

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-201			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	2FF - Semi (As)		
Property	101, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	84 B	DER	13.75	TER	17.61
Environmental	90 B	% DER<TER	21.93		
CO ₂ Emissions (t/year)	0.76	DFEE	40.24	TFEE	42.89
General Requirements Compliance	Pass	% DFEE<TFEE	6.17		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Top-floor flat, total floor area 70 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) 17.61 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)42.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.26 (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: 4.89 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 28 ErP
Combi boiler
Efficiency: 89.1% 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing South East: 3.69 m², No overhang
Windows facing South West: 4.45 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 0.90 W/m²K
Door U-value 0.71 W/m²K
Photovoltaic array 436.89 kWh/Year

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1232 (8)
Measured/design AP50					Yes
Infiltration rate					4.8900
Number of sides sheltered					0.3677 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3125 (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												
	0.3985	0.3907	0.3828	0.3438	0.3360	0.2969	0.2969	0.2891	0.3125	0.3360	0.3516	0.3672 (22b)
Effective ac	0.5794	0.5763	0.5733	0.5591	0.5564	0.5441	0.5441	0.5418	0.5488	0.5564	0.5618	0.5674 (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
Windows (Uw = 1.40)			8.1400	1.3258	10.7917		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.2500	9.1950	60.0000	2206.8000 (29a)
APT Wall to Stairwell	17.6900		17.6900	0.2400	4.2456	110.0000	1945.9000 (29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377	9.0000	632.6100 (30)
Total net area of external elements Aum (m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8752		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
2F - Timber			70.4100			9.0000	633.6900 (32c)
2F - Metal			43.3800			20.0000	867.6000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	13043.9000 (34)
	185.5726 (35)
	7.3022 (36)
(33) + (36) =	42.1774 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 31.0448 Feb 30.8797 Mar 30.7177 Apr 29.9573 May 29.8150 Jun 29.1526 Jul 29.1526 Aug 29.0300 Sep 29.4078 Oct 29.8150 Nov 30.1028 Dec 30.4037 (38)
Heat transfer coeff	Jan 73.2222 Feb 73.0571 Mar 72.8952 Apr 72.1347 May 71.9924 Jun 71.3300 Jul 71.3300 Aug 71.2074 Sep 71.5852 Oct 71.9924 Nov 72.2802 Dec 72.5811 (39)
Average = Sum(39)m / 12 =	72.1340 (39)
HLP	Jan 1.0417 Feb 1.0394 Mar 1.0371 Apr 1.0262 May 1.0242 Jun 1.0148 Jul 1.0148 Aug 1.0131 Sep 1.0184 Oct 1.0242 Nov 1.0283 Dec 1.0326 (40)
HLP (average)	1.0262 (40)
Days in month	Jan 31 Feb 28 Mar 31 Apr 30 May 31 Jun 30 Jul 31 Aug 31 Sep 30 Oct 31 Nov 30 Dec 31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.2531 (42)
Average daily hot water use (litres/day)													87.7122 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)	
Energy conte	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)	
Energy content (annual)												Total = Sum(45)m = 1380.0543 (45)	
Distribution loss (46)m = 0.15 x (45)m													
	21.4623	18.7711	19.3701	16.8873	16.2038	13.9826	12.9569	14.8683	15.0459	17.5345	19.1403	20.7851 (46)	

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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	21.7572	19.6149	21.6581	20.8933	21.5416	20.7913	21.4498	21.5093	20.8469	21.6099	20.9895	21.7380	(61)
Total heat required for water heating calculated for each month	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(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	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(64)
Heat gains from water heating, kWh/month	53.0141	46.5130	48.3515	42.6568	41.3038	36.1926	34.0837	38.3354	38.5634	44.2706	47.6750	51.5082	(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	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.7448	17.5371	14.2622	10.7974	8.0712	6.8140	7.3628	9.5704	12.8454	16.3102	19.0364	20.2935	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9730	200.0273	194.8504	183.8295	169.9175	156.8422	148.1071	146.0528	151.2297	162.2506	176.1626	189.2379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	(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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	(71)
Water heating gains (Table 5)	71.2555	69.2157	64.9886	59.2456	55.5158	50.2675	45.8114	51.5260	53.5603	59.5035	66.2153	69.2314	(72)
Total internal gains	348.7704	346.5773	333.8983	313.6696	293.3017	273.7210	261.0785	266.9464	277.4325	297.8615	321.2114	338.5600	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
Southeast				3.6900	36.7938	0.6200	0.7000				0.7700			40.8342 (77)
Southwest				4.4500	36.7938	0.6200	0.7000				0.7700			49.2445 (79)
Solar gains	90.0788	153.4375	209.9398	260.1256	291.3624	289.2554	278.8731	255.5690	227.3204	169.5811	107.8936	77.0886	(83)	
Total gains	438.8492	500.0148	543.8382	573.7952	584.6640	562.9763	539.9516	522.5155	504.7529	467.4426	429.1050	415.6486	(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	49.4837	49.5956	49.7057	50.2297	50.3290	50.7964	50.7964	50.8839	50.6153	50.3290	50.1286	49.9208		
alpha	4.2989	4.3064	4.3137	4.3486	4.3553	4.3864	4.3864	4.3923	4.3744	4.3553	4.3419	4.3281		
util living area	0.9921	0.9854	0.9715	0.9382	0.8639	0.7205	0.5574	0.5942	0.8050	0.9475	0.9856	0.9937	(86)	
MIT	19.6452	19.8233	20.0895	20.4223	20.7159	20.9119	20.9777	20.9704	20.8484	20.4716	19.9959	19.6097	(87)	
Th 2	20.0487	20.0507	20.0526	20.0615	20.0632	20.0710	20.0710	20.0725	20.0680	20.0632	20.0598	20.0563	(88)	
util rest of house	0.9902	0.9818	0.9643	0.9213	0.8250	0.6437	0.4503	0.4882	0.7405	0.9298	0.9814	0.9922	(89)	
MIT 2	18.2378	18.4976	18.8832	19.3622	19.7602	20.0004	20.0597	20.0562	19.9326	19.4391	18.7564	18.1913	(90)	
Living area fraction	18.9164	19.1368	19.4648	19.8733	20.2210	20.4399	20.5023	20.4970	20.3741	19.9369	19.3540	18.8752	(92)	
MIT	18.9164	19.1368	19.4648	19.8733	20.2210	20.4399	20.5023	20.4970	20.3741	19.9369	19.3540	18.8752	(92)	
Temperature adjustment	18.7664	18.9868	19.3148	19.7233	20.0710	20.2899	20.3523	20.3470	20.2241	19.7869	19.2040	18.7252	(93)	
adjusted MIT	18.7664	18.9868	19.3148	19.7233	20.0710	20.2899	20.3523	20.3470	20.2241	19.7869	19.2040	18.7252	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	432.9750	488.2770	520.4918	524.4343	482.5668	373.3127	261.2958	272.2184	379.8259	431.6257	418.9616	411.1343	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1059.2591	1029.1401	934.1374	780.7365	602.6479	405.8579	267.6549	281.0548	438.3980	661.3890	874.8786	1054.2527	(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	465.9554	363.4600	307.7523	184.5376	89.3403	0.0000	0.0000	0.0000	0.0000	170.9439	328.2602	478.4801	(98)
Space heating												2388.7299	(98)
Space heating per m2												33.9839	(99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2654.1444	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	465.9554	363.4600	307.7523	184.5376	89.3403	0.0000	0.0000	0.0000	0.0000	170.9439	328.2602	478.4801	(98)	
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)	
Space heating fuel (main heating system)	517.7282	403.8444	341.9470	205.0418	99.2670	0.0000	0.0000	0.0000	0.0000	189.9377	364.7336	531.6445	(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	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(64)	
Efficiency of water heater (217)m	89.1136	89.0347	88.8874	88.5848	88.0171	86.7000	86.7000	86.7000	86.7000	88.4924	88.9451	89.1485	(216)	
Fuel for water heating, kWh/month	184.9765	162.5831	169.6437	150.6751	147.2063	131.4980	124.3708	139.1364	139.7378	156.5180	167.0597	179.8184	(219)	
Water heating fuel used												1853.2238	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2654.1444	(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)													348.6988	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
Total delivered energy for all uses													4931.0670	(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	2654.1444	0.2160	573.2952	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1853.2238	0.2160	400.2963	(264)
Space and water heating			973.5915	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	348.6988	0.5190	180.9747	(268)
Energy saving/generation technologies				
PV Unit	-436.8881	0.5190	-226.7449	(269)
Total CO2, kg/year			966.7463	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7500	(273)

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

DER			13.7500	ZC1
Total Floor Area		TFA	70.2900	
Assumed number of occupants		N	2.2531	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.6901	ZC2
CO2 emissions from cooking, equation (L16)			2.4623	ZC3
Total CO2 emissions			32.9024	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			32.9024	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1848 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4348 (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) =				0.3695 (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	0.4712	0.4619	0.4527	0.4065	0.3973	0.3511	0.3511	0.3418	0.3695	0.3973	0.4157	0.4342 (22b)
	0.6110	0.6067	0.6025	0.5826	0.5789	0.5616	0.5616	0.5584	0.5683	0.5789	0.5864	0.5943 (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)			8.1400	1.3258	10.7917		(27)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.1800	6.6204		(29a)
APT Wall to Stairwell	17.6900		17.6900	0.1800	3.1842		(29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377		(30)
Total net area of external elements Aum(A, m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.8540	(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)							6.5053 (36)
Total fabric heat loss						(33) + (36) =	38.3593 (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	32.7388	32.5078	32.2814	31.2181	31.0192	30.0931	30.0931	29.9216	30.4498	31.0192	31.4216	31.8424 (38)
Heat transfer coeff	71.0981	70.8671	70.6407	69.5774	69.3784	68.4523	68.4523	68.2808	68.8091	69.3784	69.7809	70.2017 (39)
Average = Sum(39)m / 12 =												69.5764 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0115	1.0082	1.0050	0.9899	0.9870	0.9739	0.9739	0.9714	0.9789	0.9870	0.9928	0.9987 (40)
HLP (average)												0.9898 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2531 (42)
Average daily hot water use (litres/day)												87.7122 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)
Energy conte	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)
Energy content (annual)										Total = Sum(45)m =		1380.0543 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4623	18.7711	19.3701	16.8873	16.2038	13.9826	12.9569	14.8683	15.0459	17.5345	19.1403	20.7851 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Combi loss	49.1669	42.7939	45.5911	42.3902	42.0153	38.9298	40.2275	42.0153	42.3902	45.5911	45.8506	49.1669 (61)
Total heat required for water heating calculated for each month	192.2490	167.9345	174.7249	154.9722	150.0404	132.1472	126.6071	141.1373	142.6960	162.4878	173.4525	187.7343 (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	192.2490	167.9345	174.7249	154.9722	150.0404	132.1472	126.6071	141.1373	142.6960	162.4878	173.4525	187.7343 (64)
Heat gains from water heating, kWh/month	59.8665	52.3077	54.3348	48.0311	46.4222	40.7272	38.7781	43.4619	43.9492	50.2659	53.8903	58.3654 (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	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.7448	17.5371	14.2622	10.7974	8.0712	6.8140	7.3628	9.5704	12.8454	16.3102	19.0364	20.2935 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9730	200.0273	194.8504	183.8295	169.9175	156.8422	148.1071	146.0528	151.2297	162.2506	176.1626	189.2379 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657 (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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258 (71)
Water heating gains (Table 5)	80.4658	77.8389	73.0306	66.7098	62.3954	56.5656	52.1211	58.4165	61.0406	67.5617	74.8476	78.4481 (72)
Total internal gains	357.9807	355.2005	341.9404	321.1338	300.1813	280.0190	267.3882	273.8369	284.9128	305.9197	329.8438	347.7767 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Southeast				3.6900	36.7938			0.6300		0.7000	0.7700		41.4928 (77)
Southwest				4.4500	36.7938			0.6300		0.7000	0.7700		50.0388 (79)

Solar gains	91.5316	155.9123	213.3259	264.3212	296.0618	293.9208	283.3710	259.6911	230.9869		172.3163	109.6338	78.3320 (83)
Total gains	449.5123	511.1127	555.2663	585.4550	596.2430	573.9398	550.7592	533.5280	515.8997		478.2360	439.4776	426.1087 (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	68.6552	68.8789	69.0997	70.1557	70.3569	71.3088	71.3088	71.4879	70.9391	70.3569	69.9511	69.5318
alpha	5.5770	5.5919	5.6066	5.6770	5.6905	5.7539	5.7539	5.7659	5.7293	5.6905	5.6634	5.6355
util living area	0.9972	0.9938	0.9850	0.9575	0.8819	0.7178	0.5390	0.5770	0.8139	0.9653	0.9938	0.9979 (86)
MIT	19.9870	20.1318	20.3449	20.6128	20.8356	20.9639	20.9941	20.9914	20.9243	20.6421	20.2666	19.9638 (87)
Th 2	20.0738	20.0765	20.0792	20.0918	20.0942	20.1052	20.1052	20.1072	20.1009	20.0942	20.0894	20.0844 (88)
util rest of house	0.9963	0.9917	0.9798	0.9423	0.8403	0.6353	0.4336	0.4710	0.7429	0.9498	0.9914	0.9973 (89)
MIT 2	18.7214	18.9342	19.2446	19.6341	19.9301	20.0805	20.1029	20.1035	20.0411	19.6818	19.1410	18.6955 (90)
Living area fraction									fLA = Living area / (4) =			0.4821 (91)
MIT	19.3316	19.5116	19.7751	20.1060	20.3667	20.5064	20.5326	20.5316	20.4669	20.1448	19.6837	19.3070 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3316	19.5116	19.7751	20.1060	20.3667	20.5064	20.5326	20.5316	20.4669	20.1448	19.6837	19.3070 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9954	0.9901	0.9777	0.9425	0.8541	0.6738	0.4847	0.5224	0.7740	0.9508	0.9900	0.9965 (94)
Useful gains	447.4252	506.0715	542.8827	551.8118	509.2450	386.7430	266.9367	278.6900	399.2810	454.7244	435.0786	424.6099 (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	1068.7168	1035.4837	937.7628	779.6848	601.2835	404.3089	269.1923	282.1088	438.0999	662.2046	878.1028	1060.5370 (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	462.2410	355.7650	293.7908	164.0686	68.4766	0.0000	0.0000	0.0000	0.0000	154.3652	318.9774	473.1298 (98)
Space heating												2290.8144 (98)
Space heating per m2										(98) / (4) =		32.5909 (99)

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2452.6920 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	462.2410	355.7650	293.7908	164.0686	68.4766	0.0000	0.0000	0.0000	0.0000	154.3652	318.9774	473.1298	(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)	494.9047	380.9047	314.5512	175.6623	73.3155	0.0000	0.0000	0.0000	0.0000	165.2733	341.5176	506.5629	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	192.2490	167.9345	174.7249	154.9722	150.0404	132.1472	126.6071	141.1373	142.6960	162.4878	173.4525	187.7343	(64)
Efficiency of water heater	87.1791	86.8952	86.3496	85.1949	83.2134	80.3000	80.3000	80.3000	80.3000	84.9224	86.5648	87.2814	(216)
(217)m	87.1791	86.8952	86.3496	85.1949	83.2134	80.3000	80.3000	80.3000	80.3000	84.9224	86.5648	87.2814	(217)
Fuel for water heating, kWh/month	220.5219	193.2609	202.3459	181.9031	180.3080	164.5669	157.6676	175.7625	177.7036	191.3368	200.3730	215.0908	(219)
Water heating fuel used												2260.8410	(219)
Annual totals kWh/year													
Space heating fuel - main system												2452.6920	(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)												348.6988	(232)
Total delivered energy for all uses												5137.2318	(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	2452.6920	0.2160	529.7815 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2260.8410	0.2160	488.3417 (264)
Space and water heating			1018.1231 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	348.6988	0.5190	180.9747 (268)
Total CO2, kg/m2/year			1238.0228 (272)
Emissions per m2 for space and water heating			14.4846 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5747 (272b)
Emissions per m2 for pumps and fans			0.5538 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4846 * 1.00) + 2.5747 + 0.5538, rounded to 2 d.p.			17.6100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1848 (8)
Measured/design AP50					Yes
Infiltration rate					4.8900
Number of sides sheltered					0.4293 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3649 (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	0.4652	0.4561	0.4470	0.4014	0.3922	0.3466	0.3466	0.3375	0.3649	0.3922	0.4105	0.4287 (22b)
	0.6082	0.6040	0.5999	0.5805	0.5769	0.5601	0.5601	0.5570	0.5666	0.5769	0.5842	0.5919 (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
Windows (Uw = 1.40)			8.1400	1.3258	10.7917		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.2500	9.1950	60.0000	2206.8000 (29a)
APT Wall to Stairwell	17.6900		17.6900	0.2400	4.2456	110.0000	1945.9000 (29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377	9.0000	632.6100 (30)
Total net area of external elements Aum (m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8752		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
2F - Timber			70.4100			9.0000	633.6900 (32c)
2F - Metal			43.3800			20.0000	867.6000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	13043.9000 (34)
	185.5726 (35)
	7.3022 (36)
(33) + (36) =	42.1774 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	32.5893
Heat transfer coeff	74.7667
Average = Sum(39)m / 12 =	
HLP	1.0637
HLP (average)	1.0426
Days in month	31

4. Water heating energy requirements (kWh/year)

												2.2531 (42)
Average daily hot water use (litres/day)												87.7122 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)
Energy content	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)
Energy content (annual)												Total = Sum(45)m = 1380.0543 (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 Built)

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	30.4049	26.5924	27.4409	23.9237	22.9553	19.8087	18.3557	21.0634	21.3150	24.8405	27.1154	29.4456	(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	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.7448	17.5371	14.2622	10.7974	8.0712	6.8140	7.3628	9.5704	12.8454	16.3102	19.0364	20.2935	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9730	200.0273	194.8504	183.8295	169.9175	156.8422	148.1071	146.0528	151.2297	162.2506	176.1626	189.2379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	(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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	(71)
Water heating gains (Table 5)	40.8669	39.5720	36.8830	33.2273	30.8539	27.5121	24.6716	28.3110	29.6041	33.3878	37.6603	39.5774	(72)
Total internal gains	315.3818	313.9336	302.7927	284.6513	265.6398	247.9655	236.9387	240.7314	250.4764	268.7458	289.6564	305.9060	(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
Southeast					3.6900	36.7938	0.6200		0.7000			0.7700	40.8342
Southwest					4.4500	36.7938	0.6200		0.7000			0.7700	49.2445 (77)
Solar gains	90.0788	153.4375	209.9398	260.1256	291.3624	289.2554	278.8731	255.5690	227.3204	169.5811	107.8936		77.0886 (83)
Total gains	405.4605	467.3710	512.7325	544.7770	557.0022	537.2209	515.8118	496.3005	477.7968	438.3269	397.5500		382.9946 (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	48.4615	48.6079	48.7522	49.4418	49.5730	50.1930	50.1930	50.3095	49.9524	49.5730	49.3083	49.0346		
alpha	4.2308	4.2405	4.2501	4.2961	4.3049	4.3462	4.3462	4.3540	4.3302	4.3049	4.2872	4.2690		
util living area	0.9942	0.9887	0.9772	0.9485	0.8825	0.7471	0.5847	0.6244	0.8307	0.9582	0.9892	0.9954	(86)	
MIT	19.5527	19.7357	20.0115	20.3635	20.6761	20.8953	20.9723	20.9630	20.8214	20.4145	19.9202	19.5233	(87)	
Th 2	20.0306	20.0332	20.0358	20.0480	20.0503	20.0609	20.0609	20.0629	20.0568	20.0503	20.0457	20.0408	(88)	
util rest of house	0.9927	0.9859	0.9712	0.9338	0.8466	0.6709	0.4734	0.5151	0.7694	0.9433	0.9860	0.9943	(89)	
MIT 2	18.7064	18.8902	19.1649	19.5177	19.8114	20.0026	20.0512	20.0488	19.9456	19.5731	19.0842	18.6851	(90)	
Living area fraction														
MIT	19.1144	19.2979	19.5731	19.9255	20.2283	20.4330	20.4953	20.4896	20.3679	19.9787	19.4873	19.0892	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.1144	19.2979	19.5731	19.9255	20.2283	20.4330	20.4953	20.4896	20.3679	19.9787	19.4873	19.0892	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	401.7812	459.5010	496.1490	507.5244	475.7563	377.6971	271.6638	281.3791	378.2590	412.9009	391.0463	380.2235	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1107.6246	1073.2378	971.6043	807.9976	623.3378	421.0670	281.1915	294.5314	454.6423	685.4952	910.2483	1100.2076	(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	525.1475	412.4311	353.7387	216.3407	109.8006	0.0000	0.0000	0.0000	0.0000	202.8102	373.8255	535.6681	(98)
Space heating												2729.7623	(98)
Space heating per m2												38.8357	(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	0.0000	0.0000	0.0000	0.0000	0.0000	678.5620	534.1871	547.3539	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8323	0.8988	0.8828	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	564.7455	480.1173	483.2184	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	712.5656	685.9244	664.7783	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 Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	106.4305	153.1205	135.0806	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												394.6316 (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	26.6076	38.2801	33.7702	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.6579 (107)
Space cooling per m2												1.4036 (108)
Energy for space heating												38.8357 (99)
Energy for space cooling												1.4036 (108)
Total												40.2393 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1848 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4348 (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) =				0.3695 (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	0.4712	0.4619	0.4527	0.4065	0.3973	0.3511	0.3511	0.3418	0.3695	0.3973	0.4157	0.4342 (22b)
	0.6110	0.6067	0.6025	0.5826	0.5789	0.5616	0.5616	0.5584	0.5683	0.5789	0.5864	0.5943 (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)			8.1400	1.3258	10.7917		(27)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.1800	6.6204		(29a)
APT Wall to Stairwell	17.6900		17.6900	0.1800	3.1842		(29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377		(30)
Total net area of external elements Aum(A, m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.8540	(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)							6.5053 (36)
Total fabric heat loss						(33) + (36) =	38.3593 (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	32.7388	32.5078	32.2814	31.2181	31.0192	30.0931	30.0931	29.9216	30.4498	31.0192	31.4216	31.8424 (38)
Heat transfer coeff	71.0981	70.8671	70.6407	69.5774	69.3784	68.4523	68.4523	68.2808	68.8091	69.3784	69.7809	70.2017 (39)
Average = Sum(39)m / 12 =												69.5764 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0115	1.0082	1.0050	0.9899	0.9870	0.9739	0.9739	0.9714	0.9789	0.9870	0.9928	0.9987 (40)
HLP (average)												0.9898 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2531 (42)
Average daily hot water use (litres/day)												87.7122 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)
Energy conte	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)
Energy content (annual)										Total = Sum(45)m =		1380.0543 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	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	30.4049	26.5924	27.4409	23.9237	22.9553	19.8087	18.3557	21.0634	21.3150	24.8405	27.1154	29.4456 (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	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	112.6572	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.7448	17.5371	14.2622	10.7974	8.0712	6.8140	7.3628	9.5704	12.8454	16.3102	19.0364	20.2935	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9730	200.0273	194.8504	183.8295	169.9175	156.8422	148.1071	146.0528	151.2297	162.2506	176.1626	189.2379	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	34.2657	(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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	(71)
Water heating gains (Table 5)	40.8669	39.5720	36.8830	33.2273	30.8539	27.5121	24.6716	28.3110	29.6041	33.3878	37.6603	39.5774	(72)
Total internal gains	315.3818	313.9336	302.7927	284.6513	265.6398	247.9655	236.9387	240.7314	250.4764	268.7458	289.6564	305.9060	(73)

6. Solar gains

[Jan]													Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Southeast													3.6900	36.7938	0.6300	0.7000	0.7700		41.4928	(77)
Southwest													4.4500	36.7938	0.6300	0.7000	0.7700		50.0388	(79)
Solar gains	91.5316	155.9123	213.3259	264.3212	296.0618	293.9208	283.3710	259.6911	230.9869	172.3163	109.6338	78.3320	(83)							
Total gains	406.9134	469.8458	516.1187	548.9725	561.7015	541.8863	520.3097	500.4226	481.4633	441.0621	399.2902	384.2380	(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	68.6552	68.8789	69.0997	70.1557	70.3569	71.3088	71.3088	71.4879	70.9391	70.3569	69.9511	69.5318	
alpha	5.5770	5.5919	5.6066	5.6770	5.6905	5.7539	5.7539	5.7659	5.7293	5.6905	5.6634	5.6355	
util living area	0.9983	0.9959	0.9893	0.9674	0.9027	0.7487	0.5681	0.6110	0.8454	0.9755	0.9961	0.9988	(86)
MIT	19.9293	20.0769	20.2950	20.5723	20.8097	20.9553	20.9923	20.9885	20.9065	20.5989	20.2129	19.9068	(87)
Th 2	20.0738	20.0765	20.0792	20.0918	20.0942	20.1052	20.1052	20.1072	20.1009	20.0942	20.0894	20.0844	(88)
util rest of house	0.9978	0.9945	0.9855	0.9551	0.8655	0.6668	0.4582	0.5009	0.7790	0.9638	0.9946	0.9984	(89)
MIT 2	19.0931	19.2422	19.4607	19.7417	19.9616	20.0837	20.1031	20.1038	20.0487	19.7725	19.3888	19.0793	(90)
Living area fraction									fLA = Living area / (4) =			0.4821	(91)
MIT	19.4963	19.6447	19.8630	20.1422	20.3705	20.5039	20.5318	20.5303	20.4623	20.1709	19.7862	19.4783	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4963	19.6447	19.8630	20.1422	20.3705	20.5039	20.5318	20.5303	20.4623	20.1709	19.7862	19.4783	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	405.8175	466.8691	508.0446	524.7646	493.2082	382.0969	266.1795	277.4182	389.0599	425.6262	396.8653	383.4793	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1080.4249	1044.9112	943.9699	782.1997	601.5484	404.1389	269.1411	282.0235	437.7853	664.0171	885.2524	1072.5628	(96)
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	501.9080	388.4443	324.3284	185.3533	80.6051	0.0000	0.0000	0.0000	0.0000	177.3628	351.6387	512.6781	(98)
Space heating												2522.3188	(98)
Space heating per m2												35.8845	(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	643.4519	506.5472	518.9342	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8944	0.9491	0.9370	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	575.4847	480.7536	486.2547	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	718.0187	691.1818	669.5963	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	102.6245	156.5586	136.4062	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												395.5892	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.6561	39.1396	34.1015	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												98.8973 (107)
Energy for space heating												1.4070 (108)
Energy for space cooling												35.8845 (99)
Total												1.4070 (108)
Target Fabric Energy Efficiency (TFEE)												37.2915 (109)
												42.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1232 (8)
Measured/design AP50					Yes
Infiltration rate					4.8900
Number of sides sheltered					0.3677 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
	0.3282	0.3047	0.3125	0.2969	0.2969	0.2891	0.2813	0.2735	0.2656	0.2891	0.2735	0.2891 (22b)
Effective ac	0.5538	0.5464	0.5488	0.5441	0.5441	0.5418	0.5396	0.5374	0.5353	0.5418	0.5374	0.5418 (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
Windows (Uw = 1.40)			8.1400	1.3258	10.7917		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.2500	9.1950	60.0000	2206.8000 (29a)
APT Wall to Stairwell	17.6900		17.6900	0.2400	4.2456	110.0000	1945.9000 (29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377	9.0000	632.6100 (30)
Total net area of external elements Aum (m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.8752		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
2F - Timber			70.4100			9.0000	633.6900 (32c)
2F - Metal			43.3800			20.0000	867.6000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 13043.9000 (34)
185.5726 (35)
7.3022 (36)
(33) + (36) = 42.1774 (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	29.6760	29.2786	29.4078	29.1526	29.1526	29.0300	28.9106	28.7945	28.6816	29.0300	28.7945	29.0300 (38)
Heat transfer coeff												
	71.8534	71.4560	71.5852	71.3300	71.3300	71.2074	71.0880	70.9719	70.8590	71.2074	70.9719	71.2074 (39)
Average = Sum(39)m / 12 =												71.2556 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0222	1.0166	1.0184	1.0148	1.0148	1.0131	1.0114	1.0097	1.0081	1.0131	1.0097	1.0131 (40)
HLP (average)												1.0137 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)
Energy conte	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)
Energy content (annual)										Total = Sum(45)m =		1380.0543 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4623	18.7711	19.3701	16.8873	16.2038	13.9826	12.9569	14.8683	15.0459	17.5345	19.1403	20.7851 (46)

AES
Sustainability
Consultants

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	(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	(57)
Combi loss	21.7572	19.6149	21.6581	20.8933	21.5416	20.7913	21.4498	21.5093	20.8469	21.6099	20.9895	(61)
Total heat required for water heating calculated for each month	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	(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	(63)
	Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	(64)
	Total per year (kWh/year) = Sum(64)m =											1634.4541 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.0141	46.5130	48.3515	42.6568	41.3038	36.1926	34.0837	38.3354	38.5634	44.2706	47.6750	(65)
												1634 (64)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.3619	43.8428	35.6554	26.9934	20.1779	17.0350	18.4070	23.9261	32.1135	40.7755	47.5910	50.7338	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.4820	298.5482	290.8215	274.3724	253.6082	234.0929	221.0554	217.9893	225.7159	242.1651	262.9292	282.4446	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	(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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	(71)
Water heating gains (Table 5)	71.2555	69.2157	64.9886	59.2456	55.5158	50.2675	45.8114	51.5260	53.5603	59.5035	66.2153	69.2314	(72)
Total internal gains	514.9344	510.4417	490.3004	459.4463	428.1368	400.2304	384.1087	392.2763	410.2246	441.2790	475.5704	501.2447	(73)

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
				3.6900	45.1778		0.6200		0.7000		0.7700		50.1389 (77)
				4.4500	45.1778		0.6200		0.7000		0.7700		60.4656 (79)
Solar gains	110.6045	160.2888	221.5171	277.8313	297.7267	322.0996	307.6744	287.3019	253.8299	191.1939	132.0198		93.0733 (83)
Total gains	625.5388	670.7305	711.8175	737.2776	725.8635	722.3300	691.7831	679.5782	664.0545	632.4729	607.5902		594.3180 (84)

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	50.4264	50.7068	50.6153	50.7964	50.7964	50.8839	50.9693	51.0527	51.1340	50.8839	51.0527	50.8839
alpha	4.3618	4.3805	4.3744	4.3864	4.3864	4.3923	4.3980	4.4035	4.4089	4.3923	4.4035	4.3923
util living area												
	0.9674	0.9549	0.9229	0.8550	0.7346	0.5414	0.3964	0.4026	0.6289	0.8447	0.9408	0.9717 (86)
MIT	20.0464	20.1669	20.4026	20.6712	20.8735	20.9744	20.9948	20.9945	20.9501	20.7414	20.3792	20.0268 (87)
Th 2	20.0648	20.0695	20.0680	20.0710	20.0710	20.0725	20.0739	20.0753	20.0766	20.0725	20.0753	20.0725 (88)
util rest of house												
	0.9601	0.9452	0.9060	0.8234	0.6787	0.4612	0.3044	0.3095	0.5515	0.8047	0.9260	0.9653 (89)
MIT 2	18.8267	19.0012	19.3317	19.6983	19.9507	20.0555	20.0719	20.0731	20.0391	19.7969	19.3098	18.8050 (90)
Living area fraction												
	19.4148	19.5632	19.8481	20.1674	20.3956	20.4985	20.5168	20.5174	20.4784	20.2523	19.8254	19.3941 (91)
MIT												19.3941 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2648	19.4132	19.6981	20.0174	20.2456	20.3485	20.3668	20.3674	20.3284	20.1023	19.6754	19.2441 (93)

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1232 (8)
Measured/design AP50					Yes
Infiltration rate					4.8900
Number of sides sheltered					0.3677 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3125 (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												
	0.3985	0.3907	0.3828	0.3438	0.3360	0.2969	0.2969	0.2891	0.3125	0.3360	0.3516	0.3672 (22b)
Effective ac	0.5794	0.5763	0.5733	0.5591	0.5564	0.5441	0.5441	0.5418	0.5488	0.5564	0.5618	0.5674 (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
Windows (Uw = 1.40)			8.1400	1.3258	10.7917		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.2500	9.1950	60.0000	2206.8000 (29a)
APT Wall to Stairwell	17.6900		17.6900	0.2400	4.2456	110.0000	1945.9000 (29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377	9.0000	632.6100 (30)
Total net area of external elements Aum (m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8752		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
2F - Timber			70.4100			9.0000	633.6900 (32c)
2F - Metal			43.3800			20.0000	867.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13043.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		185.5726 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3022 (36)
Total fabric heat loss	(33) + (36) =	42.1774 (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	31.0448	30.8797	30.7177	29.9573	29.8150	29.1526	29.1526	29.0300	29.4078	29.8150	30.1028	30.4037 (38)
Heat transfer coeff	73.2222	73.0571	72.8952	72.1347	71.9924	71.3300	71.3300	71.2074	71.5852	71.9924	72.2802	72.5811 (39)
Average = Sum(39)m / 12 =												72.1340 (39)
HLP	1.0417	1.0394	1.0371	1.0262	1.0242	1.0148	1.0148	1.0131	1.0184	1.0242	1.0283	1.0326 (40)
HLP (average)												1.0262 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2531 (42)
Average daily hot water use (litres/day)												87.7122 (43)
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)
Energy conte	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)
Energy content (annual)										Total = Sum(45)m =		1380.0543 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4623	18.7711	19.3701	16.8873	16.2038	13.9826	12.9569	14.8683	15.0459	17.5345	19.1403	20.7851 (46)

FULL SAP CALCULATION PRINTOUT

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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	21.7572	19.6149	21.6581	20.8933	21.5416	20.7913	21.4498	21.5093	20.8469	21.6099	20.9895	21.7380	(61)
Total heat required for water heating calculated for each month	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(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	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(64)
Heat gains from water heating, kWh/month	53.0141	46.5130	48.3515	42.6568	41.3038	36.1926	34.0837	38.3354	38.5634	44.2706	47.6750	51.5082	(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	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.3619	43.8428	35.6554	26.9934	20.1779	17.0350	18.4070	23.9261	32.1135	40.7755	47.5910	50.7338	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.4820	298.5482	290.8215	274.3724	253.6082	234.0929	221.0554	217.9893	225.7159	242.1651	262.9292	282.4446	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	(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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	(71)
Water heating gains (Table 5)	71.2555	69.2157	64.9886	59.2456	55.5158	50.2675	45.8114	51.5260	53.5603	59.5035	66.2153	69.2314	(72)
Total internal gains	514.9344	510.4417	490.3004	459.4463	428.1368	400.2304	384.1087	392.2763	410.2246	441.2790	475.5704	501.2447	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Southeast					3.6900	36.7938	0.6200	0.7000			0.7700	40.8342
Southwest					4.4500	36.7938	0.6200	0.7000			0.7700	49.2445 (77)
Solar gains	90.0788	153.4375	209.9398	260.1256	291.3624	289.2554	278.8731	255.5690	227.3204	169.5811	107.8936	77.0886 (83)
Total gains	605.0131	663.8791	700.2402	719.5719	719.4992	689.4857	662.9818	647.8453	637.5450	610.8601	583.4640	578.3334 (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	49.4837	49.5956	49.7057	50.2297	50.3290	50.7964	50.7964	50.8839	50.6153	50.3290	50.1286	49.9208	
alpha	4.2989	4.3064	4.3137	4.3486	4.3553	4.3864	4.3864	4.3923	4.3744	4.3553	4.3419	4.3281	
util living area	0.9749	0.9610	0.9356	0.8822	0.7829	0.6210	0.4638	0.4928	0.6982	0.8857	0.9581	0.9788	(86)
MIT	19.9109	20.0734	20.3079	20.5890	20.8164	20.9509	20.9890	20.9856	20.9155	20.6411	20.2308	19.8735	(87)
Th 2	20.0487	20.0507	20.0526	20.0615	20.0632	20.0710	20.0710	20.0725	20.0680	20.0632	20.0598	20.0563	(88)
util rest of house	0.9693	0.9526	0.9214	0.8557	0.7346	0.5448	0.3703	0.3991	0.6267	0.8548	0.9475	0.9740	(89)
MIT 2	18.6205	18.8543	19.1880	19.5824	19.8771	20.0339	20.0658	20.0651	19.9979	19.6605	19.0893	18.5724	(90)
Living area fraction	19.2427	19.4421	19.7279	20.0678	20.3300	20.4760	20.5109	20.5089	20.4403	20.1333	19.6397	19.1997	(91)
MIT	19.0927	19.2921	19.5779	19.9178	20.1800	20.3260	20.3609	20.3589	20.2903	19.9833	19.4897	19.0497	(92)
Temperature adjustment												-0.1500	
adjusted MIT													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9622	0.9443	0.9130	0.8511	0.7411	0.5666	0.4000	0.4287	0.6448	0.8517	0.9396	0.9675	(94)
Ext temp.	582.1236	626.8722	639.2892	612.4059	533.2084	390.6312	265.2248	277.7366	411.0719	520.3000	548.2482	559.5383	(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	1083.1517	1051.4447	953.3180	794.7621	610.4941	408.4383	268.2664	281.9026	443.1349	675.5270	895.5279	1077.8106	(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 m ²	372.7649	285.3128	233.6374	131.2965	57.5006	0.0000	0.0000	0.0000	0.0000	115.4889	250.0414	385.5946	(98)
												1831.6371	(98)
												26.0583	(99)

8c. Space cooling requirement

Not applicable

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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 %)												90.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2035.1523	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	372.7649	285.3128	233.6374	131.2965	57.5006	0.0000	0.0000	0.0000	0.0000	115.4889	250.0414	385.5946	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	414.1833	317.0142	259.5971	145.8850	63.8895	0.0000	0.0000	0.0000	0.0000	128.3211	277.8238	428.4384	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(64)
Efficiency of water heater	88.9618	88.8616	88.6761	88.3056	87.6883	86.7000	86.7000	86.7000	86.7000	88.1700	88.7410	89.0052	(216)
(217)m													(217)
Fuel for water heating, kWh/month	185.2923	162.9000	170.0480	151.1515	147.7583	131.4980	124.3708	139.1364	139.7378	157.0905	167.4440	180.1079	(219)
Water heating fuel used												1856.5353	(219)
Annual totals kWh/year													
Space heating fuel - main system												2035.1523	(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)												348.6988	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4315.3865	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2035.1523	3.4800	70.8233	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1856.5353	3.4800	64.6074	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	348.6988	13.1900	45.9934	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			311.3166	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			1.1341	(257)
SAP value		$[(255) \times (256)] / [(4) + 45.0] =$	84.1790	
SAP rating (Section 12)			84	(258)
SAP band			B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2035.1523	0.2160	439.5929	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1856.5353	0.2160	401.0116	(264)
Space and water heating			840.6045	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	348.6988	0.5190	180.9747	(268)
Energy saving/generation technologies				
PV Unit	-436.8881	0.5190	-226.7449	(269)
Total kg/year			833.7593	(272)
CO2 emissions per m2			11.8600	(273)
EI value			90.3093	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8793 = 3.958$, stars = 4
Water heating environmental impact	$0.216 / 0.8793 = 0.2456$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.3100 (2b)	= 162.3699 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 162.3699 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1232 (8)
Measured/design AP50					Yes
Infiltration rate					4.8900
Number of sides sheltered					0.3677 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
	0.3282	0.3047	0.3125	0.2969	0.2969	0.2891	0.2813	0.2735	0.2656	0.2891	0.2735	0.2891 (22b)
Effective ac	0.5538	0.5464	0.5488	0.5441	0.5441	0.5418	0.5396	0.5374	0.5353	0.5418	0.5374	0.5418 (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
Windows (Uw = 1.40)			8.1400	1.3258	10.7917		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	47.0400	10.2600	36.7800	0.2500	9.1950	60.0000	2206.8000 (29a)
APT Wall to Stairwell	17.6900		17.6900	0.2400	4.2456	110.0000	1945.9000 (29a)
APT External Plane Ceiling	70.2900		70.2900	0.1300	9.1377	9.0000	632.6100 (30)
Total net area of external elements Aum (m ²)			135.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.8752		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
2F - Timber			70.4100			9.0000	633.6900 (32c)
2F - Metal			43.3800			20.0000	867.6000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 13043.9000 (34)
185.5726 (35)
7.3022 (36)
(33) + (36) = 42.1774 (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	29.6760	29.2786	29.4078	29.1526	29.1526	29.0300	28.9106	28.7945	28.6816	29.0300	28.7945	29.0300 (38)
Heat transfer coeff	71.8534	71.4560	71.5852	71.3300	71.3300	71.2074	71.0880	70.9719	70.8590	71.2074	70.9719	71.2074 (39)
Average = Sum(39)m / 12 =												71.2556 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0222	1.0166	1.0184	1.0148	1.0148	1.0131	1.0114	1.0097	1.0081	1.0131	1.0097	1.0131 (40)
HLP (average)												1.0137 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)

2.2531 (42)
87.7122 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4834	92.9749	89.4664	85.9579	82.4495	78.9410	78.9410	82.4495	85.9579	89.4664	92.9749	96.4834 (44)
Energy conte	143.0821	125.1405	129.1338	112.5820	108.0251	93.2174	86.3797	99.1219	100.3058	116.8967	127.6019	138.5674 (45)
Energy content (annual)										Total = Sum(45)m =		1380.0543 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4623	18.7711	19.3701	16.8873	16.2038	13.9826	12.9569	14.8683	15.0459	17.5345	19.1403	20.7851 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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)
Combi loss	21.7572	19.6149	21.6581	20.8933	21.5416	20.7913	21.4498	21.5093	20.8469	21.6099	20.9895	21.7380	(61)
Total heat required for water heating calculated for each month	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(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	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(64)
Heat gains from water heating, kWh/month	53.0141	46.5130	48.3515	42.6568	41.3038	36.1926	34.0837	38.3354	38.5634	44.2706	47.6750	51.5082	(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	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	135.1887	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.3619	43.8428	35.6554	26.9934	20.1779	17.0350	18.4070	23.9261	32.1135	40.7755	47.5910	50.7338	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.4820	298.5482	290.8215	274.3724	253.6082	234.0929	221.0554	217.9893	225.7159	242.1651	262.9292	282.4446	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	50.7720	(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)	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	-90.1258	(71)
Water heating gains (Table 5)	71.2555	69.2157	64.9886	59.2456	55.5158	50.2675	45.8114	51.5260	53.5603	59.5035	66.2153	69.2314	(72)
Total internal gains	514.9344	510.4417	490.3004	459.4463	428.1368	400.2304	384.1087	392.2763	410.2246	441.2790	475.5704	501.2447	(73)

6. Solar gains

[Jan]											Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast											3.6900	45.1778	0.6200	0.7000	0.7700	50.1389 (77)
Southwest											4.4500	45.1778	0.6200	0.7000	0.7700	60.4656 (79)
Solar gains	110.6045	160.2888	221.5171	277.8313	297.7267	322.0996	307.6744	287.3019	253.8299	191.1939	132.0198	93.0733 (83)				
Total gains	625.5388	670.7305	711.8175	737.2776	725.8635	722.3300	691.7831	679.5782	664.0545	632.4729	607.5902	594.3180 (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	50.4264	50.7068	50.6153	50.7964	50.7964	50.8839	50.9693	51.0527	51.1340	50.8839	51.0527	50.8839		
alpha	4.3618	4.3805	4.3744	4.3864	4.3864	4.3923	4.3980	4.4035	4.4089	4.3923	4.4035	4.3923		
util living area	0.9674	0.9549	0.9229	0.8550	0.7346	0.5414	0.3964	0.4026	0.6289	0.8447	0.9408	0.9717	(86)	
MIT	20.0464	20.1669	20.4026	20.6712	20.8735	20.9744	20.9948	20.9945	20.9501	20.7414	20.3792	20.0268	(87)	
Th 2	20.0648	20.0695	20.0680	20.0710	20.0710	20.0725	20.0739	20.0753	20.0766	20.0725	20.0753	20.0725	(88)	
util rest of house	0.9601	0.9452	0.9060	0.8234	0.6787	0.4612	0.3044	0.3095	0.5515	0.8047	0.9260	0.9653	(89)	
MIT 2	18.8267	19.0012	19.3317	19.6983	19.9507	20.0555	20.0719	20.0731	20.0391	19.7969	19.3098	18.8050	(90)	
Living area fraction	19.4148	19.5632	19.8481	20.1674	20.3956	20.4985	20.5168	20.5174	20.4784	20.2523	19.8254	19.3941	(91)	
MIT	19.2648	19.4132	19.6981	20.0174	20.2456	20.3485	20.3668	20.3674	20.3284	20.1023	19.6754	19.2441	(92)	
Temperature adjustment												-0.1500		
adjusted MIT														(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9524	0.9368	0.8982	0.8214	0.6898	0.4857	0.3339	0.3392	0.5735	0.8061	0.9184	0.9581	(94)	
Ext temp.	595.7720	628.3731	639.3653	605.5663	500.7358	350.8674	230.9611	230.5442	380.8559	509.8510	557.9874	569.4017	(95)	
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)	
Month fracti	1032.1576	1008.4752	908.9930	750.2034	552.4967	359.4937	232.2336	231.8903	398.8201	619.6671	835.7230	1014.2832	(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	324.6709	255.4286	200.6031	104.1387	38.5101	0.0000	0.0000	0.0000	0.0000	81.7032	199.9697	330.9919	(98)	
Space heating per m2												1536.0161	(98)	
												21.8526	(99)	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1706.6846 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	324.6709	255.4286	200.6031	104.1387	38.5101	0.0000	0.0000	0.0000	0.0000	81.7032	199.9697	330.9919	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	360.7454	283.8096	222.8923	115.7097	42.7890	0.0000	0.0000	0.0000	0.0000	90.7813	222.1885	367.7687	(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	164.8393	144.7555	150.7919	133.4753	129.5667	114.0087	107.8294	120.6313	121.1526	138.5066	148.5914	160.3054	(64)
Efficiency of water heater (217)m	88.8610	88.7777	88.5536	88.1160	87.4345	86.7000	86.7000	86.7000	86.7000	87.8958	88.5630	88.8960	(216)
Fuel for water heating, kWh/month	185.5023	163.0538	170.2832	151.4768	148.1871	131.4980	124.3708	139.1364	139.7378	157.5805	167.7805	180.3292	(219)
Water heating fuel used												1858.9363	(219)
Annual totals kWh/year													
Space heating fuel - main system												1706.6846	(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)												348.6988	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3989.3196	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1706.6846	3.9200	66.9020 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1858.9363	3.9200	72.8703 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	348.6988	16.9600	59.1393 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			299.6317 (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	1706.6846	0.2160	368.6439 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1858.9363	0.2160	401.5302 (264)
Space and water heating			770.1741 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	348.6988	0.5190	180.9747 (268)
Energy saving/generation technologies			
PV Unit	-436.8881	0.5190	-226.7449 (269)
Total kg/year			763.3289 (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	1706.6846	1.2200	2082.1552 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1858.9363	1.2200	2267.9022 (264)
Space and water heating			4350.0574 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	348.6988	3.0700	1070.5053 (268)
Energy saving/generation technologies			
PV Unit	-436.8881	3.0700	-1341.2464 (269)
Primary energy kWh/year			4309.5663 (272)
Primary energy kWh/m2/year			61.3112 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Current energy efficiency rating: B 84
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/m²	

Potential energy efficiency rating: B 84
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, Southern England):

	Current	Potential	Saving
Electricity	£72	£72	£0
Mains gas	£228	£228	£0
Space heating	£168	£168	£0
Water heating	£73	£73	£0
Lighting	£59	£59	£0
Total cost of fuels	£300	£300	£0
Total cost of uses	£300	£300	£0
Delivered energy	57 kWh/m²	57 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	61 kWh/m²	61 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built)



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

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	185.6 (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	214.33 (P1)
Transmission heat loss coefficient	42.18 (37)
Summer heat loss coefficient	256.51 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
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 East	3.6900	127.3119	0.6200	0.7000	0.9000	165.1467
South West	4.4500	127.3119	0.6200	0.7000	0.9000	199.1607
total:						364.3074

Solar gains	Jun	Jul	Aug	
	388	364	339	(P3)
Internal gains	397	381	389	
Total summer gains	785	745	728	(P5)
Summer gain/loss ratio	3.06	2.91	2.84	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 185.6)	0.70	0.70	0.70	
Threshold temperature	19.16	20.91	20.84	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			