

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)							
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:												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 24.0638	Feb 24.0638	Mar 24.0638	Apr 24.0638	May 24.0638	Jun 24.0638	Jul 24.0638	Aug 24.0638	Sep 24.0638	Oct 24.0638	Nov 24.0638	Dec 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	Jan 0.8790	Feb 0.8790	Mar 0.8790	Apr 0.8790	May 0.8790	Jun 0.8790	Jul 0.8790	Aug 0.8790	Sep 0.8790	Oct 0.8790	Nov 0.8790	Dec 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												
Solar input	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)
	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)
												Total per year (kWh/year) = Sum(64)m = 1464.6982 (64)
Heat gains from water heating, kWh/month												
	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 m2												(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

DER			16.2300	ZC1
Total Floor Area		TFA	62.0600	
Assumed number of occupants		N	2.0392	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	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/m ² /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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	46.3192	40.3153	42.9505	39.9350	39.5818	36.6750	37.8975	39.5818	39.9350	42.9505	43.1950	46.3192													(61)
Total heat required for water heating calculated for each month	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608													(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	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)
Heat gains from water heating, kWh/month	56.3991	49.2781	51.1877	45.2491	43.7334	38.3683	36.5321	40.9446	41.4037	47.3545	50.7690	54.9849													(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)	75.8052	73.3305	68.8007	62.8460	58.7815	53.2894	49.1023	55.0330	57.5051	63.6486	70.5125	73.9044	(72)
Total internal gains	328.7271	326.0632	313.8534	294.7858	275.6891	257.2733	245.7339	251.8539	262.0060	281.2623	303.1584	319.4741	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	6.3900	11.2829	0.6300	0.7000	0.7700	22.0341 (75)							
Solar gains	22.0341	44.8510	80.8073	132.7087	178.3866	190.1790	177.9085	141.8308	98.4649	54.8115	27.7246	17.9941	(83)
Total gains	350.7612	370.9142	394.6607	427.4946	454.0757	447.4522	423.6425	393.6846	360.4709	336.0738	330.8830	337.4682	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	73.1112	73.3158	73.5174	74.4796	74.6624	75.5254	75.5254	75.6874	75.1906	74.6624	74.2935	73.9117	
alpha	5.8741	5.8877	5.9012	5.9653	5.9775	6.0350	6.0350	6.0458	6.0127	5.9775	5.9529	5.9274	
util living area	0.9985	0.9975	0.9942	0.9788	0.9178	0.7583	0.5821	0.6452	0.8939	0.9860	0.9971	0.9988	(86)
MIT	20.0040	20.0943	20.2805	20.5561	20.8107	20.9591	20.9929	20.9875	20.8844	20.5760	20.2496	19.9889	(87)
Th 2	20.1253	20.1276	20.1298	20.1401	20.1420	20.1510	20.1510	20.1526	20.1475	20.1420	20.1381	20.1340	(88)
util rest of house	0.9980	0.9967	0.9921	0.9704	0.8851	0.6797	0.4754	0.5365	0.8401	0.9790	0.9959	0.9984	(89)
MIT 2	18.7847	18.9183	19.1915	19.5964	19.9448	20.1218	20.1481	20.1469	20.0462	19.6299	19.1535	18.7692	(90)
Living area fraction										f _{LA} = Living area / (4) =		0.3896	(91)
MIT	19.2598	19.3765	19.6158	19.9703	20.2822	20.4480	20.4773	20.4744	20.3728	19.9985	19.5805	19.2444	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2598	19.3765	19.6158	19.9703	20.2822	20.4480	20.4773	20.4744	20.3728	19.9985	19.5805	19.2444	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9973	0.9957	0.9904	0.9683	0.8912	0.7088	0.5173	0.5792	0.8563	0.9775	0.9948	0.9979	(94)
Ext temp.	349.8200	369.3340	390.8701	413.9448	404.6578	317.1565	219.1312	228.0114	308.6678	328.5002	329.1769	336.7459	(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	881.8398	850.9717	768.8718	640.5761	495.3868	333.7062	221.2496	232.0030	359.5396	542.5100	723.9893	877.2262	(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	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 per m2												2076.9990	(98)
												33.4676	(99)

8c. Space cooling requirement

Not applicable

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

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	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

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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

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	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	(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)
(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	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)	-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)	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	(72)
Total internal gains	288.4218	287.0127	276.7995	260.2426	242.9745	226.9025	216.8743	220.4921	229.3903	246.0678	265.1250	279.8547	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	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	312.2934	335.6041	364.3458	404.0188	436.2379	432.9417	409.6197	374.1510	336.0668	305.4503	295.1617	299.3495	(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	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	47.5379	47.6408	47.7421	48.2236	48.3148	48.7438	48.7438	48.8241	48.5777	48.3148	48.1307	47.9397	(85)
tau	4.1692	4.1761	4.1828	4.2149	4.2210	4.2496	4.2496	4.2549	4.2385	4.2210	4.2087	4.1960	
util living area	0.9938	0.9908	0.9821	0.9535	0.8773	0.7291	0.5747	0.6396	0.8641	0.9692	0.9901	0.9949	(86)
MIT	19.5293	19.6608	19.9285	20.3148	20.6708	20.8985	20.9718	20.9561	20.7748	20.3341	19.8709	19.5032	(87)
Th 2	20.1415	20.1432	20.1448	20.1527	20.1541	20.1610	20.1610	20.1622	20.1583	20.1541	20.1512	20.1481	(88)
util rest of house	0.9925	0.9888	0.9780	0.9419	0.8454	0.6617	0.4774	0.5426	0.8166	0.9594	0.9876	0.9938	(89)
MIT 2	18.7813	18.9135	19.1806	19.5656	19.9020	20.1003	20.1495	20.1429	20.0046	19.5900	19.1295	18.7604	(90)
Living area fraction													(91)
MIT	19.0727	19.2047	19.4720	19.8575	20.2016	20.4113	20.4699	20.4597	20.3047	19.8799	19.4184	19.0498	(92)
Temperature adjustment												0.0000	(93)
adjusted MIT	19.0727	19.2047	19.4720	19.8575	20.2016	20.4113	20.4699	20.4597	20.3047	19.8799	19.4184	19.0498	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Utilisation	0.9904	0.9860	0.9738	0.9370	0.8474	0.6831	0.5145	0.5788	0.8260	0.9555	0.9848	0.9919	(94)
Useful gains	309.2799	330.8956	354.8131	378.5752	369.6533	295.7363	210.7469	216.5601	277.5796	291.8463	290.6678	296.9133	(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	853.2938	824.4728	746.0783	623.9216	483.1659	327.3657	218.0013	228.3173	350.7220	527.4029	702.7625	850.5574	(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	404.7463	331.6839	291.1013	176.6494	84.4534	0.0000	0.0000	0.0000	0.0000	175.2541	296.7082	411.9112	(98)
Space heating												2172.5078	(98)
Space heating per m2											(98) / (4) =	35.0066	(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	(100)
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	(100)
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	529.5245	416.8597	427.4222	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8464	0.9049	0.8765	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	448.1827	377.2059	374.6417	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	583.1317	554.4543	514.5324	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)

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)
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)					23.9945		(32)					
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	28.2997	28.1352	27.9740	27.2167	27.0750	26.4154	26.4154	Aug 26.2933	Sep 26.6695	Oct 27.0750	Nov 27.3616	Dec 27.6613 (38)
Heat transfer coeff	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)
Average = Sum(39)m / 12 =												57.8638 (39)
HLP	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)
HLP (average)												0.9324 (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												
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	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													
	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)													
	-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)													
	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	(72)
Total internal gains	288.4218	287.0127	276.7995	260.2426	242.9745	226.9025	216.8743	220.4921	229.3903	246.0678	265.1250	279.8547	(73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
Northeast	6.3900		11.2829		0.6300		0.7000		0.7700		22.0341 (75)	
Solar gains	22.0341	44.8510	80.8073	132.7087	178.3866	190.1790	177.9085	141.8308	98.4649	54.8115	27.7246	17.9941 (83)
Total gains	310.4559	331.8637	357.6067	392.9514	421.3611	417.0815	394.7828	362.3229	327.8552	300.8792	292.8496	297.8489 (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	73.1112	73.3158	73.5174	74.4796	74.6624	75.5254	75.5254	75.6874	75.1906	74.6624	74.2935	73.9117	
alpha	5.8741	5.8877	5.9012	5.9653	5.9775	6.0350	6.0350	6.0458	6.0127	5.9775	5.9529	5.9274	
util living area	0.9992	0.9986	0.9965	0.9858	0.9380	0.7952	0.6203	0.6916	0.9243	0.9919	0.9985	0.9994	(86)
MIT	19.9411	20.0336	20.2239	20.5071	20.7768	20.9470	20.9902	20.9820	20.8541	20.5241	20.1905	19.9269	(87)
Th 2	20.1253	20.1276	20.1298	20.1401	20.1420	20.1510	20.1510	20.1526	20.1475	20.1420	20.1381	20.1340	(88)
util rest of house	0.9990	0.9982	0.9952	0.9798	0.9110	0.7189	0.5088	0.5796	0.8801	0.9876	0.9978	0.9992	(89)
MIT 2	19.1473	19.2415	19.4331	19.7219	19.9789	20.1242	20.1482	20.1468	20.0558	19.7421	19.4071	19.1403	(90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)	
MIT	19.4566	19.5502	19.7412	20.0278	20.2898	20.4448	20.4762	20.4722	20.3669	20.0468	19.7123	19.4468	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4566	19.5502	19.7412	20.0278	20.2898	20.4448	20.4762	20.4722	20.3669	20.0468	19.7123	19.4468	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9987	0.9978	0.9944	0.9788	0.9164	0.7472	0.5527	0.6238	0.8934	0.9870	0.9974	0.9990	(94)
Useful gains	310.0482	331.1192	355.6065	384.6374	386.1143	311.6504	218.1912	226.0051	292.9136	296.9603	292.0941	297.5455	(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	893.4425	861.1799	776.2239	643.9049	495.8259	333.5231	221.1904	231.8775	359.1990	545.2960	731.6334	889.0250	(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	434.0453	356.2008	312.9394	186.6726	81.6254	0.0000	0.0000	0.0000	0.0000	184.7617	316.4682	440.0608	(98)
Space heating												2312.7743 (98)	
Space heating per m2												(98) / (4) = 37.2667 (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	536.3943	422.2678	432.7522	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8789	0.9386	0.9125	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	471.4155	396.3582	394.8852	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	564.5938	537.1125	500.7073	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	67.0884	104.7212	78.7317	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												250.5413 (104)	
Cooled fraction												fC = cooled area / (4) = 1.0000 (105)	

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)	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

Energy content (annual)	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)
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)
RHI water heating demand	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)
Heat gains from water heating, kWh/month												1465 (64)
												1465 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.5563	40.4627	32.9065	24.9123	18.6223	15.7217	16.9879	22.0815	29.6377	37.6319	43.9219	46.8225 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (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	469.4151	465.1647	446.6837	418.4908	390.0134	364.6200	349.9640	357.6735	374.0926	402.4742	433.7560	457.0479 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	6.3900	12.9465	0.4300	0.0000	0.7700	27.3914 (75)						
Solar gains	27.3914	52.1496	92.5221	159.3235	205.9051	228.3016	211.6606	170.6238	119.4534	66.6760	35.3513	22.1245 (83)
Total gains	496.8065	517.3142	539.2058	577.8143	595.9185	592.9216	561.6246	528.2973	493.5461	469.1502	469.1074	479.1724 (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)												21.0000 (85)
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	0.9634	0.9537	0.9236	0.8451	0.6998	0.5009	0.3285	0.3487	0.6212	0.8551	0.9414	0.9676 (86)
MIT	20.0641	20.1599	20.3943	20.6831	20.8936	20.9807	20.9977	20.9971	20.9528	20.7207	20.3528	20.0299 (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	0.9567	0.9452	0.9092	0.8168	0.6503	0.4333	0.2507	0.2663	0.5503	0.8218	0.9290	0.9615 (89)
MIT 2	18.9518	19.0886	19.4208	19.8151	20.0796	20.1716	20.1846	20.1843	20.1478	19.8726	19.3665	18.9032 (90)
Living area fraction	19.3852	19.5060	19.8001	20.1533	20.3968	20.4868	20.5014	20.5010	20.4614	20.2030	19.7508	19.3422 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3852	19.5060	19.8001	20.1533	20.3968	20.4868	20.5014	20.5010	20.4614	20.2030	19.7508	19.3422 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9486	0.9368	0.9014	0.8156	0.6637	0.4587	0.2810	0.2984	0.5752	0.8226	0.9212	0.9538 (94)
Useful gains	471.2790	484.6049	486.0514	471.2672	395.5257	271.9809	157.8101	157.6646	283.8765	385.9354	432.1401	457.0334 (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	801.0612	780.3781	698.2321	581.1247	430.7606	277.4795	158.2674	158.2466	297.9162	480.1970	657.3566	798.7182 (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	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												1193.7922 (98)
RHI space heating demand												1194 (98)

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



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	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	0.2000 (18)
Number of sides sheltered				2	2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

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

3. Heat losses and heat loss parameter

Element	Gross 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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	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)
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	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	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.5563	40.4627	32.9065	24.9123	18.6223	15.7217	16.9879	22.0815	29.6377	37.6319	43.9219	46.8225 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (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	469.4151	465.1647	446.6837	418.4908	390.0134	364.6200	349.9640	357.6735	374.0926	402.4742	433.7560	457.0479 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
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	493.2867	513.7561	534.2300	562.2670	583.2768	570.6592	542.7095	511.3324	480.7692	461.8568	463.7927	476.5427 (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)	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374	50.3374 (85)
tau	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558	4.3558
alpha	0.9671	0.9574	0.9331	0.8721	0.7526	0.5817	0.4351	0.4792	0.7028	0.8863	0.9508	0.9713 (86)
util living area	20.0107	20.1192	20.3332	20.6132	20.8442	20.9608	20.9912	20.9866	20.9122	20.6399	20.2767	19.9660 (87)
MIT	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	0.9611	0.9497	0.9206	0.8482	0.7093	0.5172	0.3577	0.3992	0.6411	0.8600	0.9405	0.9660 (89)
MIT 2	18.8750	19.0304	19.3348	19.7222	20.0213	20.1535	20.1805	20.1774	20.1062	19.7658	19.2585	18.8109 (90)
Living area fraction	19.3175	19.4546	19.7238	20.0694	20.3419	20.4680	20.4963	20.4927	20.4202	20.1063	19.6552	19.2609 (92)
MIT	19.3175	19.4546	19.7238	20.0694	20.3419	20.4680	20.4963	20.4927	20.4202	20.1063	19.6552	19.2609 (93)
Temperature adjustment												0.0000
adjusted MIT	19.3175	19.4546	19.7238	20.0694	20.3419	20.4680	20.4963	20.4927	20.4202	20.1063	19.6552	19.2609 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	470.2203	483.5961	487.3848	474.7805	418.8426	308.2335	210.3480	219.8083	317.2052	395.8707	432.5059	456.8121 (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	819.1878	793.9377	721.3437	609.2778	471.4071	320.0959	212.5415	223.2524	344.7603	518.5606	684.8753	821.5590 (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	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												1322.5517 (98)
Space heating per m ²												(98) / (4) = 21.3109 (99)

8c. Space cooling requirement

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													
Space heating fuel - main system													1414.4938 (211)
Space heating fuel - secondary													0.0000 (215)
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 (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)
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)			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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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)
	Solar input (sum of months) = Sum(63)m =											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)
	Total per year (kWh/year) = Sum(64)m =											1464.6982 (64)
Heat gains from water heating, kWh/month	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	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.5563	40.4627	32.9065	24.9123	18.6223	15.7217	16.9879	22.0815	29.6377	37.6319	43.9219	46.8225 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747 (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	469.4151	465.1647	446.6837	418.4908	390.0134	364.6200	349.9640	357.6735	374.0926	402.4742	433.7560	457.0479 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	6.3900	12.9465	0.4300	0.0000	0.7700		27.3914 (75)					
Solar gains	27.3914	52.1496	92.5221	159.3235	205.9051	228.3016	211.6606	170.6238	119.4534	66.6760	35.3513	22.1245 (83)
Total gains	496.8065	517.3142	539.2058	577.8143	595.9185	592.9216	561.6246	528.2973	493.5461	469.1502	469.1074	479.1724 (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	0.9634	0.9537	0.9236	0.8451	0.6998	0.5009	0.3285	0.3487	0.6212	0.8551	0.9414	0.9676 (86)
MIT	20.0641	20.1599	20.3943	20.6831	20.8936	20.9807	20.9977	20.9971	20.9528	20.7207	20.3528	20.0299 (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	0.9567	0.9452	0.9092	0.8168	0.6503	0.4333	0.2507	0.2663	0.5503	0.8218	0.9290	0.9615 (89)
MIT 2	18.9518	19.0886	19.4208	19.8151	20.0796	20.1716	20.1846	20.1843	20.1478	19.8726	19.3665	18.9032 (90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)
MIT	19.3852	19.5060	19.8001	20.1533	20.3968	20.4868	20.5014	20.5010	20.4614	20.2030	19.7508	19.3422 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.3852	19.5060	19.8001	20.1533	20.3968	20.4868	20.5014	20.5010	20.4614	20.2030	19.7508	19.3422 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9486	0.9368	0.9014	0.8156	0.6637	0.4587	0.2810	0.2984	0.5752	0.8226	0.9212	0.9538 (94)
Useful gains	471.2790	484.6049	486.0514	471.2672	395.5257	271.9809	157.8101	157.6646	283.8765	385.9354	432.1401	457.0334 (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	801.0612	780.3781	698.2321	581.1247	430.7606	277.4795	158.2674	158.2466	297.9162	480.1970	657.3566	798.7182 (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	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												1193.7922 (98)
Space heating per m ²												(98) / (4) = 19.2361 (99)

8c. Space cooling requirement

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

	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													1276.7831 (211)
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: (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													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			