

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-030			Issued on Date	12/02/2020
Assessment Reference	030	Prop Type Ref	2FF Det		
Property	Plot 030, 2 Bed, K, Ba, ES, Welwyn Garden City				
SAP Rating	84 B	DER	17.47	TER	19.26
Environmental	88 B	% DER<TER	9.32		
CO₂ Emissions (t/year)	0.86	DFEE	43.15	TFEE	48.87
General Requirements Compliance	Pass	% DFEE<TFEE	11.71		
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) 19.26 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.47 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.2 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	1.35 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (East Anglia): Slight OK

Based on:

Overshading: Average
Windows facing North East: 3.99 m², No overhang
Windows facing South East: 4.52 m², No overhang
Windows facing South West: 2.90 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)	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)			8.8900	1.3258	11.7860		(27)					
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)					
External Wall	48.1500	11.4100	36.7400	0.2500	9.1850	52.8000	1939.8720 (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)			122.0100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5567		(33)					
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) =	8873.4600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							157.3309 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1792 (36)					
Total fabric heat loss						(33) + (36) =	42.7359 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 21.7760	Feb 21.7760	Mar 21.7760	Apr 21.7760	May 21.7760	Jun 21.7760	Jul 21.7760	Aug 21.7760	Sep 21.7760	Oct 21.7760	Nov 21.7760	Dec 21.7760 (38)
Heat transfer coeff	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120 (39)
Average = Sum(39)m / 12 =												64.5120 (39)
HLP	Jan 1.1438	Feb 1.1438	Mar 1.1438	Apr 1.1438	May 1.1438	Jun 1.1438	Jul 1.1438	Aug 1.1438	Sep 1.1438	Oct 1.1438	Nov 1.1438	Dec 1.1438 (40)
HLP (average)												1.1438 (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)

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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)
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)
								Solar input (sum of months) =	Sum(63)m =			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)
								Total per year (kWh/year) =	Sum(64)m =			1404.3028 (64)
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	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												
	14.6875	13.0453	10.6092	8.0318	6.0039	5.0687	5.4769	7.1191	9.5553	12.1326	14.1606	15.0957 (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)												
	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												
	294.8125	293.0434	282.5354	265.6908	248.8095	232.3503	221.5334	226.6014	235.1432	252.1678	271.7235	286.1784 (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					
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Southeast	2.0000	36.7938	0.4300	0.0000	0.7700	24.3649 (77)						
Southwest	2.9000	36.7938	0.4300	0.0000	0.7700	35.3291 (79)						
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (77)						
Solar gains	105.2995	184.3150	265.3389	350.8108	413.0572	418.9203	400.2008	352.4092	294.7254	207.2532	127.0261	89.5310 (83)
Total gains	400.1119	477.3584	547.8742	616.5015	661.8667	651.2706	621.7343	579.0106	529.8686	459.4210	398.7496	375.7093 (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)												
tau	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076
alpha	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472
util living area	0.9811	0.9647	0.9319	0.8617	0.7403	0.5812	0.4407	0.4880	0.7078	0.8998	0.9679	0.9846 (86)
MIT	19.3844	19.6361	19.9977	20.4117	20.7405	20.9190	20.9768	20.9665	20.8346	20.3925	19.7950	19.3159 (87)
Th 2	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652 (88)
util rest of house	0.9771	0.9575	0.9179	0.8334	0.6894	0.5034	0.3437	0.3880	0.6352	0.8727	0.9600	0.9814 (89)
MIT 2	17.8241	18.1863	18.7014	19.2739	19.6993	19.9021	19.9534	19.9468	19.8208	19.2629	18.4201	17.7250 (90)
Living area fraction									fLA = Living area / (4) =			0.3821 (91)
MIT	18.4203	18.7402	19.1967	19.7087	20.0972	20.2907	20.3444	20.3364	20.2081	19.6945	18.9454	18.3329 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4203	18.7402	19.1967	19.7087	20.0972	20.2907	20.3444	20.3364	20.2081	19.6945	18.9454	18.3329 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9690	0.9464	0.9053	0.8254	0.6964	0.5289	0.3801	0.4250	0.6536	0.8642	0.9498	0.9742 (94)
Ext temp.	387.6961	451.7745	495.9706	508.8653	460.8928	344.4810	236.3257	246.1002	346.3015	397.0433	378.7316	366.0216 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	910.9283	892.8615	819.0878	697.2893	541.7185	367.1163	241.5611	253.9471	394.0479	586.7047	764.1729	911.7391 (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	389.2847	296.4105	240.3992	135.6653	60.1344	0.0000	0.0000	0.0000	0.0000	141.1081	277.5177	406.0138 (98)
Space heating per m2										(98) / (4) =		34.5130 (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	2081.8543	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	389.2847	296.4105	240.3992	135.6653	60.1344	0.0000	0.0000	0.0000	0.0000	141.1081	277.5177	406.0138	(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)	416.3473	317.0166	257.1114	145.0966	64.3148	0.0000	0.0000	0.0000	0.0000	150.9177	296.8104	434.2394	(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	89.6194	89.5261	89.3505	89.0057	88.3984	87.3000	87.3000	87.3000	87.3000	89.0074	89.4638	89.6639	(217)	
Fuel for water heating, kWh/month	159.0968	139.7223	145.5007	128.8163	125.5547	111.3518	104.8107	117.9550	118.6751	133.6848	143.2885	154.4843	(219)	
Water heating fuel used												1582.9411	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2081.8543	(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)		259.3860 (232)
Total delivered energy for all uses		4037.7962 (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	2081.8543	0.2160	449.6805 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1582.9411	0.2160	341.9153 (264)
Space and water heating			791.5958 (265)
Pumps and fans	113.6148	0.5190	58.9661 (267)
Energy for lighting	259.3860	0.5190	134.6213 (268)
Total CO2, kg/year			985.1832 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4700 (273)

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

DER			17.4700 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			37.5877 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			37.5877 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	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)			11.4100	1.3258	15.1269		(27)
External Wall	48.1500	11.4100	36.7400	0.1800	6.6132		(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)			122.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	34.0293	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.3375 (36)
Total fabric heat loss	(33) + (36) = 40.3668 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	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)
Heat transfer coeff	66.2667	66.1065	65.9496	65.2123	65.0744	64.4323	64.4323	64.3134	64.6796	65.0744	65.3534	65.6452 (39)
Average = Sum(39)m / 12 =												65.2117 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1749	1.1721	1.1693	1.1562	1.1538	1.1424	1.1424	1.1403	1.1468	1.1538	1.1587	1.1639 (40)
HLP (average)												1.1562 (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)

	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	44.1759	44.1759	44.1759	44.1759	44.1759	44.1759	44.1759	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	168.6770	168.6770	168.6770	168.6770	168.6770	168.6770	168.6770	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	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	168.6770	168.6770	168.6770	168.6770	168.6770	168.6770	168.6770	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	52.4406	52.4406	52.4406	52.4406	52.4406	52.4406	52.4406	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	14.6875	13.0453	10.6092	8.0316	6.0039	5.0687	5.4769	7.1191	9.5553	12.1326	14.1606	15.0957	(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	304.9441	302.6413	291.6021	274.2278	256.8139	239.8234	229.0117	234.6106	243.6874	261.2416	281.3254	296.3129	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.9900	11.2829	0.6300	0.6300	0.7000	0.7700	13.7584	(75)					
Southeast	4.5200	36.7938	0.6300	0.6300	0.7000	0.7700	50.8259	(77)					
Southwest	2.9000	36.7938	0.6300	0.6300	0.7000	0.7700	32.6096	(79)					
Solar gains	97.1938	170.1271	244.9139	323.8065	381.2614	386.6731	369.3947	325.2819	272.0384	191.2995	117.2481	82.6392	(83)
Total gains	402.1380	472.7683	536.5160	598.0344	638.0753	626.4966	598.4063	559.8925	515.7258	452.5412	398.5735	378.9520	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000	(85)
tau	59.1046	59.2478	59.3888	60.0602	60.1875	60.7874	60.7874	60.8997	60.5549	60.1875	59.9305	59.6642		
alpha	4.9403	4.9499	4.9593	5.0040	5.0125	5.0525	5.0525	5.0600	5.0370	5.0125	4.9954	4.9776		
util living area	0.9957	0.9899	0.9742	0.9254	0.8109	0.6287	0.4680	0.5183	0.7688	0.9516	0.9908	0.9968	(86)	
MIT	19.8293	20.0110	20.2805	20.6081	20.8539	20.9691	20.9942	20.9906	20.9170	20.5904	20.1463	19.7956	(87)	
Th 2	19.9401	19.9424	19.9446	19.9552	19.9571	19.9663	19.9663	19.9681	19.9628	19.9571	19.9531	19.9490	(88)	
util rest of house	0.9943	0.9866	0.9656	0.9008	0.7549	0.5393	0.3611	0.4072	0.6863	0.9303	0.9872	0.9957	(89)	
MIT 2	18.3946	18.6599	19.0488	19.5112	19.8215	19.9470	19.9643	19.9644	19.9011	19.4991	18.8658	18.3518	(90)	
Living area fraction									fLA = Living area / (4) =			0.3821	(91)	
MIT	18.9428	19.1762	19.5194	19.9303	20.2160	20.3376	20.3578	20.3565	20.2893	19.9161	19.3551	18.9035	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9428	19.1762	19.5194	19.9303	20.2160	20.3376	20.3578	20.3565	20.2893	19.9161	19.3551	18.9035	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	399.0873	464.9345	515.7102	538.2972	491.2829	358.6877	240.6296	251.8670	368.3927	420.5277	392.3475	376.7513	(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	970.3276	943.7468	858.6238	719.3126	554.1714	369.6848	242.1268	254.4557	400.3199	606.2408	800.9106	965.2132	(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	425.0027	321.7619	255.1277	130.3310	46.7890	0.0000	0.0000	0.0000	0.0000	138.1705	294.1654	437.8157	(98)
Space heating												2049.1639	(98)
Space heating per m2												36.3327	(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

	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													2193.9657 (211)
Space heating requirement	425.0027	321.7619	255.1277	130.3310	46.7890	0.0000	0.0000	0.0000	0.0000	138.1705	294.1654	437.8157	(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)	455.0350	344.4988	273.1560	139.5407	50.0953	0.0000	0.0000	0.0000	0.0000	147.9342	314.9523	468.7534	(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	87.2294	86.9103	86.2667	84.8852	82.6800	80.3000	80.3000	80.3000	80.3000	84.9129	86.6266	87.3446	(217)
Fuel for water heating, kWh/month	198.0219	173.6125	181.9801	164.0341	163.0496	147.8614	141.6625	157.9205	159.6645	171.9330	179.9042	193.1167	(219)
Water heating fuel used													2032.7609 (219)
Annual totals kWh/year													
Space heating fuel - main system													2193.9657 (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)													259.3860 (232)
Total delivered energy for all uses													4561.1125 (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	2193.9657	0.2160	473.8966 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2032.7609	0.2160	439.0764 (264)
Space and water heating			912.9729 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	259.3860	0.5190	134.6213 (268)
Total CO2, kg/m2/year			1086.5192 (272)
Emissions per m2 for space and water heating			16.1875 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3869 (272b)
Emissions per m2 for pumps and fans			0.6902 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1875 * 1.00) + 2.3869 + 0.6902, rounded to 2 d.p.			19.2600 (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)	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				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												
Effective ac	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)			8.8900	1.3258	11.7860		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	48.1500	11.4100	36.7400	0.2500	9.1850	52.8000	1939.8720 (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)			122.0100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5567		(33)
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) =		8873.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							157.3309 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1792 (36)
Total fabric heat loss						(33) + (36) =	42.7359 (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	67.6727	67.5500	67.4297	66.8646	66.7589	66.2667	66.2667	66.1756	66.4563	66.7589	66.9728	67.1964 (39)
Average = Sum(39)m / 12 =												66.8641 (39)
HLP	1.1999	1.1977	1.1956	1.1855	1.1837	1.1749	1.1749	1.1733	1.1783	1.1837	1.1875	1.1914 (40)
HLP (average)												1.1855 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	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	14.6875	13.0453	10.6092	8.0318	6.0039	5.0687	5.4769	7.1191	9.5553	12.1326	14.1606	15.0957	(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	266.3650	265.2590	256.1239	241.1442	225.4743	210.7192	201.3486	204.5612	212.4421	227.5368	244.9130	258.3880	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058	(75)						
Southeast	2.0000	36.7938	0.4300	0.0000	0.7700	24.3649	(77)						
Southwest	2.9000	36.7938	0.4300	0.0000	0.7700	35.3291	(79)						
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997	(77)						
Solar gains	105.2995	184.3150	265.3389	350.8108	413.0572	418.9203	400.2008	352.4092	294.7254	207.2532	127.0261	89.5310	(83)
Total gains	371.6645	449.5740	521.4628	591.9550	638.5315	629.6395	601.5495	556.9704	507.1675	434.7900	371.9391	347.9190	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	36.4231	36.4893	36.5544	36.8633	36.9217	37.1959	37.1959	37.2471	37.0898	36.9217	36.8038	36.6813	21.0000 (85)
tau	3.4282	3.4326	3.4370	3.4576	3.4614	3.4797	3.4797	3.4831	3.4727	3.4614	3.4536	3.4454	
alpha	0.9851	0.9711	0.9427	0.8788	0.7648	0.6066	0.4638	0.5142	0.7358	0.9156	0.9743	0.9879	(86)
util living area	19.2233	19.4854	19.8682	20.3258	20.6906	20.9013	20.9706	20.9578	20.8004	20.3083	19.6737	19.1701	(87)
MIT	19.9201	19.9218	19.9236	19.9316	19.9331	19.9401	19.9401	19.9414	19.9374	19.9331	19.9300	19.9269	(88)
Th 2	0.9818	0.9650	0.9303	0.8523	0.7145	0.5262	0.3607	0.4086	0.6634	0.8912	0.9678	0.9853	(89)
util rest of house	18.3105	18.5702	18.9457	19.3875	19.7150	19.8873	19.9299	19.9255	19.8170	19.3829	18.7652	18.2629	(90)
Living area fraction	18.6593	18.9199	19.2982	19.7460	20.0878	20.2747	20.3275	20.3199	20.1927	19.7365	19.1123	18.6096	(92)
MIT	18.6593	18.9199	19.2982	19.7460	20.0878	20.2747	20.3275	20.3199	20.1927	19.7365	19.1123	18.6096	(92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
adjusted MIT	18.6593	18.9199	19.2982	19.7460	20.0878	20.2747	20.3275	20.3199	20.1927	19.7365	19.1123	18.6096	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	363.0329	430.5725	480.5509	501.4291	461.3083	348.0680	240.3098	249.3987	346.0601	385.1391	357.5488	341.2941	(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	971.7304	947.0442	862.9756	725.2168	559.9608	376.0442	247.0106	259.4029	404.9008	609.9437	804.4988	968.2703	(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	452.8709	347.0690	284.5240	161.1272	73.3974	0.0000	0.0000	0.0000	0.0000	167.2546	321.8040	466.4703	(98)
Space heating												2274.5174	(98)
Space heating per m2												40.3283	(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	622.9073	490.3738	502.9345	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8648	0.9135	0.8924	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	538.7042	447.9689	448.8119	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	806.4187	772.2212	721.1996	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	192.7545	241.2437	202.6564	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												636.6546 (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	48.1886	60.3109	50.6641	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												159.1637 (107)
Energy for space heating												2.8221 (108)
Energy for space cooling												40.3283 (99)
Total												2.8221 (108)
Dwelling Fabric Energy Efficiency (DFEE)												43.1504 (109)
												43.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	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)			11.4100	1.3258	15.1269		(27)					
External Wall	48.1500	11.4100	36.7400	0.1800	6.6132		(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)			122.0100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	34.0293	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3375 (36)					
Total fabric heat loss							(33) + (36) =	40.3668 (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 =	66.2667	66.1065	65.9496	65.2123	65.0744	64.4323	64.4323	64.3134	64.6796	65.0744	65.3534	65.6452 (39)
	65.2117 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1749	1.1721	1.1693	1.1562	1.1538	1.1424	1.1424	1.1403	1.1468	1.1538	1.1587	1.1639 (40)
Days in month												1.1562 (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												1.8782 (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 =
Distribution loss (46)m = 0.15 x (45)m												1239.9620 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	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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Calculation Type: New Build (As Designed)



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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)
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	(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	26.4565	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	14.6875	13.0453	10.6092	8.0318	6.0039	5.0687	5.4769	7.1191	9.5553	12.1326	14.1606	15.0957	(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	266.3650	265.2590	256.1239	241.1442	225.4743	210.7192	201.3486	204.5612	212.4421	227.5368	244.9130	258.3880	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	3.9900	11.2829	0.6300	0.7000	0.7700	13.7584 (75)							
Southeast	4.5200	36.7938	0.6300	0.7000	0.7700	50.8259 (77)							
Southwest	2.9000	36.7938	0.6300	0.7000	0.7700	32.6096 (79)							
Solar gains	97.1938	170.1271	244.9139	323.8065	381.2614	386.6731	369.3947	325.2819	272.0384	191.2995	117.2481	82.6392	(83)
Total gains	363.5589	435.3860	501.0378	564.9507	606.7357	597.3923	570.7433	529.8431	484.4805	418.8363	362.1611	341.0272	(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	59.1046	59.2478	59.3888	60.0602	60.1875	60.7874	60.7874	60.8997	60.5549	60.1875	59.9305	59.6642	
alpha	4.9403	4.9499	4.9593	5.0040	5.0125	5.0525	5.0525	5.0600	5.0370	5.0125	4.9954	4.9776	
util living area	0.9973	0.9929	0.9803	0.9383	0.8326	0.6535	0.4893	0.5450	0.7983	0.9636	0.9939	0.9980	(86)
MIT	19.7666	19.9518	20.2282	20.5693	20.8336	20.9634	20.9930	20.9882	20.9008	20.5454	20.0882	19.7335	(87)
Th 2	19.9401	19.9424	19.9446	19.9552	19.9571	19.9663	19.9663	19.9681	19.9628	19.9571	19.9531	19.9490	(88)
util rest of house	0.9963	0.9905	0.9735	0.9169	0.7793	0.5628	0.3783	0.4295	0.7186	0.9465	0.9914	0.9973	(89)
MIT 2	18.8225	19.0084	19.2827	19.6176	19.8498	19.9504	19.9646	19.9649	19.9110	19.6036	19.1536	18.7967	(90)
Living area fraction	fLA = Living area / (4) =												0.3821 (91)
MIT	19.1832	19.3689	19.6440	19.9813	20.2257	20.3375	20.3576	20.3559	20.2892	19.9634	19.5107	19.1547	(92)
Temperature adjustment													0.0000
adjusted MIT	19.1832	19.3689	19.6440	19.9813	20.2257	20.3375	20.3576	20.3559	20.2892	19.9634	19.5107	19.1547	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9954	0.9888	0.9711	0.9175	0.7943	0.5967	0.4210	0.4740	0.7460	0.9466	0.9901	0.9966	(94)
Useful gains	361.8962	430.5189	486.5360	518.3548	481.9235	356.4870	240.2673	251.1482	361.4325	396.4909	358.5612	339.8722	(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	986.2619	956.4861	866.8386	722.6341	554.8040	369.6784	242.1081	254.4172	400.3168	609.3201	811.0800	981.7006	(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	464.5281	353.4500	282.9451	147.0811	54.2231	0.0000	0.0000	0.0000	0.0000	158.3449	325.8135	477.5203	(98)
Space heating													2263.9061 (98)
Space heating per m2													(98) / (4) = 40.1402 (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	605.6633	476.7988	488.7815	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9167	0.9577	0.9417	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	555.2309	456.6342	460.2860	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	768.7273	736.2140	689.4924	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	153.7174	208.0074	170.5295	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												532.2543 (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	38.4293	52.0018	42.6324	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													133.0636 (107)
Space cooling per m2													2.3593 (108)
Energy for space heating													40.1402 (99)
Energy for space cooling													2.3593 (108)
Total													42.4995 (109)
Target Fabric Energy Efficiency (TFEE)													48.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	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	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)			8.8900	1.3258	11.7860		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	48.1500	11.4100	36.7400	0.2500	9.1850	52.8000	1939.8720 (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)			122.0100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5567		(33)
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) =	8873.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							157.3309 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1792 (36)
Total fabric heat loss						(33) + (36) =	42.7359 (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	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	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120 (39)
Average = Sum(39)m / 12 =												64.5120 (39)
HLP	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438 (40)
HLP (average)												1.1438 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	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												1404 (64)
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	36.7188	32.6133	26.5229	20.0795	15.0097	12.6718	13.6923	17.7978	23.8882	30.3316	35.4014	37.7393 (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	432.0531	428.6579	412.3861	387.1847	361.5926	338.4028	324.6388	331.3330	345.6384	371.0199	399.2864	420.4719 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Southeast	2.0000	40.9830	0.4300	0.0000	0.7700	27.1390 (77)						
Southwest	2.9000	40.9830	0.4300	0.0000	0.7700	39.3515 (79)						
Southeast	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (77)						
Solar gains	117.7891	192.3106	272.6596	379.9095	432.5667	457.5539	432.6617	383.3496	321.3893	226.1154	145.5990	99.1673 (83)
Total gains	549.8422	620.9685	685.0457	767.0941	794.1593	795.9567	757.3005	714.6826	667.0278	597.1353	544.8853	519.6392 (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)	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076 (85)
tau	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472
alpha	0.9495	0.9247	0.8734	0.7669	0.6199	0.4384	0.2871	0.3037	0.5417	0.7941	0.9165	0.9567 (86)
MIT	19.7509	19.9500	20.2808	20.6376	20.8678	20.9710	20.9955	20.9945	20.9393	20.6576	20.1540	19.6921 (87)
Th 2	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652 (88)
util rest of house	0.9399	0.9110	0.8506	0.7278	0.5613	0.3631	0.2009	0.2128	0.4610	0.7489	0.8985	0.9483 (89)
MIT 2	18.3481	18.6285	19.0885	19.5616	19.8414	19.9461	19.9638	19.9635	19.9210	19.6011	18.9228	18.2651 (90)
Living area fraction	18.8841	19.1335	19.5441	19.9727	20.2336	20.3377	20.3580	20.3574	20.3101	20.0048	19.3932	18.8103 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8841	19.1335	19.5441	19.9727	20.2336	20.3377	20.3580	20.3574	20.3101	20.0048	19.3932	18.8103 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	509.8669	557.4528	575.4466	558.5518	458.3503	311.0050	177.1215	176.9230	326.0925	448.3204	483.0792	486.5268 (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	915.0443	898.8743	809.2428	675.6149	498.9084	318.5417	177.9217	177.8873	342.5628	555.1112	754.3519	910.2857 (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	301.4520	229.4352	173.9443	84.2854	30.1752	0.0000	0.0000	0.0000	0.0000	79.4524	195.3164	315.2767 (98)
Space heating												1409.3375 (98)
RHI space heating demand												1409 (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)	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)

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			8.8900	1.3258	11.7860		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	48.1500	11.4100	36.7400	0.2500	9.1850	52.8000	1939.8720 (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)			122.0100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5567		(33)
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) =	8873.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							157.3309 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1792 (36)
Total fabric heat loss						(33) + (36) =	42.7359 (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	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	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120 (39)
Average = Sum(39)m / 12 =												64.5120 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438 (40)
HLP (average)												1.1438 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	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)
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	36.7188	32.6133	26.5229	20.0795	15.0097	12.6718	13.6923	17.7978	23.8882	30.3316	35.4014	37.7393 (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	432.0531	428.6579	412.3861	387.1847	361.5926	338.4028	324.6388	331.3330	345.6384	371.0199	399.2864	420.4719 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Southeast	2.0000	36.7938	0.4300	0.0000	0.7700	24.3649 (77)						
Southwest	2.9000	36.7938	0.4300	0.0000	0.7700	35.3291 (79)						
Southeast	2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (77)						
Solar gains	105.2995	184.3150	265.3389	350.8108	413.0572	418.9203	400.2008	352.4092	294.7254	207.2532	127.0261	89.5310 (83)
Total gains	537.3526	612.9729	677.7250	737.9954	774.6498	757.3230	724.8397	683.7422	640.3638	578.2731	526.3125	510.0029 (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	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076
alpha	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472
util living area	0.9556	0.9306	0.8858	0.8014	0.6718	0.5144	0.3829	0.4210	0.6230	0.8341	0.9315	0.9623 (86)
MIT	19.6698	19.8954	20.2094	20.5538	20.8124	20.9450	20.9851	20.9790	20.8910	20.5550	20.0412	19.6009 (87)
Th 2	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652 (88)
util rest of house	0.9472	0.9179	0.8653	0.7669	0.6185	0.4411	0.2966	0.3317	0.5497	0.7968	0.9168	0.9550 (89)
MIT 2	18.2320	18.5512	18.9900	19.4543	19.7784	19.9236	19.9579	19.9541	19.8741	19.4698	18.7647	18.1338 (90)
Living area fraction	18.7813	19.0648	19.4559	19.8744	20.1734	20.3139	20.3504	20.3457	20.2627	19.8845	19.2524	0.3821 (91)
Temperature adjustment	18.7813	19.0648	19.4559	19.8744	20.1734	20.3139	20.3504	20.3457	20.2627	19.8845	19.2524	18.6944 (92)
adjusted MIT	18.7813	19.0648	19.4559	19.8744	20.1734	20.3139	20.3504	20.3457	20.2627	19.8845	19.2524	0.0000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9350	0.9046	0.8537	0.7636	0.6298	0.4665	0.3292	0.3652	0.5718	0.7936	0.9044	0.9435 (94)
Ext temp.	502.4317	554.5033	578.5764	563.5421	487.8807	353.3232	238.6334	249.6887	366.1835	458.9074	476.0124	481.1743 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	934.2201	913.7979	835.8133	707.9815	546.6387	368.6143	241.9445	254.5440	397.5664	598.9587	783.9766	935.0623 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	321.2505	241.4460	191.3843	103.9963	43.7159	0.0000	0.0000	0.0000	0.0000	104.1982	221.7342	337.6927 (98)
												1565.4181 (98)
												27.7556 (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	1674.2439	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	321.2505	241.4460	191.3843	103.9963	43.7159	0.0000	0.0000	0.0000	0.0000	104.1982	221.7342	337.6927	(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)	343.5835	258.2310	204.6890	111.2260	46.7550	0.0000	0.0000	0.0000	0.0000	111.4419	237.1489	361.1686	(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	89.4916	89.3819	89.1777	88.7933	88.1811	87.3000	87.3000	87.3000	87.3000	88.7653	89.3008	89.5453	(217)	
Fuel for water heating, kWh/month	159.3239	139.9478	145.7825	129.1244	125.8641	111.3518	104.8107	117.9550	118.6751	134.0495	143.5500	154.6890	(219)	
Water heating fuel used												1585.1239	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1674.2439	(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)		259.3860 (232)
Total delivered energy for all uses		3632.3686 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1674.2439	3.4800	58.2637	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1585.1239	3.4800	55.1623	(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	259.3860	13.1900	34.2130	(250)
Additional standing charges			120.0000	(251)
Total energy cost			282.6248	(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] =	1.1706	(257)
SAP value		83.6696	
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	1674.2439	0.2160	361.6367	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1585.1239	0.2160	342.3868	(264)
Space and water heating			704.0235	(265)
Pumps and fans	113.6148	0.5190	58.9661	(267)
Energy for lighting	259.3860	0.5190	134.6213	(268)
Total kg/year			897.6109	(272)
CO2 emissions per m2			15.9200	(273)
EI value			88.1381	
EI rating			88	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8849 = 3.933$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8849 = 0.2441$, 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)

	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)			8.8900	1.3258	11.7860		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	48.1500	11.4100	36.7400	0.2500	9.1850	52.8000	1939.8720 (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)			122.0100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.5567		(33)
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) =	8873.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							157.3309 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1792 (36)
Total fabric heat loss						(33) + (36) =	42.7359 (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	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	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120	64.5120 (39)
Average = Sum(39)m / 12 =												64.5120 (39)
HLP	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438	1.1438 (40)
HLP (average)												1.1438 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0240	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)
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	36.7188	32.6133	26.5229	20.0795	15.0097	12.6718	13.6923	17.7978	23.8882	30.3316	35.4014	37.7393 (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	432.0531	428.6579	412.3861	387.1847	361.5926	338.4028	324.6388	331.3330	345.6384	371.0199	399.2864	420.4719 (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					
Northeast	3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)						
Southeast	2.0000	40.9830	0.4300	0.0000	0.7700	27.1390 (77)						
Southwest	2.9000	40.9830	0.4300	0.0000	0.7700	39.3515 (79)						
Southeast	2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (77)						
Solar gains	117.7891	192.3106	272.6596	379.9095	432.5667	457.5539	432.6617	383.3496	321.3893	226.1154	145.5990	99.1673 (83)
Total gains	549.8422	620.9685	685.0457	767.0941	794.1593	795.9567	757.3005	714.6826	667.0278	597.1353	544.8853	519.6392 (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	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076	38.2076
alpha	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472	3.5472
util living area	0.9495	0.9247	0.8734	0.7669	0.6199	0.4384	0.2871	0.3037	0.5417	0.7941	0.9165	0.9567 (86)
MIT	19.7509	19.9500	20.2808	20.6376	20.8678	20.9710	20.9955	20.9945	20.9393	20.6576	20.1540	19.6921 (87)
Th 2	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652	19.9652 (88)
util rest of house	0.9399	0.9110	0.8506	0.7278	0.5613	0.3631	0.2009	0.2128	0.4610	0.7489	0.8985	0.9483 (89)
MIT 2	18.3481	18.6285	19.0885	19.5616	19.8414	19.9461	19.9638	19.9635	19.9210	19.6011	18.9228	18.2651 (90)
Living area fraction	18.8841	19.1335	19.5441	19.9727	20.2336	20.3377	20.3580	20.3574	20.3101	20.0048	19.3932	18.8103 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8841	19.1335	19.5441	19.9727	20.2336	20.3377	20.3580	20.3574	20.3101	20.0048	19.3932	18.8103 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9273	0.8977	0.8400	0.7281	0.5772	0.3907	0.2339	0.2476	0.4889	0.7508	0.8866	0.9363 (94)
Ext temp.	509.8669	557.4528	575.4466	558.5518	458.3503	311.0050	177.1215	176.9230	326.0925	448.3204	483.0792	486.5268 (95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Month fracti	915.0443	898.8743	809.2428	675.6149	498.9084	318.5417	177.9217	177.8873	342.5628	555.1112	754.3519	910.2857 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	301.4520	229.4352	173.9443	84.2854	30.1752	0.0000	0.0000	0.0000	0.0000	79.4524	195.3164	315.2767 (98)
												1409.3375 (98)
												24.9883 (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													1507.3129 (211)
Space heating requirement	301.4520	229.4352	173.9443	84.2854	30.1752	0.0000	0.0000	0.0000	0.0000	79.4524	195.3164	315.2767	(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)	322.4085	245.3852	186.0367	90.1448	32.2730	0.0000	0.0000	0.0000	0.0000	84.9758	208.8945	337.1943	(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	89.4472	89.3445	89.1030	88.6277	87.9649	87.3000	87.3000	87.3000	87.3000	88.5537	89.2043	89.4986	(217)
Fuel for water heating, kWh/month	159.4031	140.0063	145.9048	129.3657	126.1735	111.3518	104.8107	117.9550	118.6751	134.3699	143.7054	154.7696	(219)
Water heating fuel used													1586.4909 (219)
Annual totals kWh/year													
Space heating fuel - main system													1507.3129 (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)													259.3860 (232)
Total delivered energy for all uses													3466.8045 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1507.3129	3.9200	59.0867 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1586.4909	3.9200	62.1904 (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	259.3860	16.9600	43.9919 (250)
Additional standing charges			88.0000 (251)
Total energy cost			272.5380 (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	1507.3129	0.2160	325.5796 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1586.4909	0.2160	342.6820 (264)
Space and water heating			668.2616 (265)
Pumps and fans	113.6148	0.5190	58.9661 (267)
Energy for lighting	259.3860	0.5190	134.6213 (268)
Total kg/year			861.8490 (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	1507.3129	1.2200	1838.9217 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1586.4909	1.2200	1935.5188 (264)
Space and water heating			3774.4405 (265)
Pumps and fans	113.6148	3.0700	348.7975 (267)
Energy for lighting	259.3860	3.0700	796.3149 (268)
Primary energy kWh/year			4919.5529 (272)
Primary energy kWh/m2/year			87.2261 (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 88

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

Recommended measures: (none)	SAP change	Cost change	CO2 change
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Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0	0.00 kg/m ²	

Potential energy efficiency rating: B 84
 Potential environmental impact rating: B 88

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

Typical heating and lighting costs of this home (per year, East Anglia):			
	Current	Potential	Saving
Electricity	£63	£63	£0
Mains gas	£209	£209	£0
Space heating	£166	£166	£0
Water heating	£62	£62	£0
Lighting	£44	£44	£0
Total cost of fuels	£272	£272	£0
Total cost of uses	£272	£272	£0
Delivered energy	61 kWh/m ²	61 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	87 kWh/m ²	87 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	157.3 (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	42.74 (37)
Summer heat loss coefficient	304.05 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
South East	2.0000	122.3147	0.4300	0.0000	0.9000	94.6716
South West	2.9000	122.3147	0.4300	0.0000	0.9000	137.2738
South East	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862

total: 505.7085

Solar gains	535	506	448	(P4)
Internal gains	335	322	328	
Total summer gains	870	827	776	(P5)

Summer gain/loss ratio	2.86	2.72	2.55	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 157.3)	0.90	0.90	0.90	
Threshold temperature	19.16	21.22	21.05	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight