CO₂ Emissions (t/year)	0.72	DFEE	41.43	TFEE	48.79
General Requirements Compliance	Pass	% DFEE<TFEE	15.08		
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 46 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) 20.32 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.89 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.09 (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 South East: 2.00 m², No overhang

Windows facing South West: 3.99 m², No overhang

Windows facing North West: 3.79 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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 108.4038 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				2	2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			7.2600	1.3258	9.6250		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	39.5200	9.7800	29.7400	0.2500	7.4350	52.8000	1570.2720 (29a)
External Wall to Corridor	3.7300	2.1200	1.6100	0.2200	0.3542	52.8000	85.0080 (29a)
Plane Ceiling	42.4700		42.4700	0.0800	3.3976	9.0000	382.2300 (30)
Sloping Ceiling	3.6100		3.6100	0.2000	0.7220	9.0000	32.4900 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m ²)			89.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.2663		(33)
AAC Party Wall			21.5100	0.0000	0.0000	52.8000	1135.7280 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7432.0180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.4840 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8307 (36)
Total fabric heat loss						(33) + (36) =	33.0970 (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)	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866 (38)
Heat transfer coeff	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836 (39)
Average = Sum(39)m / 12 =												50.9836 (39)
HLP	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146 (40)
HLP (average)												1.1146 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use												

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy cont	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy content (annual)	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1123.2292 (45)
Water storage loss:	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691 (61)
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917 (65)
												Total per year (kWh/year) = Sum(64)m = 1287.1451 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.1609	10.8012	8.7841	6.6502	4.9711	4.1968	4.5348	5.8945	7.9115	10.0455	11.7246	12.4989 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964 (72)
Total internal gains	254.5798	252.9793	243.9694	229.5900	215.3122	201.2802	191.9876	196.5761	203.8052	218.3476	235.0477	247.2642 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Southeast	2.0000	36.7938	0.4300	0.0000	0.7700	24.3649 (77)						
Southwest	3.9900	36.7938	0.4300	0.0000	0.7700	48.6079 (79)						
Northwest	1.2700	11.2829	0.4300	0.0000	0.7700	4.7444 (81)						
Northwest	2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)						
Solar gains	87.1314	153.1200	221.9972	296.0034	350.6599	356.5306	340.2351	298.1738	247.4236	172.5983	105.2198	74.0121 (83)
Total gains	341.7112	406.0992	465.9666	525.5934	565.9721	557.8108	532.2227	494.7499	451.2289	390.9459	340.2675	321.2763 (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	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924
Feb	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995
Mar	0.9793	0.9612	0.9243	0.8453	0.7127	0.5486	0.4113	0.4578	0.6804	0.8882	0.9644	0.9832 (86)
Apr	19.5197	19.7669	20.1162	20.5055	20.7973	20.9420	20.9845	20.9770	20.8718	20.4759	19.9101	19.4514 (87)
May	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889 (88)
Jun	0.9749	0.9533	0.9090	0.8149	0.6607	0.4737	0.3212	0.3639	0.6075	0.8588	0.9557	0.9796 (89)
Jul	18.0308	18.3856	18.8807	19.4140	19.7848	19.9447	19.9812	19.9766	19.8794	19.3893	18.5964	17.9322 (90)
Aug	18.6548	18.9645	19.3985	19.8715	20.2091	20.3627	20.4017	20.3959	20.2953	19.8447	19.1470	18.5689 (92)
Sep	18.6548	18.9645	19.3985	19.8715	20.2091	20.3627	20.4017	20.3959	20.2953	19.8447	19.1470	18.5689 (93)
Oct												0.0000
Nov												0.0000
Dec												0.0000
Temperature adjustment												0.0000
adjusted MIT	18.6548	18.9645	19.3985	19.8715	20.2091	20.3627	20.4017	20.3959	20.2953	19.8447	19.1470	18.5689 (93)

8. Space heating requirement

Utilisation	0.9672	0.9431	0.8984	0.8110	0.6727	0.5022	0.3586	0.4025	0.6310	0.8540	0.9465	0.9728 (94)
Useful gains	330.5149	383.0106	418.6227	426.2606	380.7331	280.1558	190.8631	199.1547	284.7057	333.8500	322.0612	312.5470 (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	731.8589	717.0582	657.6118	559.3654	433.8263	293.8021	193.8254	203.7232	315.8592	471.3267	614.1983	732.5780 (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	298.5999	224.4800	177.8079	95.8354	39.5013	0.0000	0.0000	0.0000	0.0000	102.2826	210.3387	312.5031 (98)
Space heating												1461.3490 (98)
Space heating per m ²												(98) / (4) = 31.9490 (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

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 1562.9401 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	298.5999	224.4800	177.8079	95.8354	39.5013	0.0000	0.0000	0.0000	0.0000	102.2826	210.3387	312.5031	(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)	319.3582	240.0856	190.1689	102.4977	42.2474	0.0000	0.0000	0.0000	0.0000	109.3932	224.9612	334.2279	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.5026	89.3934	89.1890	88.7975	88.1714	87.3000	87.3000	87.3000	87.3000	88.8199	89.3274	87.3000	(216)
Fuel for water heating, kWh/month	145.7286	128.0434	133.4723	118.3562	115.4796	102.2906	96.4142	108.3185	108.9221	122.7938	131.3784	141.5360	(219)
Water heating fuel used												1452.7335	(219)
Annual totals kWh/year													
Space heating fuel - main system												1562.9401	(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) 32.0114 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 107.0114 (231)
 Electricity for lighting (calculated in Appendix L) 214.7654 (232)
 Total delivered energy for all uses 3337.4504 (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	1562.9401	0.2160	337.5951	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1452.7335	0.2160	313.7904	(264)
Space and water heating			651.3855	(265)
Pumps and fans	107.0114	0.5190	55.5389	(267)
Energy for lighting	214.7654	0.5190	111.4632	(268)
Total CO2, kg/year			818.3877	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8900	(273)

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

DER		17.8900	ZC1
Total Floor Area	TFA	45.7400	
Assumed number of occupants	N	1.5659	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.6439	ZC2
CO2 emissions from cooking, equation (L16)		3.4233	ZC3
Total CO2 emissions		38.9572	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		38.9572	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	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 108.4038 (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) =	0.1845 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4345 (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) =	0.3693 (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	0.4709	0.4617	0.4524	0.4063	0.3970	0.3509	0.3509	0.3416	0.3693	0.3970	0.4155	0.4340 (22b)
Effective ac	0.6109	0.6066	0.6023	0.5825	0.5788	0.5615	0.5615	0.5584	0.5682	0.5788	0.5863	0.5942 (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)			9.3100	1.3258	12.3428		(27)					
External Wall	39.5200	9.3100	30.2100	0.1800	5.4378		(29a)					
External Wall to Corridor	3.7300	2.1200	1.6100	0.1800	0.2898		(29a)					
Plane Ceiling	42.4700		42.4700	0.1300	5.5211		(30)					
Sloping Ceiling	3.6100		3.6100	0.1300	0.4693		(30)					
Dormer roof	0.5100		0.5100	0.1300	0.0663		(30)					
Total net area of external elements Aum(A, m2)			89.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 26.2471		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0416 (36)					
Total fabric heat loss							(33) + (36) = 32.2887 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 21.8527	Feb 21.6987	Mar 21.5477	Apr 20.8387	May 20.7060	Jun 20.0885	Jul 20.0885	Aug 19.9741	Sep 20.3263	Oct 20.7060	Nov 20.9744	Dec 21.2549 (38)
Heat transfer coeff	54.1414	53.9874	53.8364	53.1274	52.9947	52.3772	52.3772	52.2628	52.6150	52.9947	53.2631	53.5436 (39)
Average = Sum(39)m / 12 =												53.1267 (39)
HLP	Jan 1.1837	Feb 1.1803	Mar 1.1770	Apr 1.1615	May 1.1586	Jun 1.1451	Jul 1.1451	Aug 1.1426	Sep 1.1503	Oct 1.1586	Nov 1.1645	Dec 1.1706 (40)
HLP (average)												1.1615 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)												Total = Sum(45)m = 1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (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)

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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	(57)
Combi loss	40.0170	34.8301	37.1067	34.5015	34.1964	31.6850	32.7412	34.1964	34.5015	37.1067	37.3179	40.0170	40.0170	(61)
Total heat required for water heating calculated for each month	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973	152.7973	(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	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973	152.7973	(64)
Heat gains from water heating, kWh/month	48.7255	42.5734	44.2232	39.0926	37.7831	33.1480	31.5616	35.3737	35.7704	40.9116	43.8614	47.5037	47.5037	(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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.2058	10.8411	8.8166	6.6747	4.9894	4.2123	4.5515	5.9162	7.9408	10.0826	11.7679	12.5451	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	65.4913	63.3532	59.4398	54.2953	50.7838	46.0389	42.4215	47.5453	49.6811	54.9886	60.9186	63.8491	(72)
Total internal gains	263.3750	261.2855	251.7863	236.9183	222.1512	207.6344	198.3471	203.4225	211.1440	226.1750	243.3607	256.0630	(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							
Southeast	1.9000	36.7938	0.6300	0.7000	0.7700	21.3649 (77)							
Southwest	3.8000	36.7938	0.6300	0.7000	0.7700	42.7298 (79)							
Northwest	3.6100	11.2829	0.6300	0.7000	0.7700	12.4481 (81)							
Solar gains	76.5427	134.5153	195.0323	260.0629	308.0946	313.2575	298.9379	261.9742	217.3749	151.6292	92.4335	65.0174	(83)
Total gains	339.9177	395.8008	446.8185	496.9813	530.2458	520.8919	497.2851	465.3967	428.5189	377.8042	335.7942	321.0804	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.6684	58.8358	59.0008	59.7882	59.9378	60.6445	60.6445	60.7772	60.3704	59.9378	59.6359	59.3234	
alpha	4.9112	4.9224	4.9334	4.9859	4.9959	5.0430	5.0430	5.0518	5.0247	4.9959	4.9757	4.9549	
util living area	0.9949	0.9886	0.9717	0.9200	0.8013	0.6168	0.4582	0.5075	0.7581	0.9468	0.9892	0.9961	(86)
MIT	19.8450	20.0241	20.2921	20.6196	20.8607	20.9714	20.9947	20.9913	20.9216	20.6034	20.1641	19.8142	(87)
Th 2	19.9331	19.9358	19.9384	19.9509	19.9533	19.9642	19.9642	19.9662	19.9600	19.9533	19.9485	19.9436	(88)
util rest of house	0.9932	0.9849	0.9624	0.8941	0.7442	0.5281	0.3531	0.3981	0.6747	0.9238	0.9850	0.9948	(89)
MIT 2	18.4123	18.6739	19.0602	19.5224	19.8249	19.9464	19.9623	19.9629	19.9023	19.5129	18.8880	18.3750	(90)
Living area fraction	fLA = Living area / (4) = 0.4191 (91)												
MIT	19.0128	19.2398	19.5765	19.9823	20.2590	20.3760	20.3950	20.3939	20.3295	19.9700	19.4228	18.9782	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.0128	19.2398	19.5765	19.9823	20.2590	20.3760	20.3950	20.3939	20.3295	19.9700	19.4228	18.9782	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	336.9244	388.5459	428.2381	444.7699	404.1418	294.0239	197.5965	206.7132	302.7464	349.1823	329.8433	318.8841	(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	796.5686	774.1653	703.9919	588.7724	453.5824	302.5307	198.7715	208.7331	327.7654	496.5580	656.3516	791.2760	(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	341.9753	259.1363	205.1608	103.6818	36.7838	0.0000	0.0000	0.0000	0.0000	109.6475	235.0860	351.4596	(98)
Space heating	1642.9310 (98)												
Space heating per m2	(98) / (4) = 35.9189 (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

	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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1759.0267 (211)
Space heating requirement	341.9753	259.1363	205.1608	103.6818	36.7838	0.0000	0.0000	0.0000	0.0000	109.6475	235.0860	351.4596	(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)	366.1406	277.4478	219.6582	111.0083	39.3831	0.0000	0.0000	0.0000	0.0000	117.3956	251.6980	376.2950	(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	156.4719	136.6822	142.2090	126.1322	122.1182	107.5549	103.0458	114.8719	116.1406	132.2492	141.1734	152.7973	(64)
Efficiency of water heater (217)m	86.9662	86.6371	85.9731	84.5624	82.4319	80.3000	80.3000	80.3000	80.3000	84.5836	86.3261	87.0811	(217)
Fuel for water heating, kWh/month	179.9226	157.7641	165.4111	149.1587	148.1443	133.9414	128.3260	143.0535	144.6333	156.3532	163.5351	175.4656	(219)
Water heating fuel used													1845.7090 (219)
Annual totals kWh/year													
Space heating fuel - main system													1759.0267 (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)													215.5588 (232)
Total delivered energy for all uses													3895.2945 (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	1759.0267	0.2160	379.9498 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1845.7090	0.2160	398.6731 (264)
Space and water heating			778.6229 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	215.5588	0.5190	111.8750 (268)
Total CO2, kg/m2/year			929.4229 (272)
Emissions per m2 for space and water heating			17.0228 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4459 (272b)
Emissions per m2 for pumps and fans			0.8510 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.0228 * 1.00) + 2.4459 + 0.8510, rounded to 2 d.p.			20.3200 (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	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 108.4038 (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) =	0.1845 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3845	(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) =	0.3268 (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	0.4167	0.4085	0.4004	0.3595	0.3513	0.3105	0.3105	0.3023	0.3268	0.3513	0.3677	0.3840 (22b)
Effective ac	0.5868	0.5834	0.5801	0.5646	0.5617	0.5482	0.5482	0.5457	0.5534	0.5617	0.5676	0.5737 (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)			7.2600	1.3258	9.6250		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	39.5200	9.7800	29.7400	0.2500	7.4350	52.8000	1570.2720 (29a)
External Wall to Corridor	3.7300	2.1200	1.6100	0.2200	0.3542	52.8000	85.0080 (29a)
Plane Ceiling	42.4700		42.4700	0.0800	3.3976	9.0000	382.2300 (30)
Sloping Ceiling	3.6100		3.6100	0.2000	0.7220	9.0000	32.4900 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			89.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.2663		(33)
AAC Party Wall			21.5100	0.0000	0.0000	52.8000	1135.7280 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7432.0180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.4840 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8307 (36)
Total fabric heat loss						(33) + (36) =	33.0970 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	20.9924	20.8718	20.7536	20.1983	20.0945	19.6109	19.6109	19.5213	19.7971	20.0945	20.3046	20.5243 (38)
Heat transfer coeff	54.0894	53.9688	53.8506	53.2953	53.1914	52.7078	52.7078	52.6183	52.8941	53.1914	53.4016	53.6213 (39)
Average = Sum(39)m / 12 =	53.2948 (39)											
HLP	1.1825	1.1799	1.1773	1.1652	1.1629	1.1523	1.1523	1.1504	1.1564	1.1629	1.1675	1.1723 (40)
HLP (average)	1.1652 (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	1.5659 (42)											
Average daily hot water use (litres/day)	71.3891 (43)											
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)	Total = Sum(45)m = 1123.2292 (45)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8903	0.9324	0.9140	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	441.1174	363.6849	365.5021	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	687.9241	658.4419	613.5313	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	177.7009	219.2992	184.5338	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												581.5338 (104)
Cooled fraction												FC = cooled area / (4) =
Intermittency factor (Table 10b)												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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	44.4252	54.8248	46.1334	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												145.3834 (107)
Space cooling per m2												3.1785 (108)
Energy for space heating												38.2510 (99)
Energy for space cooling												3.1785 (108)
Total												41.4294 (109)
Dwelling Fabric Energy Efficiency (DFEE)												41.4 (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	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 108.4038 (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) =	0.1845 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4345	(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) =	0.3693 (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	0.4709	0.4617	0.4524	0.4063	0.3970	0.3509	0.3509	0.3416	0.3693	0.3970	0.4155	0.4340 (22b)
Effective ac	0.6109	0.6066	0.6023	0.5825	0.5788	0.5615	0.5615	0.5584	0.5682	0.5788	0.5863	0.5942 (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)			9.3100	1.3258	12.3428		(27)					
External Wall	39.5200	9.3100	30.2100	0.1800	5.4378		(29a)					
External Wall to Corridor	3.7300	2.1200	1.6100	0.1800	0.2898		(29a)					
Plane Ceiling	42.4700		42.4700	0.1300	5.5211		(30)					
Sloping Ceiling	3.6100		3.6100	0.1300	0.4693		(30)					
Dormer roof	0.5100		0.5100	0.1300	0.0663		(30)					
Total net area of external elements Aum(A, m2)			89.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 26.2471		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0416 (36)					
Total fabric heat loss							(33) + (36) = 32.2887 (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	21.8527	21.6987	21.5477	20.8387	20.7060	20.0885	20.0885	19.9741	20.3263	20.7060	20.9744	21.2549 (38)
Average = Sum(39)m / 12 =	54.1414	53.9874	53.8364	53.1274	52.9947	52.3772	52.3772	52.2628	52.6150	52.9947	53.2631	53.5436 (39)
	53.1267 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1837	1.1803	1.1770	1.1615	1.1586	1.1451	1.1451	1.1426	1.1503	1.1586	1.1645	1.1706 (40)
Days in month												1.1615 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy conte	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Energy content (annual)												Total = Sum(45)m = 1123.2292 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												0.0000 (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)

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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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	24.7467	21.6436	22.3342	19.4715	18.6834	16.1224	14.9397	17.1436	17.3483	20.2178	22.0693	23.9658		(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	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	78.2929	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.2058	10.8411	8.8166	6.6747	4.9894	4.2123	4.5515	5.9162	7.9408	10.0826	11.7679	12.5451	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	136.1901	137.6033	134.0420	126.4605	116.8901	107.8953	101.8863	100.4730	104.0343	111.6159	121.1862	130.1810	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	30.8293	(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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	(71)
Water heating gains (Table 5)	33.2616	32.2077	30.0191	27.0438	25.1121	22.3922	20.0803	23.0424	24.0949	27.1744	30.6518	32.2121	(72)
Total internal gains	228.1454	227.1400	219.3656	206.6669	193.4795	180.9876	173.0059	175.9196	182.5578	195.3608	210.0938	221.4261	(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								
Southeast	1.9000	36.7938	0.6300	0.7000	0.7700	21.3649 (77)							
Southwest	3.8000	36.7938	0.6300	0.7000	0.7700	42.7298 (79)							
Northwest	3.6100	11.2829	0.6300	0.7000	0.7700	12.4481 (81)							
Solar gains	76.5427	134.5153	195.0323	260.0629	308.0946	313.2575	298.9379	261.9742	217.3749	151.6292	92.4335	65.0174	(83)
Total gains	304.6881	361.6553	414.3979	466.7298	501.5741	494.2451	471.9439	437.8938	399.9327	346.9900	302.5273	286.4434	(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)	58.6684	58.8358	59.0008	59.7882	59.9378	60.6445	60.6445	60.7772	60.3704	59.9378	59.6359	59.3234	21.0000 (85)
tau	4.9112	4.9224	4.9334	4.9859	4.9959	5.0430	5.0430	5.0518	5.0247	4.9959	4.9757	4.9549	
alpha	0.9968	0.9922	0.9789	0.9349	0.8258	0.6442	0.4815	0.5367	0.7912	0.9608	0.9931	0.9976	(86)
util living area	19.7747	19.9578	20.2338	20.5769	20.8388	20.9654	20.9934	20.9889	20.9043	20.5536	20.0991	19.7445	(87)
MIT	19.9331	19.9358	19.9384	19.9509	19.9533	19.9642	19.9642	19.9662	19.9600	19.9533	19.9485	19.9436	(88)
Th 2	0.9958	0.9895	0.9716	0.9125	0.7715	0.5538	0.3717	0.4223	0.7106	0.9427	0.9903	0.9969	(89)
util rest of house	18.8250	19.0090	19.2829	19.6206	19.8499	19.9492	19.9626	19.9632	19.9104	19.6077	19.1606	18.8033	(90)
MIT 2	19.2230	19.4067	19.6814	20.0214	20.2643	20.3751	20.3946	20.3931	20.3269	20.0042	19.5539	19.1978	(92)
Living area fraction												0.4191	(91)
MIT												0.0000	(93)
Temperature adjustment												0.0000	(93)
adjusted MIT												19.1978	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9879	0.9695	0.9143	0.7890	0.5910	0.4180	0.4706	0.7414	0.9438	0.9890	0.9961	(94)
Useful gains	303.1047	357.2702	401.7435	426.7206	395.7423	292.0828	197.2742	206.0772	296.5291	327.4952	299.1873	285.3263	(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	807.9507	783.1761	709.6415	590.8514	453.8648	302.4844	198.7505	208.6911	327.6308	498.3706	663.3349	803.0357	(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	375.6054	286.2087	229.0761	118.1742	43.2432	0.0000	0.0000	0.0000	0.0000	127.1313	262.1863	385.1758	(98)
Space heating												1826.8009	(98)
Space heating per m2												(98) / (4) =	39.9388 (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	492.3453	387.5910	397.1973	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9217	0.9605	0.9454	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	453.7711	372.2675	375.4921	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	637.3840	610.2143	571.2746	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	132.2013	177.0324	145.6622	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												454.8958 (104)	
Cooled fraction												FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	33.0503	44.2581	36.4155	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													113.7240 (107)
Space cooling per m2													2.4863 (108)
Energy for space heating													39.9388 (99)
Energy for space cooling													2.4863 (108)
Total													42.4251 (109)
Target Fabric Energy Efficiency (TFEE)													48.8 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 108.4038 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2000 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.1700 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			7.2600	1.3258	9.6250		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	39.5200	9.7800	29.7400	0.2500	7.4350	52.8000	1570.2720 (29a)
External Wall to Corridor	3.7300	2.1200	1.6100	0.2200	0.3542	52.8000	85.0080 (29a)
Plane Ceiling	42.4700		42.4700	0.0800	3.3976	9.0000	382.2300 (30)
Sloping Ceiling	3.6100		3.6100	0.2000	0.7220	9.0000	32.4900 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m ²)	89.8400						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.2663		
AAC Party Wall			21.5100	0.0000	0.0000	52.8000	1135.7280 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			7432.0180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.4840 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8307 (36)
Total fabric heat loss						(33) + (36) =	33.0970 (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	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866 (38)
Average = Sum(39)m / 12 =	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836 (39)
HLP	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146 (40)
HLP (average)	1.1146 (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	1.5659 (42)											
Average daily hot water use (litres/day)	71.3891 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Energy conte	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy content (annual)	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1123.2292 (45)
Water storage loss:	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691 (61)
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (64)
RHI water heating demand												1287.1451 (64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917 (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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4023	27.0030	21.9603	16.6254	12.4277	10.4920	11.3369	14.7362	19.7789	25.1138	29.3115	31.2472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964 (72)
Total internal gains	370.6901	367.7462	353.9566	332.6420	311.1318	291.5082	279.7628	285.6949	297.7036	319.1812	343.1137	360.9218 (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 Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	2.0000	40.9830	0.4300	0.0000	0.7700	27.1390 (77)	
Southwest	3.9900	40.9830	0.4300	0.0000	0.7700	54.1422 (79)	
Northwest	1.2700	12.9465	0.4300	0.0000	0.7700	5.4440 (81)	
Northwest	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)	

Solar gains	97.5274	159.8914	228.3501	320.8785	367.5351	389.7009	368.1243	324.6618	270.0865	188.4747	120.6865	82.0255 (83)
Total gains	468.2175	527.6376	582.3067	653.5205	678.6669	681.2091	647.8871	610.3567	567.7901	507.6559	463.8001	442.9473 (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	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924
alpha	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995
util living area	0.9439	0.9164	0.8592	0.7426	0.5886	0.4092	0.2661	0.2821	0.5121	0.7726	0.9068	0.9520 (86)
MIT	19.8856	20.0777	20.3885	20.7106	20.9028	20.9806	20.9972	20.9966	20.9566	20.7215	20.2624	19.8274 (87)
Th 2	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889 (88)
util rest of house	0.9333	0.9014	0.8347	0.7023	0.5312	0.3391	0.1877	0.1991	0.4350	0.7256	0.8872	0.9426 (89)
MIT 2	18.5521	18.8211	19.2497	19.6708	19.8995	19.9765	19.9880	19.9878	19.9580	19.6971	19.0866	18.4704 (90)
Living area fraction									fLA = Living area / (4) =			0.4191 (91)
MIT	19.1110	19.3477	19.7270	20.1066	20.3200	20.3973	20.4110	20.4106	20.3765	20.1265	19.5794	19.0391 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1110	19.3477	19.7270	20.1066	20.3200	20.3973	20.4110	20.4106	20.3765	20.1265	19.5794	19.0391 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	431.7576	469.7609	481.9160	462.2004	373.6507	250.5455	142.8939	142.7804	264.2055	371.8588	407.1639	412.7295 (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	734.7227	721.3032	648.8689	540.7635	398.6914	254.7812	143.3148	143.2959	274.1147	444.9063	605.6562	731.0606 (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	225.4060	169.0364	124.2129	56.5654	18.6303	0.0000	0.0000	0.0000	0.0000	54.3473	142.9145	236.8383 (98)
Space heating												1027.9512 (98)
RHI space heating demand												1028 (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	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	108.4038 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	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 (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)			7.2600	1.3258	9.6250		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	39.5200	9.7800	29.7400	0.2500	7.4350	52.8000	1570.2720 (29a)
External Wall to Corridor	3.7300	2.1200	1.6100	0.2200	0.3542	52.8000	85.0080 (29a)
Plane Ceiling	42.4700		42.4700	0.0800	3.3976	9.0000	382.2300 (30)
Sloping Ceiling	3.6100		3.6100	0.2000	0.7220	9.0000	32.4900 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			89.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	27.2663		(33)
AAC Party Wall			21.5100	0.0000	0.0000	52.8000	1135.7280 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7432.0180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.4840 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8307 (36)
Total fabric heat loss						(33) + (36) =	33.0970 (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	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866 (38)
Heat transfer coeff	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836 (39)
Average = Sum(39)m / 12 =												50.9836 (39)
HLP	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146 (40)
HLP (average)												1.1146 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy cont	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy content (annual)	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1123.2292 (45)
Distribution loss	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (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												
Combi loss	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691 (61)
Total heat required for water heating calculated for each month												
Solar input	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (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 (63)
Heat gains from water heating, kWh/month												
	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (64)
Total per year (kWh/year) = Sum(64)m =												1287.1451 (64)
	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4023	27.0030	21.9603	16.6254	12.4277	10.4920	11.3369	14.7362	19.7789	25.1138	29.3115	31.2472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964 (72)
Total internal gains	370.6901	367.7462	353.9566	332.6420	311.1318	291.5082	279.7628	285.6949	297.7036	319.1812	343.1137	360.9218 (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						
Southeast		2.0000	36.7938	0.4300	0.0000	0.7700	24.3649 (77)					
Southwest		3.9900	36.7938	0.4300	0.0000	0.7700	48.6079 (79)					
Northwest		1.2700	11.2829	0.4300	0.0000	0.7700	4.7444 (81)					
Northwest		2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)					
Solar gains	87.1314	153.1200	221.9972	296.0034	350.6599	356.5306	340.2351	298.1738	247.4236	172.5983	105.2198	74.0121 (83)
Total gains	457.8215	520.8661	575.9538	628.6455	661.7917	648.0388	619.9980	583.8686	545.1273	491.7795	448.3335	434.9340 (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	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924
Feb	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995
Mar												
Apr												
May												
Jun												
Jul												
Aug												
Sep												
Oct												
Nov												
Dec												
util living area	0.9508	0.9230	0.8730	0.7797	0.6417	0.4829	0.3564	0.3933	0.5934	0.8158	0.9236	0.9582 (86)
MIT	19.8080	20.0259	20.3226	20.6370	20.8583	20.9618	20.9904	20.9860	20.9190	20.6304	20.1562	19.7403 (87)
Th 2	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889 (88)
util rest of house												
MIT 2	0.9415	0.9092	0.8509	0.7436	0.5886	0.4136	0.2769	0.3104	0.5218	0.7765	0.9074	0.9501 (89)
Living area fraction	18.4415	18.7482	19.1597	19.5782	19.8501	19.9606	19.9843	19.9817	19.9226	19.5826	18.9388	18.3454 (90)
MIT	19.0142	19.2837	19.6471	20.0220	20.2726	20.3802	20.4059	20.4026	20.3402	20.0218	19.4490	18.9300 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0142	19.2837	19.6471	20.0220	20.2726	20.3802	20.4059	20.4026	20.3402	20.0218	19.4490	18.9300 (93)

8. Space heating requirement

Utilisation	0.9305	0.8978	0.8425	0.7449	0.6041	0.4410	0.3100	0.3448	0.5476	0.7779	0.8972	0.9396 (94)
Useful gains	425.9866	467.6356	485.2242	468.2614	399.7739	285.7697	192.2190	201.3311	298.5156	382.5373	402.2302	408.6501 (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												
Month fracti	750.1822	733.3318	670.2865	567.0378	437.0639	294.6976	194.0401	204.0673	318.1465	480.3553	629.5975	750.9883 (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	241.2015	178.5479	137.6864	71.1190	27.7438	0.0000	0.0000	0.0000	0.0000	72.7766	163.7045	254.6996 (98)
Space heating per m2												1147.4792 (98)
												(98) / (4) = 25.0870 (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 1227.2505 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	241.2015	178.5479	137.6864	71.1190	27.7438	0.0000	0.0000	0.0000	0.0000	72.7766	163.7045	254.6996	(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)	257.9695	190.9603	147.2581	76.0631	29.6725	0.0000	0.0000	0.0000	0.0000	77.8359	175.0850	272.4060	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.3505	89.2224	88.9875	88.5639	87.9660	87.3000	87.3000	87.3000	87.3000	88.5532	89.1357	87.3000	(216)
Fuel for water heating, kWh/month	145.9766	128.2888	133.7744	118.6685	115.7492	102.2906	96.4142	108.3185	108.9221	123.1637	131.6608	141.7605	(219)
Water heating fuel used												1454.9879	(219)
Annual totals kWh/year													
Space heating fuel - main system													1227.2505 (211)
Space heating fuel - secondary													0.0000 (215)

Electricity for pumps and fans:

(MEVD)centralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420
 mechanical ventilation fans (SFP = 0.2420) 32.0114 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 107.0114 (231)
 Electricity for lighting (calculated in Appendix L) 214.7654 (232)
 Total delivered energy for all uses 3004.0152 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1227.2505	3.4800	42.7083	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1454.9879	3.4800	50.6336	(247)
Mechanical ventilation fans	32.0114	13.1900	4.2223	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	214.7654	13.1900	28.3275	(250)
Additional standing charges			120.0000	(251)
Total energy cost			255.7843	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
 Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.1839 (257)
 SAP value 83.4842
 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	1227.2505	0.2160	265.0861	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1454.9879	0.2160	314.2774	(264)
Space and water heating			579.3635	(265)
Pumps and fans	107.0114	0.5190	55.5389	(267)
Energy for lighting	214.7654	0.5190	111.4632	(268)
Total kg/year			746.3656	(272)
CO2 emissions per m2			16.3200	(273)
EI value			88.9781	
EI rating			89	(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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8837 = 3.938$, stars = 4
 $0.216 / 0.8837 = 0.2444$, 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	45.7400 (1b)	2.3700 (2b)	108.4038 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.7400		108.4038 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	108.4038 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			7.2600	1.3258	9.6250		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	39.5200	9.7800	29.7400	0.2500	7.4350	52.8000	1570.2720 (29a)
External Wall to Corridor	3.7300	2.1200	1.6100	0.2200	0.3542	52.8000	85.0080 (29a)
Plane Ceiling	42.4700		42.4700	0.0800	3.3976	9.0000	382.2300 (30)
Sloping Ceiling	3.6100		3.6100	0.2000	0.7220	9.0000	32.4900 (30)
Dormer roof	0.5100		0.5100	0.2000	0.1020	9.0000	4.5900 (30)
Total net area of external elements Aum(A, m2)			89.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	27.2663			(33)
AAC Party Wall			21.5100	0.0000	0.0000	52.8000	1135.7280 (32)
E-FC-4			45.7400			70.0000	3201.8000 (32d)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				7432.0180 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.4840 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8307 (36)
Total fabric heat loss			(33) + (36) =				33.0970 (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	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866	17.8866 (38)
Average = Sum(39)m / 12 =	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836	50.9836 (39)
HLP	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146	1.1146 (40)
HLP (average)												1.1146 (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												1.5659 (42)
Average daily hot water use (litres/day)												71.3891 (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	78.5281	75.6725	72.8169	69.9614	67.1058	64.2502	64.2502	67.1058	69.9614	72.8169	75.6725	78.5281 (44)
Energy content (annual)	116.4548	101.8522	105.1023	91.6307	87.9219	75.8699	70.3046	80.6756	81.6391	95.1425	103.8555	112.7803 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1123.2292 (45)
Water storage loss:	17.4682	15.2778	15.7653	13.7446	13.1883	11.3805	10.5457	12.1013	12.2459	14.2714	15.5783	16.9170 (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	13.9760	12.6103	13.9402	13.4667	13.8982	13.4298	13.8650	13.8865	13.4499	13.9228	13.5014	13.9691 (61)
Total heat required for water heating calculated for each month	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494 (64)
Heat gains from water heating, kWh/month	42.2152	37.0184	38.4316	33.8339	32.7086	28.5842	26.8425	30.2962	30.5075	35.1156	37.9073	40.9917 (65)
												Total per year (kWh/year) = Sum(64)m = 1287.1451 (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	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515	93.9515 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4023	27.0030	21.9603	16.6254	12.4277	10.4920	11.3369	14.7362	19.7789	25.1138	29.3115	31.2472 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.2688	205.3781	200.0627	188.7470	174.4628	161.0378	152.0690	149.9597	155.2751	166.5909	180.8750	194.3000 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610	45.9610 (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)	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344	-62.6344 (71)
Water heating gains (Table 5)	56.7409	55.0869	51.6553	46.9915	43.9631	39.7003	36.0787	40.7208	42.3715	47.1984	52.6490	55.0964 (72)
Total internal gains	370.6901	367.7462	353.9566	332.6420	311.1318	291.5082	279.7628	285.6949	297.7036	319.1812	343.1137	360.9218 (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					
Southeast	2.0000	40.9830	0.4300	0.0000	0.7700	27.1390 (77)						
Southwest	3.9900	40.9830	0.4300	0.0000	0.7700	54.1422 (79)						
Northwest	1.2700	12.9465	0.4300	0.0000	0.7700	5.4440 (81)						
Northwest	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)						
Solar gains	97.5274	159.8914	228.3501	320.8785	367.5351	389.7009	368.1243	324.6618	270.0865	188.4747	120.6865	82.0255 (83)
Total gains	468.2175	527.6376	582.3067	653.5205	678.6669	681.2091	647.8871	610.3567	567.7901	507.6559	463.8001	442.9473 (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)	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924	40.4924 (85)
tau	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995	3.6995
alpha	0.9439	0.9164	0.8592	0.7426	0.5886	0.4092	0.2661	0.2821	0.5121	0.7726	0.9068	0.9520 (86)
util living area	19.8856	20.0777	20.3885	20.7106	20.9028	20.9806	20.9972	20.9966	20.9566	20.7215	20.2624	19.8274 (87)
MIT	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889	19.9889 (88)
util rest of house	0.9333	0.9014	0.8347	0.7023	0.5312	0.3391	0.1877	0.1991	0.4350	0.7256	0.8872	0.9426 (89)
MIT 2	18.5521	18.8211	19.2497	19.6708	19.8995	19.9765	19.9880	19.9878	19.9580	19.6971	19.0866	18.4704 (90)
Living area fraction	19.1110	19.3477	19.7270	20.1066	20.3200	20.3973	20.4110	20.4106	20.3765	20.1265	19.5794	19.0391 (91)
MIT	19.1110	19.3477	19.7270	20.1066	20.3200	20.3973	20.4110	20.4106	20.3765	20.1265	19.5794	19.0391 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1110	19.3477	19.7270	20.1066	20.3200	20.3973	20.4110	20.4106	20.3765	20.1265	19.5794	19.0391 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	431.7576	469.7609	481.9160	462.2004	373.6507	250.5455	142.8939	142.7804	264.2055	371.8588	407.1639	412.7295 (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	734.7227	721.3032	648.8689	540.7635	398.6914	254.7812	143.3148	143.2959	274.1147	444.9063	605.6562	731.0606 (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	225.4060	169.0364	124.2129	56.5654	18.6303	0.0000	0.0000	0.0000	0.0000	54.3473	142.9145	236.8383 (98)
Space heating												1027.9512 (98)
Space heating per m2												(98) / (4) = 22.4738 (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													1099.4131 (211)
Space heating requirement	225.4060	169.0364	124.2129	56.5654	18.6303	0.0000	0.0000	0.0000	0.0000	54.3473	142.9145	236.8383	(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)	241.0760	180.7876	132.8481	60.4978	19.9254	0.0000	0.0000	0.0000	0.0000	58.1255	152.8497	253.3030	(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	130.4309	114.4624	119.0425	105.0974	101.8200	89.2997	84.1696	94.5620	95.0890	109.0653	117.3569	126.7494	(64)
Efficiency of water heater (217)m	89.3002	89.1802	88.9052	88.3936	87.7801	87.3000	87.3000	87.3000	87.3000	88.3388	89.0285	87.3000	(216)
Fuel for water heating, kWh/month	146.0589	128.3496	133.8983	118.8970	115.9945	102.2906	96.4142	108.3185	108.9221	123.4625	131.8194	141.8443	(219)
Water heating fuel used													1456.2697 (219)
Annual totals kWh/year													
Space heating fuel - main system													1099.4131 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDcentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													32.0114 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													107.0114 (231)
Electricity for lighting (calculated in Appendix L)													214.7654 (232)
Total delivered energy for all uses													2877.4596 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1099.4131	3.9200	43.0970 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1456.2697	3.9200	57.0858 (247)
Mechanical ventilation fans	32.0114	16.9600	5.4291 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	214.7654	16.9600	36.4242 (250)
Additional standing charges			88.0000 (251)
Total energy cost			242.7561 (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	1099.4131	0.2160	237.4732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1456.2697	0.2160	314.5543 (264)
Space and water heating			552.0275 (265)
Pumps and fans	107.0114	0.5190	55.5389 (267)
Energy for lighting	214.7654	0.5190	111.4632 (268)
Total kg/year			719.0296 (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	1099.4131	1.2200	1341.2840 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1456.2697	1.2200	1776.6491 (264)
Space and water heating			3117.9330 (265)
Pumps and fans	107.0114	3.0700	328.5251 (267)
Energy for lighting	214.7654	3.0700	659.3296 (268)
Primary energy kWh/year			4105.7878 (272)
Primary energy kWh/m2/year			89.7636 (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 89

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)	Total Savings £0	0.00 kg/m ²	

Potential energy efficiency rating: B 83
 Potential environmental impact rating: B 89

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	£55	£55	£0
Mains gas	£188	£188	£0
Space heating	£149	£149	£0
Water heating	£57	£57	£0
Lighting	£36	£36	£0
Total cost of fuels	£243	£243	£0
Total cost of uses	£242	£242	£0
Delivered energy	63 kWh/m ²	63 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	16 kg/m ²	16 kg/m ²	0 kg/m ²
Primary energy	90 kWh/m ²	90 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	East Anglia
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	162.5 (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	214.64 (P1)
Transmission heat loss coefficient	33.10 (37)
Summer heat loss coefficient	247.74 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North 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
South East	2.0000	122.3147	0.4300	0.0000	0.9000	94.6716
South West	3.9900	122.3147	0.4300	0.0000	0.9000	188.8698
North West	1.2700	100.0415	0.4300	0.0000	0.9000	49.1694
North West	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644

total: 430.2751

Solar gains	455	Jul	430	Aug	379	(P4)
Internal gains	289		277		283	
Total summer gains	744		707		662	(P5)

Summer gain/loss ratio	3.00	2.85	2.67	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 162.5)	0.86	0.86	0.86	
Threshold temperature	19.27	21.32	21.14	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight