

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	4907-0015-3990-020			Issued on Date	12/02/2020
Assessment Reference	020	Prop Type Ref	1FF Semi		
Property	Plot 020, 2 Bed, K, Ba, Welwyn Garden City				
SAP Rating	85 B	DER	14.75	TER	16.33
Environmental	90 B	% DER<TER	9.70		
CO₂ Emissions (t/year)	0.78	DFEE	30.75	TFEE	34.09
General Requirements Compliance	Pass	% DFEE<TFEE	9.80		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client	TW North Thames, Taylor Wimpey				

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 62 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.33 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 34.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 30.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (East Anglia): Slight OK
Based on:
Overshading: Average
Windows facing South West: 5.45 m², No overhang
Windows facing North West: 2.52 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:												
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)			5.4500	1.3258	7.2254		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	43.6300	7.9700	35.6600	0.2500	8.9150	52.8000	1882.8480 (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)			57.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0449	(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) =
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							14127.3080 (34)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							227.6395 (35)
Total fabric heat loss							4.5312 (36)
							(33) + (36) =
							28.5761 (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 =	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494 (39)
HLP	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548 (40)
HLP (average)												0.8548 (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	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	14.0506	12.6731	14.0026	13.5189	13.9463	13.4695	13.9018	13.9306	13.4965	13.9793	13.5655	14.0413	(61)	
Total heat required for water heating calculated for each month	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	148.8455	130.5655	135.6571	119.5802	115.7146	101.2879	95.2784	107.3115	107.9925	124.1054	133.7767	144.5829	(64)	
Total per year (kWh/year) = Sum(64)m =													1464.6982 (64)	
Heat gains from water heating, kWh/month	48.3319	42.3675	43.9508	38.6451	37.3245	32.5670	30.5332	34.5318	34.7941	40.1118	43.3616	46.9154	(65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	101.9620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.3616	15.4204	12.5407	9.4941	7.0970	5.9916	6.4741	8.4153	11.2950	14.3416	16.7387	17.8441	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	178.1108	179.9590	175.3015	165.3863	152.8701	141.1066	133.2479	131.3997	136.0572	145.9724	158.4886	170.2521	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	33.1962	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	-81.5696	(71)
Water heating gains (Table 5)	64.9623	63.0469	59.0736	53.6738	50.1674	45.2319	41.0392	46.4137	48.3251	53.9136	60.2245	63.0584	(72)
Total internal gains	317.0233	315.0149	303.5045	285.1428	266.7231	248.9187	237.3498	242.8172	252.2658	270.8162	292.0404	307.7432	(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		5.4500	36.7938	0.4300	0.0000	0.7700	66.3943 (79)						
Northwest		2.5200	11.2829	0.4300	0.0000	0.7700	9.4142 (81)						
Solar gains	75.8085	132.2569	189.2655	248.4311	290.9708	294.4562	281.5611	248.9700	209.6205	148.4115	91.3705	64.5078	(83)
Total gains	392.8317	447.2718	492.7700	533.5739	557.6938	543.3749	518.9109	491.7872	461.8863	419.2277	383.4109	372.2509	(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	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	(86)
alpha	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	(87)
util living area	0.9955	0.9896	0.9732	0.9219	0.7985	0.6098	0.4476	0.4923	0.7408	0.9446	0.9900	0.9967	(88)
MIT	20.1447	20.2888	20.4993	20.7408	20.9169	20.9859	20.9981	20.9966	20.9587	20.7309	20.3815	20.1008	(89)
Th 2	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	(90)
util rest of house	0.9942	0.9867	0.9656	0.9007	0.7520	0.5403	0.3680	0.4093	0.6734	0.9249	0.9866	0.9958	(91)
MIT 2	19.0587	19.2678	19.5700	19.9043	20.1254	20.1964	20.2053	20.2045	20.1734	19.8976	19.4036	18.9949	(92)
Living area fraction													fLA = Living area / (4) = 0.3896 (91)
MIT	19.4818	19.6656	19.9321	20.2302	20.4338	20.5040	20.5141	20.5132	20.4794	20.2223	19.7846	19.4258	(92)
Temperature adjustment													0.0000
adjusted MIT	19.4818	19.6656	19.9321	20.2302	20.4338	20.5040	20.5141	20.5132	20.4794	20.2223	19.7846	19.4258	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9927	0.9842	0.9625	0.9014	0.7661	0.5669	0.3991	0.4417	0.6977	0.9253	0.9844	0.9945	(94)
Useful gains	389.9660	440.2160	474.2862	480.9782	427.2315	308.0384	207.0980	217.2186	322.2536	387.9289	377.4240	370.2137	(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	805.3858	783.3055	712.5632	601.0628	463.3241	313.2045	207.6434	218.2012	338.4236	510.4552	672.9128	807.7196	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	309.0723	230.5561	177.2780	86.4609	26.8529	0.0000	0.0000	0.0000	0.0000	91.1595	212.7519	325.5044	(98)
Space heating													1459.6362 (98)
Space heating per m ²													(98) / (4) = 23.5198 (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													1561.1082 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	309.0723	230.5561	177.2780	86.4609	26.8529	0.0000	0.0000	0.0000	0.0000	91.1595	212.7519	325.5044	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	330.5587	246.5841	189.6022	92.4716	28.7197	0.0000	0.0000	0.0000	0.0000	97.4968	227.5421	348.1330	(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	89.4344	89.3163	89.0844	88.6148	87.8853	87.3000	87.3000	87.3000	87.3000	88.6271	89.2372	87.3000	(216)
Fuel for water heating, kWh/month	166.4297	146.1833	152.2792	134.9438	131.6655	116.0228	109.1391	122.9226	123.7028	140.0310	149.9113	161.5613	(219)
Water heating fuel used													1654.7924 (219)
Annual totals kWh/year													
Space heating fuel - main system													1561.1082 (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)													306.6114 (232)
Total delivered energy for all uses													3641.3116 (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	1561.1082	0.2160	337.1994	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1654.7924	0.2160	357.4352	(264)
Space and water heating			694.6345	(265)
Pumps and fans	118.7996	0.5190	61.6570	(267)
Energy for lighting	306.6114	0.5190	159.1313	(268)
Total CO2, kg/year			915.4228	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7500	(273)

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

	TFA	N	EF	
DER				14.7500 ZC1
Total Floor Area				62.0600
Assumed number of occupants				2.0392
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				17.0069 ZC2
CO2 emissions from cooking, equation (L16)				2.7061 ZC3
Total CO2 emissions				34.4630 ZC4
Residual CO2 emissions offset from biofuel CHP				0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year				0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000 ZC7
Net CO2 emissions				34.4630 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross 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)			7.9700	1.3258	10.5663		(27)					
External Wall	43.6300	7.9700	35.6600	0.1800	6.4188		(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)			57.1200				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	21.1517	(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)							4.8245 (36)					
Total fabric heat loss						(33) + (36) =	25.9762 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	54.7066	54.5413	54.3793	53.6182	53.4758	52.8130	52.8130	52.6902	53.0683	53.4758	53.7639	54.0651 (39)
Average = Sum(39)m / 12 =												53.6175 (39)
HLP	0.8815	0.8788	0.8762	0.8640	0.8617	0.8510	0.8510	0.8490	0.8551	0.8617	0.8663	0.8712 (40)
HLP (average)												0.8640 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.0392 (42)
Average daily hot water use (litres/day)												82.6319 (43)
Daily hot water use	90.8951	87.5898	84.2846	80.9793	77.6740	74.3687	74.3687	77.6740	80.9793	84.2846	87.5898	90.8951 (44)
Energy conte	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Energy content (annual)												Total = Sum(45)m = 1300.1221 (45)
Distribution loss (46)m = 0.15 x (45)m	20.2192	17.6839	18.2482	15.9092	15.2652	13.1727	12.2065	14.0071	14.1744	16.5189	18.0317	19.5812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Combi loss	46.3192	40.3153	42.9505	39.9350	39.5818	36.6750	37.8975	39.5818	39.9350	42.9505	43.1950	46.3192 (61)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	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	17.3616	15.4204	12.5407	9.4941	7.0970	5.9916	6.4741	8.4153	11.2950	14.3416	16.7387	17.8441 (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	327.8662	325.2985	313.2316	294.3150	275.3372	256.9762	245.4129	251.4366	261.4459	280.5511	302.3284	318.5892 (73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access factor	Gains						
	m2	Table 6a	g	Specific data	Table 6d	W						
		W/m2	or Table 6b	or Table 6c								
Southwest	5.4500	36.7938	0.6300	0.7000	0.7700	61.2835 (79)						
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)						
Solar gains	69.9730	122.0761	174.6964	229.3076	268.5728	271.7899	259.8874	229.8051	193.4846	136.9872	84.3371	59.5422 (83)
Total gains	397.8392	447.3746	487.9280	523.6227	543.9100	528.7660	505.3003	481.2417	454.9305	417.5384	386.6655	378.1314 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	78.7788	79.0175	79.2530	80.3779	80.5920	81.6035	81.6035	81.7936	81.2109	80.5920	80.1602	79.7136
alpha	6.2519	6.2678	6.2835	6.3585	6.3728	6.4402	6.4402	6.4529	6.4141	6.3728	6.3440	6.3142
util living area	0.9969	0.9928	0.9807	0.9378	0.8228	0.6258	0.4582	0.5006	0.7561	0.9544	0.9926	0.9977 (86)
MIT	20.1774	20.3092	20.5063	20.7482	20.9204	20.9887	20.9986	20.9977	20.9645	20.7482	20.4199	20.1534 (87)
Th 2	20.1832	20.1855	20.1877	20.1982	20.2002	20.2094	20.2094	20.2110	20.2058	20.2002	20.1962	20.1921 (88)
util rest of house	0.9959	0.9905	0.9746	0.9184	0.7761	0.5543	0.3768	0.4164	0.6870	0.9360	0.9898	0.9970 (89)
MIT 2	19.0816	19.2749	19.5607	19.9062	20.1243	20.2019	20.2088	20.2101	20.1789	19.9135	19.4451	19.0534 (90)
Living area fraction									fLA = Living area / (4) =			0.3896 (91)
MIT	19.5085	19.6779	19.9291	20.2342	20.4345	20.5085	20.5166	20.5169	20.4850	20.2387	19.8249	19.4820 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5085	19.6779	19.9291	20.2342	20.4345	20.5085	20.5166	20.5169	20.4850	20.2387	19.8249	19.4820 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9948	0.9887	0.9722	0.9194	0.7906	0.5819	0.4086	0.4493	0.7125	0.9371	0.9882	0.9961 (94)
Ext temp.	395.7687	442.3330	474.3589	481.4094	430.0264	307.6741	206.4567	216.2242	324.1156	391.2615	382.0930	376.6524 (95)
Heat loss rate W	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)
Month fracti	832.0086	806.0045	730.2658	607.7218	467.0851	312.0433	206.8451	216.9226	338.8394	515.4387	684.1400	826.2219 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	324.5624	244.3872	190.3948	90.9450	27.5717	0.0000	0.0000	0.0000	0.0000	92.3878	217.4739	334.4797 (98)
												1522.2025 (98)
												24.5279 (99)

8c. Space cooling requirement

Not applicable

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

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

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1629.7672 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	324.5624	244.3872	190.3948	90.9450	27.5717	0.0000	0.0000	0.0000	0.0000	92.3878	217.4739	334.4797	(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)	347.4973	261.6566	203.8488	97.3715	29.5200	0.0000	0.0000	0.0000	0.0000	98.9163	232.8414	358.1153	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	181.1140	158.2078	164.6049	145.9963	141.3502	124.4933	119.2741	132.9627	134.4311	153.0766	163.4062	176.8608	(64)
Efficiency of water heater	86.5031	86.1422	85.4184	83.8978	81.7916	80.3000	80.3000	80.3000	80.3000	83.8249	85.7716	86.6312	(216)
Fuel for water heating, kWh/month	209.3728	183.6588	192.7044	174.0167	172.8175	155.0353	148.5356	165.5824	167.4111	182.6146	190.5132	204.1536	(219)
Water heating fuel used													2146.4159 (219)
Annual totals kWh/year													
Space heating fuel - main system													1629.7672 (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)													306.6114 (232)
Total delivered energy for all uses													4157.7945 (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	1629.7672	0.2160	352.0297 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2146.4159	0.2160	463.6258 (264)
Space and water heating			815.6555 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	306.6114	0.5190	159.1313 (268)
Total CO2, kg/m2/year			1013.7119 (272)
Emissions per m2 for space and water heating			13.1430 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5642 (272b)
Emissions per m2 for pumps and fans			0.6272 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.1430 * 1.00) + 2.5642 + 0.6272, rounded to 2 d.p.			16.3300 (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)
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)			5.4500	1.3258	7.2254		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	43.6300	7.9700	35.6600	0.2500	8.9150	52.8000	1882.8480 (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 (m2)			57.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.0449		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) = 11644.9080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.6395 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5312 (36)
Total fabric heat loss							(33) + (36) = 28.5761 (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	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	56.2722	56.1471	56.0244	55.4482	55.3404	54.8386	54.8386	54.7457	55.0319	55.3404	55.5585	55.7865 (39)
Average = Sum(39)m / 12 =												55.4477 (39)
HLP	0.9067	0.9047	0.9027	0.8935	0.8917	0.8836	0.8836	0.8821	0.8868	0.8917	0.8952	0.8989 (40)
HLP (average)												0.8935 (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 content (annual)	134.7948	117.8924	121.6544	106.0613	101.7683	87.8183	81.3766	93.3808	94.4961	110.1261	120.2112	130.5416 (45)
Distribution loss (46)m = 0.15 x (45)m	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)
Total = Sum(45)m												1300.1221 (45)

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	17.3616	15.4204	12.5407	9.4941	7.0970	5.9916	6.4741	8.4153	11.2950	14.3416	16.7387	17.8441	(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	287.5609	286.2480	276.1776	259.7718	242.6226	226.6054	216.5532	220.0748	228.8302	245.3566	264.2949	278.9699	(73)

6. Solar gains

[Jan]													
		Area	Solar flux	Specific data	Specific data	FF	Access	Gains					
		m2	Table 6a	g	or Table 6b	or Table 6c	factor	W					
			W/m2	or Table 6b			Table 6d						
Southwest		5.4500	36.7938	0.4300		0.0000	0.7700	66.3943	(79)				
Northwest		2.5200	11.2829	0.4300		0.0000	0.7700	9.4142	(81)				
Solar gains	75.8085	132.2569	189.2655	248.4311	290.9708	294.4562	281.5611	248.9700	209.6205	148.4115	91.3705	64.5078	(83)
Total gains	363.3693	418.5049	465.4431	508.2029	533.5934	521.0615	498.1143	469.0448	438.4507	393.7681	355.6654	343.4776	(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	57.4830	57.6112	57.7373	58.3372	58.4509	58.9857	58.9857	59.0859	58.7786	58.4509	58.2214	57.9835			
alpha	4.8322	4.8407	4.8492	4.8891	4.8967	4.9324	4.9324	4.9391	4.9186	4.8967	4.8814	4.8656			
util living area	0.9938	0.9869	0.9702	0.9225	0.8151	0.6389	0.4773	0.5251	0.7663	0.9449	0.9876	0.9952	(86)		
MIT	19.8455	20.0201	20.2795	20.5955	20.8403	20.9638	20.9929	20.9889	20.9123	20.5926	20.1577	19.8099	(87)		
Th 2	20.1618	20.1635	20.1652	20.1731	20.1745	20.1814	20.1814	20.1827	20.1788	20.1745	20.1715	20.1684	(88)		
util rest of house	0.9923	0.9838	0.9629	0.9035	0.7728	0.5691	0.3919	0.4371	0.7031	0.9273	0.9841	0.9940	(89)		
MIT 2	19.1003	19.2747	19.5313	19.8410	20.0611	20.1622	20.1790	20.1786	20.1261	19.8448	19.4189	19.0702	(90)		
Living area fraction														0.3896	(91)
MIT	19.3907	19.5651	19.8228	20.1350	20.3647	20.4745	20.4961	20.4943	20.4324	20.1361	19.7067	19.3584	(92)		
Temperature adjustment														0.0000	
adjusted MIT	19.3907	19.5651	19.8228	20.1350	20.3647	20.4745	20.4961	20.4943	20.4324	20.1361	19.7067	19.3584	(93)		

8. Space heating requirement

Utilisation	0.9905	0.9811	0.9593	0.9025	0.7832	0.5949	0.4251	0.4713	0.7239	0.9264	0.9817	0.9926	(94)	
Useful gains	359.9060	410.5780	446.5078	458.6732	417.9072	309.9729	211.7694	221.0555	317.3897	364.7853	349.1391	340.9194	(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	849.1849	823.4025	746.4010	622.9603	479.5087	322.1521	213.6577	224.1448	348.4866	527.7330	700.4114	845.6352	(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	364.0235	277.4180	223.1206	118.2867	45.8315	0.0000	0.0000	0.0000	0.0000	121.2331	252.9161	375.5085	(98)	
Space heating												1778.3381	(98)	
Space heating per m2												(98) / (4) =	28.6551	(99)

8c. Space cooling requirement

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

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	150.2145	198.5768	170.6025	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													519.3938 (104)
Cooled fraction									fC = cooled area / (4) =				1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	37.5536	49.6442	42.6506	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													129.8484 (107)
Space cooling per m2													2.0923 (108)
Energy for space heating													28.6551 (99)
Energy for space cooling													2.0923 (108)
Total													30.7474 (109)
Dwelling Fabric Energy Efficiency (DFEE)													30.7 (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 infiltr rate	0.4171	0.4089	0.4007	0.3598	0.3516	0.3108	0.3108	0.3026	0.3271	0.3516	0.3680	0.3844 (22b)
Effective ac	0.5870	0.5836	0.5803	0.5647	0.5618	0.5483	0.5483	0.5458	0.5535	0.5618	0.5677	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.9700	1.3258	10.5663		(27)
External Wall	43.6300	7.9700	35.6600	0.1800	6.4188		(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)			57.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 21.1517		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8245 (36)
Total fabric heat loss							(33) + (36) = 25.9762 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.7305	28.5651	28.4031	27.6420	27.4996	26.8368	26.8368	26.7140	27.0921	27.4996	27.7877	28.0889 (38)
Heat transfer coeff	54.7066	54.5413	54.3793	53.6182	53.4758	52.8130	52.8130	52.6902	53.0683	53.4758	53.7639	54.0651 (39)
Average = Sum(39)m / 12 =												53.6175 (39)
HLP	0.8815	0.8788	0.8762	0.8640	0.8617	0.8510	0.8510	0.8490	0.8551	0.8617	0.8663	0.8712 (40)
HLP (average)												0.8640 (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	17.3616	15.4204	12.5407	9.4941	7.0970	5.9916	6.4741	8.4153	11.2950	14.3416	16.7387	17.8441 (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	287.5609	286.2480	276.1776	259.7718	242.6226	226.6054	216.5532	220.0748	228.8302	245.3566	264.2949	278.9699 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Southwest	5.4500	36.7938	0.6300	0.7000	0.7700	61.2835 (79)						
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895 (81)						
Solar gains	69.9730	122.0761	174.6964	229.3076	268.5728	271.7899	259.8874	229.8051	193.4846	136.9872	84.3371	59.5422 (83)
Total gains	357.5338	408.3242	450.8740	489.0795	511.1954	498.3953	476.4406	449.8799	422.3148	382.3438	348.6320	338.5120 (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	78.7788	79.0175	79.2530	80.3779	80.5920	81.6035	81.6035	81.7936	81.2109	80.5920	80.1602	79.7136
alpha	6.2519	6.2678	6.2835	6.3585	6.3728	6.4402	6.4402	6.4529	6.4141	6.3728	6.3440	6.3142
util living area	0.9983	0.9956	0.9870	0.9533	0.8522	0.6592	0.4853	0.5341	0.7963	0.9694	0.9958	0.9988 (86)
MIT	20.1142	20.2492	20.4529	20.7086	20.9015	20.9849	20.9981	20.9967	20.9522	20.7037	20.3614	20.0909 (87)
Th 2	20.1832	20.1855	20.1877	20.1982	20.2002	20.2094	20.2094	20.2110	20.2058	20.2002	20.1962	20.1921 (88)
util rest of house	0.9977	0.9941	0.9827	0.9377	0.8087	0.5858	0.3994	0.4450	0.7293	0.9560	0.9941	0.9984 (89)
MIT 2	19.3683	19.5046	19.7079	19.9632	20.1345	20.2025	20.2088	20.2101	20.1802	19.9640	19.6257	19.3524 (90)
Living area fraction	fLA = Living area / (4) = 0.3896 (91)											
MIT	19.6589	19.7947	19.9982	20.2537	20.4333	20.5073	20.5164	20.5165	20.4810	20.2522	19.9124	19.6402 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.6589	19.7947	19.9982	20.2537	20.4333	20.5073	20.5164	20.5165	20.4810	20.2522	19.9124	19.6402 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9933	0.9814	0.9389	0.8223	0.6142	0.4330	0.4799	0.7540	0.9570	0.9934	0.9980 (94)
Useful gains	356.5487	405.5820	442.4970	459.2099	420.3793	306.0898	206.2913	215.8832	318.4222	365.9025	346.3270	337.8373 (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	840.2349	812.3772	734.0212	608.7631	467.0219	311.9826	206.8350	216.9015	338.6280	516.1601	688.8424	834.7741 (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	359.8625	273.3663	216.8940	107.6783	34.7021	0.0000	0.0000	0.0000	0.0000	111.7917	246.6110	369.7210 (98)
Space heating	1720.6270 (98)											
Space heating per m2	(98) / (4) = 27.7252 (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	496.4419	390.8159	400.4456	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9548	0.9823	0.9748	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	473.9869	383.8798	390.3428	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	659.2404	632.1293	602.4912	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	133.3825	184.6976	157.8384	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling	475.9185 (104)											
Cooled fraction	fc = cooled area / (4) = 1.0000 (105)											
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.3456	46.1744	39.4596	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													118.9796 (107)
Space cooling per m2													1.9172 (108)
Energy for space heating													27.7252 (99)
Energy for space cooling													1.9172 (108)
Total													29.6424 (109)
Target Fabric Energy Efficiency (TFEE)													34.1 (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)	2.3900 (2b)	148.3234 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.0600		148.3234 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	148.3234 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	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)			5.4500	1.3258	7.2254		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	43.6300	7.9700	35.6600	0.2500	8.9150	52.8000	1882.8480 (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)			57.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0449	(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) = 14127.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							227.6395 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5312 (36)
Total fabric heat loss							(33) + (36) = 28.5761 (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 =	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494 (39)
HLP	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548 (40)
HLP (average)												0.8548 (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	43.4040	38.5511	31.3518	23.7354	17.7425	14.9789	16.1853	21.0382	28.2374	35.8539	41.8468	44.6104	44.6104	(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	467.2628	463.2530	445.1290	417.3138	389.1336	363.8772	349.1614	356.6303	372.6924	400.6963	431.6809	454.8357	454.8357	(73)

6. Solar gains

[Jan]	Area	Solar flux	Specific data	FF	Access	Gains								
	m2	Table 6a	g		factor	W								
		W/m2	or Table 6b	or Table 6c	Table 6d									
Southwest	5.4500	40.9830	0.4300	0.0000	0.7700	73.9537 (79)								
Northwest	2.5200	12.9465	0.4300	0.0000	0.7700	10.8022 (81)								
Solar gains	84.7559	137.9009	194.3228	268.8049	304.4881	321.4019	304.1880	270.6055	228.3841	161.7971	104.6707	71.4167	71.4167	(83)
Total gains	552.0187	601.1539	639.4518	686.1187	693.6217	685.2791	653.3494	627.2358	601.0765	562.4934	536.3516	526.2524	526.2524	(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	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	
alpha	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	
util living area	0.9736	0.9563	0.9114	0.8010	0.6315	0.4318	0.2760	0.2874	0.5237	0.8100	0.9446	0.9787	0.9787	(86)
MIT	20.4343	20.5449	20.7236	20.8955	20.9777	20.9979	20.9999	20.9999	20.9940	20.9072	20.6561	20.3957	20.3957	(87)
Th 2	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	(88)
util rest of house	0.9671	0.9460	0.8917	0.7641	0.5786	0.3714	0.2116	0.2204	0.4570	0.7659	0.9296	0.9733	0.9733	(89)
MIT 2	19.4751	19.6305	19.8761	20.0956	20.1871	20.2049	20.2061	20.2060	20.2023	20.1141	19.7888	19.4204	19.4204	(90)
Living area fraction	19.8488	19.9867	20.2063	20.4072	20.4951	20.5139	20.5154	20.5153	20.5108	20.4231	20.1267	19.8004	19.8004	(92)
Temperature adjustment	19.8488	19.9867	20.2063	20.4072	20.4951	20.5139	20.5154	20.5153	20.5108	20.4231	20.1267	19.8004	19.8004	(93)
adjusted MIT	19.8488	19.9867	20.2063	20.4072	20.4951	20.5139	20.5154	20.5153	20.5108	20.4231	20.1267	19.8004	19.8004	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	531.9015	566.7365	570.2212	531.0175	414.9239	270.6167	154.6349	154.6282	290.2404	437.9865	497.6879	510.4590	510.4590	(94)
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	4.7000	(96)
Heat loss rate W	803.6363	784.4283	700.5865	578.6224	424.1378	271.2900	154.6578	154.6570	292.3427	478.6706	659.2306	801.0654	801.0654	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	202.1707	146.2888	96.9917	34.2755	6.8551	0.0000	0.0000	0.0000	0.0000	30.2690	116.3108	216.2111	216.2111	(98)
Space heating													849.3728 (98)	
RHI space heating demand													849 (98)	

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



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
DTC			2.1200	1.0800	2.2896		(26)
Windows (Uw = 1.40)			5.4500	1.3258	7.2254		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	43.6300	7.9700	35.6600	0.2500	8.9150	52.8000	1882.8480 (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)			57.1200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	24.0449	(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) = 14127.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							227.6395 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5312 (36)
Total fabric heat loss							(33) + (36) = 28.5761 (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 =	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494 (39)
HLP	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548 (40)
HLP (average)												0.8548 (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	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)
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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.4040	38.5511	31.3518	23.7354	17.7425	14.9789	16.1853	21.0382	28.2374	35.8539	41.8468	44.6104	(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	467.2628	463.2530	445.1290	417.3138	389.1336	363.8772	349.1614	356.6303	372.6924	400.6963	431.6809	454.8357	(73)

6. Solar gains

[Jan]			Area	Solar flux	Specific data	Specific data	FF	Access	Gains				
			m ²	Table 6a	g	or Table 6b	or Table 6c	factor	W				
				W/m ²				Table 6d					
Southwest			5.4500	36.7938	0.4300		0.0000	0.7700	66.3943 (79)				
Northwest			2.5200	11.2829	0.4300		0.0000	0.7700	9.4142 (81)				
Solar gains	75.8085	132.2569	189.2655	248.4311	290.9708	294.4562	281.5611	248.9700	209.6205	148.4115	91.3705	64.5078	(83)
Total gains	543.0712	595.5098	634.3945	665.7449	680.1044	658.3334	630.7225	605.6002	582.3129	549.1078	523.0514	519.3435	(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	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735
alpha	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316
util living area	0.9780	0.9612	0.9242	0.8397	0.6922	0.5108	0.3694	0.4019	0.6131	0.8578	0.9582	0.9826	(86)
MIT	20.3868	20.5131	20.6838	20.8567	20.9609	20.9943	20.9993	20.9989	20.9844	20.8605	20.5918	20.3416	(87)
Th 2	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	(88)
util rest of house	0.9726	0.9520	0.9072	0.8075	0.6427	0.4495	0.3031	0.3331	0.5485	0.8219	0.9468	0.9783	(89)
MIT 2	19.4071	19.5858	19.8223	20.0487	20.1703	20.2024	20.2058	20.2056	20.1947	20.0586	19.6997	19.3427	(90)
Living area fraction													fLA = Living area / (4) =
MIT	19.7888	19.9471	20.1580	20.3635	20.4783	20.5109	20.5150	20.5147	20.5024	20.3710	20.0473	19.7319	(92)
Temperature adjustment													0.0000
adjusted MIT	19.7888	19.9471	20.1580	20.3635	20.4783	20.5109	20.5150	20.5147	20.5024	20.3710	20.0473	19.7319	(93)

8. Space heating requirement

Utilisation	0.9692	0.9486	0.9060	0.8143	0.6601	0.4732	0.3290	0.3599	0.5731	0.8299	0.9442	0.9751	(94)
Useful gains	526.3319	564.8896	574.7655	542.1199	448.9435	311.5427	207.4950	217.9516	333.7186	455.7272	493.8469	506.3895	(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	821.6714	798.2379	724.5468	608.1338	465.6847	313.5720	207.6867	218.2801	339.6420	518.3464	686.8447	823.9571	(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	219.7326	156.8101	111.4373	47.5300	12.4554	0.0000	0.0000	0.0000	0.0000	46.5887	138.9584	236.2703	(98)
Space heating													969.7828 (98)
Space heating per m2													(98) / (4) =
													15.6265 (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													1037.2008 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	219.7326	156.8101	111.4373	47.5300	12.4554	0.0000	0.0000	0.0000	0.0000	46.5887	138.9584	236.2703	(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)	235.0082	167.7113	119.1842	50.8343	13.3213	0.0000	0.0000	0.0000	0.0000	49.8274	148.6186	252.6955	(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	89.1799	89.0175	88.7147	88.1869	87.6010	87.3000	87.3000	87.3000	87.3000	88.1507	88.9016	87.3000	(216)
Fuel for water heating, kWh/month	166.9047	146.6740	152.9139	135.5986	132.0928	116.0228	109.1391	122.9226	123.7028	140.7877	150.4773	161.9833	(219)
Water heating fuel used													1659.2195 (219)
Annual totals kWh/year													
Space heating fuel - main system													1037.2008 (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)													306.6114 (232)
Total delivered energy for all uses													3121.8314 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1037.2008	3.4800	36.0946 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1659.2195	3.4800	57.7408 (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	306.6114	13.1900	40.4420 (250)
Additional standing charges			120.0000 (251)
Total energy cost			269.9471 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0590 (257)
SAP value		85.2268
SAP rating (Section 12)		B (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	1037.2008	0.2160	224.0354 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1659.2195	0.2160	358.3914 (264)
Space and water heating			582.4268 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	306.6114	0.5190	159.1313 (268)
Total kg/year			803.2151 (272)
CO2 emissions per m2			12.9400 (273)
EI value			89.9467
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8818 = 3.946$, stars = 4
Water heating environmental impact	$0.216 / 0.8818 = 0.2449$, stars = 4

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



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				4.0000	
Infiltration rate				0.2000	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)			5.4500	1.3258	7.2254		(27)
French Door (Uw = 1.40)			2.5200	1.3258	3.3409		(27)
External Wall	43.6300	7.9700	35.6600	0.2500	8.9150	52.8000	1882.8480 (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)			57.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.0449		(33)
AAC Party Wall			25.5800	0.0000	0.0000	52.8000	1350.6240 (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) = 14127.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							227.6395 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5312 (36)
Total fabric heat loss							(33) + (36) = 28.5761 (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 =	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494	53.0494 (39)
HLP	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548	0.8548 (40)
HLP (average)												0.8548 (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	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	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	43.4040	38.5511	31.3518	23.7354	17.7425	14.9789	16.1853	21.0382	28.2374	35.8539	41.8468	44.6104	44.6104	(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	467.2628	463.2530	445.1290	417.3138	389.1336	363.8772	349.1614	356.6303	372.6924	400.6963	431.6809	454.8357	454.8357	(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		5.4500	40.9830	0.4300		0.0000	0.7700	73.9537 (79)						
Northwest		2.5200	12.9465	0.4300		0.0000	0.7700	10.8022 (81)						
Solar gains	84.7559	137.9009	194.3228	268.8049	304.4881	321.4019	304.1880	270.6055	228.3841	161.7971	104.6707	71.4167	71.4167	(83)
Total gains	552.0187	601.1539	639.4518	686.1187	693.6217	685.2791	653.3494	627.2358	601.0765	562.4934	536.3516	526.2524	526.2524	(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	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	73.9735	
alpha	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	5.9316	
util living area	0.9736	0.9563	0.9114	0.8010	0.6315	0.4318	0.2760	0.2874	0.5237	0.8100	0.9446	0.9787	0.9787	(86)
MIT	20.4343	20.5449	20.7236	20.8955	20.9777	20.9979	20.9999	20.9999	20.9940	20.9072	20.6561	20.3957	20.3957	(87)
Th 2	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	20.2061	(88)
util rest of house	0.9671	0.9460	0.8917	0.7641	0.5786	0.3714	0.2116	0.2204	0.4570	0.7659	0.9296	0.9733	0.9733	(89)
MIT 2	19.4751	19.6305	19.8761	20.0956	20.1871	20.2049	20.2061	20.2060	20.2023	20.1141	19.7888	19.4204	19.4204	(90)
Living area fraction									FLA = Living area / (4) =			0.3896	0.3896	(91)
MIT	19.8488	19.9867	20.2063	20.4072	20.4951	20.5139	20.5154	20.5153	20.5108	20.4231	20.1267	19.8004	19.8004	(92)
Temperature adjustment												0.0000	0.0000	
adjusted MIT	19.8488	19.9867	20.2063	20.4072	20.4951	20.5139	20.5154	20.5153	20.5108	20.4231	20.1267	19.8004	19.8004	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9636	0.9427	0.8917	0.7739	0.5982	0.3949	0.2367	0.2465	0.4829	0.7787	0.9279	0.9700	0.9700	(94)
Useful gains	531.9015	566.7365	570.2212	531.0175	414.9239	270.6167	154.6349	154.6282	290.2404	437.9865	497.6879	510.4590	510.4590	(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	4.7000	(96)
Heat loss rate W	803.6363	784.4283	700.5865	578.6224	424.1378	271.2900	154.6578	154.6570	292.3427	478.6706	659.2306	801.0654	801.0654	(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	202.1707	146.2888	96.9917	34.2755	6.8551	0.0000	0.0000	0.0000	0.0000	30.2690	116.3108	216.2111	216.2111	(98)
Space heating													849.3728 (98)	
Space heating per m2													(98) / (4) = 13.6863 (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													908.4201 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	202.1707	146.2888	96.9917	34.2755	6.8551	0.0000	0.0000	0.0000	0.0000	30.2690	116.3108	216.2111	(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)	216.2253	156.4587	103.7345	36.6583	7.3317	0.0000	0.0000	0.0000	0.0000	32.3732	124.3965	231.2418	(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	89.1149	88.9621	88.6062	87.9931	87.4730	87.3000	87.3000	87.3000	87.3000	87.9095	88.7596	87.3000	(216)
Fuel for water heating, kWh/month	167.0265	146.7653	153.1012	135.8972	132.2861	116.0228	109.1391	122.9226	123.7028	141.1741	150.7180	162.1069	(219)
Water heating fuel used												1660.8625	(219)
Annual totals kWh/year													
Space heating fuel - main system													908.4201 (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)													306.6114 (232)
Total delivered energy for all uses													2994.6936 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	908.4201	3.9200	35.6101 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1660.8625	3.9200	65.1058 (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	306.6114	16.9600	52.0013 (250)
Additional standing charges			88.0000 (251)
Total energy cost			260.8656 (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	908.4201	0.2160	196.2187 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1660.8625	0.2160	358.7463 (264)
Space and water heating			554.9650 (265)
Pumps and fans	118.7996	0.5190	61.6570 (267)
Energy for lighting	306.6114	0.5190	159.1313 (268)
Total kg/year			775.7534 (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	908.4201	1.2200	1108.2725 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1660.8625	1.2200	2026.2522 (264)
Space and water heating			3134.5247 (265)
Pumps and fans	118.7996	3.0700	364.7148 (267)
Energy for lighting	306.6114	3.0700	941.2971 (268)
Primary energy kWh/year			4440.5366 (272)
Primary energy kWh/m2/year			71.5523 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

B 85

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 90

(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 85
 Potential environmental impact rating: B 90

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

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

	Current	Potential	Saving
Electricity	£72	£72	£0
Mains gas	£189	£189	£0
Space heating	£144	£144	£0
Water heating	£65	£65	£0
Lighting	£52	£52	£0
Total cost of fuels	£261	£261	£0
Total cost of uses	£261	£261	£0
Delivered energy	48 kWh/m ²	48 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m ²	13 kg/m ²	13 kg/m ²	0 kg/m ²
Primary energy	72 kWh/m ²	72 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	East Anglia
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	227.6 (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	28.58 (37)
Summer heat loss coefficient	224.36 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South West	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
South West	5.4500	122.3147	0.4300	0.0000	0.9000	257.9800
North West	2.5200	100.0415	0.4300	0.0000	0.9000	97.5644
total:						355.5444

	Jun	Jul	Aug
Solar gains	376	356	316 (P4)
Internal gains	361	346	354
Total summer gains	737	702	670 (P5)

	3.28	3.13	2.99
Summer gain/loss ratio			(P6)
Summer external temperature	15.40	17.60	17.60
Thermal mass temperature increment (TMP = 227.6)	0.41	0.41	0.41
Threshold temperature	19.09	21.13	20.99 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight