

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-016		<b>Issued on Date</b>	12/02/2020	
<b>Assessment Reference</b>	016	<b>Prop Type Ref</b>	GFF Semi		
<b>Property</b>	Plot 016, 2 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	85 B	<b>DER</b>	15.86	<b>TER</b>	17.75
<b>Environmental</b>	89 B	<b>% DER&lt;TER</b>	10.64		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.83	<b>DFEE</b>	34.98	<b>TFEE</b>	40.74
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	14.13		
<b>Assessor Details</b>	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			<b>Assessor ID</b>	4907-0015
<b>Client</b>	TW North Thames, Taylor Wimpey				

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### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Ground-floor flat, total floor area 62 m<sup>2</sup>

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) 17.75 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 15.86 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)40.7 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)35.0 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
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): Medium OK  
Based on:  
Overshading: Average  
Windows facing South West: 6.93 m<sup>2</sup>, No overhang  
Air change rate: 2.00 ach  
Blinds/curtains: None

#### 10 Key features

Party wall U-value 0.00 W/m<sup>2</sup>K  
Door U-value 1.08 W/m<sup>2</sup>K

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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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	0.2000 (18)
Number of sides sheltered				2	2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												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)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.2001	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (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) = 14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss							(33) + (36) = 33.8655 (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	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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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### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	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	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						
Southwest		6.9300	36.7938	0.4300	0.0000	0.7700	84.4243 (79)					
Solar gains	84.4243	143.8058	196.7614	243.7969	273.0728	271.0981	261.3675	239.5263	213.0510	158.9361	101.1208	72.2496 (83)
Total gains	401.9922	459.3045	500.6593	529.2375	540.0185	520.2048	498.9204	482.6076	465.6711	430.2022	393.6863	380.5526 (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	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055
alpha	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
util living area	0.9959	0.9906	0.9777	0.9414	0.8505	0.6821	0.5084	0.5466	0.7805	0.9527	0.9909	0.9969 (86)
MIT	20.0452	20.1944	20.4070	20.6545	20.8615	20.9692	20.9949	20.9924	20.9350	20.6725	20.3000	20.0007 (87)
Th 2	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9946	0.9879	0.9709	0.9231	0.8064	0.6036	0.4115	0.4484	0.7102	0.9342	0.9878	0.9960 (89)
MIT 2	18.8571	19.0737	19.3800	19.7271	19.9958	20.1120	20.1315	20.1302	20.0818	19.7576	19.2284	18.7922 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.3200	19.5104	19.7802	20.0885	20.3331	20.4460	20.4679	20.4661	20.4142	20.1141	19.6459	19.2631 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3200	19.5104	19.7802	20.0885	20.3331	20.4460	20.4679	20.4661	20.4142	20.1141	19.6459	19.2631 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9931	0.9853	0.9675	0.9220	0.8174	0.6330	0.4493	0.4868	0.7345	0.9337	0.9854	0.9948 (94)
Useful gains	399.2066	452.5510	484.3895	487.9602	441.4117	329.2833	224.1893	234.9341	342.0513	401.6649	387.9455	378.5564 (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	876.2510	852.3516	774.7494	652.7218	503.6434	341.0494	225.6496	237.2143	368.3631	555.0404	731.9141	878.7618 (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	354.9210	268.6659	216.0278	118.6283	46.3003	0.0000	0.0000	0.0000	0.0000	114.1113	247.6574	372.1529 (98)
Space heating												1738.4650 (98)
Space heating per m2												(98) / (4) = 28.0126 (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													1859.3209 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	354.9210	268.6659	216.0278	118.6283	46.3003	0.0000	0.0000	0.0000	0.0000	114.1113	247.6574	372.1529	(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)	379.5947	287.3433	231.0457	126.8752	49.5191	0.0000	0.0000	0.0000	0.0000	122.0442	264.8742	398.0245	(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	89.5304	89.4280	89.2382	88.8648	88.1912	87.3000	87.3000	87.3000	87.3000	88.8042	89.3513	87.3000	(216)
Fuel for water heating, kWh/month	166.2514	146.0008	152.0167	134.5642	131.2088	116.0228	109.1391	122.9226	123.7028	139.7518	149.7199	161.3987	(219)
Water heating fuel used													1652.6996 (219)
Annual totals kWh/year													
Space heating fuel - main system													1859.3209 (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													3947.0504 (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	1859.3209	0.2160	401.6133 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1652.6996	0.2160	356.9831 (264)
Space and water heating			758.5964 (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			984.3769 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8600 (273)

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

	TFA	N	EF
DER			15.8600 ZC1
Total Floor Area			62.0600
Assumed number of occupants			2.0392
CO2 emission factor in Table 12 for electricity displaced from grid			0.5190
CO2 emissions from appliances, equation (L14)			17.0069 ZC2
CO2 emissions from cooking, equation (L16)			2.7061 ZC3
Total CO2 emissions			35.5730 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m <sup>2</sup> /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			35.5730 ZC8

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	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 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)					
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)					
External Wall	31.4900	6.9300	24.5600	0.1800	4.4208		(29a)					
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)					
Total net area of external elements Aum(A, m2)			107.0400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 25.8427		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8425 (36)					
Total fabric heat loss							(33) + (36) = 32.6852 (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 =	61.4157	61.2503	61.0883	60.3272	60.1848	59.5220	59.5220	59.3992	59.7773	60.1848	60.4729	60.7741 (39)
	60.3266 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9896	0.9870	0.9843	0.9721	0.9698	0.9591	0.9591	0.9571	0.9632	0.9698	0.9744	0.9793 (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	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

## Calculation Type: New Build (As Designed)



### 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	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							
Southwest	6.9300	36.7938	0.6300	0.7000	0.7700	77.9256 (79)						
Solar gains	77.9256	132.7361	181.6153	225.0302	252.0526	250.2299	241.2483	221.0884	196.6510	146.7017	93.3369	66.6881 (83)
Total gains	406.3364	458.5184	495.2403	519.6431	527.6124	507.3940	486.8643	472.7890	458.4512	427.7027	396.1904	385.8371 (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	70.1730	70.3624	70.5490	71.4391	71.6081	72.4056	72.4056	72.5552	72.0963	71.6081	71.2670	70.9138
alpha	5.6782	5.6908	5.7033	5.7626	5.7739	5.8270	5.8270	5.8370	5.8064	5.7739	5.7511	5.7276
util living area	0.9968	0.9931	0.9837	0.9548	0.8763	0.7098	0.5311	0.5677	0.8045	0.9620	0.9930	0.9976 (86)
MIT	20.0326	20.1722	20.3780	20.6343	20.8477	20.9674	20.9948	20.9925	20.9316	20.6644	20.3009	20.0065 (87)
Th 2	20.0920	20.0942	20.0964	20.1067	20.1086	20.1176	20.1176	20.1192	20.1141	20.1086	20.1047	20.1006 (88)
util rest of house	0.9958	0.9909	0.9782	0.9389	0.8340	0.6282	0.4282	0.4643	0.7332	0.9454	0.9903	0.9969 (89)
MIT 2	18.8015	19.0062	19.3053	19.6756	19.9573	20.0953	20.1155	20.1160	20.0605	19.7237	19.2024	18.7699 (90)
Living area fraction	fLA = Living area / (4) =											0.3896 (91)
MIT	19.2812	19.4605	19.7232	20.0492	20.3042	20.4351	20.4581	20.4575	20.3999	20.0902	19.6304	19.2517 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2812	19.4605	19.7232	20.0492	20.3042	20.4351	20.4581	20.4575	20.3999	20.0902	19.6304	19.2517 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	404.1373	453.4047	483.0148	487.2697	445.4584	334.3025	228.1126	238.6746	347.5038	404.1643	391.5942	384.2430 (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	920.0772	891.8349	807.7853	672.5982	517.8424	347.3165	229.6431	241.0120	376.5894	571.1691	757.7490	914.7540 (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	383.8593	294.6251	241.6292	133.4366	53.8537	0.0000	0.0000	0.0000	0.0000	124.2515	263.6315	394.7002 (98)
Space heating												1889.9871 (98)
Space heating per m2												(98) / (4) = 30.4542 (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

## Calculation Type: New Build (As Designed)



### 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												2023.5408 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	383.8593	294.6251	241.6292	133.4366	53.8537	0.0000	0.0000	0.0000	0.0000	124.2515	263.6315	394.7002 (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)	410.9842	315.4445	258.7037	142.8657	57.6592	0.0000	0.0000	0.0000	0.0000	133.0316	282.2607	422.5912 (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	86.8963	86.5947	86.0162	84.8256	82.8538	80.3000	80.3000	80.3000	80.3000	84.5313	86.2489	80.3000 (216)
Fuel for water heating, kWh/month	208.4255	182.6991	191.3651	172.1134	170.6018	155.0353	148.5356	165.5824	167.4111	181.0885	189.4589	203.2569 (219)
Water heating fuel used												2135.5735 (219)
Annual totals kWh/year												
Space heating fuel - main system												2023.5408 (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												4550.3446 (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	2023.5408	0.2160	437.0848 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2135.5735	0.2160	461.2839 (264)
Space and water heating			898.3687 (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			1101.4172 (272)
Emissions per m2 for space and water heating			14.4758 (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) = (14.4758 * 1.00) + 2.6446 + 0.6272, rounded to 2 d.p.			17.7500 (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)
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 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)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.2001		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (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) =	12010.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							193.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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 =	61.5616	61.4365	61.3138	60.7376	60.6298	60.1280	60.1280	60.0351	60.3213	60.6298	60.8479	61.0759 (39)

HLP (average)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9920	0.9900	0.9880	0.9787	0.9770	0.9689	0.9689	0.9674	0.9720	0.9770	0.9805	0.9841 (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														
(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														
	17.9063	15.9042	12.9342	9.7920	7.3196	6.1795	6.6772	8.6793	11.6493	14.7915	17.2638	18.4039	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	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														
	288.1055	286.7318	276.5710	260.0697	242.8452	226.7934	216.7563	220.3388	229.1845	245.8065	264.8200	279.5297	279.5297	(73)

#### 6. Solar gains

[Jan]			Area	Solar flux					FF	Access	Gains			
			m2	Table 6a	Specific data	g	Specific data	Specific data	Table 6c	factor	W	Table 6d	Table 6d	W
Southwest			6.9300	36.7938	0.4300				0.0000	0.7700			84.4243	(79)
Solar gains	84.4243	143.8058	196.7614	243.7969	273.0728	271.0981	261.3675	239.5263	213.0510	158.9361	101.1208	72.2496	72.2496	(83)
Total gains	372.5298	430.5376	473.3324	503.8666	515.9180	497.8915	478.1239	459.8652	442.2355	404.7425	365.9409	351.7793	351.7793	(84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)														
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	54.1920	54.3023	54.4110	54.9271	55.0248	55.4840	55.4840	55.5699	55.3062	55.0248	54.8276	54.6229	54.6229	(85)
alpha	4.6128	4.6202	4.6274	4.6618	4.6683	4.6989	4.6989	4.7047	4.6871	4.6683	4.6552	4.6415	4.6415	
util living area														
	0.9941	0.9878	0.9740	0.9387	0.8581	0.7049	0.5375	0.5775	0.7983	0.9508	0.9884	0.9954	0.9954	(86)
MIT														
	19.7442	19.9230	20.1820	20.4983	20.7679	20.9350	20.9854	20.9797	20.8788	20.5292	20.0733	19.7072	19.7072	(87)
Th 2														
	20.0900	20.0917	20.0934	20.1011	20.1026	20.1094	20.1094	20.1106	20.1067	20.1026	20.0996	20.0966	20.0966	(88)
util rest of house														
	0.9926	0.9847	0.9671	0.9217	0.8183	0.6290	0.4360	0.4760	0.7335	0.9338	0.9850	0.9943	0.9943	(89)
MIT 2														
	18.9401	19.1188	19.3754	19.6877	19.9354	20.0746	20.1045	20.1032	20.0340	19.7229	19.2754	18.9085	18.9085	(90)
Living area fraction														
										fLA = Living area / (4) =		0.3896	0.3896	(91)
MIT														
	19.2534	19.4321	19.6897	20.0035	20.2598	20.4098	20.4477	20.4447	20.3631	20.0371	19.5863	19.2197	19.2197	(92)
Temperature adjustment														
												0.0000	0.0000	
adjusted MIT														
	19.2534	19.4321	19.6897	20.0035	20.2598	20.4098	20.4477	20.4447	20.3631	20.0371	19.5863	19.2197	19.2197	(93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9908	0.9819	0.9634	0.9196	0.8260	0.6560	0.4755	0.5153	0.7537	0.9324	0.9824	0.9928	0.9928	(94)
Useful gains	369.0918	422.7392	456.0220	463.3552	426.1518	326.5982	227.3501	236.9900	333.3246	377.3651	359.5121	349.2320	349.2320	(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														
	920.5556	892.8011	808.7102	674.4008	518.9776	349.3340	231.3554	242.8235	377.8007	572.1684	759.7653	917.3431	917.3431	(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														
	410.2891	315.8816	262.4000	151.9528	69.0624	0.0000	0.0000	0.0000	0.0000	144.9336	288.1823	422.6747	422.6747	(98)
Space heating														
												2065.3766	2065.3766	(98)
Space heating per m2														
												(98) / (4) =	33.2803	(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	4.2000	
Heat loss rate W														
	0.0000	0.0000	0.0000	0.0000	0.0000	565.2035	444.9474	456.2668	0.0000	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8813	0.9350	0.9223	0.0000	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss														
	0.0000	0.0000	0.0000	0.0000	0.0000	498.1248	416.0185	420.8346	0.0000	0.0000	0.0000	0.0000	0.0000	(102)
Total gains														
	0.0000	0.0000	0.0000	0.0000	0.0000	658.9017	634.3671	614.5137	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	115.7594	162.4513	144.0972	0.0000	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											422.3080 (104)	
Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	28.9398	40.6128	36.0243	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												105.5770 (107)
Space cooling per m2												1.7012 (108)
Energy for space heating												33.2803 (99)
Energy for space cooling												1.7012 (108)
Total												34.9815 (109)
Dwelling Fabric Energy Efficiency (DFEE)												35.0 (109)

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# 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	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)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1300	8.0678		(28a)
External Wall	31.4900	6.9300	24.5600	0.1800	4.4208		(29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	25.8427	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.8425 (36)
Total fabric heat loss	(33) + (36) = 32.6852 (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 =	61.4157	61.2503	61.0883	60.3272	60.1848	59.5220	59.5220	59.3992	59.7773	60.1848	60.4729	60.7741 (39)
	60.3266 (39)											

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9896	0.9870	0.9843	0.9721	0.9698	0.9591	0.9591	0.9571	0.9632	0.9698	0.9744	0.9793 (40)
HLP (average)	0.9721 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0392 (42)
Average daily hot water use (litres/day)	82.6319 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
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

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.4247	35.4994	31.1523	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													90.0764 (107)
Space cooling per m2													1.4514 (108)
Energy for space heating													33.9709 (99)
Energy for space cooling													1.4514 (108)
Total													35.4223 (109)
Target Fabric Energy Efficiency (TFEE)													40.7 (109)

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# 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	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)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.2001	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (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) =		14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss					(33) + (36) =		33.8655 (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	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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 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						
Southwest	6.9300	40.9830	0.4300	0.0000	0.7700	94.0365 (79)						
Solar gains	94.0365	149.1983	200.6969	261.9071	283.9216	294.1975	280.6538	258.5300	230.5028	172.2993	115.3678	79.7160 (83)
Total gains	562.6609	613.6607	646.8094	679.9655	673.6118	658.5446	630.3230	615.8203	604.0811	574.1204	548.3615	535.9512 (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	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055
alpha	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
util living area	0.9777	0.9633	0.9283	0.8427	0.6959	0.4911	0.3144	0.3217	0.5677	0.8378	0.9533	0.9820 (86)
MIT	20.3332	20.4499	20.6401	20.8372	20.9549	20.9945	20.9997	20.9996	20.9881	20.8685	20.5788	20.2936 (87)
Th 2	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9718	0.9539	0.9103	0.8070	0.6375	0.4175	0.2344	0.2400	0.4908	0.7936	0.9395	0.9771 (89)
MIT 2	19.2720	19.4371	19.7014	19.9591	20.0949	20.1306	20.1335	20.1335	20.1263	20.0023	19.6215	19.2157 (90)
Living area fraction	19.6855	19.8317	20.0671	20.3012	20.4299	20.4672	20.4710	20.4710	20.4621	20.3398	19.9945	19.6357 (91)
Temperature adjustment	19.6855	19.8317	20.0671	20.3012	20.4299	20.4672	20.4710	20.4710	20.4621	20.3398	19.9945	0.0000 (92)
adjusted MIT	19.6855	19.8317	20.0671	20.3012	20.4299	20.4672	20.4710	20.4710	20.4621	20.3398	19.9945	19.6357 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9680	0.9501	0.9088	0.8144	0.6582	0.4461	0.2656	0.2718	0.5205	0.8049	0.9369	0.9736 (94)
Ext temp.	544.6832	583.0205	587.8180	553.7743	443.3401	293.7696	167.4163	167.4054	314.4014	462.1325	513.7767	521.8125 (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	874.2361	853.5994	762.3225	630.1310	462.6233	295.6148	167.4899	167.4885	318.6523	521.5364	717.2476	871.3315 (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	245.1873	181.8290	129.8313	54.9768	14.3467	0.0000	0.0000	0.0000	0.0000	44.1964	146.4991	260.0422 (98)
												1076.9089 (98)
												1077 (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)	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	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2168	0.2125	0.2083	0.1870	0.1828	0.1615	0.1615	0.1573	0.1700	0.1828	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.2001		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (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) =	14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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						
Southwest	6.9300	36.7938	0.4300	0.0000	0.7700	84.4243 (79)						
Solar gains	84.4243	143.8058	196.7614	243.7969	273.0728	271.0981	261.3675	239.5263	213.0510	158.9361	101.1208	72.2496 (83)
Total gains	553.0487	608.2682	642.8739	661.8553	662.7631	635.4452	611.0367	596.8166	586.6292	560.7571	534.1145	528.4848 (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)	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055 (85)
tau	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
alpha	0.9814	0.9672	0.9383	0.8744	0.7526	0.5749	0.4182	0.4468	0.6577	0.8798	0.9648	0.9853 (86)
util living area	20.2822	20.4162	20.5963	20.7885	20.9272	20.9866	20.9981	20.9972	20.9722	20.8114	20.5083	20.2357 (87)
MIT	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9765	0.9589	0.9229	0.8443	0.7004	0.5023	0.3369	0.3641	0.5858	0.8450	0.9544	0.9813 (89)
MIT 2	19.1988	19.3893	19.6412	19.8983	20.0659	20.1248	20.1328	20.1324	20.1133	19.9330	19.5230	19.1323 (90)
Living area fraction	19.6209	19.7894	20.0133	20.2451	20.4015	20.4605	20.4700	20.4693	20.4479	20.2752	19.9069	19.5622 (92)
MIT	19.6209	19.7894	20.0133	20.2451	20.4015	20.4605	20.4700	20.4693	20.4479	20.2752	19.9069	19.5622 (93)
Temperature adjustment												0.0000
adjusted MIT	19.6209	19.7894	20.0133	20.2451	20.4015	20.4605	20.4700	20.4693	20.4479	20.2752	19.9069	19.5622 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	538.0839	580.8723	591.7166	561.5826	475.4004	336.9053	225.2287	236.5805	359.4199	477.3488	508.0233	516.8691 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	893.8040	868.6320	788.3513	661.8619	507.6342	341.8977	225.7687	237.4010	370.3304	564.4417	747.1383	896.2139 (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	264.6558	193.3745	146.2962	72.2012	23.9820	0.0000	0.0000	0.0000	0.0000	64.7971	172.1627	282.2325 (98)
Space heating												1219.7020 (98)
Space heating per m2												(98) / (4) = 19.6536 (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													1304.4941 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	264.6558	193.3745	146.2962	72.2012	23.9820	0.0000	0.0000	0.0000	0.0000	64.7971	172.1627	282.2325	(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)	283.0543	206.8176	156.4665	77.2205	25.6492	0.0000	0.0000	0.0000	0.0000	69.3017	184.1313	301.8530	(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	89.3214	89.1824	88.9316	88.4778	87.8332	87.3000	87.3000	87.3000	87.3000	88.3718	89.0723	87.3000	(216)
Fuel for water heating, kWh/month	166.6402	146.4028	152.5409	135.1528	131.7436	116.0228	109.1391	122.9226	123.7028	140.4355	150.1889	161.7439	(219)
Water heating fuel used													1656.6358 (219)
Annual totals kWh/year													
Space heating fuel - main system													1304.4941 (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													3396.1597 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1304.4941	3.4800	45.3964 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1656.6358	3.4800	57.6509 (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			280.4278 (255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1001 (257)
SAP value		84.6532
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	1304.4941	0.2160	281.7707 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1656.6358	0.2160	357.8333 (264)
Space and water heating			639.6041 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			865.3846 (272)
CO2 emissions per m2			13.9400 (273)
EI value			89.1685
EI rating			89 (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	$3.48 / 0.8832 = 3.940$ , stars = 4
Water heating environmental impact	$0.216 / 0.8832 = 0.2446$ , 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)			6.9300	1.3258	9.1875		(27)
Jetfloor Grey			62.0600	0.1500	9.3090	75.0000	4654.5000 (28a)
External Wall	31.4900	6.9300	24.5600	0.2500	6.1400	52.8000	1296.7680 (29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.2000	2.2740	52.8000	600.3360 (29a)
Total net area of external elements Aum(A, m2)			107.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	29.2001	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (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) =		14492.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.5243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6654 (36)
Total fabric heat loss						(33) + (36) =	33.8655 (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	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389	58.3389 (39)
Average = Sum(39)m / 12 =												58.3389 (39)
HLP	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400	0.9400 (40)
HLP (average)												0.9400 (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)

#### 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	Solar flux	g	FF	Access	Gains						
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
Southwest	6.9300	40.9830	0.4300	0.0000	0.7700	94.0365 (79)						
Solar gains	94.0365	149.1983	200.6969	261.9071	283.9216	294.1975	280.6538	258.5300	230.5028	172.2993	115.3678	79.7160 (83)
Total gains	562.6609	613.6607	646.8094	679.9655	673.6118	658.5446	630.3230	615.8203	604.0811	574.1204	548.3615	535.9512 (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	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055	69.0055
alpha	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004	5.6004
util living area	0.9777	0.9633	0.9283	0.8427	0.6959	0.4911	0.3144	0.3217	0.5677	0.8378	0.9533	0.9820 (86)
MIT	20.3332	20.4499	20.6401	20.8372	20.9549	20.9945	20.9997	20.9996	20.9881	20.8685	20.5788	20.2936 (87)
Th 2	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336	20.1336 (88)
util rest of house	0.9718	0.9539	0.9103	0.8070	0.6375	0.4175	0.2344	0.2400	0.4908	0.7936	0.9395	0.9771 (89)
MIT 2	19.2720	19.4371	19.7014	19.9591	20.0949	20.1306	20.1335	20.1335	20.1263	20.0023	19.6215	19.2157 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.6855	19.8317	20.0671	20.3012	20.4299	20.4672	20.4710	20.4710	20.4621	20.3398	19.9945	19.6357 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6855	19.8317	20.0671	20.3012	20.4299	20.4672	20.4710	20.4710	20.4621	20.3398	19.9945	19.6357 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9680	0.9501	0.9088	0.8144	0.6582	0.4461	0.2656	0.2718	0.5205	0.8049	0.9369	0.9736 (94)
Useful gains	544.6832	583.0205	587.8180	553.7743	443.3401	293.7696	167.4163	167.4054	314.4014	462.1325	513.7767	521.8125 (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	874.2361	853.5994	762.3225	630.1310	462.6233	295.6148	167.4899	167.4885	318.6523	521.5364	717.2476	871.3315 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	245.1873	181.8290	129.8313	54.9768	14.3467	0.0000	0.0000	0.0000	0.0000	44.1964	146.4991	260.0422 (98)
Space heating												1076.9089 (98)
Space heating per m <sup>2</sup>										(98) / (4) =		17.3527 (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													1151.7742 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	245.1873	181.8290	129.8313	54.9768	14.3467	0.0000	0.0000	0.0000	0.0000	44.1964	146.4991	260.0422	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	262.2324	194.4695	138.8570	58.7987	15.3440	0.0000	0.0000	0.0000	0.0000	47.2689	156.6835	278.1200	(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	89.2640	89.1345	88.8361	88.2832	87.6418	87.3000	87.3000	87.3000	87.3000	88.1182	88.9439	87.3000	(216)
Fuel for water heating, kWh/month	166.7474	146.4816	152.7049	135.4508	132.0312	116.0228	109.1391	122.9226	123.7028	140.8397	150.4058	161.8527	(219)
Water heating fuel used													1658.3013 (219)
Annual totals kWh/year													
Space heating fuel - main system													1151.7742 (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													3245.1053 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1151.7742	3.9200	45.1495 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1658.3013	3.9200	65.0054 (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			271.9360 (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	1151.7742	0.2160	248.7832 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1658.3013	0.2160	358.1931 (264)
Space and water heating			606.9763 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	316.2303	0.5190	164.1235 (268)
Total kg/year			832.7568 (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	1151.7742	1.2200	1405.1645 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1658.3013	1.2200	2023.1276 (264)
Space and water heating			3428.2921 (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			4763.8338 (272)
Primary energy kWh/m2/year			76.7617 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85  
 Current environmental impact rating: B 89



# 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:	SAP change	Cost change	CO2 change
(none)			

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

Potential energy efficiency rating: B 85  
 Potential environmental impact rating: B 89

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

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

	Current	Potential	Saving
Electricity	£74	£74	£0
Mains gas	£198	£198	£0
Space heating	£153	£153	£0
Water heating	£65	£65	£0
Lighting	£54	£54	£0
Total cost of fuels	£272	£272	£0
Total cost of uses	£272	£272	£0
Delivered energy	52 kWh/m <sup>2</sup>	52 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	13 kg/m <sup>2</sup>	13 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	77 kWh/m <sup>2</sup>	77 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014  
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No improvements selected / applicable  
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# 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	233.5 (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	33.87 (37)
Summer heat loss coefficient	131.76 (P2)

#### Overhangs

Orientation	Ratio	Z_overhangs	Overhang type	
South West	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South West	6.9300	122.3147	0.4300	0.0000	0.9000	328.0369
total:						328.0369

	Jun	Jul	Aug	
Solar gains	344	328	302	(P4)
Internal gains	361	347	354	
Total summer gains	705	675	656	(P5)
Summer gain/loss ratio	5.35	5.12	4.98	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 233.5)	0.37	0.37	0.37	
Threshold temperature	21.12	23.09	22.95	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			