

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-029			Issued on Date	12/02/2020
Assessment Reference	029	Prop Type Ref	2FF Semi		
Property	Plot 029, 2 Bed, K, Ba, ES, Welwyn Garden City				
SAP Rating	84 B	DER	16.34	TER	18.73
Environmental	89 B	% DER<TER	12.74		
CO₂ Emissions (t/year)	0.80	DFEE	36.65	TFEE	44.53
General Requirements Compliance	Pass	% DFEE<TFEE	17.69		
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 56 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.73 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.34 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 36.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1900 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (East Anglia): Slight OK
Based on:
Overshading: Average
Windows facing North East: 3.99 m², No overhang
Windows facing South West: 3.97 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	56.4000 (1b)	x 2.3400 (2b)	= 131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 131.9760 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes								
Measured/design AP50				4.0000								
Infiltration rate				0.2000	(18)							
Number of sides sheltered				2	(19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	26.3000	7.9600	18.3400	0.2500	4.5850	52.8000	968.3520 (29a)
External Wall to Stairwell	18.9800	2.1200	16.8600	0.2000	3.3720	52.8000	890.2080 (29a)
Plane ceiling	44.9400		44.9400	0.0800	3.5952	9.0000	404.4600 (30)
Sloping ceiling	7.6700		7.6700	0.2000	1.5340	9.0000	69.0300 (30)
Dormer ceiling	2.2700		2.2700	0.2000	0.4540	9.0000	20.4300 (30)
Total net area of external elements Aum(A, m2)			100.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3828		(33)
AAC Party Wall			23.1600	0.0000	0.0000	52.8000	1222.8480 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32d)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9124.7880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							161.7870 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8026 (36)
Total fabric heat loss						(33) + (36) =	32.1854 (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	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760 (38)
Average = Sum(39)m / 12 =	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614 (39)
HLP	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568 (40)
HLP (average)												0.9568 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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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	1745.0531	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	322.8017	250.7924	206.3351	116.4605	49.7196	0.0000	0.0000	0.0000	0.0000	118.4682	230.6537	336.3933	(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)	345.2425	268.2272	220.6792	124.5567	53.1760	0.0000	0.0000	0.0000	0.0000	126.7040	246.6885	359.7790	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)	
Efficiency of water heater (217)m	89.4950	89.4094	89.2357	88.8837	88.2656	87.3000	87.3000	87.3000	87.3000	88.8677	89.3303	89.5427	(217)	
Fuel for water heating, kWh/month	159.3180	139.9048	145.6879	128.9931	125.7437	111.3518	104.8107	117.9550	118.6751	133.8951	143.5028	154.6935	(219)	
Water heating fuel used												1584.5313	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1745.0531	(211)
Space heating fuel - secondary													0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398		
mechanical ventilation fans (SFP = 0.2398)		38.6148 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		113.6148 (231)
Electricity for lighting (calculated in Appendix L)		276.1610 (232)
Total delivered energy for all uses		3719.3602 (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	1745.0531	0.2160	376.9315	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1584.5313	0.2160	342.2588	(264)
Space and water heating			719.1902	(265)
Pumps and fans	113.6148	0.5190	58.9661	(267)
Energy for lighting	276.1610	0.5190	143.3275	(268)
Total CO2, kg/year			921.4839	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3400	(273)

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

DER		16.3400	ZC1
Total Floor Area		56.4000	TFA
Assumed number of occupants		1.8782	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		17.2085	ZC2
CO2 emissions from cooking, equation (L16)		2.9092	ZC3
Total CO2 emissions		36.4577	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.4577	ZC8

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1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	x 2.3400 (2b)	= 131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 131.9760 (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) =	0.1515 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4015 (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) =	0.3413 (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	0.4352	0.4266	0.4181	0.3754	0.3669	0.3242	0.3242	0.3157	0.3413	0.3669	0.3840	0.4010 (22b)
	0.5947	0.5910	0.5874	0.5705	0.5673	0.5526	0.5526	0.5498	0.5582	0.5673	0.5737	0.5804 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.9600	1.3258	10.5530		(27)
External Wall	26.3000	7.9600	18.3400	0.1800	3.3012		(29a)
External Wall to Stairwell	18.9800	2.1200	16.8600	0.1800	3.0348		(29a)
Plane ceiling	44.9400		44.9400	0.1300	5.8422		(30)
Sloping ceiling	7.6700		7.6700	0.1300	0.9971		(30)
Dormer ceiling	2.2700		2.2700	0.1300	0.2951		(30)
Total net area of external elements Aum(A, m2)			100.1600				(31)
Fabric heat loss, W/K = Sum (A x U)					26.1434		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5103 (36)
Total fabric heat loss							(33) + (36) = 32.6537 (37)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	25.8999	25.7397	25.5828	24.8455	24.7076	24.0655	24.0655	23.9466	24.3128	24.7076	24.9866	25.2784 (38)
Average = Sum(39)m / 12 =	58.5536	58.3935	58.2365	57.4993	57.3613	56.7192	56.7192	56.6003	56.9665	57.3613	57.6404	57.9321 (39)
	57.4986											57.4986 (39)

HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0382	1.0353	1.0326	1.0195	1.0170	1.0057	1.0057	1.0036	1.0100	1.0170	1.0220	1.0272 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m = 1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m	19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (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	0.0000	(57)
Combi loss	44.1759	38.4498	40.9631	38.0871	37.7503	34.9779	36.1439	37.7503	38.0871	40.9631	41.1962	44.1759	44.1759	44.1759	(61)
Total heat required for water heating calculated for each month	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770	168.6770	168.6770	(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	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770	168.6770	168.6770	(64)
Heat gains from water heating, kWh/month	53.7893	46.9978	48.8191	43.1553	41.7098	36.5929	34.8417	39.0500	39.4878	45.1633	48.4198	52.4406	52.4406	52.4406	(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	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	72.2975	69.9373	65.6171	59.9380	56.0615	50.8235	46.8302	52.4865	54.8442	60.7034	67.2497	70.4847	(72)
Total internal gains	305.8940	303.4850	292.2882	274.7473	257.2022	240.1512	229.3659	235.0710	244.3053	262.0263	282.2412	297.2891	(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)						
Southwest	3.9700	36.7938	0.6300	0.7000	0.7700	44.6414 (79)						
Solar gains	58.3997	104.0463	154.4994	211.7785	255.7807	262.0998	249.2927	215.2162	174.1386	118.2662	70.7816	49.4395 (83)
Total gains	364.2937	407.5313	446.7876	486.5258	512.9829	502.2511	478.6586	450.2873	418.4439	380.2925	353.0228	346.7286 (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	66.8903	67.0737	67.2545	68.1168	68.2806	69.0536	69.0536	69.1987	68.7538	68.2806	67.9501	67.6079	
alpha	5.4594	5.4716	5.4836	5.5411	5.5520	5.6036	5.6036	5.6132	5.5836	5.5520	5.5300	5.5072	
util living area	0.9971	0.9941	0.9854	0.9541	0.8635	0.6860	0.5148	0.5666	0.8204	0.9686	0.9940	0.9978 (86)	
MIT	19.9553	20.0901	20.3123	20.6051	20.8455	20.9684	20.9946	20.9911	20.9149	20.6106	20.2322	19.9315 (87)	
Th 2	20.0516	20.0540	20.0563	20.0671	20.0692	20.0786	20.0786	20.0804	20.0750	20.0692	20.0650	20.0608 (88)	
util rest of house	0.9962	0.9922	0.9804	0.9378	0.8179	0.6020	0.4105	0.4593	0.7490	0.9541	0.9916	0.9971 (89)	
MIT 2	18.6589	18.8570	19.1804	19.6028	19.9180	20.0576	20.0766	20.0766	20.0075	19.6185	19.0731	18.6310 (90)	
Living area fraction	fLA = Living area / (4) =											0.3821 (91)	
MIT	19.1543	19.3282	19.6129	19.9858	20.2724	20.4056	20.4274	20.4260	20.3542	19.9975	19.5160	19.1279 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.1543	19.3282	19.6129	19.9858	20.2724	20.4056	20.4274	20.4260	20.3542	19.9975	19.5160	19.1279 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9950	0.9902	0.9773	0.9361	0.8289	0.6330	0.4506	0.5005	0.7725	0.9527	0.9897	0.9961 (94)	
Useful gains	362.4574	403.5391	436.6676	455.4357	425.2027	317.9440	215.6647	225.3875	323.2656	362.3210	349.3945	345.3714 (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	869.7710	842.5106	763.6487	637.4246	491.7234	329.2894	217.0848	227.8754	356.2798	539.0551	715.6614	864.8050 (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	377.4413	294.9888	243.2739	131.0320	49.4914	0.0000	0.0000	0.0000	0.0000	131.4902	263.7121	386.4586 (98)	
Space heating												1877.8884 (98)	
Space heating per m ²												(98) / (4) = 33.2959 (99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												93.4000 (206)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
Space heating requirement												2010.5871 (211)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	377.4413	294.9888	243.2739	131.0320	49.4914	0.0000	0.0000	0.0000	0.0000	131.4902	263.7121	386.4586	(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)	404.1127	315.8339	260.4646	140.2912	52.9887	0.0000	0.0000	0.0000	0.0000	140.7818	282.3470	413.7672	(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	172.7334	150.8871	156.9882	139.2406	134.8095	118.7327	113.7550	126.8101	128.2106	145.9933	155.8450	168.6770	(64)
Efficiency of water heater (217)m	86.9658	86.7093	86.1500	84.8986	82.7837	80.3000	80.3000	80.3000	80.3000	84.7890	86.3650	80.3000	(216)
Fuel for water heating, kWh/month	198.6223	174.0149	182.2265	164.0081	162.8455	147.8614	141.6625	157.9205	159.6645	172.1843	180.4493	193.7205	(219)
Water heating fuel used												2035.1801 (219)	
Annual totals kWh/year												2010.5871 (211)	
Space heating fuel - main system												0.0000 (215)	
Space heating fuel - secondary													
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)												276.1610 (232)	
Total delivered energy for all uses												4396.9282 (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	2010.5871	0.2160	434.2868 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2035.1801	0.2160	439.5989 (264)
Space and water heating			873.8857 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	276.1610	0.5190	143.3275 (268)
Total CO2, kg/m2/year			1056.1383 (272)
Emissions per m2 for space and water heating			15.4944 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5413 (272b)
Emissions per m2 for pumps and fans			0.6902 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4944 * 1.00) + 2.5413 + 0.6902, rounded to 2 d.p.			18.7300 (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	56.4000 (1b)	2.3400 (2b)	131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		131.9760 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	131.9760 (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) =	0.1515 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3515 (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) =	0.2988 (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	0.3810	0.3735	0.3660	0.3287	0.3212	0.2839	0.2839	0.2764	0.2988	0.3212	0.3362	0.3511 (22b)
Effective ac	0.5726	0.5698	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	26.3000	7.9600	18.3400	0.2500	4.5850	52.8000	968.3520 (29a)
External Wall to Stairwell	18.9800	2.1200	16.8600	0.2000	3.3720	52.8000	890.2080 (29a)
Plane ceiling	44.9400		44.9400	0.0800	3.5952	9.0000	404.4600 (30)
Sloping ceiling	7.6700		7.6700	0.2000	1.5340	9.0000	69.0300 (30)
Dormer ceiling	2.2700		2.2700	0.2000	0.4540	9.0000	20.4300 (30)
Total net area of external elements Aum(A, m2)			100.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3828		(33)
AAC Party Wall			23.1600	0.0000	0.0000	52.8000	1222.8480 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32d)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9124.7880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							161.7870 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8026 (36)
Total fabric heat loss						(33) + (36) =	32.1854 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	24.9368	24.8141	24.6938	24.1287	24.0230	23.5308	23.5308	23.4397	23.7204	24.0230	24.2368	24.4604 (38)
Heat transfer coeff	57.1222	56.9995	56.8792	56.3141	56.2084	55.7162	55.7162	55.6250	55.9058	56.2084	56.4222	56.6458 (39)
Average = Sum(39)m / 12 =	56.3136 (39)											
HLP	1.0128	1.0106	1.0085	0.9985	0.9966	0.9879	0.9879	0.9863	0.9912	0.9966	1.0004	1.0044 (40)
HLP (average)	0.9985 (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	1.8782 (42)											
Average daily hot water use (litres/day)	78.8083 (43)											
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)	Total = Sum(45)m = 1239.9620 (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	0.0000	0.0000	0.0000	0.0000	0.0000	
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	0.0000	0.0000	0.0000	0.0000	0.0000	
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	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains from water heating, kWh/month	27.3185	23.8929	24.6553	21.4951	20.6251	17.7979	16.4924	18.9252	19.1512	22.3189	24.3629	26.4565	(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	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	36.7184	35.5549	33.1389	29.8543	27.7219	24.7193	22.1671	25.4371	26.5990	29.9986	33.8373	35.5598	(72)
Total internal gains	267.3149	266.1026	256.8100	241.6637	225.8626	211.0470	201.7028	205.0216	213.0600	228.3214	245.8288	259.3643	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)
Southwest	1.4500	36.7938	0.4300	0.0000	0.7700	17.6645 (79)
Southwest	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)

Solar gains	63.2700	112.7234	167.3841	229.4400	277.1119	283.9580	270.0828	233.1645	188.6611	128.1292	76.6846	53.5625	(83)
Total gains	330.5849	378.8260	424.1941	471.1037	502.9744	495.0050	471.7856	438.1861	401.7211	356.4507	322.5134	312.9268	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T_{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, $u_{L,A}$ (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.3727	44.4682	44.5623	45.0094	45.0941	45.4924	45.4924	45.5669	45.3381	45.0941	44.9231	44.7458	
alpha	3.9582	3.9645	3.9708	4.0006	4.0063	4.0328	4.0328	4.0378	4.0225	4.0063	3.9949	3.9831	
util living area	0.9901	0.9822	0.9640	0.9163	0.8154	0.6540	0.5011	0.5543	0.7843	0.9413	0.9829	0.9920	(86)
MIT	19.5009	19.6940	20.0041	20.4003	20.7294	20.9208	20.9790	20.9687	20.8300	20.4017	19.8785	19.4626	(87)
Th 2	20.0727	20.0745	20.0763	20.0846	20.0862	20.0934	20.0934	20.0948	20.0906	20.0862	20.0830	20.0797	(88)
util rest of house	0.9880	0.9783	0.9560	0.8970	0.7735	0.5811	0.4057	0.4571	0.7223	0.9238	0.9785	0.9902	(89)
MIT 2	18.6986	18.8913	19.1981	19.5869	19.8884	20.0490	20.0856	20.0822	19.9830	19.5963	19.0823	18.6660	(90)
Living area fraction													fLA = Living area / (4) = 0.3821 (91)
MIT	19.0052	19.1980	19.5061	19.8977	20.2097	20.3821	20.4270	20.4209	20.3066	19.9040	19.3865	18.9704	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0052	19.1980	19.5061	19.8977	20.2097	20.3821	20.4270	20.4209	20.3066	19.9040	19.3865	18.9704	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	325.5345	368.8789	402.9739	420.4684	392.1439	299.6704	208.3848	216.1631	296.6262	327.8108	314.2207	309.0001	(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	839.9927	814.9780	739.7743	619.3261	478.3176	322.1588	213.2238	223.6626	346.9861	522.9638	693.2338	836.6794	(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	382.7568	299.7786	250.5794	143.1776	64.1133	0.0000	0.0000	0.0000	0.0000	145.1938	272.8895	392.5934	(98)
Space heating													1951.0823 (98)
Space heating per m2													(98) / (4) = 34.5937 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	523.7322	412.2998	422.7504	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8771	0.9262	0.9064	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	459.3671	381.8645	383.1673	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	649.4901	621.0207	582.9737	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	136.8885	177.9322	148.6560	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												463.4767 (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	34.2221	44.4831	37.1640	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												115.8692 (107)
Energy for space heating												2.0544 (108)
Energy for space cooling												34.5937 (99)
Total												2.0544 (108)
Dwelling Fabric Energy Efficiency (DFEE)												36.6481 (109)
												36.6 (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	56.4000 (1b)	2.3400 (2b)	131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	131.9760 (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) =	0.1515 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4015 (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) =	0.3413 (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	0.4352	0.4266	0.4181	0.3754	0.3669	0.3242	0.3242	0.3157	0.3413	0.3669	0.3840	0.4010 (22b)
Effective ac	0.5947	0.5910	0.5874	0.5705	0.5673	0.5526	0.5526	0.5498	0.5582	0.5673	0.5737	0.5804 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			7.9600	1.3258	10.5530		(27)					
External Wall	26.3000	7.9600	18.3400	0.1800	3.3012		(29a)					
External Wall to Stairwell	18.9800	2.1200	16.8600	0.1800	3.0348		(29a)					
Plane ceiling	44.9400		44.9400	0.1300	5.8422		(30)					
Sloping ceiling	7.6700		7.6700	0.1300	0.9971		(30)					
Dormer ceiling	2.2700		2.2700	0.1300	0.2951		(30)					
Total net area of external elements Aum(A, m2)			100.1600				(31)					
Fabric heat loss, W/K = Sum (A x U)					26.1434		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5103 (36)					
Total fabric heat loss							(33) + (36) = 32.6537 (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	25.8999	25.7397	25.5828	24.8455	24.7076	24.0655	24.0655	23.9466	24.3128	24.7076	24.9866	25.2784 (38)
Average = Sum(39)m / 12 =	58.5536	58.3935	58.2365	57.4993	57.3613	56.7192	56.7192	56.6003	56.9665	57.3613	57.6404	57.9321 (39)
	58.5536	58.3935	58.2365	57.4993	57.3613	56.7192	56.7192	56.6003	56.9665	57.3613	57.6404	57.9321 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0382	1.0353	1.0326	1.0195	1.0170	1.0057	1.0057	1.0036	1.0100	1.0170	1.0220	1.0272 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy conte	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Energy content (annual)												Total = Sum(45)m = 1239.9620 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	27.3185	23.8929	24.6553	21.4951	20.6251	17.7979	16.4924	18.9252	19.1512	22.3189	24.3629	26.4565	(65)								

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123	93.9123
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.6374	13.8890	11.2953	8.5513	6.3922	5.3965	5.8311	7.5795	10.1732	12.9173	15.0764	16.0720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	163.7855	165.4850	161.2021	152.0844	140.5748	129.7575	122.5309	120.8313	125.1142	134.2319	145.7415	156.5588	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	32.3912	(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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	(71)
Water heating gains (Table 5)	36.7184	35.5549	33.1389	29.8543	27.7219	24.7193	22.1671	25.4371	26.5990	29.9986	33.8373	35.5598	(72)
Total internal gains	267.3149	266.1026	256.8100	241.6637	225.8626	211.0470	201.7028	205.0216	213.0600	228.3214	245.8288	259.3643	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	3.9900	11.2829	0.6300	0.7000	0.7700	13.7584 (75)
Southwest	3.9700	36.7938	0.6300	0.7000	0.7700	44.6414 (79)

Solar gains	58.3997	104.0463	154.4994	211.7785	255.7807	262.0998	249.2927	215.2162	174.1386	118.2662	70.7816	49.4395	(83)
Total gains	325.7146	370.1489	411.3094	453.4422	481.6433	473.1468	450.9956	420.2379	387.1986	346.5877	316.6105	308.8037	(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	66.8903	67.0737	67.2545	68.1168	68.2806	69.0536	69.0536	69.1987	68.7538	68.2806	67.9501	67.6079	
alpha	5.4594	5.4716	5.4836	5.5411	5.5520	5.6036	5.6036	5.6132	5.5836	5.5520	5.5300	5.5072	
util living area	0.9983	0.9963	0.9900	0.9654	0.8871	0.7182	0.5442	0.6028	0.8544	0.9788	0.9964	0.9988	(86)
MIT	19.8906	20.0283	20.2560	20.5600	20.8188	20.9604	20.9929	20.9880	20.8936	20.5609	20.1719	19.8676	(87)
Th 2	20.0516	20.0540	20.0563	20.0671	20.0692	20.0786	20.0786	20.0804	20.0750	20.0692	20.0650	20.0608	(88)
util rest of house	0.9978	0.9950	0.9864	0.9524	0.8460	0.6340	0.4351	0.4908	0.7886	0.9685	0.9950	0.9984	(89)
MIT 2	19.0363	19.1754	19.4033	19.7085	19.9453	20.0602	20.0768	20.0768	20.0151	19.7150	19.3280	19.0208	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	19.3627	19.5013	19.7291	20.0338	20.2790	20.4041	20.4268	20.4250	20.3508	20.0382	19.6505	19.3444	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.3627	19.5013	19.7291	20.0338	20.2790	20.4041	20.4268	20.4250	20.3508	20.0382	19.6505	19.3444	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9941	0.9848	0.9518	0.8563	0.6653	0.4771	0.5340	0.8104	0.9660	0.9941	0.9979	(94)
Useful gains	324.8202	367.9598	405.0641	431.5870	412.4454	314.7703	215.1698	224.4000	313.8026	335.5086	314.7570	308.1665	(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	881.9770	852.6211	770.4167	640.1862	492.1047	329.2061	217.0546	227.8147	356.0855	541.3902	723.4130	877.3448	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	414.5247	325.6924	271.8223	150.1915	59.2665	0.0000	0.0000	0.0000	0.0000	153.1759	294.2324	423.4687	(98)
Space heating	2092.3743 (98)												
Space heating per m2	(98) / (4) = 37.0988 (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	533.1605	419.7221	430.1622	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9067	0.9542	0.9369	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.4020	400.5070	403.0288	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	623.9416	596.7206	561.9952	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	101.1885	145.9829	118.2711	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling	365.4425 (104)												



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Cooled fraction										FC = cooled area / (4) =	1.0000 (105)	
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	25.2971	36.4957	29.5678	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											91.3606 (107)	
Space cooling per m2											1.6199 (108)	
Energy for space heating											37.0988 (99)	
Energy for space cooling											1.6199 (108)	
Total											38.7187 (109)	
Target Fabric Energy Efficiency (TFEE)											44.5 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	56.4000 (1b)	2.3400 (2b)	131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	131.9760 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	26.3000	7.9600	18.3400	0.2500	4.5850	52.8000	968.3520 (29a)
External Wall to Stairwell	18.9800	2.1200	16.8600	0.2000	3.3720	52.8000	890.2080 (29a)
Plane ceiling	44.9400		44.9400	0.0800	3.5952	9.0000	404.4600 (30)
Sloping ceiling	7.6700		7.6700	0.2000	1.5340	9.0000	69.0300 (30)
Dormer ceiling	2.2700		2.2700	0.2000	0.4540	9.0000	20.4300 (30)
Total net area of external elements Aum(A, m2)			100.1600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.3828			(33)
AAC Party Wall			23.1600	0.0000	0.0000	52.8000	1222.8480 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32d)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				9124.7880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							161.7870 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8026 (36)
Total fabric heat loss			(33) + (36) =				32.1854 (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)	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760 (38)
Heat transfer coeff	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614 (39)
Average = Sum(39)m / 12 =												
HLP	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568 (40)
HLP (average)												
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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	86.6892	83.5368	80.3845	77.2322	74.0798	70.9275	70.9275	74.0798	77.2322	80.3845	83.5368	86.6892 (44)
Energy content (annual)	128.5575	112.4372	116.0252	101.1535	97.0592	83.7547	77.6111	89.0598	90.1235	105.0303	114.6487	124.5011 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1239.9620 (45)
19.2836	16.8656	17.4038	15.1730	14.5589	12.5632	11.6417	13.3590	13.5185	15.7545	17.1973	18.6752 (46)	
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0240	12.6507	13.9804	13.5003	13.9291	13.4554	13.8887	13.9149	13.4799	13.9592	13.5427	14.0156 (61)
Total heat required for water heating calculated for each month	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	46.2514	40.5481	42.0735	37.0086	35.7545	31.2123	29.2779	33.0911	33.3360	38.4124	41.5064	44.9005 (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	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947	112.6947 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0934	34.7225	28.2382	21.3781	15.9804	13.4913	14.5779	18.9489	25.4331	32.2932	37.6909	40.1800 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4559	246.9926	240.6002	226.9916	209.8132	193.6679	182.8819	180.3452	186.7376	200.3462	217.5246	233.6699 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477	48.1477 (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)	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298	-75.1298 (71)
Water heating gains (Table 5)	62.1658	60.3394	56.5504	51.4009	48.0571	43.3504	39.3520	44.4773	46.3000	51.6295	57.6477	60.3502 (72)
Total internal gains	434.4278	430.7670	414.1014	388.4833	362.5633	339.2223	325.5243	332.4840	347.1833	372.9815	401.5758	422.9126 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Southwest	1.4500	40.9830	0.4300	0.0000	0.7700	19.6757 (79)						
Southwest	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (79)						
Solar gains	70.9744	118.0344	172.7456	249.5228	291.2205	311.0919	292.9423	254.6442	206.6368	140.3387	88.1648	59.4819 (83)
Total gains	505.4022	548.8014	586.8470	638.0061	653.7838	650.3142	618.4666	587.1282	553.8202	513.3202	489.7406	482.3945 (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)												
tau	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718	46.9718 (85)
alpha	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315	4.1315
util living area	0.9542	0.9356	0.8918	0.7938	0.6438	0.4540	0.2953	0.3107	0.5564	0.8088	0.9238	0.9604 (86)
MIT	20.0354	20.1766	20.4364	20.7230	20.9083	20.9831	20.9979	20.9975	20.9620	20.7503	20.3559	19.9894 (87)
Th 2	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195	20.1195 (88)
util rest of house	0.9457	0.9240	0.8725	0.7597	0.5910	0.3866	0.2195	0.2311	0.4843	0.7686	0.9079	0.9529 (89)
MIT 2	18.8604	19.0599	19.4229	19.8053	20.0315	20.1080	20.1188	20.1186	20.0909	19.8493	19.3175	18.7954 (90)
Living area fraction										FLA = Living area / (4) =		0.3821 (91)
MIT	19.3094	19.4866	19.8101	20.1559	20.3665	20.4424	20.4547	20.4544	20.4238	20.1935	19.7143	19.2516 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3094	19.4866	19.8101	20.1559	20.3665	20.4424	20.4547	20.4544	20.4238	20.1935	19.7143	19.2516 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	473.2122	501.7398	507.5658	485.6317	396.4324	267.7178	153.6729	153.5778	282.3855	396.4121	440.4630	455.3162 (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	788.3429	770.9237	691.2531	575.0078	424.4887	272.0927	154.0440	154.0296	292.6735	474.5124	648.3084	785.2251 (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	234.4572	180.8916	136.6634	64.3508	20.8739	0.0000	0.0000	0.0000	0.0000	58.1067	149.6487	245.4522 (98)
Space heating												1090.4444 (98)
RHI space heating demand												1090 (98)

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	56.4000 (1b)	2.3400 (2b)	131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	131.9760 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)						
Pressure test					Yes							
Measured/design AP50					4.0000							
Infiltration rate					0.2000	(18)						
Number of sides sheltered					2	(19)						
Shelter factor					(20) = 1 - [0.075 x (19)] =	0.8500 (20)						
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =	0.1700 (21)						
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Mechanical extract ventilation - decentralised	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)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	26.3000	7.9600	18.3400	0.2500	4.5850	52.8000	968.3520 (29a)
External Wall to Stairwell	18.9800	2.1200	16.8600	0.2000	3.3720	52.8000	890.2080 (29a)
Plane ceiling	44.9400		44.9400	0.0800	3.5952	9.0000	404.4600 (30)
Sloping ceiling	7.6700		7.6700	0.2000	1.5340	9.0000	69.0300 (30)
Dormer ceiling	2.2700		2.2700	0.2000	0.4540	9.0000	20.4300 (30)
Total net area of external elements Aum(A, m2)			100.1600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	26.3828			(33)
AAC Party Wall			23.1600	0.0000	0.0000	52.8000	1222.8480 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32d)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				9124.7880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							161.7870 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8026 (36)
Total fabric heat loss			(33) + (36) =				32.1854 (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	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760 (38)
Average = Sum(39)m / 12 =	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614 (39)
HLP	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568 (40)
HLP (average)												0.9568 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (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 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	1300.9797	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	250.1929	190.7712	151.4949	80.4135	31.4370	0.0000	0.0000	0.0000	0.0000	77.8103	170.6288	263.6675	(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)	267.5860	204.0333	162.0266	86.0037	33.6224	0.0000	0.0000	0.0000	0.0000	83.2196	182.4907	281.9973	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)	
Efficiency of water heater (217)m	89.3116	89.2051	88.9935	88.5913	87.9867	87.3000	87.3000	87.3000	87.3000	88.5378	89.0989	89.3717	(217)	
Fuel for water heating, kWh/month	159.6451	140.2252	146.0844	129.4188	126.1422	111.3518	104.8107	117.9550	118.6751	134.3940	143.8753	154.9894	(219)	
Water heating fuel used												1587.5669	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1300.9797	(211)
Space heating fuel - secondary													0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398		
mechanical ventilation fans (SFP = 0.2398)		38.6148 (230a)
central heating pump		30.0000 (230c)
main heating flue fan		45.0000 (230e)
Total electricity for the above, kWh/year		113.6148 (231)
Electricity for lighting (calculated in Appendix L)		276.1610 (232)
Total delivered energy for all uses		3278.3225 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1300.9797	3.4800	45.2741	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1587.5669	3.4800	55.2473	(247)
Mechanical ventilation fans	38.6148	13.1900	5.0933	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	276.1610	13.1900	36.4256	(250)
Additional standing charges			120.0000	(251)
Total energy cost			271.9329	(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] =	1.1263	(257)
SAP value		84.2874	
SAP rating (Section 12)		84	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1300.9797	0.2160	281.0116	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1587.5669	0.2160	342.9145	(264)
Space and water heating			623.9261	(265)
Pumps and fans	113.6148	0.5190	58.9661	(267)
Energy for lighting	276.1610	0.5190	143.3275	(268)
Total kg/year			826.2197	(272)
CO2 emissions per m2			14.6500	(273)
EI value			89.0815	
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
Water heating energy efficiency	$3.48 / 0.8836 = 3.939$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8836 = 0.2445$, 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	56.4000 (1b)	x 2.3400 (2b)	= 131.9760 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 131.9760 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes								
Measured/design AP50				4.0000								
Infiltration rate				0.2000	(18)							
Number of sides sheltered				2	(19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)							
Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.7000	Apr 4.2000	May 4.2000	Jun 3.7000	Jul 3.8000	Aug 3.8000	Sep 4.0000	Oct 4.2000	Nov 4.3000	Dec 4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4400	1.3258	7.2121		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	26.3000	7.9600	18.3400	0.2500	4.5850	52.8000	968.3520 (29a)
External Wall to Stairwell	18.9800	2.1200	16.8600	0.2000	3.3720	52.8000	890.2080 (29a)
Plane ceiling	44.9400		44.9400	0.0800	3.5952	9.0000	404.4600 (30)
Sloping ceiling	7.6700		7.6700	0.2000	1.5340	9.0000	69.0300 (30)
Dormer ceiling	2.2700		2.2700	0.2000	0.4540	9.0000	20.4300 (30)
Total net area of external elements Aum(A, m2)			100.1600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.3828		(33)
AAC Party Wall			23.1600	0.0000	0.0000	52.8000	1222.8480 (32)
E-FC-4			56.4000			70.0000	3948.0000 (32d)
Metal			114.3900			14.0000	1601.4600 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9124.7880 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							161.7870 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8026 (36)
Total fabric heat loss						(33) + (36) =	32.1854 (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	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760	21.7760 (38)
Average = Sum(39)m / 12 =	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614	53.9614 (39)
HLP	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568	0.9568 (40)
HLP (average)												0.9568 (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												1.8782 (42)
Average daily hot water use (litres/day)												78.8083 (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

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													1166.2507 (211)
Space heating requirement	234.4572	180.8916	136.6634	64.3508	20.8739	0.0000	0.0000	0.0000	0.0000	58.1067	149.6487	245.4522	(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)	250.7563	193.4669	146.1641	68.8244	22.3250	0.0000	0.0000	0.0000	0.0000	62.1462	160.0521	262.5157	(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	142.5816	125.0879	130.0056	114.6538	110.9884	97.2101	91.4998	102.9747	103.6034	118.9894	128.1914	138.5167	(64)
Efficiency of water heater (217)m	89.2627	89.1639	88.9112	88.4240	87.7914	87.3000	87.3000	87.3000	87.3000	88.3247	88.9949	89.3189	(216)
Fuel for water heating, kWh/month	159.7326	140.2899	146.2196	129.6637	126.4228	111.3518	104.8107	117.9550	118.6751	134.7182	144.0435	155.0811	(219)
Water heating fuel used													1588.9641 (219)
Annual totals kWh/year													
Space heating fuel - main system													1166.2507 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.9550, total flow = 29.0000, SFP = 0.2398													
mechanical ventilation fans (SFP = 0.2398)													38.6148 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													113.6148 (231)
Electricity for lighting (calculated in Appendix L)													276.1610 (232)
Total delivered energy for all uses													3144.9906 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1166.2507	3.9200	45.7170	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1588.9641	3.9200	62.2874	(247)
Mechanical ventilation fans	38.6148	16.9600	6.5491	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	276.1610	16.9600	46.8369	(250)
Additional standing charges			88.0000	(251)
Total energy cost			262.1104	(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	1166.2507	0.2160	251.9101	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1588.9641	0.2160	343.2162	(264)
Space and water heating			595.1264	(265)
Pumps and fans	113.6148	0.5190	58.9661	(267)
Energy for lighting	276.1610	0.5190	143.3275	(268)
Total kg/year			797.4200	(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	1166.2507	1.2200	1422.8258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1588.9641	1.2200	1938.5362	(264)
Space and water heating			3361.3620	(265)
Pumps and fans	113.6148	3.0700	348.7975	(267)
Energy for lighting	276.1610	3.0700	847.8142	(268)
Primary energy kWh/year			4557.9737	(272)
Primary energy kWh/m2/year			80.8151	(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 84
 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: (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 84
 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	£66	£66	£0
Mains gas	£196	£196	£0
Space heating	£153	£153	£0
Water heating	£62	£62	£0
Lighting	£47	£47	£0
Total cost of fuels	£262	£262	£0
Total cost of uses	£262	£262	£0
Delivered energy	56 kWh/m ²	56 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	14 kg/m ²	14 kg/m ²	0 kg/m ²
Primary energy	81 kWh/m ²	81 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	161.8 (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	261.31 (P1)
Transmission heat loss coefficient	32.19 (37)
Summer heat loss coefficient	293.50 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North 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 West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
South West	1.4500	122.3147	0.4300	0.0000	0.9000	68.6369
South West	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862

total: 342.4001

	Jun	Jul	Aug	
Solar gains	364	342	298	(P4)
Internal gains	336	323	329	
Total summer gains	700	665	627	(P5)

	2.38	2.27	2.14	
Summer gain/loss ratio				(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 161.8)	0.87	0.87	0.87	
Threshold temperature	18.65	20.73	20.60	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight