

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-021		Issued on Date	12/02/2020	
Assessment Reference	021	Prop Type Ref	1FF Semi		
Property	Plot 021, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	85 B	DER	14.94	TER	16.61
Environmental	90 B	% DER<TER	10.08		
CO₂ Emissions (t/year)	0.78	DFEE	30.83	TFEE	34.85
General Requirements Compliance	Pass	% DFEE<TFEE	11.52		
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

Mid-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) 16.61 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.94 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)34.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)30.8 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	(no floor)		
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (East Anglia): Slight OK
Based on:
Overshading: Average
Windows facing North East: 6.93 m², No overhang
Air change rate: 4.00 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 (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:	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)			6.9300	1.3258	9.1875		(27)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	20.1185			(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
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) =				14182.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1291 (36)
Total fabric heat loss			(33) + (36) =				24.2476 (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	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210 (39)
Average = Sum(39)m / 12 =	48.7210 (39)											
HLP	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851 (40)
HLP (average)	0.7851 (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)											

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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)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
												Total per year (kWh/year) = Sum(64)m = 1464.6982 (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	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	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039 (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	317.5679	315.4987	303.8979	285.4406	266.9457	249.1067	237.5529	243.0812	252.6202	271.2661	292.5655	308.3030 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	6.9300	11.2829	0.4300	0.0000	0.7700	25.8890 (75)						
Solar gains	25.8890	52.6977	94.9446	155.9263	209.5955	223.4510	209.0338	166.6442	115.6914	64.4008	32.5750	21.1422 (83)
Total gains	343.4569	368.1964	398.8425	441.3669	476.5412	472.5576	446.5867	409.7254	368.3116	335.6669	325.1405	329.4452 (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)	0.9977	0.9958	0.9886	0.9552	0.8419	0.6433	0.4777	0.5417	0.8222	0.9745	0.9952	0.9982 (86)
tau	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585 (87)
alpha	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906 (88)
util living area	0.9977	0.9958	0.9886	0.9552	0.8419	0.6433	0.4777	0.5417	0.8222	0.9745	0.9952	0.9982 (86)
MIT	20.1766	20.2696	20.4542	20.7064	20.9093	20.9864	20.9982	20.9962	20.9417	20.6860	20.3817	20.1440 (87)
Th 2	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663 (88)
util rest of house	0.9970	0.9945	0.9850	0.9414	0.8012	0.5762	0.3993	0.4580	0.7631	0.9641	0.9935	0.9977 (89)
MIT 2	19.1513	19.2869	19.5549	19.9123	20.1753	20.2566	20.2655	20.2645	20.2167	19.8890	19.4509	19.1036 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.5508	19.6698	19.9053	20.2217	20.4613	20.5410	20.5510	20.5496	20.4992	20.1995	19.8136	19.5090 (92)
Temperature adjustment												0.0000 (93)
adjusted MIT	19.5508	19.6698	19.9053	20.2217	20.4613	20.5410	20.5510	20.5496	20.4992	20.1995	19.8136	19.5090 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	342.1197	365.6953	392.0221	415.0906	387.3099	284.4243	191.9892	201.0434	288.4780	323.2178	322.6068	328.4502 (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	743.0319	719.6002	653.1199	551.6040	426.8570	289.4494	192.4959	202.1713	311.7751	467.6995	619.4193	745.8677 (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	298.2787	237.8241	194.2568	98.2897	29.4231	0.0000	0.0000	0.0000	0.0000	107.4944	213.7050	310.5586 (98)
Space heating												1489.8304 (98)
Space heating per m ²												(98) / (4) = 24.0063 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1593.4015 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	298.2787	237.8241	194.2568	98.2897	29.4231	0.0000	0.0000	0.0000	0.0000	107.4944	213.7050	310.5586	(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)	319.0146	254.3574	207.7613	105.1226	31.4685	0.0000	0.0000	0.0000	0.0000	114.9673	228.5615	332.1482	(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	89.4090	89.3394	89.1562	88.7152	87.9303	87.3000	87.3000	87.3000	87.3000	88.7566	89.2406	87.3000	(216)
Fuel for water heating, kWh/month	166.4770	146.1456	152.1566	134.7912	131.5981	116.0228	109.1391	122.9226	123.7028	139.8266	149.9056	161.6204	(219)
Water heating fuel used													1654.3084 (219)
Annual totals kWh/year													
Space heating fuel - main system													1593.4015 (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)													316.2303 (232)
Total delivered energy for all uses													3682.7397 (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	1593.4015	0.2160	344.1747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1654.3084	0.2160	357.3306 (264)
Space and water heating			701.5053 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total CO2, kg/year			927.2858 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9400 (273)

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

	TFA	N	EF	
DER				14.9400 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				34.6530 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				34.6530 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (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				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 infilt rate												
Effective ac	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)
	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 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					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			6.9300	1.3258	9.1875		(27)					
External Wall	31.4900	6.9300	24.5600	0.1800	4.4208		(29a)					
External Wall to Corridor	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)					
Total net area of external elements Aum(A, m ²)			44.9800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	17.7749	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss							(33) + (36) =					
							22.3380 (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	51.0685	50.9031	50.7411	49.9800	49.8376	49.1748	49.1748	49.0520	49.4301	49.8376	50.1257	50.4269 (39)
Average = Sum(39)m / 12 =												49.9794 (39)
HLP	0.8229	0.8202	0.8176	0.8054	0.8031	0.7924	0.7924	0.7904	0.7965	0.8031	0.8077	0.8126 (40)
HLP (average)												0.8053 (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 =
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												
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039 (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	328.4109	325.7823	313.6250	294.6129	275.5598	257.1641	245.6160	251.7006	261.8002	281.0011	302.8535	319.1490 (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	6.9300	11.2829	0.6300	0.7000	0.7700	23.8961 (75)						
Solar gains	23.8961	48.6412	87.6361	143.9236	193.4615	206.2505	192.9431	153.8165	106.7859	59.4435	30.0675	19.5148 (83)
Total gains	352.3070	374.4235	401.2610	438.5365	469.0213	463.4146	438.5590	405.5170	368.5861	340.4445	332.9210	338.6638 (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	84.3911	84.6651	84.9355	86.2289	86.4752	87.6409	87.6409	87.8602	87.1882	86.4752	85.9783	85.4648	
alpha	6.6261	6.6443	6.6624	6.7486	6.7650	6.8427	6.8427	6.8573	6.8125	6.7650	6.7319	6.6977	
util living area	0.9983	0.9970	0.9919	0.9657	0.8660	0.6629	0.4914	0.5519	0.8358	0.9792	0.9964	0.9987 (86)	
MIT	20.1936	20.2816	20.4560	20.7073	20.9074	20.9878	20.9986	20.9971	20.9466	20.7013	20.4109	20.1794 (87)	
Th 2	20.2335	20.2358	20.2381	20.2487	20.2507	20.2599	20.2599	20.2617	20.2564	20.2507	20.2467	20.2425 (88)	
util rest of house	0.9978	0.9960	0.9891	0.9537	0.8259	0.5931	0.4098	0.4658	0.7753	0.9697	0.9950	0.9983 (89)	
MIT 2	19.1442	19.2744	19.5299	19.8964	20.1589	20.2517	20.2594	20.2604	20.2125	19.8938	19.4720	19.1304 (90)	
Living area fraction	fLA = Living area / (4) = 0.3896 (91)												
MIT	19.5531	19.6668	19.8907	20.2124	20.4505	20.5385	20.5474	20.5474	20.4985	20.2084	19.8378	19.5391 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.5531	19.6668	19.8907	20.2124	20.4505	20.5385	20.5474	20.5474	20.4985	20.2084	19.8378	19.5391 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	351.2995	372.5825	396.2557	417.9485	392.7654	287.3178	193.7020	202.5397	293.5949	329.9115	330.9199	337.9087 (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	778.9520	751.6782	679.4590	565.3930	436.1060	292.0266	194.1120	203.4383	316.2789	478.8608	638.4898	773.5034 (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	318.1735	254.7523	210.7033	106.1600	32.2454	0.0000	0.0000	0.0000	0.0000	110.8182	221.4503	324.0824 (98)
Space heating	1578.3855 (98)											
Space heating per m2	(98) / (4) = 25.4332 (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)
Fraction of space heat from main system(s)	1.0000 (202)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1689.9202 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	318.1735	254.7523	210.7033	106.1600	32.2454	0.0000	0.0000	0.0000	0.0000	110.8182	221.4503	324.0824	(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)	340.6568	272.7541	225.5924	113.6617	34.5240	0.0000	0.0000	0.0000	0.0000	118.6491	237.0988	346.9833	(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	86.4554	86.2442	85.6738	84.2635	82.0018	80.3000	80.3000	80.3000	80.3000	84.2529	85.8170	86.5563	(217)
Fuel for water heating, kWh/month	209.4883	183.4416	192.1297	173.2615	172.3745	155.0353	148.5356	165.5824	167.4111	181.6870	190.4124	204.3303	(219)
Water heating fuel used													2143.6896 (219)
Annual totals kWh/year													
Space heating fuel - main system													1689.9202 (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)													316.2303 (232)
Total delivered energy for all uses													4224.8401 (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	1689.9202	0.2160	365.0228 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2143.6896	0.2160	463.0370 (264)
Space and water heating			828.0597 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total CO2, kg/m2/year			1031.1082 (272)
Emissions per m2 for space and water heating			13.3429 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6446 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.3429 * 1.00) + 2.6446 + 0.6272, rounded to 2 d.p.			16.6100 (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 (m ²)	Storey height (m)	Volume (m ³)
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	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				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)
Effective ac	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	20.1185	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
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) = 11699.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1291 (36)
Total fabric heat loss							(33) + (36) = 24.2476 (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	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)
Average = Sum(39)m / 12 =	51.9438	51.8186	51.6960	51.1198	51.0120	50.5102	50.5102	50.4173	50.7035	51.0120	51.2301	51.4581 (39)
												51.1193 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8370	0.8350	0.8330	0.8237	0.8220	0.8139	0.8139	0.8124	0.8170	0.8220	0.8255	0.8292 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
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	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	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039	(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	288.1055	286.7318	276.5710	260.0697	242.8452	226.7934	216.7563	220.3388	229.1845	245.8065	264.8200	279.5297	(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	6.9300	11.2829	0.4300	0.0000	0.7700	25.8890 (75)							
Solar gains	25.8890	52.6977	94.9446	155.9263	209.5955	223.4510	209.0338	166.6442	115.6914	64.4008	32.5750	21.1422	(83)
Total gains	313.9945	339.4295	371.5156	415.9960	452.4407	450.2443	425.7902	386.9830	344.8760	310.2073	297.3951	300.6719	(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)	0.9967	0.9944	0.9866	0.9552	0.8592	0.6779	0.5138	0.5827	0.8466	0.9742	0.9939	0.9973	(86)
MIT	19.8790	19.9953	20.2249	20.5514	20.8261	20.9633	20.9929	20.9869	20.8824	20.5368	20.1556	19.8564	(87)
Th 2	20.2214	20.2231	20.2248	20.2328	20.2343	20.2413	20.2413	20.2426	20.2386	20.2343	20.2313	20.2281	(88)
util rest of house	0.9958	0.9930	0.9831	0.9430	0.8233	0.6110	0.4290	0.4941	0.7945	0.9651	0.9921	0.9967	(89)
MIT 2	19.1817	19.2989	19.5282	19.8535	20.1068	20.2213	20.2388	20.2375	20.1630	19.8446	19.4657	19.1646	(90)
Living area fraction	19.4534	19.5702	19.7996	20.1254	20.3871	20.5104	20.5326	20.5295	20.4433	20.1143	19.7345	19.4341	(91)
MIT	19.4534	19.5702	19.7996	20.1254	20.3871	20.5104	20.5326	20.5295	20.4433	20.1143	19.7345	19.4341	(92)
Temperature adjustment												0.0000	(93)
adjusted MIT	19.4534	19.5702	19.7996	20.1254	20.3871	20.5104	20.5326	20.5295	20.4433	20.1143	19.7345	19.4341	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	312.3597	336.5286	364.3635	391.4821	376.0173	286.1553	196.7443	204.5182	279.3038	298.8239	294.6190	299.4111	(94)	
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	787.1228	760.1894	687.5380	573.8425	443.1453	298.5346	198.6378	208.1979	321.6265	485.3417	647.2671	783.9192	(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	353.2238	284.7001	240.4418	131.2994	49.9432	0.0000	0.0000	0.0000	0.0000	138.7692	253.9066	360.4740	(98)	
Space heating												1812.7582	(98)	
Space heating per m2												(98) / (4) =	29.2098	(99)

8c. Space cooling requirement

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	474.7957	373.7754	383.1711	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9229	0.9611	0.9427	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	438.1770	359.2407	361.1963	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	603.2103	573.1978	529.3268	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	118.8240	159.1841	125.0890	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												403.0971 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	29.7060	39.7960	31.2723	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												100.7743 (107)
Space cooling per m2												1.6238 (108)
Energy for space heating												29.2098 (99)
Energy for space cooling												1.6238 (108)
Total												30.8336 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.8 (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)	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					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 infilt rate												
Effective ac	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)
	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)			6.9300	1.3258	9.1875		(27)
External Wall	31.4900	6.9300	24.5600	0.1800	4.4208		(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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 17.7749		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)
Total fabric heat loss							(33) + (36) = 22.3380 (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	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	51.0685	50.9031	50.7411	49.9800	49.8376	49.1748	49.1748	49.0520	49.4301	49.8376	50.1257	50.4269 (39)
Average = Sum(39)m / 12 =												49.9794 (39)
HLP	0.8229	0.8202	0.8176	0.8054	0.8031	0.7924	0.7924	0.7904	0.7965	0.8031	0.8077	0.8126 (40)
HLP (average)												0.8053 (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												
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 (57)
												0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039 (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	288.1055	286.7318	276.5710	260.0697	242.8452	226.7934	216.7563	220.3388	229.1845	245.8065	264.8200	279.5297 (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	6.9300	11.2829	0.6300	0.7000	0.7700	23.8961 (75)						
Solar gains	23.8961	48.6412	87.6361	143.9236	193.4615	206.2505	192.9431	153.8165	106.7859	59.4435	30.0675	19.5148 (83)
Total gains	312.0016	335.3730	364.2071	403.9933	436.3067	433.0438	409.6994	374.1553	335.9704	305.2499	294.8876	299.0444 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	84.3911	84.6651	84.9355	86.2289	86.4752	87.6409	87.6409	87.8602	87.1882	86.4752	85.9783	85.4648
alpha	6.6261	6.6443	6.6624	6.7486	6.7650	6.8427	6.8427	6.8573	6.8125	6.7650	6.7319	6.6977
util living area	0.9992	0.9984	0.9953	0.9772	0.8960	0.7024	0.5249	0.5955	0.8785	0.9884	0.9982	0.9994 (86)
MIT	20.1293	20.2196	20.3988	20.6609	20.8828	20.9829	20.9979	20.9954	20.9257	20.6501	20.3506	20.1159 (87)
Th 2	20.2335	20.2358	20.2381	20.2487	20.2507	20.2599	20.2599	20.2617	20.2564	20.2507	20.2467	20.2425 (88)
util rest of house	0.9989	0.9979	0.9936	0.9686	0.8607	0.6312	0.4384	0.5039	0.8250	0.9826	0.9975	0.9992 (89)
MIT 2	19.4257	19.5178	19.6981	19.9647	20.1689	20.2519	20.2594	20.2602	20.2125	19.9583	19.6579	19.4199 (90)
Living area fraction										fLA = Living area / (4) =		0.3896 (91)
MIT	19.6998	19.7913	19.9711	20.2360	20.4471	20.5367	20.5471	20.5467	20.4904	20.2278	19.9278	19.6911 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6998	19.7913	19.9711	20.2360	20.4471	20.5367	20.5471	20.5467	20.4904	20.2278	19.9278	19.6911 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9987	0.9975	0.9929	0.9684	0.8708	0.6587	0.4723	0.5398	0.8436	0.9824	0.9971	0.9990 (94)
Useful gains	311.5899	334.5420	361.6204	391.2362	379.9549	285.2267	193.4811	201.9697	283.4153	299.8813	294.0460	298.7470 (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	786.4447	758.0124	683.5399	566.5717	435.9330	291.9365	194.0982	203.4025	315.8770	479.8277	643.0006	781.1655 (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	353.2920	284.5721	239.5081	126.2416	41.6477	0.0000	0.0000	0.0000	0.0000	133.8801	251.2474	358.9194 (98)
Space heating per m2												1789.3082 (98)
												28.8319 (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	462.2429	363.8934	372.7954	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9495	0.9800	0.9671	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	438.9207	356.6122	360.5291	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	583.1058	554.3905	514.3333	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	103.8132	147.1470	114.4304	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												365.3906 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.9533	36.7868	28.6076	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2													91.3477 (107)
Energy for space heating													1.4719 (108)
Energy for space cooling													28.8319 (99)
Total													1.4719 (108)
Target Fabric Energy Efficiency (TFEE)													30.3038 (109)
													34.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	x 2.3900 (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	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1700 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	20.1185			(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
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) =	14182.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1291 (36)
Total fabric heat loss						(33) + (36) =	24.2476 (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	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210 (39)
Average = Sum(39)m / 12 =												48.7210 (39)
HLP	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851 (40)
HLP (average)												0.7851 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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												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 (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	44.7657	39.7605	32.3354	24.4800	18.2991	15.4488	16.6930	21.6982	29.1233	36.9787	43.1596	46.0098 (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	468.6244	464.4624	446.1125	418.0584	389.6902	364.3471	349.6691	357.2903	373.5782	401.8211	432.9937	456.2352 (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	6.9300	12.9465	0.4300			0.0000	0.7700	29.7061 (75)				
Solar gains	29.7061	56.5566	100.3409	172.7874	223.3055	247.5947	229.5474	185.0427	129.5481	72.3106	38.3388	23.9942 (83)
Total gains	498.3305	521.0189	546.4534	590.8459	612.9958	611.9418	579.2166	542.3330	503.1263	474.1316	471.3325	480.2294 (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	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585
alpha	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906
util living area	0.9804	0.9717	0.9402	0.8407	0.6567	0.4444	0.2859	0.3053	0.5733	0.8587	0.9606	0.9837 (86)
MIT	20.4658	20.5394	20.7057	20.8888	20.9797	20.9985	20.9999	20.9999	20.9932	20.8941	20.6587	20.4375 (87)
Th 2	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663 (88)
util rest of house	0.9755	0.9647	0.9256	0.8082	0.6061	0.3869	0.2243	0.2395	0.5066	0.8213	0.9494	0.9795 (89)
MIT 2	19.5691	19.6738	19.9065	20.1459	20.2488	20.2654	20.2663	20.2663	20.2619	20.1573	19.8445	19.5288 (90)
Living area fraction	19.9184	20.0110	20.2179	20.4354	20.5336	20.5510	20.5521	20.5521	20.5468	20.4444	20.1617	19.8829 (91)
MIT	19.9184	20.0110	20.2179	20.4354	20.5336	20.5510	20.5521	20.5521	20.5468	20.4444	20.1617	19.8829 (92)
Temperature adjustment												0.0000
adjusted MIT	19.9184	20.0110	20.2179	20.4354	20.5336	20.5510	20.5521	20.5521	20.5468	20.4444	20.1617	19.8829 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9727	0.9619	0.9246	0.8161	0.6249	0.4093	0.2483	0.2652	0.5324	0.8311	0.9476	0.9769 (94)
Ext temp.	484.7123	501.1615	505.2320	482.2004	383.0544	250.4660	143.8159	143.8078	267.8670	394.0274	446.6254	469.1196 (95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Month fracti	741.4579	721.6085	643.9877	532.7822	391.4047	250.9640	143.8306	143.8297	270.2478	440.6505	607.1464	739.7251 (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)
RHI space heating demand	191.0187	148.1403	103.2343	36.4189	6.2126	0.0000	0.0000	0.0000	0.0000	34.6876	115.5751	201.3305 (98)
												837 (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)	2.3900 (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:												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)			6.9300	1.3258	9.1875		(27)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.1185		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
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) = 14182.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1291 (36)
Total fabric heat loss							(33) + (36) = 24.2476 (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	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210 (39)
Average = Sum(39)m / 12 =												48.7210 (39)
HLP	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851 (40)
HLP (average)												0.7851 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	44.7657	39.7605	32.3354	24.4800	18.2991	15.4488	16.6930	21.6982	29.1233	36.9787	43.1596	46.0098 (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	468.6244	464.4624	446.1125	418.0584	389.6902	364.3471	349.6691	357.2903	373.5782	401.8211	432.9937	456.2352 (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	6.9300	11.2829	0.4300	0.0000	0.7700	25.8890 (75)						
Solar gains	25.8890	52.6977	94.9446	155.9263	209.5955	223.4510	209.0338	166.6442	115.6914	64.4008	32.5750	21.1422 (83)
Total gains	494.5134	517.1601	541.0571	573.9847	599.2857	587.7981	558.7030	523.9345	489.2697	466.2219	465.5687	477.3775 (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)	0.9833	0.9751	0.9505	0.8760	0.7207	0.5261	0.3832	0.4267	0.6663	0.8979	0.9696	0.9865 (86)
tau	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585 (87)
alpha	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906 (88)
MIT	20.4277	20.5103	20.6641	20.8484	20.9629	20.9955	20.9995	20.9990	20.9822	20.8460	20.6052	20.3923 (87)
Th 2	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663 (88)
util rest of house	0.9791	0.9689	0.9384	0.8487	0.6739	0.4677	0.3196	0.3592	0.6032	0.8690	0.9610	0.9830 (89)
MIT 2	19.5143	19.6323	19.8490	20.0957	20.2318	20.2633	20.2661	20.2658	20.2528	20.0978	19.7694	19.4636 (90)
Living area fraction	19.8701	19.9744	20.1666	20.3889	20.5167	20.5486	20.5518	20.5515	20.5370	20.3893	20.0950	19.8254 (92)
MIT	19.8701	19.9744	20.1666	20.3889	20.5167	20.5486	20.5518	20.5515	20.5370	20.3893	20.0950	19.8254 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8701	19.9744	20.1666	20.3889	20.5167	20.5486	20.5518	20.5515	20.5370	20.3893	20.0950	19.8254 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	482.8420	499.5812	506.7347	489.9512	413.7175	288.2105	192.3980	201.9819	306.7967	407.6277	446.3058	468.0613 (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	758.5925	734.4398	665.8493	559.7530	429.5565	289.8207	192.5375	202.2656	313.6155	476.9460	633.1314	761.2867 (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	205.1584	157.8250	118.3812	50.2573	11.7842	0.0000	0.0000	0.0000	0.0000	51.5729	134.5144	218.1596 (98)
Space heating												947.6530 (98)
Space heating per m2												(98) / (4) = 15.2699 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1013.5327 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	205.1584	157.8250	118.3812	50.2573	11.7842	0.0000	0.0000	0.0000	0.0000	51.5729	134.5144	218.1596	(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)	219.4208	168.7968	126.6110	53.7511	12.6034	0.0000	0.0000	0.0000	0.0000	55.1581	143.8657	233.3258	(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													
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	89.1264	89.0226	88.7626	88.2231	87.5862	87.3000	87.3000	87.3000	87.3000	88.2157	88.8756	87.3000	(216)
Fuel for water heating, kWh/month	167.0050	146.6655	152.8314	135.5430	132.1150	116.0228	109.1391	122.9226	123.7028	140.6840	150.5213	162.0943	(219)
Water heating fuel used													1659.2468 (219)
Annual totals kWh/year													
Space heating fuel - main system													1013.5327 (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)													316.2303 (232)
Total delivered energy for all uses													3107.8093 (238)

 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1013.5327	3.4800	35.2709 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1659.2468	3.4800	57.7418 (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	316.2303	13.1900	41.7108 (250)
Additional standing charges			120.0000 (251)
Total energy cost			270.3932 (255)

 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0608 (257)
SAP value		85.2024
SAP rating (Section 12)		85 (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	1013.5327	0.2160	218.9231 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1659.2468	0.2160	358.3973 (264)
Space and water heating			577.3204 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			803.1009 (272)
CO2 emissions per m2			12.9400 (273)
EI value			89.9481
EI rating			90 (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	$3.48 / 0.8818 = 3.946$, stars = 4
Water heating environmental impact	$0.216 / 0.8818 = 0.2449$, 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	(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)			6.9300	1.3258	9.1875		(27)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	20.1185			(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
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) =	14182.2200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1291 (36)
Total fabric heat loss						(33) + (36) =	24.2476 (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	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210	48.7210 (39)
Average = Sum(39)m / 12 =												48.7210 (39)
HLP	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851	0.7851 (40)
HLP (average)												0.7851 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1464.6982 (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	44.7657	39.7605	32.3354	24.4800	18.2991	15.4488	16.6930	21.6982	29.1233	36.9787	43.1596	46.0098 (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	468.6244	464.4624	446.1125	418.0584	389.6902	364.3471	349.6691	357.2903	373.5782	401.8211	432.9937	456.2352 (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	6.9300	12.9465	0.4300	0.0000	0.7700		29.7061 (75)					
Solar gains	29.7061	56.5566	100.3409	172.7874	223.3055	247.5947	229.5474	185.0427	129.5481	72.3106	38.3388	23.9942 (83)
Total gains	498.3305	521.0189	546.4534	590.8459	612.9958	611.9418	579.2166	542.3330	503.1263	474.1316	471.3325	480.2294 (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)	0.9804	0.9717	0.9402	0.8407	0.6567	0.4444	0.2859	0.3053	0.5733	0.8587	0.9606	0.9837 (86)
tau	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585	80.8585 (87)
alpha	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906	6.3906 (88)
MIT	20.4658	20.5394	20.7057	20.8888	20.9797	20.9985	20.9999	20.9999	20.9932	20.8941	20.6587	20.4375 (87)
Th 2	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663	20.2663 (88)
util rest of house	0.9755	0.9647	0.9256	0.8082	0.6061	0.3869	0.2243	0.2395	0.5066	0.8213	0.9494	0.9795 (89)
MIT 2	19.5691	19.6738	19.9065	20.1459	20.2488	20.2654	20.2663	20.2663	20.2619	20.1573	19.8445	19.5288 (90)
Living area fraction	19.9184	20.0110	20.2179	20.4354	20.5336	20.5510	20.5521	20.5521	20.5468	20.4444	20.1617	19.8829 (92)
MIT	19.9184	20.0110	20.2179	20.4354	20.5336	20.5510	20.5521	20.5521	20.5468	20.4444	20.1617	19.8829 (93)
Temperature adjustment												0.0000
adjusted MIT	19.9184	20.0110	20.2179	20.4354	20.5336	20.5510	20.5521	20.5521	20.5468	20.4444	20.1617	19.8829 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	484.7123	501.1615	505.2320	482.2004	383.0544	250.4660	143.8159	143.8078	267.8670	394.0274	446.6254	469.1196 (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	741.4579	721.6085	643.9877	532.7822	391.4047	250.9640	143.8306	143.8297	270.2478	440.6505	607.1464	739.7251 (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	191.0187	148.1403	103.2343	36.4189	6.2126	0.0000	0.0000	0.0000	0.0000	34.6876	115.5751	201.3305 (98)
Space heating												836.6180 (98)
Space heating per m2												(98) / (4) = 13.4808 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													894.7786 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	191.0187	148.1403	103.2343	36.4189	6.2126	0.0000	0.0000	0.0000	0.0000	34.6876	115.5751	201.3305	(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)	204.2981	158.4389	110.4110	38.9507	6.6445	0.0000	0.0000	0.0000	0.0000	37.0990	123.6097	215.3268	(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	89.0701	88.9722	88.6546	88.0266	87.4576	87.3000	87.3000	87.3000	87.3000	87.9796	88.7546	87.3000	(216)
Fuel for water heating, kWh/month	167.1104	146.7487	153.0174	135.8455	132.3094	116.0228	109.1391	122.9226	123.7028	141.0616	150.7265	162.2078	(219)
Water heating fuel used													1660.8147 (219)
Annual totals kWh/year													
Space heating fuel - main system													894.7786 (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)													316.2303 (232)
Total delivered energy for all uses													2990.6232 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	894.7786	3.9200	35.0753 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1660.8147	3.9200	65.1039 (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	316.2303	16.9600	53.6327 (250)
Additional standing charges			88.0000 (251)
Total energy cost			261.9603 (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	894.7786	0.2160	193.2722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1660.8147	0.2160	358.7360 (264)
Space and water heating			552.0082 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			777.7887 (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	894.7786	1.2200	1091.6299 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1660.8147	1.2200	2026.1940 (264)
Space and water heating			3117.8239 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	316.2303	3.0700	970.8269 (268)
Primary energy kWh/year			4453.3656 (272)
Primary energy kWh/m2/year			71.7590 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
 Current environmental impact rating: B 90

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

(For testing purposes):

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

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

Potential energy efficiency rating: B 85
 Potential environmental impact rating: B 90

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	£74	£74	£0
Mains gas	£188	£188	£0
Space heating	£143	£143	£0
Water heating	£65	£65	£0
Lighting	£54	£54	£0
Total cost of fuels	£262	£262	£0
Total cost of uses	£262	£262	£0
Delivered energy	48 kWh/m ²	48 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	13 kg/m ²	13 kg/m ²	0 kg/m ²
Primary energy	72 kWh/m ²	72 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	228.5 (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	195.79 (P1)
Transmission heat loss coefficient	24.25 (37)
Summer heat loss coefficient	220.03 (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	6.9300	100.0415	0.4300	0.0000	0.9000	268.3022
total:						268.3022

	Jun	Jul	Aug	
Solar gains	289	268	216	(P4)
Internal gains	361	347	354	
Total summer gains	651	615	571	(P5)
Summer gain/loss ratio	2.96	2.79	2.59	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 228.5)	0.40	0.40	0.40	
Threshold temperature	18.76	20.80	20.59	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			