

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-013			Issued on Date	12/02/2020
Assessment Reference	013	Prop Type Ref	GFF Semi		
Property	Plot 013, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	84 B	DER	17.81	TER	19.52
Environmental	88 B	% DER<TER	8.76		
CO₂ Emissions (t/year)	0.93	DFEE	42.84	TFEE	49.48
General Requirements Compliance	Pass	% DFEE<TFEE	13.42		
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

Ground-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) 19.52 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.81 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.8 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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof (no roof)			
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): Medium OK
Based on:
Overshading: Average
Windows facing North East: 6.51 m², No overhang
Air change rate: 2.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 1.08 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 148.3234 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	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)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m ²)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.7697 (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	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Average = Sum(39)m / 12 =	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)												0.9868 (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												
Average daily hot water use (litres/day)												
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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)
	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)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	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	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547	(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	317.8119	315.7154	304.0741	285.5741	267.0454	249.1909	237.6439	243.1995	252.7789	271.4677	292.8008	308.5538	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast		3.9900	11.2829	0.4300	0.0000	0.7700	14.9058	(75)					
Northeast		2.5200	11.2829	0.4300	0.0000	0.7700	9.4142	(75)					
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609	(83)
Total gains	342.1319	365.2194	393.2645	432.0503	463.9382	459.0994	434.0090	399.7440	361.4587	331.9654	323.4015	328.4146	(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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	
util living area	0.9982	0.9970	0.9930	0.9765	0.9159	0.7700	0.6019	0.6694	0.9013	0.9855	0.9966	0.9986	(86)
MIT	19.8786	19.9763	20.1811	20.4746	20.7619	20.9367	20.9865	20.9767	20.8407	20.4901	20.1292	19.8462	(87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(88)
util rest of house	0.9976	0.9961	0.9907	0.9676	0.8834	0.6904	0.4875	0.5542	0.8499	0.9785	0.9953	0.9981	(89)
MIT 2	18.5851	18.7278	19.0263	19.4493	19.8429	20.0472	20.0885	20.0830	19.9499	19.4756	18.9517	18.5377	(90)
Living area fraction												fLA = Living area / (4) = 0.3896 (91)	
MIT	19.0891	19.2143	19.4762	19.8488	20.2010	20.3938	20.4383	20.4312	20.2970	19.8708	19.4105	19.0475	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0891	19.2143	19.4762	19.8488	20.2010	20.3938	20.4383	20.4312	20.2970	19.8708	19.4105	19.0475	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9967	0.9948	0.9885	0.9646	0.8878	0.7186	0.5323	0.5992	0.8633	0.9762	0.9940	0.9974	(94)
Useful gains	341.0084	363.3101	388.7298	416.7426	411.8666	329.9209	231.0348	239.5117	312.0441	324.0636	321.4631	327.5457	(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	905.7274	876.6499	794.7046	670.5381	520.6263	354.8299	235.0721	246.8844	379.5220	567.7741	753.9334	909.3074	(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	420.1510	344.9644	302.0453	182.7328	80.9172	0.0000	0.0000	0.0000	0.0000	181.3206	311.3786	432.8307	(98)
Space heating												2256.3406 (98)	
Space heating per m ²												(98) / (4) = 36.3574 (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													2413.1985 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	420.1510	344.9644	302.0453	182.7328	80.9172	0.0000	0.0000	0.0000	0.0000	181.3206	311.3786	432.8307	(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)	449.3593	368.9459	323.0431	195.4361	86.5425	0.0000	0.0000	0.0000	0.0000	193.9258	333.0252	462.9206	(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	89.6405	89.5983	89.4834	89.2066	88.5890	87.3000	87.3000	87.3000	87.3000	89.1718	89.5140	87.3000	(216)
Fuel for water heating, kWh/month	166.0472	145.7233	151.6002	134.0486	130.6195	116.0228	109.1391	122.9226	123.7028	139.1755	149.4479	161.2265	(219)
Water heating fuel used													1649.6761 (219)
Annual totals kWh/year													
Space heating fuel - main system													2413.1985 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													4502.2138 (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	2413.1985	0.2160	521.2509	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1649.6761	0.2160	356.3300	(264)
Space and water heating			877.5809	(265)
Pumps and fans	118.7996	0.5190	61.6570	(267)
Energy for lighting	320.5396	0.5190	166.3601	(268)
Total CO2, kg/year			1105.5980	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8100	(273)

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

	DER	TFA	N	EF	
DER					17.8100 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				37.5230	ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year				0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000	ZC7
Net CO2 emissions				37.5230	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)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3848 (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) =		0.3271 (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 infiltr rate	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
Effective ac	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (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)			6.5100	1.3258	8.6307		(27)
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)
External Wall	43.6300	6.5100	37.1200	0.1800	6.6816		(29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.5467	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6119 (36)
Total fabric heat loss						(33) + (36) =	35.1586 (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	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Average = Sum(39)m / 12 =	63.8890	63.7237	63.5617	62.8006	62.6582	61.9954	61.9954	61.8726	62.2507	62.6582	62.9463	63.2474 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0295	1.0268	1.0242	1.0119	1.0096	0.9990	0.9990	0.9970	1.0031	1.0096	1.0143	1.0191 (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)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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 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)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547 (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	328.6549	325.9990	313.8012	294.7463	275.6595	257.2483	245.7070	251.8189	261.9590	281.2026	303.0888	319.3998 (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	6.5100	11.2829	0.6300	0.7000	0.7700	22.4479 (75)						
Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321 (83)
Total gains	351.1027	371.6923	396.1260	429.9473	457.3961	450.9987	426.9565	396.3131	362.2730	337.0434	331.3340	337.7319 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	67.4564	67.6314	67.8038	68.6255	68.7814	69.5169	69.5169	69.6548	69.2317	68.7814	68.4667	68.1407
alpha	5.4971	5.5088	5.5203	5.5750	5.5854	5.6345	5.6345	5.6437	5.6154	5.5854	5.5644	5.5427
util living area	0.9985	0.9976	0.9946	0.9814	0.9302	0.7900	0.6194	0.6830	0.9110	0.9877	0.9972	0.9988 (86)
MIT	19.8916	19.9858	20.1828	20.4754	20.7558	20.9370	20.9871	20.9783	20.8453	20.5050	20.1550	19.8757 (87)
Th 2	20.0588	20.0611	20.0632	20.0734	20.0753	20.0842	20.0842	20.0859	20.0808	20.0753	20.0714	20.0674 (88)
util rest of house	0.9980	0.9968	0.9926	0.9737	0.8999	0.7093	0.5005	0.5644	0.8602	0.9813	0.9961	0.9984 (89)
MIT 2	18.5713	18.7106	18.9995	19.4298	19.8179	20.0383	20.0789	20.0758	19.9426	19.4771	18.9659	18.5544 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.0857	19.2074	19.4605	19.8372	20.1833	20.3885	20.4327	20.4275	20.2943	19.8776	19.4292	19.0692 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0857	19.2074	19.4605	19.8372	20.1833	20.3885	20.4327	20.4275	20.2943	19.8776	19.4292	19.0692 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	350.1445	370.1170	392.4831	417.5737	413.5115	332.9400	233.6527	242.1215	316.6292	330.1079	329.6619	336.9893 (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	944.6438	911.7238	823.7929	686.8644	531.5507	358.8590	237.6125	249.1897	385.5982	581.3180	776.0771	940.4378 (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	442.3075	363.9598	320.8945	193.8893	87.8212	0.0000	0.0000	0.0000	0.0000	186.9003	321.4189	448.9657 (98)
Space heating												2366.1571 (98)
Space heating per m2												38.1269 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2533.3587 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	442.3075	363.9598	320.8945	193.8893	87.8212	0.0000	0.0000	0.0000	0.0000	186.9003	321.4189	448.9657	(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)	473.5626	389.6786	343.5701	207.5902	94.0270	0.0000	0.0000	0.0000	0.0000	200.1074	344.1316	480.6913	(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	87.2132	87.0814	86.7026	85.7663	83.8918	80.3000	80.3000	80.3000	80.3000	85.5548	86.7236	87.2970	(216)
Fuel for water heating, kWh/month	207.6682	181.6779	189.8500	170.2258	168.4910	155.0353	148.5356	165.5824	167.4111	178.9222	188.4219	202.5966	(219)
Water heating fuel used													2124.4179 (219)
Annual totals kWh/year													
Space heating fuel - main system													2533.3587 (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)													320.5396 (232)
Total delivered energy for all uses													5053.3163 (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	2533.3587	0.2160	547.2055 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2124.4179	0.2160	458.8743 (264)
Space and water heating			1006.0798 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total CO2, kg/m2/year			1211.3648 (272)
Emissions per m2 for space and water heating			16.2114 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6806 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2114 * 1.00) + 2.6806 + 0.6272, rounded to 2 d.p.			19.5200 (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)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3348	(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) =		0.2846 (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	0.3629	0.3558	0.3487	0.3131	0.3060	0.2704	0.2704	0.2633	0.2846	0.3060	0.3202	0.3344 (22b)
	0.5658	0.5633	0.5608	0.5490	0.5468	0.5366	0.5366	0.5347	0.5405	0.5468	0.5513	0.5559 (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)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			30.0000	1861.8000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12032.2960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss						(33) + (36) =	36.7697 (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	27.6961	27.5710	27.4483	26.8722	26.7644	26.2625	26.2625	26.1696	26.4558	26.7644	26.9824	27.2104 (38)
Heat transfer coeff	64.4659	64.3407	64.2180	63.6419	63.5341	63.0323	63.0323	62.9393	63.2256	63.5341	63.7522	63.9801 (39)
Average = Sum(39)m / 12 =												63.6414 (39)
HLP	1.0388	1.0368	1.0348	1.0255	1.0238	1.0157	1.0157	1.0142	1.0188	1.0238	1.0273	1.0309 (40)
HLP (average)												1.0255 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
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)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	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547	(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	288.3495	286.9485	276.7473	260.2031	242.9449	226.8776	216.8473	220.4571	229.3433	246.0081	265.0553	279.7805	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W					
Northeast			3.9900	11.2829	0.4300	0.0000	0.7700	14.9058	(75)				
Northeast			2.5200	11.2829	0.4300	0.0000	0.7700	9.4142	(75)				
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609	(83)
Total gains	312.6695	336.4524	365.9376	406.6793	439.8377	436.7861	413.2124	377.0016	338.0231	306.5058	295.6561	299.6414	(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	51.8461	51.9470	52.0462	52.5174	52.6065	53.0253	53.0253	53.1036	52.8632	52.6065	52.4265	52.2397		
alpha	4.4564	4.4631	4.4697	4.5012	4.5071	4.5350	4.5350	4.5402	4.5242	4.5071	4.4951	4.4826		
util living area	0.9971	0.9955	0.9906	0.9725	0.9159	0.7853	0.6305	0.6980	0.9060	0.9829	0.9952	0.9976		(86)
MIT	19.5574	19.6773	19.9264	20.2913	20.6441	20.8855	20.9681	20.9500	20.7537	20.3196	19.8806	19.5338		(87)
Th 2	20.0512	20.0528	20.0545	20.0621	20.0636	20.0703	20.0703	20.0715	20.0677	20.0636	20.0607	20.0576		(88)
util rest of house	0.9964	0.9943	0.9878	0.9636	0.8864	0.7115	0.5150	0.5854	0.8609	0.9759	0.9936	0.9970		(89)
MIT 2	18.7235	18.8443	19.0936	19.4595	19.7958	20.0057	20.0591	20.0519	19.9042	19.4917	19.0536	18.7050		(90)
Living area fraction														(91)
MIT	19.0484	19.1688	19.4181	19.7836	20.1263	20.3485	20.4133	20.4018	20.2352	19.8143	19.3758	19.0279		(92)
Temperature adjustment														(93)
adjusted MIT	19.0484	19.1688	19.4181	19.7836	20.1263	20.3485	20.4133	20.4018	20.2352	19.8143	19.3758	19.0279		(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	311.1886	334.0270	360.6051	390.5375	390.8904	321.2804	231.2924	236.8706	294.2310	298.3719	293.3309	298.4695	(94)	
Ext temp.	4.3000	4.0000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)	
Heat loss rate W	950.7665	918.0671	829.5724	692.6549	535.3585	362.3419	240.3584	251.8697	387.8996	585.4211	782.6103	948.6924	(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	475.8459	392.4749	348.9117	217.5245	107.4843	0.0000	0.0000	0.0000	0.0000	213.5646	352.2812	483.7658	(98)	
Space heating												2591.8530	(98)	
Space heating per m2												(98) / (4) =	41.7637	(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	592.5034	466.4388	478.3390	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8159	0.8847	0.8504	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	483.4268	412.6378	406.7827	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	587.5919	558.6177	517.8177	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	74.9989	108.6090	82.6101	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													266.2180 (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	18.7497	27.1523	20.6525	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													66.5545 (107)
Space cooling per m2													1.0724 (108)
Energy for space heating													41.7637 (99)
Energy for space cooling													1.0724 (108)
Total													42.8361 (109)
Dwelling Fabric Energy Efficiency (DFEE)													42.8 (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)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (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) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3848	0.3848 (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) =		0.3271 (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	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
Effective ac	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (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)			6.5100	1.3258	8.6307		(27)					
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)					
External Wall	43.6300	6.5100	37.1200	0.1800	6.6816		(29a)					
External Wall to Corridor	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)					
Total net area of external elements Aum(A, m2)			119.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)					27.5467		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.6119 (36)					
Total fabric heat loss							(33) + (36) = 35.1586 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	63.8890	63.7237	63.5617	62.8006	62.6582	61.9954	61.9954	61.8726	62.2507	62.6582	62.9463	63.2474 (39)
Average = Sum(39)m / 12 =												62.7999 (39)
HLP	1.0295	1.0268	1.0242	1.0119	1.0096	0.9990	0.9990	0.9970	1.0031	1.0096	1.0143	1.0191 (40)
HLP (average)												1.0119 (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	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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	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	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	18.1503	16.1209	13.1104	9.9254	7.4194	6.2637	6.7682	8.7976	11.8081	14.9931	17.4991	18.6547	18.6547	(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	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	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	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	-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	37.2851	(72)
Total internal gains														
	288.3495	286.9485	276.7473	260.2031	242.9449	226.8776	216.8473	220.4571	229.3433	246.0081	265.0553	279.7805	279.7805	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast			6.5100	11.2829	0.6300	0.7000	0.7700	22.4479 (75)						
Solar gains	22.4479	45.6933	82.3248	135.2009	181.7366	193.7504	181.2495	144.4942	100.3140	55.8408	28.2452	18.3321	18.3321	(83)
Total gains	310.7974	332.6418	359.0720	395.4041	424.6815	420.6280	398.0969	364.9513	329.6573	301.8489	293.3005	298.1125	298.1125	(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	67.4564	67.6314	67.8038	68.6255	68.7814	69.5169	69.5169	69.6548	69.2317	68.7814	68.4667	68.1407	68.1407	
alpha	5.4971	5.5088	5.5203	5.5750	5.5854	5.6345	5.6345	5.6437	5.6154	5.5854	5.5644	5.5427	5.5427	
util living area														
	0.9992	0.9986	0.9966	0.9873	0.9471	0.8234	0.6573	0.7277	0.9363	0.9927	0.9985	0.9994	0.9994	(86)
MIT														
	19.8296	19.9260	20.1268	20.4264	20.7197	20.9215	20.9827	20.9703	20.8121	20.4533	20.0968	19.8146	19.8146	(87)
Th 2														
	20.0588	20.0611	20.0632	20.0734	20.0753	20.0842	20.0842	20.0859	20.0808	20.0753	20.0714	20.0674	20.0674	(88)
util rest of house														
	0.9989	0.9982	0.9953	0.9817	0.9222	0.7465	0.5345	0.6076	0.8954	0.9886	0.9978	0.9992	0.9992	(89)
MIT 2														
	18.9814	19.0795	19.2815	19.5867	19.8685	20.0438	20.0792	20.0760	19.9608	19.6167	19.2586	18.9734	18.9734	(90)
Living area fraction														
	19.3119	19.4093	19.6109	19.9139	20.2002	20.3858	20.4312	20.4245	20.2925	19.9427	19.5852	19.3011	19.3011	(91)
MIT														
	19.3119	19.4093	19.6109	19.9139	20.2002	20.3858	20.4312	20.4245	20.2925	19.9427	19.5852	19.3011	19.3011	(92)
Temperature adjustment														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(93)
adjusted MIT														
	19.3119	19.4093	19.6109	19.9139	20.2002	20.3858	20.4312	20.4245	20.2925	19.9427	19.5852	19.3011	19.3011	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9986	0.9977	0.9945	0.9805	0.9262	0.7743	0.5831	0.6551	0.9067	0.9879	0.9974	0.9989	0.9989	(94)
Useful gains	310.3684	331.8777	357.1054	387.7129	393.3308	325.6950	232.1238	239.0759	298.8994	298.1859	292.5363	297.7894	297.7894	(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	4.2000	(96)
Heat loss rate W														
	959.0950	924.5863	833.3497	691.6780	532.6048	358.6909	237.5188	249.0052	385.4866	585.3957	785.8965	955.1090	955.1090	(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	1.0000	(97a)
Space heating kWh														
	482.6526	398.3002	354.3258	218.8549	103.6199	0.0000	0.0000	0.0000	0.0000	213.6841	355.2194	489.0457	489.0457	(98)
Space heating														
												2615.7026	2615.7026	(98)
Space heating per m2														
												(98) / (4) =	42.1480	(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	582.7564	458.7657	470.2318	0.0000	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8387	0.9097	0.8771	0.0000	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	488.7670	417.3428	412.4388	0.0000	0.0000	0.0000	0.0000	0.0000	(102)
Total gains														
	0.0000	0.0000	0.0000	0.0000	0.0000	568.7059	540.9502	503.7329	0.0000	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	0.0000	(103a)
Space cooling kWh														
	0.0000	0.0000	0.0000	0.0000	0.0000	57.5560	91.9639	67.9228	0.0000	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling														
													217.4427	(104)
Cooled fraction														
													1.0000	(105)
Intermittency factor (Table 10b)														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	14.3890	22.9910	16.9807	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													54.3607 (107)
Space cooling per m2													0.8759 (108)
Energy for space heating													42.1480 (99)
Energy for space cooling													0.8759 (108)
Total													43.0239 (109)
Target Fabric Energy Efficiency (TFEE)													49.5 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												
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)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m ²)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss						(33) + (36) =	36.7697 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
Average = Sum(39)m / 12 =	61.2431 (39)											
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)	0.9868 (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)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	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	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	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	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	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	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (64)	
RHI water heating demand													1465 (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	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	122.3544	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368	46.6368	(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	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	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	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	-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	63.0584	(72)
Total internal gains	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622	456.8622	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast		3.9900	12.9465	0.4300	0.0000	0.7700	17.1035 (75)							
Northeast		2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (75)							
Solar gains	27.9058	53.1289	94.2596	162.3155	209.7719	232.5890	215.6355	173.8280	121.6967	67.9281	36.0152	22.5400	22.5400	(83)
Total gains	497.1402	518.1331	540.8128	580.7075	599.7115	597.1466	565.5321	531.4139	495.6718	470.2531	469.5971	479.4022	479.4022	(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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	
util living area	0.9881	0.9837	0.9675	0.9124	0.7783	0.5617	0.3671	0.3903	0.6965	0.9210	0.9776	0.9899	0.9899	(86)
MIT	20.1654	20.2461	20.4499	20.7129	20.9114	20.9875	20.9990	20.9987	20.9634	20.7451	20.4148	20.1379	20.1379	(87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(88)
util rest of house	0.9847	0.9789	0.9576	0.8863	0.7204	0.4765	0.2699	0.2872	0.6091	0.8908	0.9699	0.9870	0.9870	(89)
MIT 2	19.0015	19.1180	19.4095	19.7708	20.0146	20.0873	20.0941	20.0940	20.0701	19.8205	19.3624	18.9620	18.9620	(90)
Living area fraction	19.4550	19.5575	19.8148	20.1379	20.3640	20.4380	20.4467	20.4465	20.4181	20.1808	19.7724	19.4202	19.4202	(91)
Temperature adjustment	19.4550	19.5575	19.8148	20.1379	20.3640	20.4380	20.4467	20.4465	20.4181	20.1808	19.7724	19.4202	19.4202	(92)
adjusted MIT	19.4550	19.5575	19.8148	20.1379	20.3640	20.4380	20.4467	20.4465	20.4181	20.1808	19.7724	19.4202	19.4202	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9816	0.9754	0.9539	0.8877	0.7387	0.5095	0.3079	0.3275	0.6419	0.8941	0.9665	0.9841	0.9841	(94)
Ext temp.	488.0058	505.3904	515.9023	515.4782	443.0194	304.2327	174.1258	174.0383	318.1540	420.4741	453.8888	471.8010	471.8010	(95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000	4.7000	(96)
Month fracti	903.6412	879.2988	784.8208	651.4954	481.6176	308.5442	174.3384	174.3270	331.8228	537.7614	739.3532	901.5100	901.5100	(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	1.0000	(97a)
Space heating	309.2327	251.2665	200.0754	97.9323	28.7170	0.0000	0.0000	0.0000	0.0000	87.2617	205.5343	319.7035	319.7035	(98)
RHI space heating demand													1499.7235 (98)	
													1500 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (5)

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss							(33) + (36) = 36.7697 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
Average = Sum(39)m / 12 =												61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)												0.9868 (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)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368	(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	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast		3.9900	11.2829	0.4300	0.0000	0.7700	14.9058 (75)						
Northeast		2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (75)						
Solar gains	24.3199	49.5039	89.1904	146.4762	196.8927	209.9085	196.3651	156.5445	108.6798	60.4977	30.6008	19.8609	(83)
Total gains	493.5544	514.5081	535.7435	564.8682	586.8323	574.4661	546.2617	514.1305	482.6549	462.8227	464.1826	476.7231	(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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	
util living area	0.9897	0.9854	0.9729	0.9331	0.8306	0.6520	0.4877	0.5381	0.7825	0.9438	0.9823	0.9914	(86)
MIT	20.1205	20.2115	20.3962	20.6478	20.8648	20.9714	20.9950	20.9916	20.9261	20.6706	20.3493	20.0844	(87)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(88)
util rest of house	0.9868	0.9812	0.9648	0.9126	0.7828	0.5717	0.3902	0.4371	0.7102	0.9223	0.9764	0.9890	(89)
MIT 2	18.9364	19.0680	19.3332	19.6843	19.9624	20.0749	20.0923	20.0906	20.0356	19.7215	19.2684	18.8841	(90)
Living area fraction	fLA = Living area / (4) = 0.3896 (91)												
MIT	19.3978	19.5135	19.7473	20.0597	20.3140	20.4242	20.4440	20.4417	20.3826	20.0913	19.6895	19.3518	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.3978	19.5135	19.7473	20.0597	20.3140	20.4242	20.4440	20.4417	20.3826	20.0913	19.6895	19.3518	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9839	0.9778	0.9610	0.9117	0.7953	0.6020	0.4283	0.4765	0.7349	0.9222	0.9731	0.9864	(94)
Useful gains	485.5990	503.1023	514.8249	515.0174	466.7238	345.8043	233.9760	245.0029	354.6930	426.8013	451.7015	470.2282	(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	924.6330	894.9760	811.3083	683.4566	527.5464	356.6900	235.4182	247.5250	384.7631	581.2762	771.0215	927.9412	(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	326.6413	263.3391	220.5836	121.2762	45.2520	0.0000	0.0000	0.0000	0.0000	114.9293	229.9104	340.5385	(98)
Space heating	1662.4705 (98)												
Space heating per m ²	(98) / (4) = 26.7881 (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													1778.0433 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	326.6413	263.3391	220.5836	121.2762	45.2520	0.0000	0.0000	0.0000	0.0000	114.9293	229.9104	340.5385	(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)	349.3490	281.6461	235.9183	129.7072	48.3979	0.0000	0.0000	0.0000	0.0000	122.9191	245.8934	364.2123	(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	89.4733	89.4136	89.2542	88.8825	88.1765	87.3000	87.3000	87.3000	87.3000	88.8098	89.2960	87.3000	(216)
Fuel for water heating, kWh/month	166.3573	146.0242	151.9896	134.5375	131.2306	116.0228	109.1391	122.9226	123.7028	139.7428	149.8127	161.5055	(219)
Water heating fuel used													1652.9875 (219)
Annual totals kWh/year													
Space heating fuel - main system													1778.0433 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3870.3700 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1778.0433	3.4800	61.8759 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1652.9875	3.4800	57.5240 (247)
Mechanical ventilation fans	43.7996	13.1900	5.7772 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	320.5396	13.1900	42.2792 (250)
Additional standing charges			120.0000 (251)
Total energy cost			297.3487 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1665 (257)
SAP value		83.7272
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1778.0433	0.2160	384.0574 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1652.9875	0.2160	357.0453 (264)
Space and water heating			741.1027 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			969.1197 (272)
CO2 emissions per m2			15.6200 (273)
EI value			87.8702
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8850 = 3.932$, stars = 4
Water heating environmental impact	$0.216 / 0.8850 = 0.2441$, 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 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.8000	4.7000	4.2000	4.2000	3.7000	3.8000	3.8000	4.0000	4.2000	4.3000	4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate	0.2083	0.2040	0.1998	0.1785	0.1785	0.1573	0.1615	0.1615	0.1700	0.1785	0.1828	0.1913 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
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)			3.9900	1.3258	5.2898		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	43.6300	6.5100	37.1200	0.2500	9.2800	52.8000	1959.9360 (29a)
External Wall to Corridor	13.4900	2.1200	11.3700	0.2200	2.5014	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			119.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.0107		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14514.6960 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.8817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7591 (36)
Total fabric heat loss						(33) + (36) =	36.7697 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431	61.2431 (39)
Average = Sum(39)m / 12 =												61.2431 (39)
HLP	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868	0.9868 (40)
HLP (average)												0.9868 (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)											
Daily hot water use	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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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	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	45.3757	40.3023	32.7760	24.8136	18.5484	15.6594	16.9205	21.9939	29.5202	37.4826	43.7478	46.6368	(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	469.2344	465.0042	446.5532	418.3920	389.9396	364.5576	349.8966	357.5860	373.9751	402.3250	433.5818	456.8622	(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		3.9900	12.9465	0.4300	0.0000	0.0000	0.7700	17.1035 (75)				
Northeast		2.5200	12.9465	0.4300	0.0000	0.0000	0.7700	10.8022 (75)				
Solar gains	27.9058	53.1289	94.2596	162.3155	209.7719	232.5890	215.6355	173.8280	121.6967	67.9281	36.0152	22.5400 (83)
Total gains	497.1402	518.1331	540.8128	580.7075	599.7115	597.1466	565.5321	531.4139	495.6718	470.2531	469.5971	479.4022 (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	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	65.8337	(86)
alpha	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	5.3889	(87)
util living area	0.9881	0.9837	0.9675	0.9124	0.7783	0.5617	0.3671	0.3903	0.6965	0.9210	0.9776	0.9899	(88)
MIT	20.1654	20.2461	20.4499	20.7129	20.9114	20.9875	20.9990	20.9987	20.9634	20.7451	20.4148	20.1379	(89)
Th 2	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	20.0943	(90)
util rest of house	0.9847	0.9789	0.9576	0.8863	0.7204	0.4765	0.2699	0.2872	0.6091	0.8908	0.9699	0.9870	(91)
MIT 2	19.0015	19.1180	19.4095	19.7708	20.0146	20.0873	20.0941	20.0940	20.0701	19.8205	19.3624	18.9620	(92)
Living area fraction													fLA = Living area / (4) = 0.3896 (91)
MIT	19.4550	19.5575	19.8148	20.1379	20.3640	20.4380	20.4467	20.4465	20.4181	20.1808	19.7724	19.4202	(92)
Temperature adjustment													0.0000
adjusted MIT	19.4550	19.5575	19.8148	20.1379	20.3640	20.4380	20.4467	20.4465	20.4181	20.1808	19.7724	19.4202	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9816	0.9754	0.9539	0.8877	0.7387	0.5095	0.3079	0.3275	0.6419	0.8941	0.9665	0.9841	(94)
Useful gains	488.0058	505.3904	515.9023	515.4782	443.0194	304.2327	174.1258	174.0383	318.1540	420.4741	453.8888	471.8010	(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	903.6412	879.2988	784.8208	651.4954	481.6176	308.5442	174.3384	174.3270	331.8228	537.7614	739.3532	901.5100	(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	309.2327	251.2665	200.0754	97.9323	28.7170	0.0000	0.0000	0.0000	0.0000	87.2617	205.5343	319.7035	(98)
Space heating													1499.7235 (98)
Space heating per m ²													(98) / (4) = 24.1657 (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

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													1603.9824 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	309.2327	251.2665	200.0754	97.9323	28.7170	0.0000	0.0000	0.0000	0.0000	87.2617	205.5343	319.7035	(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)	330.7302	268.7342	213.9844	104.7405	30.7134	0.0000	0.0000	0.0000	0.0000	93.3280	219.8228	341.9289	(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	89.4348	89.3797	89.1792	88.7123	87.9181	87.3000	87.3000	87.3000	87.3000	88.5933	89.2108	87.3000	(216)
Fuel for water heating, kWh/month	166.4290	146.0796	152.1175	134.7955	131.6164	116.0228	109.1391	122.9226	123.7028	140.0845	149.9558	161.5838	(219)
Water heating fuel used													1654.4493 (219)
Annual totals kWh/year													
Space heating fuel - main system													1603.9824 (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)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													320.5396 (232)
Total delivered energy for all uses													3697.7710 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1603.9824	3.9200	62.8761 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1654.4493	3.9200	64.8544 (247)
Mechanical ventilation fans	43.7996	16.9600	7.4284 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	320.5396	16.9600	54.3635 (250)
Additional standing charges			88.0000 (251)
Total energy cost			290.2425 (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	1603.9824	0.2160	346.4602 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.4493	0.2160	357.3611 (264)
Space and water heating			703.8213 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	320.5396	0.5190	166.3601 (268)
Total kg/year			931.8383 (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	1603.9824	1.2200	1956.8585 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.4493	1.2200	2018.4282 (264)
Space and water heating			3975.2867 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	320.5396	3.0700	984.0566 (268)
Primary energy kWh/year			5324.0581 (272)
Primary energy kWh/m2/year			85.7889 (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 88

(For testing purposes):

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

Recommended measures:	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 88

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

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£75	£75	£0
Mains gas	£216	£216	£0
Space heating	£171	£171	£0
Water heating	£65	£65	£0
Lighting	£54	£54	£0
Total cost of fuels	£291	£291	£0
Total cost of uses	£290	£290	£0
Delivered energy	60 kWh/m ²	60 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	86 kWh/m ²	86 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	South East
Overshading	Average or unknown
Thermal mass parameter	233.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	97.89 (P1)
Transmission heat loss coefficient	36.77 (37)
Summer heat loss coefficient	134.66 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
North East	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644
total:						252.0415

	Jun	Jul	Aug
Solar gains	272	252	(P4)
Internal gains	362	347	
Total summer gains	633	599	(P5)
Summer gain/loss ratio	4.70	4.45	4.14 (P6)
Summer external temperature	15.40	17.60	
Thermal mass temperature increment (TMP = 233.9)	0.36	0.36	
Threshold temperature	20.47	22.41	22.10 (P7)
Likelihood of high internal temperature	Not significant	Medium	Medium
Assessment of likelihood of high internal temperature:	Medium		