

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-027			Issued on Date	12/02/2020
Assessment Reference	027	Prop Type Ref	2FF Semi		
Property	Plot 027, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	16.23	TER	18.47
Environmental	89 B	% DER<TER	12.14		
CO₂ Emissions (t/year)	0.86	DFEE	36.35	TFEE	44.02
General Requirements Compliance	Pass	% DFEE<TFEE	17.42		
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 62 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) 18.47 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 36.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.32 (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: 6.39 m², No overhang
Air change rate: 4.00 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	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.3900	1.3258	8.4716		(27)
External Wall	24.6500	6.3900	18.2600	0.2500	4.5650	52.8000	964.1280 (29a)
External Wall to Corridor	12.6400	2.1200	10.5200	0.2200	2.3144	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m2)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.0458		(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			9885.0780 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.2826 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4394 (36)
Total fabric heat loss				(33) + (36) =			30.4852 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Heat transfer coeff	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490 (39)
Average = Sum(39)m / 12 =	54.5490 (39)											
HLP	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790 (40)
HLP (average)	0.8790 (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	2.0392 (42)											
Average daily hot water use (litres/day)	82.6319 (43)											
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)

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Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)	
Energy content (annual)												Total = Sum(45)m =	1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m													
	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413 (61)	
Total heat required for water heating calculated for each month													
	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829 (64)	
Heat gains from water heating, kWh/month												Total per year (kWh/year) = Sum(64)m =	1464.6982 (64)
	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154 (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	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.2225	16.1851	13.1626	9.9649	7.4489	6.2887	6.7951	8.8326	11.8551	15.0527	17.5688	18.7290 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962 (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)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584 (72)
Total internal gains	317.8842	315.7796	304.1263	285.6136	267.0750	249.2158	237.6708	243.2345	252.8259	271.5274	292.8704	308.6280 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains						
	m ²	Table 6a	g		factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
Northeast	6.3900	11.2829	0.4300	0.0000	0.7700	23.8716 (75)						
Solar gains	23.8716	48.5914	87.5463	143.7762	193.2634	206.0392	192.7455	153.6589	106.6765	59.3826	30.0367	19.4948 (83)
Total gains	341.7559	364.3710	391.6726	429.3898	460.3384	455.2550	430.4163	396.8935	359.5024	330.9100	322.9071	328.1228 (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	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	
alpha	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	
util living area	0.9912	0.9872	0.9758	0.9403	0.8505	0.6927	0.5374	0.5977	0.8315	0.9578	0.9859	0.9926 (86)	
MIT	19.6954	19.8178	20.0681	20.4157	20.7360	20.9230	20.9801	20.9688	20.8234	20.4292	19.9972	19.6533 (87)	
Th 2	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854	20.1854 (88)	
util rest of house	0.9894	0.9845	0.9704	0.9263	0.8155	0.6257	0.4463	0.5053	0.7795	0.9452	0.9825	0.9911 (89)	
MIT 2	18.4210	18.5991	18.9618	19.4579	19.8934	20.1192	20.1738	20.1656	20.0127	19.4839	18.8612	18.3596 (90)	
Living area fraction												fLA = Living area / (4) =	0.3896 (91)
MIT	18.9175	19.0739	19.3928	19.8311	20.2217	20.4324	20.4879	20.4785	20.3286	19.8522	19.3038	18.8636 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.9175	19.0739	19.3928	19.8311	20.2217	20.4324	20.4879	20.4785	20.3286	19.8522	19.3038	18.8636 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9856	0.9797	0.9638	0.9191	0.8172	0.6471	0.4810	0.5398	0.7896	0.9389	0.9775	0.9877 (94)	
Useful gains	336.8284	356.9685	377.5009	394.6507	376.2030	294.5742	207.0393	214.2530	283.8718	310.6797	315.6407	324.0979 (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	797.3717	773.1724	703.2911	596.2809	464.8496	318.1507	212.0830	222.4799	339.7614	504.6985	665.7056	799.8866 (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	342.6442	279.6890	242.3879	145.1738	65.9531	0.0000	0.0000	0.0000	0.0000	144.3500	252.0467	353.9868 (98)	
Space heating												1826.2315 (98)	
Space heating per m ²												(98) / (4) =	29.4269 (99)

8c. Space cooling requirement



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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													1953.1887 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.6442	279.6890	242.3879	145.1738	65.9531	0.0000	0.0000	0.0000	0.0000	144.3500	252.0467	353.9868	(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)	366.4644	299.1326	259.2384	155.2660	70.5381	0.0000	0.0000	0.0000	0.0000	154.3850	269.5687	378.5955	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.5064	89.4564	89.3251	89.0261	88.4352	87.3000	87.3000	87.3000	87.3000	88.9920	89.3642	87.3000	(216)
Fuel for water heating, kWh/month	166.2959	145.9543	151.8690	134.3204	130.8467	116.0228	109.1391	122.9226	123.7028	139.4568	149.6983	161.4584	(219)
Water heating fuel used													1651.6871 (219)
Annual totals kWh/year													
Space heating fuel - main system													1953.1887 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.0666 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.0666 (231)
Electricity for lighting (calculated in Appendix L)													321.8157 (232)
Total delivered energy for all uses													4044.7581 (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	1953.1887	0.2160	421.8888 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1651.6871	0.2160	356.7644 (264)
Space and water heating			778.6532 (265)
Pumps and fans	118.0666	0.5190	61.2765 (267)
Energy for lighting	321.8157	0.5190	167.0224 (268)
Total CO2, kg/year			1006.9521 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.2300 (273)

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

	TFA	N	EF	
DER				16.2300 ZC1
Total Floor Area				62.0600
Assumed number of occupants				2.0392
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				17.0069 ZC2
CO2 emissions from cooking, equation (L16)				2.7061 ZC3
Total CO2 emissions				35.9430 ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year				0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000 ZC7
Net CO2 emissions				35.9430 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (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) =	0.1371 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3871 (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) =	0.3291 (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	0.4196	0.4113	0.4031	0.3620	0.3537	0.3126	0.3126	0.3044	0.3291	0.3537	0.3702	0.3867 (22b)
	0.5880	0.5846	0.5812	0.5655	0.5626	0.5489	0.5489	0.5463	0.5541	0.5626	0.5685	0.5747 (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)			6.3900	1.3258	8.4716		(27)					
External Wall	24.6500	6.3900	18.2600	0.1800	3.2868		(29a)					
External Wall to Corridor	12.6400	2.1200	10.5200	0.1800	1.8936		(29a)					
Plane ceiling	52.0400		52.0400	0.1300	6.7652		(30)					
Sloping ceiling	9.0900		9.0900	0.1300	1.1817		(30)					
Dormer Roof	2.1200		2.1200	0.1300	0.2756		(30)					
Total net area of external elements Aum(A, m2)			100.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	23.9945	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6533 (36)					
Total fabric heat loss							(33) + (36) = 30.6478 (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	28.2997	28.1352	27.9740	27.2167	27.0750	26.4154	26.4154	26.2933	26.6695	27.0750	27.3616	27.6613 (38)
Average = Sum(39)m / 12 =	58.9475	58.7830	58.6218	57.8645	57.7228	57.0632	57.0632	56.9411	57.3173	57.7228	58.0094	58.3091 (39)
	57.8638											57.8638 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9498	0.9472	0.9446	0.9324	0.9301	0.9195	0.9195	0.9175	0.9236	0.9301	0.9347	0.9396 (40)
Days in month												0.9324 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (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

	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													2223.7677 (211)
Space heating requirement	395.8228	323.6605	281.2333	163.1746	67.5023	0.0000	0.0000	0.0000	0.0000	159.2233	284.2649	402.1174	(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)	423.7931	346.5316	301.1063	174.7051	72.2723	0.0000	0.0000	0.0000	0.0000	170.4746	304.3521	430.5325	(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	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608	(64)
Efficiency of water heater (217)m	86.9662	86.8149	86.3883	85.3317	83.3083	80.3000	80.3000	80.3000	80.3000	85.1504	86.4318	87.0552	(217)
Fuel for water heating, kWh/month	208.2580	182.2357	190.5407	171.0926	169.6712	155.0353	148.5356	165.5824	167.4111	179.7721	189.0579	203.1593	(219)
Water heating fuel used													2130.3518 (219)
Annual totals kWh/year													
Space heating fuel - main system													2223.7677 (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)													321.8157 (232)
Total delivered energy for all uses													4750.9352 (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	2223.7677	0.2160	480.3338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2130.3518	0.2160	460.1560 (264)
Space and water heating			940.4898 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	321.8157	0.5190	167.0224 (268)
Total CO2, kg/m2/year			1146.4372 (272)
Emissions per m2 for space and water heating			15.1545 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6913 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1545 * 1.00) + 2.6913 + 0.6272, rounded to 2 d.p.			18.4700 (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	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		145.8410 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 145.8410 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1371 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3371	(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) =	0.2866 (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	0.3654	0.3582	0.3510	0.3152	0.3081	0.2722	0.2722	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5667	0.5642	0.5616	0.5497	0.5474	0.5371	0.5371	0.5351	0.5411	0.5474	0.5520	0.5567 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.3900	1.3258	8.4716		(27)
External Wall	24.6500	6.3900	18.2600	0.2500	4.5650	52.8000	964.1280 (29a)
External Wall to Corridor	12.6400	2.1200	10.5200	0.2200	2.3144	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m2)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 24.0458		(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9885.0780 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.2826 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4394 (36)
Total fabric heat loss							(33) + (36) = 30.4852 (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	27.2762	27.1514	27.0292	26.4549	26.3474	25.8472	25.8472	25.7546	26.0399	26.3474	26.5648	26.7920 (38)
Heat transfer coeff	57.7614	57.6366	57.5144	56.9400	56.8326	56.3324	56.3324	56.2398	56.5251	56.8326	57.0500	57.2772 (39)
Average = Sum(39)m / 12 =												56.9395 (39)
HLP	0.9307	0.9287	0.9268	0.9175	0.9158	0.9077	0.9077	0.9062	0.9108	0.9158	0.9193	0.9229 (40)
HLP (average)												0.9175 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (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

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	97.1633	131.8729	104.0787	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												333.1149	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	24.2908	32.9682	26.0197	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												83.2787	(107)
Space cooling per m2												1.3419	(108)
Energy for space heating												35.0066	(99)
Energy for space cooling												1.3419	(108)
Total												36.3485	(109)
Dwelling Fabric Energy Efficiency (DFEE)												36.3	(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	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (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) =	0.1371 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3871 (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) =	0.3291 (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	0.4196	0.4113	0.4031	0.3620	0.3537	0.3126	0.3126	0.3044	0.3291	0.3537	0.3702	0.3867 (22b)
	0.5880	0.5846	0.5812	0.5655	0.5626	0.5489	0.5489	0.5463	0.5541	0.5626	0.5685	0.5747 (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)			6.3900	1.3258	8.4716		(27)					
External Wall	24.6500	6.3900	18.2600	0.1800	3.2868		(29a)					
External Wall to Corridor	12.6400	2.1200	10.5200	0.1800	1.8936		(29a)					
Plane ceiling	52.0400		52.0400	0.1300	6.7652		(30)					
Sloping ceiling	9.0900		9.0900	0.1300	1.1817		(30)					
Dormer Roof	2.1200		2.1200	0.1300	0.2756		(30)					
Total net area of external elements Aum(A, m2)			100.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	23.9945	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.6533 (36)					
Total fabric heat loss							(33) + (36) = 30.6478 (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	28.2997	28.1352	27.9740	27.2167	27.0750	26.4154	26.4154	26.2933	26.6695	27.0750	27.3616	27.6613 (38)
Average = Sum(39)m / 12 =	58.9475	58.7830	58.6218	57.8645	57.7228	57.0632	57.0632	56.9411	57.3173	57.7228	58.0094	58.3091 (39)
	57.8638											57.8638 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9498	0.9472	0.9446	0.9324	0.9301	0.9195	0.9195	0.9175	0.9236	0.9301	0.9347	0.9396 (40)
Days in month												0.9324 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	16.7721	26.1803	19.6829	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												62.6353 (107)
Space cooling per m2												1.0093 (108)
Energy for space heating												37.2667 (99)
Energy for space cooling												1.0093 (108)
Total												38.2760 (109)
Target Fabric Energy Efficiency (TFEE)												44.0 (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	62.0600 (1b)	x 2.3500 (2b)	= 145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 145.8410 (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:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DTC			2.1200	1.0800	2.2896		(26)	
Windows (Uw = 1.40)			6.3900	1.3258	8.4716		(27)	
External Wall	24.6500	6.3900	18.2600	0.2500	4.5650	52.8000	964.1280 (29a)	
External Wall to Corridor	12.6400	2.1200	10.5200	0.2200	2.3144	52.8000	555.4560 (29a)	
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)	
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)	
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)	
Total net area of external elements Aum(A, m2)			100.5400				(31)	
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0458	(32)	
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (32)	
E-FC-4			62.0600			70.0000	4344.2000 (32d)	
Metal			114.6500			14.0000	1605.1000 (32c)	
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9885.0780 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.2826 (35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4394 (36)	
Total fabric heat loss							(33) + (36) =	30.4852 (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	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Average = Sum(39)m / 12 =	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490 (39)
HLP	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790 (40)
HLP (average)												0.8790 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)

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



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0600 (1b)	2.3500 (2b)	145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	145.8410 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.3900	1.3258	8.4716		(27)
External Wall	24.6500	6.3900	18.2600	0.2500	4.5650	52.8000	964.1280 (29a)
External Wall to Corridor	12.6400	2.1200	10.5200	0.2200	2.3144	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m ²)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0458	(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9885.0780 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.2826 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4394 (36)
Total fabric heat loss					(33) + (36) =		30.4852 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Heat transfer coeff	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490 (39)
Average = Sum(39)m / 12 =												54.5490 (39)
HLP	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790 (40)
HLP (average)												0.8790 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													1414.4938 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.6318	208.5495	174.0654	96.8380	39.1080	0.0000	0.0000	0.0000	0.0000	91.2813	181.7060	271.3717	(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)	277.6811	223.0476	186.1662	103.5701	41.8267	0.0000	0.0000	0.0000	0.0000	97.6270	194.3379	290.2371	(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.3071	89.2406	89.0700	88.7034	88.0868	87.3000	87.3000	87.3000	87.3000	88.6281	89.1149	87.3000	(216)
Fuel for water heating, kWh/month	166.6669	146.3074	152.3039	134.8090	131.3643	116.0228	109.1391	122.9226	123.7028	140.0294	150.1172	161.7957	(219)
Water heating fuel used													1655.1811 (219)
Annual totals kWh/year													1414.4938 (211)
Space heating fuel - main system													0.0000 (215)
Space heating fuel - secondary													
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.0666 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.0666 (231)
Electricity for lighting (calculated in Appendix L)													321.8157 (232)
Total delivered energy for all uses													3509.5571 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1414.4938	3.4800	49.2244 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1655.1811	3.4800	57.6003 (247)
Mechanical ventilation fans	43.0666	13.1900	5.6805 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	321.8157	13.1900	42.4475 (250)
Additional standing charges			120.0000 (251)
Total energy cost			284.8452 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1175 (257)
SAP value		84.4115
SAP rating (Section 12)		B (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	1414.4938	0.2160	305.5307 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1655.1811	0.2160	357.5191 (264)
Space and water heating			663.0498 (265)
Pumps and fans	118.0666	0.5190	61.2765 (267)
Energy for lighting	321.8157	0.5190	167.0224 (268)
Total kg/year			891.3487 (272)
CO2 emissions per m2			14.3600 (273)
EI value			88.8436
EI rating			B (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	$3.48 / 0.8839 = 3.937$, stars = 4
Water heating environmental impact	$0.216 / 0.8839 = 0.2444$, stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0600 (1b)	x 2.3500 (2b)	= 145.8410 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 145.8410 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.3900	1.3258	8.4716		(27)
External Wall	24.6500	6.3900	18.2600	0.2500	4.5650	52.8000	964.1280 (29a)
External Wall to Corridor	12.6400	2.1200	10.5200	0.2200	2.3144	52.8000	555.4560 (29a)
Plane ceiling	52.0400		52.0400	0.0800	4.1632	9.0000	468.3600 (30)
Sloping ceiling	9.0900		9.0900	0.2000	1.8180	9.0000	81.8100 (30)
Dormer Roof	2.1200		2.1200	0.2000	0.4240	9.0000	19.0800 (30)
Total net area of external elements Aum(A, m ²)			100.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.0458		(33)
AAC Party Wall			34.9800	0.0000	0.0000	52.8000	1846.9440 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9885.0780 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.2826 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4394 (36)
Total fabric heat loss						(33) + (36) =	30.4852 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638	24.0638 (38)
Heat transfer coeff	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490	54.5490 (39)
Average = Sum(39)m / 12 =												54.5490 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790	0.8790 (40)
HLP (average)												0.8790 (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												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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												1276.7831	(211)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	245.3580	198.7596	157.8625	79.0974	26.2148	0.0000	0.0000	0.0000	0.0000	70.1306	162.1559	254.2135		(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)	262.4150	212.5771	168.8369	84.5962	28.0372	0.0000	0.0000	0.0000	0.0000	75.0060	173.4287	271.8861		(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	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829		(64)	
Efficiency of water heater (217)m	89.2645	89.2037	88.9924	88.5465	87.8739	87.3000	87.3000	87.3000	87.3000	88.4289	89.0249	87.3000		(216)	
Fuel for water heating, kWh/month	166.7465	146.3679	152.4367	135.0480	131.6826	116.0228	109.1391	122.9226	123.7028	140.3448	150.2690	161.8833		(219)	
Water heating fuel used												1656.5659		(219)	
Annual totals kWh/year															
Space heating fuel - main system													1276.7831	(211)	
Space heating fuel - secondary													0.0000	(215)	
Electricity for pumps and fans:															
(MEV)Decentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)															
mechanical ventilation fans (SFP = 0.2420)														43.0666	(230a)
central heating pump														30.0000	(230c)
main heating flue fan														45.0000	(230e)
Total electricity for the above, kWh/year														118.0666	(231)
Electricity for lighting (calculated in Appendix L)														321.8157	(232)
Total delivered energy for all uses														3373.2313	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1276.7831	3.9200	50.0499 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1656.5659	3.9200	64.9374 (247)
Mechanical ventilation fans	43.0666	16.9600	7.3041 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	321.8157	16.9600	54.5799 (250)
Additional standing charges			88.0000 (251)
Total energy cost			277.5913 (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	1276.7831	0.2160	275.7852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.5659	0.2160	357.8182 (264)
Space and water heating			633.6034 (265)
Pumps and fans	118.0666	0.5190	61.2765 (267)
Energy for lighting	321.8157	0.5190	167.0224 (268)
Total kg/year			861.9023 (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	1276.7831	1.2200	1557.6754 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.5659	1.2200	2021.0104 (264)
Space and water heating			3578.6858 (265)
Pumps and fans	118.0666	3.0700	362.4644 (267)
Energy for lighting	321.8157	3.0700	987.9743 (268)
Primary energy kWh/year			4929.1245 (272)
Primary energy kWh/m2/year			79.4251 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 84

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current environmental impact rating:

B 89

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 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	£75	£75	£0
Mains gas	£203	£203	£0
Space heating	£158	£158	£0
Water heating	£65	£65	£0
Lighting	£55	£55	£0
Total cost of fuels	£278	£278	£0
Total cost of uses	£278	£278	£0
Delivered energy	54 kWh/m ²	54 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	14 kg/m ²	14 kg/m ²	0 kg/m ²
Primary energy	79 kWh/m ²	79 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	No
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	159.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	192.51 (P1)
Transmission heat loss coefficient	30.49 (37)
Summer heat loss coefficient	223.00 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type	
North East	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	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	6.3900	100.0415	0.4300	0.0000	0.9000	247.3955
total:						247.3955

	Jun	Jul	Aug	
Solar gains	267	247	199	(P4)
Internal gains	362	347	355	
Total summer gains	628	594	554	(P5)
Summer gain/loss ratio	2.82	2.67	2.48	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 159.3)	0.89	0.89	0.89	
Threshold temperature	19.10	21.15	20.97	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			