

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-022			Issued on Date	12/02/2020
Assessment Reference	022	Prop Type Ref	1FF Semi		
Property	Plot 022, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	86 B	DER	13.67	TER	15.42
Environmental	91 B	% DER<TER	11.32		
CO₂ Emissions (t/year)	0.72	DFEE	25.95	TFEE	29.12
General Requirements Compliance	Pass	% DFEE<TFEE	10.87		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client	TW North Thames, Taylor Wimpey				

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 62 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.42 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.67 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)29.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)26.0 kWh/m²/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 South West: 7.46 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	62.0600 (1b)	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:												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)			4.9400	1.3258	6.5492		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	31.4900	7.4600	24.0300	0.2500	6.0075	52.8000	1268.7840 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	20.4613	(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14154.2360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.0734 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.9901 (36)
Total fabric heat loss							(33) + (36) = 24.4514 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Average = Sum(39)m / 12 =	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247 (39)
HLP	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883 (40)
HLP (average)												0.7883 (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)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m														
	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812	19.5812	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	14.0413	(61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	144.5829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (64)	
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154	46.9154	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	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	17.6181	15.6482	12.7260	9.6344	7.2018	6.0801	6.5697	8.5396	11.4618	14.5534	16.9860	18.1078	18.1078	(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	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584	63.0584	(72)
Total internal gains	317.2798	315.2427	303.6897	285.2831	266.8279	249.0072	237.4454	242.9416	252.4327	271.0281	292.2877	308.0068	308.0068	(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		4.9400	36.7938	0.4300	0.0000	0.7700	60.1812 (79)							
Southwest		2.5200	36.7938	0.4300	0.0000	0.7700	30.6997 (79)							
Solar gains	90.8810	154.8039	211.8095	262.4422	293.9572	291.8314	281.3567	257.8451	229.3449	171.0913	108.8545	77.7752	77.7752	(83)
Total gains	408.1608	470.0467	515.4992	547.7253	560.7851	540.8387	518.8021	500.7867	481.7776	442.1194	401.1421	385.7820	385.7820	(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	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	(86)
alpha	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	(87)
util living area	0.9939	0.9845	0.9603	0.8952	0.7598	0.5713	0.4140	0.4479	0.6771	0.9167	0.9854	0.9957	0.9957	(88)
MIT	20.2801	20.4314	20.6249	20.8221	20.9494	20.9927	20.9992	20.9987	20.9801	20.8189	20.5017	20.2338	20.2338	(89)
Th 2	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	(90)
util rest of house	0.9922	0.9804	0.9501	0.8704	0.7136	0.5087	0.3452	0.3770	0.6136	0.8913	0.9808	0.9944	0.9944	(91)
MIT 2	19.2997	19.5181	19.7929	20.0605	20.2153	20.2585	20.2631	20.2628	20.2483	20.0616	19.6212	19.2325	19.2325	(92)
Living area fraction	19.6817	19.8740	20.1171	20.3572	20.5013	20.5446	20.5499	20.5495	20.5334	20.3567	19.9643	19.6226	19.6226	(93)
MIT	19.6817	19.8740	20.1171	20.3572	20.5013	20.5446	20.5499	20.5495	20.5334	20.3567	19.9643	19.6226	19.6226	(94)
Temperature adjustment	0.0000													
adjusted MIT	19.6817	19.8740	20.1171	20.3572	20.5013	20.5446	20.5499	20.5495	20.5334	20.3567	19.9643	19.6226	19.6226	(95)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9905	0.9778	0.9478	0.8739	0.7291	0.5329	0.3720	0.4046	0.6375	0.8948	0.9785	0.9931	0.9931	(96)
Useful gains	404.2972	459.6198	488.5839	478.6402	408.8429	288.2043	193.0196	202.6259	307.1336	395.6304	392.5276	383.1132	383.1132	(97)
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	(98)
Heat loss rate W	752.5457	732.5972	666.2112	560.5423	430.6003	290.8359	193.2473	203.0144	314.7529	477.3426	629.3812	754.5475	754.5475	(99)
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	259.0969	183.4408	132.1547	58.9695	16.1875	0.0000	0.0000	0.0000	0.0000	60.7939	170.5346	276.3471	276.3471	(98)
Space heating													1157.5251 (98)	
Space heating per m2													(98) / (4) = 18.6517 (99)	

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1237.9948 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.0969	183.4408	132.1547	58.9695	16.1875	0.0000	0.0000	0.0000	0.0000	60.7939	170.5346	276.3471	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	277.1090	196.1934	141.3420	63.0690	17.3129	0.0000	0.0000	0.0000	0.0000	65.0202	182.3900	295.5584	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	89.3056	89.1414	88.8503	88.3315	87.6805	87.3000	87.3000	87.3000	87.3000	88.3269	89.0648	87.3000	(216)
Fuel for water heating, kWh/month	166.6698	146.4702	152.6805	135.3766	131.9730	116.0228	109.1391	122.9226	123.7028	140.5070	150.2015	161.7716	(219)
Water heating fuel used													1657.4375 (219)
Annual totals kWh/year													
Space heating fuel - main system													1237.9948 (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)													311.1411 (232)
Total delivered energy for all uses													3325.3729 (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	1237.9948	0.2160	267.4069	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1657.4375	0.2160	358.0065	(264)
Space and water heating			625.4134	(265)
Pumps and fans	118.7996	0.5190	61.6570	(267)
Energy for lighting	311.1411	0.5190	161.4822	(268)
Total CO2, kg/year			848.5526	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6700	(273)

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

	TFA	N	EF	
DER				13.6700 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				33.3830 ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year				0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000 ZC7
Net CO2 emissions				33.3830 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3848 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3271 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.4600	1.3258	9.8902		(27)
External Wall	31.4900	7.4600	24.0300	0.1800	4.3254		(29a)
External Wall to Stairwell	13.4900	2.1200	11.3700	0.1800	2.0466		(29a)
Total net area of external elements Aum(A, m ²)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	18.3822	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1371 (36)
Total fabric heat loss							(33) + (36) =
							22.5193 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	51.2497	51.0844	50.9224	50.1613	50.0189	49.3560	49.3560	49.2333	49.6114	50.0189	50.3070	50.6081 (39)
Average = Sum(39)m / 12 =												50.1606 (39)
HLP	0.8258	0.8231	0.8205	0.8083	0.8060	0.7953	0.7953	0.7933	0.7994	0.8060	0.8106	0.8155 (40)
HLP (average)												0.8083 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Combi loss	46.3192	40.3153	42.9505	39.9350	39.5818	36.6750	37.8975	39.5818	39.9350	42.9505	43.1950	46.3192 (61)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608 (64)
Heat gains from water heating, kWh/month	56.3991	49.2781	51.1877	45.2491	43.7334	38.3683	36.5321	40.9446	41.4037	47.3545	50.7690	54.9849 (65)
	Total per year (kWh/year) = Sum(64)m = 1795.7778 (64)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6181	15.6482	12.7260	9.6344	7.2018	6.0801	6.5697	8.5396	11.4618	14.5534	16.9860	18.1078 (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	328.1227	325.5263	313.4168	294.4553	275.4420	257.0647	245.5085	251.5609	261.6127	280.7630	302.5757	318.8528 (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	7.4600	36.7938	0.6300	0.7000	0.7700	83.8853 (79)						
Solar gains	83.8853	142.8876	195.5051	242.2403	271.3293	269.3672	259.6987	237.9970	211.6907	157.9213	100.4752	71.7883 (83)
Total gains	412.0080	468.4140	508.9219	536.6956	546.7713	526.4319	505.2072	489.5579	473.3034	438.6843	403.0509	390.6411 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.0926	84.3647	84.6332	85.9173	86.1619	87.3191	87.3191	87.5368	86.8697	86.1619	85.6685	85.1587	
alpha	6.6062	6.6243	6.6422	6.7278	6.7441	6.8213	6.8213	6.8358	6.7913	6.7441	6.7112	6.6772	
util living area	0.9958	0.9895	0.9721	0.9175	0.7910	0.5925	0.4291	0.4613	0.6992	0.9323	0.9894	0.9970 (86)	
MIT	20.2834	20.4224	20.6078	20.8152	20.9472	20.9936	20.9994	20.9990	20.9816	20.8204	20.5153	20.2575 (87)	
Th 2	20.2310	20.2333	20.2356	20.2462	20.2482	20.2574	20.2574	20.2591	20.2538	20.2482	20.2441	20.2399 (88)	
util rest of house	0.9946	0.9864	0.9639	0.8947	0.7438	0.5271	0.3571	0.3877	0.6330	0.9084	0.9856	0.9961 (89)	
MIT 2	19.2730	19.4762	19.7430	20.0359	20.1988	20.2533	20.2572	20.2587	20.2403	20.0494	19.6205	19.2424 (90)	
Living area fraction	fLA = Living area / (4) = 0.3896 (91)												
MIT	19.6667	19.8449	20.0799	20.3395	20.4904	20.5417	20.5463	20.5471	20.5291	20.3498	19.9691	19.6379 (92)	
Temperature adjustment	0.0000												
adjusted MIT	19.6667	19.8449	20.0799	20.3395	20.4904	20.5417	20.5463	20.5471	20.5291	20.3498	19.9691	19.6379 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9934	0.9844	0.9619	0.8978	0.7597	0.5525	0.3852	0.4164	0.6581	0.9121	0.9839	0.9951 (94)
Useful gains	409.2684	461.1197	489.5242	481.8412	415.3967	290.8341	194.5962	203.8750	311.4841	400.1143	396.5599	388.7232 (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	787.5386	763.4493	691.5213	573.8212	439.6873	293.2600	194.7759	204.1769	318.9581	487.6735	647.4051	781.2825 (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	281.4330	203.1655	150.2858	66.2256	18.0722	0.0000	0.0000	0.0000	0.0000	65.1441	180.6085	292.0641 (98)
Space heating	1256.9989 (98)											
Space heating per m2	(98) / (4) = 20.2546 (99)											

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1345.8232 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	281.4330	203.1655	150.2858	66.2256	18.0722	0.0000	0.0000	0.0000	0.0000	65.1441	180.6085	292.0641	(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)	301.3202	217.5219	160.9056	70.9053	19.3493	0.0000	0.0000	0.0000	0.0000	69.7474	193.3710	312.7025	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608	(64)
Efficiency of water heater (217)m	86.1568	85.6819	84.8230	83.2008	81.3301	80.3000	80.3000	80.3000	80.3000	83.0706	85.3036	86.3058	(217)
Fuel for water heating, kWh/month	210.2144	184.6455	194.0570	175.4746	173.7981	155.0353	148.5356	165.5824	167.4111	184.2728	191.5584	204.9235	(219)
Water heating fuel used													2155.5086 (219)
Annual totals kWh/year													
Space heating fuel - main system													1345.8232 (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)													311.1411 (232)
Total delivered energy for all uses													3887.4729 (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	1345.8232	0.2160	290.6978 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2155.5086	0.2160	465.5899 (264)
Space and water heating			756.2877 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	311.1411	0.5190	161.4822 (268)
Total CO2, kg/m2/year			956.6949 (272)
Emissions per m2 for space and water heating			12.1864 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6020 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.1864 * 1.00) + 2.6020 + 0.6272, rounded to 2 d.p.			15.4200 (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)	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				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	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)			4.9400	1.3258	6.5492		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	31.4900	7.4600	24.0300	0.2500	6.0075	52.8000	1268.7840 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	20.4613			(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
E-FC-4			62.0600			30.0000	1861.8000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11671.8360 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 188.0734 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9901 (36)
 Total fabric heat loss (33) + (36) = 24.4514 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	27.6961	27.5710	27.4483	26.8722	26.7644	26.2625	26.2625	26.1696	26.4558	26.7644	26.9824	27.2104 (38)
Heat transfer coeff	52.1475	52.0224	51.8997	51.3235	51.2157	50.7139	50.7139	50.6210	50.9072	51.2157	51.4338	51.6618 (39)
Average = Sum(39)m / 12 =	51.3230 (39)											
HLP	0.8403	0.8383	0.8363	0.8270	0.8253	0.8172	0.8172	0.8157	0.8203	0.8253	0.8288	0.8324 (40)
HLP (average)	0.8270 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy	2.0392 (42)											
Average daily hot water use (litres/day)	82.6319 (43)											
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)	Total = Sum(45)m = 1300.1221 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	28.6439	25.0521	25.8516	22.5380	21.6258	18.6614	17.2925	19.8434	20.0804	23.4018	25.5449	27.7401	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6181	15.6482	12.7260	9.6344	7.2018	6.0801	6.5697	8.5396	11.4618	14.5534	16.9860	18.1078	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851	(72)
Total internal gains	287.8174	286.4758	276.3629	259.9121	242.7274	226.6939	216.6489	220.1991	228.9971	245.5685	264.5422	279.2335	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W		
Southwest				4.9400	36.7938	0.4300		0.0000		0.7700	60.1812	(79)	
Southwest				2.5200	36.7938	0.4300		0.0000		0.7700	30.6997	(79)	
Solar gains	90.8810	154.8039	211.8095	262.4422	293.9572	291.8314	281.3567	257.8451	229.3449	171.0913	108.8545	77.7752	(83)
Total gains	378.6983	441.2798	488.1724	522.3543	536.6846	518.5254	498.0055	478.0442	458.3420	416.6598	373.3967	357.0087	(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	62.1732	62.3228	62.4701	63.1713	63.3043	63.9307	63.9307	64.0481	63.6880	63.3043	63.0359	62.7577		
alpha	5.1449	5.1549	5.1647	5.2114	5.2203	5.2620	5.2620	5.2699	5.2459	5.2203	5.2024	5.1838		
util living area	0.9922	0.9823	0.9596	0.9021	0.7853	0.6049	0.4444	0.4814	0.7117	0.9228	0.9834	0.9941		(86)
MIT	19.9980	20.1818	20.4245	20.6958	20.8886	20.9778	20.9963	20.9944	20.9490	20.6991	20.2943	19.9598		(87)
Th 2	20.2186	20.2203	20.2220	20.2300	20.2315	20.2385	20.2385	20.2398	20.2358	20.2315	20.2285	20.2253		(88)
util rest of house	0.9903	0.9782	0.9504	0.8804	0.7425	0.5404	0.3693	0.4045	0.6495	0.9010	0.9790	0.9927		(89)
MIT 2	19.2976	19.4806	19.7192	19.9831	20.1534	20.2268	20.2372	20.2377	20.2060	19.9921	19.5999	19.2652		(90)
Living area fraction														(91)
MIT	19.5705	19.7538	19.9940	20.2608	20.4398	20.5194	20.5330	20.5326	20.4955	20.2676	19.8705	19.5358		(92)
Temperature adjustment														(93)
adjusted MIT	19.5705	19.7538	19.9940	20.2608	20.4398	20.5194	20.5330	20.5326	20.4955	20.2676	19.8705	19.5358		(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	374.3151	430.3931	462.4600	460.3913	405.0410	292.8324	198.4834	207.6749	307.7967	375.8974	364.5988	353.8386	(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	796.3169	772.7295	700.3357	583.0764	447.6165	300.1968	199.4560	209.1940	325.5766	495.1308	656.8343	792.2768	(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	313.9693	230.0501	176.9795	88.3333	31.6762	0.0000	0.0000	0.0000	0.0000	88.7097	210.4095	326.1980	(98)	
Space heating												1466.3256	(98)	
Space heating per m2												(98) / (4) =	23.6275	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	476.7109	375.2830	384.7196	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9491	0.9769	0.9707	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	452.4388	366.5973	373.4602	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	682.8869	657.4624	635.5761	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	165.9226	216.4036	195.0142	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													577.3405 (104)
Cooled fraction									fC = cooled area / (4) =				1.0000 (105)
Intermittency factor (Table 10b)													
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	41.4807	54.1009	48.7536	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													144.3351 (107)
Space cooling per m2													2.3257 (108)
Energy for space heating													23.6275 (99)
Energy for space cooling													2.3257 (108)
Total													25.9533 (109)
Dwelling Fabric Energy Efficiency (DFEE)													26.0 (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	62.0600 (1b)	x 2.3900 (2b)	= 148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 148.3234 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1348 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3848 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3271 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			7.4600	1.3258	9.8902		(27)					
External Wall	31.4900	7.4600	24.0300	0.1800	4.3254		(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)			44.9800				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 18.3822		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1371 (36)					
Total fabric heat loss							(33) + (36) = 22.5193 (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 =	51.2497	51.0844	50.9224	50.1613	50.0189	49.3560	49.3560	49.2333	49.6114	50.0189	50.3070	50.6081 (39)
												50.1606 (39)
HLP	0.8258	0.8231	0.8205	0.8083	0.8060	0.7953	0.7953	0.7933	0.7994	0.8060	0.8106	0.8155 (40)
HLP (average)												0.8083 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
												0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
 28.6439 25.0521 25.8516 22.5380 21.6258 18.6614 17.2925 19.8434 20.0804 23.4018 25.5449 27.7401 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.6181	15.6482	12.7260	9.6344	7.2018	6.0801	6.5697	8.5396	11.4618	14.5534	16.9860	18.1078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696 (71)
Water heating gains (Table 5)	38.4999	37.2800	34.7467	31.3028	29.0669	25.9186	23.2426	26.6713	27.8895	31.4540	35.4790	37.2851 (72)
Total internal gains	287.8174	286.4758	276.3629	259.9121	242.7274	226.6939	216.6489	220.1991	228.9971	245.5685	264.5422	279.2335 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Southwest	7.4600	36.7938	0.6300	0.7000	0.7700		83.8853 (79)					
Solar gains	83.8853	142.8876	195.5051	242.2403	271.3293	269.3672	259.6987	237.9970	211.6907	157.9213	100.4752	71.7883 (83)
Total gains	371.7026	429.3635	471.8680	502.1524	514.0567	496.0611	476.3476	458.1962	440.6877	403.4897	365.0174	351.0218 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	84.0926	84.3647	84.6332	85.9173	86.1619	87.3191	87.3191	87.5368	86.8697	86.1619	85.6685	85.1587
alpha	6.6062	6.6243	6.6422	6.7278	6.7441	6.8213	6.8213	6.8358	6.7913	6.7441	6.7112	6.6772
util living area	0.9977	0.9935	0.9809	0.9373	0.8235	0.6258	0.4547	0.4922	0.7405	0.9530	0.9939	0.9984 (86)
MIT	20.2200	20.3630	20.5565	20.7800	20.9324	20.9912	20.9991	20.9985	20.9742	20.7810	20.4572	20.1946 (87)
Th 2	20.2310	20.2333	20.2356	20.2462	20.2482	20.2574	20.2574	20.2591	20.2538	20.2482	20.2441	20.2399 (88)
util rest of house	0.9970	0.9915	0.9749	0.9183	0.7786	0.5580	0.3786	0.4141	0.6741	0.9347	0.9916	0.9979 (89)
MIT 2	19.5139	19.6579	19.8501	20.0718	20.2040	20.2535	20.2572	20.2587	20.2405	20.0779	19.7614	19.4963 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.7890	19.9326	20.1253	20.3478	20.4878	20.5409	20.5462	20.5469	20.5264	20.3518	20.0325	19.7684 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7890	19.9326	20.1253	20.3478	20.4878	20.5409	20.5462	20.5469	20.5264	20.3518	20.0325	19.7684 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9965	0.9905	0.9739	0.9211	0.7937	0.5843	0.4083	0.4446	0.6993	0.9376	0.9908	0.9975 (94)
Useful gains	370.3832	425.2924	459.5612	462.5363	408.0135	289.8430	194.5125	203.7155	308.1825	378.2943	361.6655	350.1397 (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	793.8072	767.9331	693.8348	574.2346	439.5577	293.2190	194.7708	204.1672	318.8216	487.7751	650.5950	787.8865 (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	315.0275	230.2546	174.2996	80.4228	23.4689	0.0000	0.0000	0.0000	0.0000	81.4537	208.0292	325.6836 (98)
Space heating per m2												1438.6399 (98)
												(98) / (4) = 23.1814 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	463.9467	365.2346	374.1729	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9706	0.9899	0.9863	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	450.3109	361.5281	369.0472	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	656.6300	632.1479	612.3770	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	148.5497	201.3412	181.0374	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												530.9283 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	37.1374	50.3353	45.2594	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												132.7321 (107)
Energy for space heating												2.1388 (108)
Energy for space cooling												23.1814 (99)
Total												2.1388 (108)
Target Fabric Energy Efficiency (TFEE)												25.3202 (109)
												29.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	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)			4.9400	1.3258	6.5492		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	31.4900	7.4600	24.0300	0.2500	6.0075	52.8000	1268.7840 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.4613		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14154.2360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.0734 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.9901 (36)
Total fabric heat loss							(33) + (36) = 24.4514 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247 (39)
Average = Sum(39)m / 12 =												48.9247 (39)
HLP	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883 (40)
HLP (average)												0.7883 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m														
	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812	19.5812	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	14.0413	(61)
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	144.5829	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	144.5829	(64)
Total per year (kWh/year) = Sum(64)m =													1464.6982 (64)	
RHI water heating demand													1465 (64)	
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154	46.9154	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.0452	39.1206	31.8150	24.0860	18.0046	15.2002	16.4244	21.3490	28.6546	36.3836	42.4650	45.2694	45.2694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076	254.1076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584	63.0584	(72)
Total internal gains	467.9040	463.8225	445.5922	417.6645	389.3957	364.0985	349.4005	356.9411	373.1095	401.2260	432.2991	455.4948	455.4948	(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		4.9400	40.9830	0.4300	0.0000	0.7700	67.0332 (79)							
Southwest		2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (79)							
Solar gains	101.2283	160.6089	216.0460	281.9375	305.6356	316.6975	302.1180	278.3021	248.1315	185.4766	124.1910	85.8126	85.8126	(83)
Total gains	569.1323	624.4314	661.6382	699.6020	695.0314	680.7960	651.5185	635.2432	621.2410	586.7026	556.4901	541.3074	541.3074	(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	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	(86)
alpha	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	(86)
util living area	0.9634	0.9375	0.8786	0.7549	0.5889	0.4017	0.2553	0.2618	0.4704	0.7523	0.9216	0.9710	0.9710	(86)
MIT	20.5640	20.6717	20.8186	20.9396	20.9886	20.9991	21.0000	21.0000	20.9977	20.9505	20.7588	20.5242	20.5242	(87)
Th 2	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	(88)
util rest of house	0.9550	0.9244	0.8555	0.7178	0.5411	0.3492	0.2000	0.2051	0.4136	0.7075	0.9030	0.9640	0.9640	(89)
MIT 2	19.7050	19.8540	20.0511	20.2009	20.2539	20.2629	20.2634	20.2634	20.2620	20.2159	19.9761	19.6494	19.6494	(90)
Living area fraction	20.0397	20.1726	20.3501	20.4887	20.5401	20.5498	20.5504	20.5504	20.5486	20.5021	20.2811	19.9902	19.9902	(91)
Temperature adjustment	20.0397	20.1726	20.3501	20.4887	20.5401	20.5498	20.5504	20.5504	20.5486	20.5021	20.2811	19.9902	19.9902	(92)
adjusted MIT	20.0397	20.1726	20.3501	20.4887	20.5401	20.5498	20.5504	20.5504	20.5486	20.5021	20.2811	19.9902	19.9902	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9521	0.9226	0.8584	0.7295	0.5593	0.3697	0.2215	0.2272	0.4357	0.7225	0.9035	0.9611	0.9611	(94)
Ext temp.	541.8755	576.1142	567.9794	510.3614	388.7125	251.6656	144.3400	144.3385	270.6728	423.9095	502.8111	520.2251	520.2251	(95)
Heat loss rate W	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000	4.7000	(96)
Month fracti	750.4891	732.5320	653.1526	537.6190	393.3609	251.9515	144.3477	144.3476	271.4661	445.3183	615.5247	748.0710	748.0710	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	155.2085	105.1128	63.3689	19.6254	3.4584	0.0000	0.0000	0.0000	0.0000	15.9281	81.1539	169.5174	169.5174	(98)
RHI space heating demand													613 (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:												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)			4.9400	1.3258	6.5492		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	31.4900	7.4600	24.0300	0.2500	6.0075	52.8000	1268.7840 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.4613		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14154.2360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.0734 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.9901 (36)
Total fabric heat loss						(33) + (36) =	24.4514 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Average = Sum(39)m / 12 =	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247 (39)
HLP	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883 (40)
HLP (average)												0.7883 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m														
	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812	19.5812	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	14.0413	(61)
Total heat required for water heating calculated for each month														
Solar input	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	144.5829	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	144.5829	(64)
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154	46.9154	(65)

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

Metabolic gains (Table 5), Watts														
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.0452	39.1206	31.8150	24.0860	18.0046	15.2002	16.4244	21.3490	28.6546	36.3836	42.4650	45.2694	45.2694	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.8370	268.5956	261.6441	246.8452	228.1643	210.6069	198.8775	196.1189	203.0704	217.8692	236.5502	254.1076	254.1076	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	49.2747	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584	63.0584	(72)
Total internal gains	467.9040	463.8225	445.5922	417.6645	389.3957	364.0985	349.4005	356.9411	373.1095	401.2260	432.2991	455.4948	455.4948	(73)

6. Solar gains

[Jan]			Area	Solar flux	Specific data	g	Specific data	FF	Access	Gains				
			m ²	Table 6a	or Table 6b	W/m ²	or Table 6c		factor	W				
									Table 6d					
Southwest			4.9400	36.7938	0.4300		0.0000	0.7700		60.1812 (79)				
Southwest			2.5200	36.7938	0.4300		0.0000	0.7700		30.6997 (79)				
Solar gains	90.8810	154.8039	211.8095	262.4422	293.9572	291.8314	281.3567	257.8451	229.3449	171.0913	108.8545	77.7752	77.7752	(83)
Total gains	558.7850	618.6265	657.4017	680.1067	683.3529	655.9299	630.7572	614.7862	602.4544	572.3173	541.1536	533.2700	533.2700	(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	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	
alpha	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	
util living area	0.9699	0.9444	0.8947	0.7975	0.6482	0.4751	0.3410	0.3657	0.5541	0.8084	0.9413	0.9766	0.9766	(86)
MIT	20.5187	20.6440	20.7878	20.9132	20.9789	20.9974	20.9997	20.9996	20.9934	20.9192	20.7013	20.4730	20.4730	(87)
Th 2	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	(88)
util rest of house	0.9630	0.9326	0.8742	0.7639	0.6022	0.4214	0.2841	0.3073	0.4974	0.7696	0.9268	0.9710	0.9710	(89)
MIT 2	19.6409	19.8157	20.0106	20.1700	20.2444	20.2617	20.2633	20.2633	20.2587	20.1806	19.8983	19.5763	19.5763	(90)
Living area fraction													fLA = Living area / (4) =	
MIT	19.9829	20.1384	20.3134	20.4596	20.5306	20.5484	20.5503	20.5501	20.5449	20.4684	20.2112	19.9257	19.9257	(92)
Temperature adjustment													0.0000	
adjusted MIT	19.9829	20.1384	20.3134	20.4596	20.5306	20.5484	20.5503	20.5501	20.5449	20.4684	20.2112	19.9257	19.9257	(93)

8. Space heating requirement

Utilisation	0.9599	0.9304	0.8757	0.7732	0.6192	0.4423	0.3063	0.3301	0.5193	0.7809	0.9257	0.9680	0.9680	(94)
Useful gains	536.3870	575.5605	575.7013	525.8406	423.1153	290.0960	193.1924	202.9261	312.8446	446.9319	500.9379	516.2028	516.2028	(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	767.2812	745.5345	675.8179	565.5490	432.0336	291.0219	193.2651	203.0449	315.3165	482.8075	641.4617	769.3760	769.3760	(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	171.7853	114.2225	74.4867	28.5901	6.6353	0.0000	0.0000	0.0000	0.0000	26.6914	101.1771	188.3609	188.3609	(98)
Space heating													711.9494 (98)	
Space heating per m ²													(98) / (4) =	11.4720 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													761.4432 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	171.7853	114.2225	74.4867	28.5901	6.6353	0.0000	0.0000	0.0000	0.0000	26.6914	101.1771	188.3609	(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)	183.7276	122.1631	79.6649	30.5776	7.0965	0.0000	0.0000	0.0000	0.0000	28.5470	108.2108	201.4555	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	88.9858	88.7645	88.4080	87.8997	87.4677	87.3000	87.3000	87.3000	87.3000	87.8498	88.6498	87.3000	(216)
Fuel for water heating, kWh/month	167.2688	147.0920	153.4443	136.0416	132.2940	116.0228	109.1391	122.9226	123.7028	141.2700	150.9047	162.3032	(219)
Water heating fuel used													1662.4058 (219)
Annual totals kWh/year													
Space heating fuel - main system													761.4432 (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)													311.1411 (232)
Total delivered energy for all uses													2853.7897 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	761.4432	3.4800	26.4982 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1662.4058	3.4800	57.8517 (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	311.1411	13.1900	41.0395 (250)
Additional standing charges			120.0000 (251)
Total energy cost			261.0591 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0241 (257)
SAP value		85.7132
SAP rating (Section 12)		86 (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	761.4432	0.2160	164.4717 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1662.4058	0.2160	359.0797 (264)
Space and water heating			523.5514 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	311.1411	0.5190	161.4822 (268)
Total kg/year			746.6906 (272)
CO2 emissions per m2			12.0300 (273)
EI value			90.6542
EI rating			91 (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	$3.48 / 0.8803 = 3.953$, stars = 4
Water heating environmental impact	$0.216 / 0.8803 = 0.2454$, stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			4.9400	1.3258	6.5492		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	31.4900	7.4600	24.0300	0.2500	6.0075	52.8000	1268.7840 (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)			44.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.4613		(33)
AAC Party Wall			37.7200	0.0000	0.0000	52.8000	1991.6160 (32)
E-FC-4			62.0600			70.0000	4344.2000 (32d)
E-FC-4			62.0600			70.0000	4344.2000 (32b)
Metal			114.6500			14.0000	1605.1000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14154.2360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							228.0734 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.9901 (36)
Total fabric heat loss							(33) + (36) = 24.4514 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734	24.4734 (38)
Heat transfer coeff	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247	48.9247 (39)
Average = Sum(39)m / 12 =												48.9247 (39)
HLP	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883	0.7883 (40)
HLP (average)												0.7883 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)													Total = Sum(45)m =	1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m														
	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	(61)	
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)	
Total per year (kWh/year) = Sum(64)m =													1464.6982 (64)	
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154	(65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	122.3544	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.0452	39.1206	31.8150	24.0860	18.0046	15.2002	16.4244	21.3490	28.6546	36.3836	42.4650	45.2694	(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	467.9040	463.8225	445.5922	417.6645	389.3957	364.0985	349.4005	356.9411	373.1095	401.2260	432.2991	455.4948	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Southwest		4.9400	40.9830	0.4300	0.0000	0.7700	67.0332 (79)						
Southwest		2.5200	40.9830	0.4300	0.0000	0.7700	34.1951 (79)						
Solar gains	101.2283	160.6089	216.0460	281.9375	305.6356	316.6975	302.1180	278.3021	248.1315	185.4766	124.1910	85.8126	(83)
Total gains	569.1323	624.4314	661.6382	699.6020	695.0314	680.7960	651.5185	635.2432	621.2410	586.7026	556.4901	541.3074	(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	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	80.3629	(86)
alpha	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	6.3575	(86)
util living area	0.9634	0.9375	0.8786	0.7549	0.5889	0.4017	0.2553	0.2618	0.4704	0.7523	0.9216	0.9710	(86)
MIT	20.5640	20.6717	20.8186	20.9396	20.9886	20.9991	21.0000	21.0000	20.9977	20.9505	20.7588	20.5242	(87)
Th 2	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	20.2634	(88)
util rest of house	0.9550	0.9244	0.8555	0.7178	0.5411	0.3492	0.2000	0.2051	0.4136	0.7075	0.9030	0.9640	(89)
MIT 2	19.7050	19.8540	20.0511	20.2009	20.2539	20.2629	20.2634	20.2634	20.2620	20.2159	19.9761	19.6494	(90)
Living area fraction													fLA = Living area / (4) = 0.3896 (91)
MIT	20.0397	20.1726	20.3501	20.4887	20.5401	20.5498	20.5504	20.5504	20.5486	20.5021	20.2811	19.9902	(92)
Temperature adjustment													0.0000
adjusted MIT	20.0397	20.1726	20.3501	20.4887	20.5401	20.5498	20.5504	20.5504	20.5486	20.5021	20.2811	19.9902	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9521	0.9226	0.8584	0.7295	0.5593	0.3697	0.2215	0.2272	0.4357	0.7225	0.9035	0.9611	(94)
Useful gains	541.8755	576.1142	567.9794	510.3614	388.7125	251.6656	144.3400	144.3385	270.6728	423.9095	502.8111	520.2251	(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	750.4891	732.5320	653.1526	537.6190	393.3609	251.9515	144.3477	144.3476	271.4661	445.3183	615.5247	748.0710	(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	155.2085	105.1128	63.3689	19.6254	3.4584	0.0000	0.0000	0.0000	0.0000	15.9281	81.1539	169.5174	(98)
Space heating													613.3732 (98)
Space heating per m ²													(98) / (4) = 9.8836 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													656.0141 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	155.2085	105.1128	63.3689	19.6254	3.4584	0.0000	0.0000	0.0000	0.0000	15.9281	81.1539	169.5174	(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)	165.9984	112.4201	67.7742	20.9898	3.6988	0.0000	0.0000	0.0000	0.0000	17.0354	86.7956	181.3020	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)
Efficiency of water heater (217)m	88.9047	88.6988	88.2940	87.7374	87.3897	87.3000	87.3000	87.3000	87.3000	87.6525	88.4813	87.3000	(216)
Fuel for water heating, kWh/month	167.4214	147.2010	153.6424	136.2934	132.4122	116.0228	109.1391	122.9226	123.7028	141.5879	151.1921	162.4557	(219)
Water heating fuel used												1663.9934	(219)
Annual totals kWh/year													
Space heating fuel - main system													656.0141 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (MEVDecentralised, Database: total watage = 5.0830, total flow = 21.0000, SFP = 0.2420)													
mechanical ventilation fans (SFP = 0.2420)													43.7996 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													118.7996 (231)
Electricity for lighting (calculated in Appendix L)													311.1411 (232)
Total delivered energy for all uses													2749.9482 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	656.0141	3.9200	25.7158 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1663.9934	3.9200	65.2285 (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	311.1411	16.9600	52.7695 (250)
Additional standing charges			88.0000 (251)
Total energy cost			251.8622 (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	656.0141	0.2160	141.6991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1663.9934	0.2160	359.4226 (264)
Space and water heating			501.1216 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	311.1411	0.5190	161.4822 (268)
Total kg/year			724.2609 (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	656.0141	1.2200	800.3373 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1663.9934	1.2200	2030.0719 (264)
Space and water heating			2830.4092 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	311.1411	3.0700	955.2031 (268)
Primary energy kWh/year			4150.3271 (272)
Primary energy kWh/m2/year			66.8760 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current environmental impact rating:

B 91

(For testing purposes):

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

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

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

Potential energy efficiency rating: B 86
 Potential environmental impact rating: B 91

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	£73	£73	£0
Mains gas	£179	£179	£0
Space heating	£134	£134	£0
Water heating	£65	£65	£0
Lighting	£53	£53	£0
Total cost of fuels	£252	£252	£0
Total cost of uses	£252	£252	£0
Delivered energy	44 kWh/m ²	44 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	12 kg/m ²	12 kg/m ²	0 kg/m ²
Primary energy	67 kWh/m ²	67 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	East Anglia
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	228.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	195.79 (P1)
Transmission heat loss coefficient	24.45 (37)
Summer heat loss coefficient	220.24 (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	4.9400	122.3147	0.4300	0.0000	0.9000	233.8387
South West	2.5200	122.3147	0.4300	0.0000	0.9000	119.2862
total:						353.1249

	Jun	Jul	Aug	
Solar gains	370	353	325	(P4)
Internal gains	361	346	354	
Total summer gains	731	700	679	(P5)
Summer gain/loss ratio	3.32	3.18	3.08	(P6)
Summer external temperature	15.40	17.60	17.60	
Thermal mass temperature increment (TMP = 228.1)	0.40	0.40	0.40	
Threshold temperature	19.12	21.18	21.09	(P7)
Likelihood of high internal temperature	Not significant		Slight	
Assessment of likelihood of high internal temperature:	Slight			