

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	4907-0015-3990-004			<b>Issued on Date</b>	12/02/2020
<b>Assessment Reference</b>	004	<b>Prop Type Ref</b>	1FF Semi		
<b>Property</b>	Plot 004, 1 Bed, K, Ba, Welwyn Garden City				
<b>SAP Rating</b>	84 B	<b>DER</b>	17.53	<b>TER</b>	19.39
<b>Environmental</b>	89 B	<b>% DER&lt;TER</b>	9.57		
<b>CO<sub>2</sub> Emissions (t/year)</b>	0.70	<b>DFEE</b>	39.05	<b>TFEE</b>	43.77
<b>General Requirements Compliance</b>	Pass	<b>% DFEE&lt;TFEE</b>	10.79		
<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

Mid-floor flat, total floor area 47 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) 19.39 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 17.53 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)43.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)39.0 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	(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: 3.99 m<sup>2</sup>, No overhang  
Windows facing North West: 3.79 m<sup>2</sup>, No overhang  
Air change rate: 4.00 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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					4.0000							
Infiltration rate					0.2000 (18)							
Number of sides sheltered					2 (19)							
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)							
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.1700 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Mechanical extract ventilation - decentralised	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)
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)			5.2600	1.3258	6.9735		(27)					
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)					
External Wall	34.9900	7.7800	27.2100	0.2500	6.8025	52.8000	1436.6880 (29a)					
External Wall to Corridor	3.6000	2.1200	1.4800	0.2200	0.3256	52.8000	78.1440 (29a)					
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)					
Total net area of external elements Aum(A, m2)			50.5200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	22.1181			(33)					
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)					
E-FC-4			46.9100			70.0000	3283.7000 (32d)					
E-FC-4			46.9100			70.0000	3283.7000 (32b)					
Metal			72.8500			14.0000	1019.9000 (32c)					
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10951.7160 (34)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				233.4623 (35)								
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				4.3670 (36)								
Total fabric heat loss			(33) + (36) =	26.4851 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Heat transfer coeff	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840 (39)
Average = Sum(39)m / 12 =												44.9840 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)



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### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1534.7801 (211)
Space heating requirement	287.8220	228.2938	184.7595	92.1945	28.3206	0.0000	0.0000	0.0000	0.0000	106.9726	207.8428	298.8136	(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)	307.8310	244.1645	197.6038	98.6037	30.2895	0.0000	0.0000	0.0000	0.0000	114.4092	222.2918	319.5867	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.4702	89.3984	89.2109	88.7589	87.9718	87.3000	87.3000	87.3000	87.3000	88.8479	89.3111	87.3000	(216)
Fuel for water heating, kWh/month	147.2509	129.3225	134.7692	119.5727	116.8694	103.2711	97.3228	109.3613	109.9774	123.9638	132.7151	143.0168	(219)
Water heating fuel used													1467.4130 (219)
Annual totals kWh/year													
Space heating fuel - main system													1534.7801 (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)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													227.0943 (232)
Total delivered energy for all uses													3337.3948 (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	1534.7801	0.2160	331.5125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1467.4130	0.2160	316.9612	(264)
Space and water heating			648.4737	(265)
Pumps and fans	108.1073	0.5190	56.1077	(267)
Energy for lighting	227.0943	0.5190	117.8619	(268)
Total CO2, kg/year			822.4434	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.5300	(273)

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

DER			17.5300	ZC1
Total Floor Area		TFA	46.9100	
Assumed number of occupants		N	1.5997	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.5861	ZC2
CO2 emissions from cooking, equation (L16)			3.3552	ZC3
Total CO2 emissions			38.4713	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			38.4713	ZC8

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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	46.9100 (1b)	x 2.3900 (2b)	= 112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4284 (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) =		0.3641 (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	0.4643	0.4552	0.4461	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4279 (22b)
Effective ac	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (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)			7.7800	1.3258	10.3144		(27)
External Wall	34.9900	7.7800	27.2100	0.1800	4.8978		(29a)
External Wall to Corridor	3.6000	2.1200	1.4800	0.1800	0.2664		(29a)
External Wall to Stairwell	11.9300		11.9300	0.1800	2.1474		(29a)
Total net area of external elements Aum(A, m2)			50.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	19.7460	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6839 (36)
Total fabric heat loss							(33) + (36) = 24.4299 (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	22.4863	22.3314	22.1797	21.4668	21.3335	20.7126	20.7126	20.5976	20.9517	21.3335	21.6033	21.8853 (38)
Heat transfer coeff	46.9162	46.7613	46.6096	45.8967	45.7634	45.1425	45.1425	45.0275	45.3816	45.7634	46.0332	46.3152 (39)
Average = Sum(39)m / 12 =												45.8961 (39)
HLP	1.0001	0.9968	0.9936	0.9784	0.9756	0.9623	0.9623	0.9599	0.9674	0.9756	0.9813	0.9873 (40)
HLP (average)												0.9784 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)												Total = Sum(45)m = 1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m	17.6647	15.4497	15.9427	13.8992	13.3366	11.5085	10.6643	12.2374	12.3836	14.4319	15.7535	17.1073 (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)



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### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1614.6317 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	304.0178	242.3027	198.7974	99.1419	31.1532	0.0000	0.0000	0.0000	0.0000	109.7809	213.6915	309.1806	(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)	325.5008	259.4247	212.8452	106.1477	33.3546	0.0000	0.0000	0.0000	0.0000	117.5385	228.7917	331.0285	(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	158.2318	138.2196	143.8085	127.5509	123.4918	108.7647	104.2048	116.1640	117.4469	133.7367	142.7613	154.5159	(64)
Efficiency of water heater (217)m	86.6685	86.4503	85.8666	84.4252	82.1489	80.3000	80.3000	80.3000	80.3000	84.5590	86.0645	86.7635	(217)
Fuel for water heating, kWh/month	182.5713	159.8833	167.4789	151.0816	150.3267	135.4479	129.7694	144.6625	146.2601	158.1578	165.8770	178.0886	(219)
Water heating fuel used													1869.6052 (219)
Annual totals kWh/year													
Space heating fuel - main system													1614.6317 (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)													227.0943 (232)
Total delivered energy for all uses													3786.3312 (238)

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1614.6317	0.2160	348.7604 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1869.6052	0.2160	403.8347 (264)
Space and water heating			752.5952 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	227.0943	0.5190	117.8619 (268)
Total CO2, kg/m2/year			909.3821 (272)
Emissions per m2 for space and water heating			16.0434 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5125 (272b)
Emissions per m2 for pumps and fans			0.8298 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0434 * 1.00) + 2.5125 + 0.8298, rounded to 2 d.p.			19.3900 (273)

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### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.3784	(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) =	0.3216 (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	0.4101	0.4020	0.3940	0.3538	0.3458	0.3055	0.3055	0.2975	0.3216	0.3458	0.3618	0.3779 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (25)

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

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	34.9900	7.7800	27.2100	0.2500	6.8025	52.8000	1436.6880 (29a)
External Wall to Corridor	3.6000	2.1200	1.4800	0.2200	0.3256	52.8000	78.1440 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m <sup>2</sup> )			50.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.1181		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
E-FC-4			46.9100			30.0000	1407.3000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			9075.3160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							193.4623 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3670 (36)
Total fabric heat loss						(33) + (36) =	26.4851 (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	21.6098	21.4890	21.3706	20.8145	20.7104	20.2260	20.2260	20.1363	20.4126	20.7104	20.9209	21.1410 (38)
Average = Sum(39)m / 12 =	48.0949	47.9741	47.8557	47.2995	47.1955	46.7111	46.7111	46.6214	46.8977	47.1955	47.4060	47.6261 (39)
												47.2991 (39)
HLP (average)	1.0253	1.0227	1.0202	1.0083	1.0061	0.9958	0.9958	0.9938	0.9997	1.0061	1.0106	1.0153 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)												Total = Sum(45)m = 1135.8629 (45)
Distribution loss (46)m = 0.15 x (45)m												



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	569.7564	540.2258	489.0361	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	122.6041	157.7058	119.9323	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												400.2421 (104)
Intermittency factor (Table 10b)												FC = cooled area / (4) =
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	1.0000 (105)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	30.6510	39.4265	29.9831	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												100.0605 (107)
Energy for space heating												2.1330 (108)
Energy for space cooling												36.9142 (99)
Total												2.1330 (108)
Dwelling Fabric Energy Efficiency (DFEE)												39.0472 (109)
												39.0 (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	46.9100 (1b)	x 2.3900 (2b)	= 112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 112.1149 (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) =	0.1784 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.4284 (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) =		0.3641 (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	0.4643	0.4552	0.4461	0.4005	0.3914	0.3459	0.3459	0.3368	0.3641	0.3914	0.4096	0.4279 (22b)
Effective ac	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915 (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)			7.7800	1.3258	10.3144		(27)
External Wall	34.9900	7.7800	27.2100	0.1800	4.8978		(29a)
External Wall to Corridor	3.6000	2.1200	1.4800	0.1800	0.2664		(29a)
External Wall to Stairwell	11.9300		11.9300	0.1800	2.1474		(29a)
Total net area of external elements Aum(A, m2)			50.5200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	19.7460	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6839 (36)
Total fabric heat loss							(33) + (36) = 24.4299 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.4863	22.3314	22.1797	21.4668	21.3335	20.7126	20.7126	20.5976	20.9517	21.3335	21.6033	21.8853 (38)
Heat transfer coeff	46.9162	46.7613	46.6096	45.8967	45.7634	45.1425	45.1425	45.0275	45.3816	45.7634	46.0332	46.3152 (39)
Average = Sum(39)m / 12 =												45.8961 (39)
HLP	1.0001	0.9968	0.9936	0.9784	0.9756	0.9623	0.9623	0.9599	0.9674	0.9756	0.9813	0.9873 (40)
HLP (average)												0.9784 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)
Energy conte	117.7647	102.9977	106.2844	92.6614	88.9108	76.7232	71.0954	81.5830	82.5573	96.2126	105.0236	114.0488 (45)
Energy content (annual)												Total = Sum(45)m = 1135.8629 (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	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	26.8674	36.2197	27.2022	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												90.2893 (107)
Energy for space heating												1.9247 (108)
Energy for space cooling												36.1370 (99)
Total												1.9247 (108)
Target Fabric Energy Efficiency (TFEE)												38.0618 (109)
												43.8 (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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	34.9900	7.7800	27.2100	0.2500	6.8025	52.8000	1436.6880 (29a)
External Wall to Corridor	3.6000	2.1200	1.4800	0.2200	0.3256	52.8000	78.1440 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			50.5200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.1181		(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10951.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							233.4623 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3670 (36)
Total fabric heat loss						(33) + (36) =	26.4851 (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	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990	18.4990 (38)
Average = Sum(39)m / 12 =	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840 (39)
HLP	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589 (40)
HLP (average)												0.9589 (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												1.5997 (42)
Average daily hot water use (litres/day)												72.1921 (43)
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)







# 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	46.9100 (1b)	2.3900 (2b)	112.1149 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	46.9100		112.1149 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 112.1149 (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)			5.2600	1.3258	6.9735		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	34.9900	7.7800	27.2100	0.2500	6.8025	52.8000	1436.6880 (29a)
External Wall to Corridor	3.6000	2.1200	1.4800	0.2200	0.3256	52.8000	78.1440 (29a)
External Wall to Stairwell	11.9300		11.9300	0.2000	2.3860	52.8000	629.9040 (29a)
Total net area of external elements Aum(A, m2)			50.5200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	22.1181			(33)
AAC Party Wall			23.1000	0.0000	0.0000	52.8000	1219.6800 (32)
E-FC-4			46.9100			70.0000	3283.7000 (32d)
E-FC-4			46.9100			70.0000	3283.7000 (32b)
Metal			72.8500			14.0000	1019.9000 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10951.7160 (34)			
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				233.4623 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				4.3670 (36)			
Total fabric heat loss			(33) + (36) =	26.4851 (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	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840	44.9840 (39)
Average = Sum(39)m / 12 =	44.9840 (39)											
HLP	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589	0.9589 (40)
HLP (average)	0.9589 (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	1.5997 (42)											
Average daily hot water use (litres/day)	72.1921 (43)											
Daily hot water use	79.4113	76.5236	73.6359	70.7483	67.8606	64.9729	64.9729	67.8606	70.7483	73.6359	76.5236	79.4113 (44)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1084.9047 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	215.6981	166.4398	126.4122	55.6894	14.5386	0.0000	0.0000	0.0000	0.0000	62.1267	146.1609	227.3201	(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)	230.6932	178.0105	135.2002	59.5608	15.5493	0.0000	0.0000	0.0000	0.0000	66.4457	156.3219	243.1231	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.2594	89.1604	88.9113	88.3754	87.6841	87.3000	87.3000	87.3000	87.3000	88.4276	89.0385	87.3000	(216)
Fuel for water heating, kWh/month	147.5987	129.6677	135.2233	120.0917	117.2529	103.2711	97.3228	109.3613	109.9774	124.5529	133.1214	143.3297	(219)
Water heating fuel used												1470.7709	(219)
Annual totals kWh/year													
Space heating fuel - main system													1084.9047 (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)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													227.0943 (232)
Total delivered energy for all uses													2890.8772 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1084.9047	3.4800	37.7547 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1470.7709	3.4800	51.1828 (247)
Mechanical ventilation fans	33.1073	13.1900	4.3669 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	227.0943	13.1900	29.9537 (250)
Additional standing charges			120.0000 (251)
Total energy cost			253.1506 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1568 (257)
SAP value		83.8624
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1084.9047	0.2160	234.3394 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1470.7709	0.2160	317.6865 (264)
Space and water heating			552.0259 (265)
Pumps and fans	108.1073	0.5190	56.1077 (267)
Energy for lighting	227.0943	0.5190	117.8619 (268)
Total kg/year			725.9956 (272)
CO2 emissions per m2			15.4800 (273)
EI value			89.4154
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	$3.48 / 0.8828 = 3.942$ , stars = 4
Water heating environmental impact	$0.216 / 0.8828 = 0.2447$ , stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													966.9929 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	202.2289	157.1113	111.7428	41.4145	8.1881	0.0000	0.0000	0.0000	0.0000	44.1390	127.7902	211.5236	(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)	216.2876	168.0335	119.5110	44.2936	8.7573	0.0000	0.0000	0.0000	0.0000	47.2075	136.6741	226.2284	(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	131.7457	115.6122	120.2288	106.1315	102.8121	90.1557	84.9628	95.4724	96.0103	110.1392	118.5293	128.0227	(64)
Efficiency of water heater (217)m	89.2101	89.1153	88.8127	88.1751	87.5283	87.3000	87.3000	87.3000	87.3000	88.1922	88.9314	87.3000	(216)
Fuel for water heating, kWh/month	147.6803	129.7333	135.3734	120.3644	117.4616	103.2711	97.3228	109.3613	109.9774	124.8855	133.2817	143.4167	(219)
Water heating fuel used													1472.1295 (219)
Annual totals kWh/year													
Space heating fuel - main system													966.9929 (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)													33.1073 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													108.1073 (231)
Electricity for lighting (calculated in Appendix L)													227.0943 (232)
Total delivered energy for all uses													2774.3241 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	966.9929	3.9200	37.9061 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1472.1295	3.9200	57.7075 (247)
Mechanical ventilation fans	33.1073	16.9600	5.6150 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	227.0943	16.9600	38.5152 (250)
Additional standing charges			88.0000 (251)
Total energy cost			240.4638 (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	966.9929	0.2160	208.8705 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1472.1295	0.2160	317.9800 (264)
Space and water heating			526.8505 (265)
Pumps and fans	108.1073	0.5190	56.1077 (267)
Energy for lighting	227.0943	0.5190	117.8619 (268)
Total kg/year			700.8201 (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	966.9929	1.2200	1179.7314 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1472.1295	1.2200	1795.9980 (264)
Space and water heating			2975.7294 (265)
Pumps and fans	108.1073	3.0700	331.8895 (267)
Energy for lighting	227.0943	3.0700	697.1795 (268)
Primary energy kWh/year			4004.7984 (272)
Primary energy kWh/m2/year			85.3720 (273)

#### SAP 2012 EPC IMPROVEMENTS



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 84  
 Current environmental impact rating: B 89

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 84  
 Potential environmental impact rating: B 89

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

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

	Current	Potential	Saving
Electricity	£57	£57	£0
Mains gas	£184	£184	£0
Space heating	£144	£144	£0
Water heating	£58	£58	£0
Lighting	£39	£39	£0
Total cost of fuels	£241	£241	£0
Total cost of uses	£241	£241	£0
Delivered energy	59 kWh/m <sup>2</sup>	59 kWh/m <sup>2</sup>	0 kWh/m <sup>2</sup>
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m <sup>2</sup>	15 kg/m <sup>2</sup>	15 kg/m <sup>2</sup>	0 kg/m <sup>2</sup>
Primary energy	85 kWh/m <sup>2</sup>	85 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	South East
Overshading	Average or unknown
Thermal mass parameter	233.5 (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	147.99 (P1)
Transmission heat loss coefficient	26.49 (37)
Summer heat loss coefficient	174.48 (P2)

#### Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
North West	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)
North 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
North East	3.9900	100.0415	0.4300	0.0000	0.9000	154.4770
North West	1.2700	100.0415	0.4300	0.0000	0.9000	49.1694
North West	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644

total: 301.2108

	Jun	Jul	Aug
Solar gains	325	301	243 (P4)
Internal gains	294	282	288
Total summer gains	619	583	531 (P5)

	3.55	3.34	3.04
Summer gain/loss ratio	3.55	3.34	3.04 (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	19.31	21.31	21.01 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight