

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-193			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	GFF - Semi (As)		
Property	85, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	84 B	DER	13.65	TER	17.74
Environmental	91 B	% DER<TER	23.05		
CO ₂ Emissions (t/year)	0.74	DFEE	39.32	TFEE	43.57
General Requirements Compliance	Pass	% DFEE<TFEE	9.76		
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

Ground-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) 17.74 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.65 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)43.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	(no roof)		
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: 3.47 (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): Medium OK

Based on:

Overshading: Average
Windows facing South East: 3.24 m², No overhang
Windows facing South West: 4.98 m², No overhang
Air change rate: 2.00 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
Air permeability 3.5 m³/m²h
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 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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) = 0.1355 (8)
Measured/design AP50					Yes
Infiltration rate					3.4700
Number of sides sheltered					0.3090 (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) =				0.2626 (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	0.3349	0.3283	0.3217	0.2889	0.2823	0.2495	0.2495	0.2429	0.2626	0.2823	0.2955	0.3086 (22b)
Effective ac	0.5561	0.5539	0.5518	0.5417	0.5399	0.5311	0.5311	0.5295	0.5345	0.5399	0.5437	0.5476 (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)			8.2200	1.3258	10.8977		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT Jet Floor Lo			70.2900	0.1600	11.2464	75.0000	5271.7500 (28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.2600	10.1452	60.0000	2341.2000 (29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.2400	3.7560	110.0000	1721.5000 (29a)
Total net area of external elements Aum (m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				37.5505		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
GF - Timber			53.1700			9.0000	478.5300 (32c)
GF - Metal Stud			48.2600			20.0000	965.2000 (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) =	17543.1800 (34)
	249.5829 (35)
	7.4025 (36)
(33) + (36) =	44.9530 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 27.0867 Feb 26.9806 Mar 26.8767 Apr 26.3884 May 26.2970 Jun 25.8718 Jul 25.8718 Aug 25.7930 Sep 26.0356 Oct 26.2970 Nov 26.4818 Dec 26.6751 (38)
Heat transfer coeff	Jan 72.0397 Feb 71.9337 Mar 71.8297 Apr 71.3414 May 71.2501 Jun 70.8248 Jul 70.8248 Aug 70.7460 Sep 70.9886 Oct 71.2501 Nov 71.4349 Dec 71.6281 (39)
Average = Sum(39)m / 12 =	71.3410 (39)
HLP	Jan 1.0249 Feb 1.0234 Mar 1.0219 Apr 1.0150 May 1.0137 Jun 1.0076 Jul 1.0076 Aug 1.0065 Sep 1.0099 Oct 1.0137 Nov 1.0163 Dec 1.0190 (40)
HLP (average)	1.0150 (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)	

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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	19.7023	17.4994	14.2314	10.7741	8.0538	6.7993	7.3469	9.5498	12.8177	16.2751	18.9954	20.2498	(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	348.7279	346.5395	333.8676	313.6464	293.2843	273.7063	261.0626	266.9258	277.4048	297.8264	321.1704	338.5163	(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			3.2400	36.7938	0.6200	0.7000	0.7700	35.8544 (77)						
Southwest			4.9800	36.7938	0.6200	0.7000	0.7700	55.1096 (79)						
Solar gains			90.9641	154.9454	212.0031	262.6821	294.2259	292.0982	281.6138	258.0808	229.5545	171.2477	108.9540	77.8463 (83)
Total gains			439.6919	501.4850	545.8707	576.3285	587.5101	565.8045	542.6765	525.0066	506.9594	469.0741	430.1244	416.3625 (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	67.6447	67.7444	67.8425	68.3068	68.3944	68.8051	68.8051	68.8817	68.6463	68.3944	68.2174	68.0334		
alpha	5.5096	5.5163	5.5228	5.5538	5.5596	5.5870	5.5870	5.5921	5.5764	5.5596	5.5478	5.5356		
util living area	0.9975	0.9944	0.9864	0.9621	0.8936	0.7410	0.5629	0.6029	0.8330	0.9696	0.9945	0.9982	(86)	
MIT	19.9534	20.0968	20.3108	20.5765	20.8112	20.9533	20.9916	20.9878	20.9073	20.6074	20.2250	19.9203	(87)	
Th 2	20.0626	20.0639	20.0651	20.0709	20.0720	20.0770	20.0770	20.0779	20.0751	20.0720	20.0698	20.0675	(88)	
util rest of house	0.9967	0.9925	0.9817	0.9480	0.8539	0.6571	0.4508	0.4906	0.7635	0.9556	0.9924	0.9976	(89)	
MIT 2	18.6644	18.8743	19.1853	19.5675	19.8814	20.0445	20.0737	20.0727	20.0004	19.6165	19.0662	18.6197	(90)	
Living area fraction	19.2858	19.4637	19.7279	20.0540	20.3297	20.4827	20.5162	20.5139	20.4377	20.0942	19.6249	19.2468	(91)	
MIT	19.2858	19.4637	19.7279	20.0540	20.3297	20.4827	20.5162	20.5139	20.4377	20.0942	19.6249	19.2468	(92)	
Temperature adjustment	19.1358	19.3137	19.5779	19.9040	20.1797	20.3327	20.3662	20.3639	20.2877	19.9442	19.4749	19.0968	(93)	
adjusted MIT	19.1358	19.3137	19.5779	19.9040	20.1797	20.3327	20.3662	20.3639	20.2877	19.9442	19.4749	19.0968	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	437.7464	496.7327	534.1230	544.6085	504.7608	385.7867	264.1548	276.4463	396.0474	447.0857	426.0290	414.9720	(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	1068.7702	1036.8338	939.3848	785.0387	604.1795	406.0156	266.7437	280.4285	439.2533	665.7779	883.9992	1067.0264	(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	469.4817	362.9479	301.5148	173.1097	73.9675	0.0000	0.0000	0.0000	0.0000	162.7070	329.7385	485.1285	(98)	
Space heating												2358.5957	(98)	
Space heating per m2												33.5552	(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													2620.6619 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.4817	362.9479	301.5148	173.1097	73.9675	0.0000	0.0000	0.0000	0.0000	162.7070	329.7385	485.1285	(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)	521.6464	403.2755	335.0164	192.3442	82.1861	0.0000	0.0000	0.0000	0.0000	180.7855	366.3762	539.0316	(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	89.1185	89.0338	88.8723	88.5329	87.8709	86.7000	86.7000	86.7000	86.7000	88.4519	88.9483	89.1572	(216)
Fuel for water heating, kWh/month	184.9664	162.5849	169.6726	150.7634	147.4512	131.4980	124.3708	139.1364	139.7378	156.5897	167.0537	179.8009	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2620.6619 (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)													347.9479 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
Total delivered energy for all uses													4897.2355 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2620.6619	0.2160	566.0630 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1853.6258	0.2160	400.3832 (264)
Space and water heating			966.4461 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	347.9479	0.5190	180.5850 (268)
Energy saving/generation technologies			
PV Unit	-436.8881	0.5190	-226.7449 (269)
Total CO ₂ , kg/year			959.2112 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6500 (273)

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

DER			13.6500 ZC1
Total Floor Area		TFA	70.2900
Assumed number of occupants		N	2.2531
CO ₂ emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO ₂ emissions from appliances, equation (L14)			16.6901 ZC2
CO ₂ emissions from cooking, equation (L16)			2.4623 ZC3
Total CO ₂ emissions			32.8024 ZC4
Residual CO ₂ emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO ₂ emissions			32.8024 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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) = 0.2032 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4532 (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) =				0.3853 (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												
	0.4912	0.4816	0.4719	0.4238	0.4141	0.3660	0.3660	0.3564	0.3853	0.4141	0.4334	0.4527 (22b)
Effective ac	0.6206	0.6160	0.6114	0.5898	0.5858	0.5670	0.5670	0.5635	0.5742	0.5858	0.5939	0.6025 (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)			8.2200	1.3258	10.8977		(27)
APT Jet Floor Lo			70.2900	0.1300	9.1377		(28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.1800	7.0236		(29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.1800	2.8170		(29a)
Total net area of external elements Aum(A, m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.9960	(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)							9.6571 (36)
Total fabric heat loss						(33) + (36) =	41.6531 (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	30.2319	30.0037	29.7800	28.7295	28.5329	27.6179	27.6179	27.4484	27.9703	28.5329	28.9305	29.3462 (38)
Heat transfer coeff	71.8850	71.6568	71.4331	70.3826	70.1860	69.2710	69.2710	69.1016	69.6235	70.1860	70.5837	70.9994 (39)
Average = Sum(39)m / 12 =												70.3816 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0227	1.0194	1.0163	1.0013	0.9985	0.9855	0.9855	0.9831	0.9905	0.9985	1.0042	1.0101 (40)
HLP (average)												1.0013 (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	19.7023	17.4994	14.2314	10.7741	8.0538	6.7993	7.3469	9.5498	12.8177	16.2751	18.9954	20.2498 (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	357.9381	355.1627	341.9096	321.1106	300.1639	280.0044	267.3724	273.8163	284.8852	305.8846	329.8028	347.7330 (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	3.2400				36.7938		0.6300		0.7000		0.7700		36.4327 (77)
Southwest	4.9800				36.7938		0.6300		0.7000		0.7700		55.9985 (79)
Solar gains	92.4312	157.4446	215.4225	266.9189	298.9715	296.8094	286.1560	262.2434	233.2570	174.0098	110.7113	79.1019	(83)
Total gains	450.3694	512.6072	557.3322	588.0295	599.1353	576.8138	553.5283	536.0597	518.1422	479.8944	440.5141	426.8348	(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	67.9036	68.1198	68.3331	69.3531	69.5473	70.4660	70.4660	70.6388	70.1093	69.5473	69.1555	68.7506
alpha	5.5269	5.5413	5.5555	5.6235	5.6365	5.6977	5.6977	5.7093	5.6740	5.6365	5.6104	5.5834
util living area	0.9972	0.9938	0.9850	0.9578	0.8832	0.7207	0.5422	0.5804	0.8162	0.9657	0.9938	0.9979 (86)
MIT	19.9723	20.1182	20.3333	20.6039	20.8302	20.9619	20.9936	20.9907	20.9209	20.6338	20.2542	19.9486 (87)
Th 2	20.0645	20.0672	20.0698	20.0822	20.0846	20.0954	20.0954	20.0974	20.0912	20.0846	20.0799	20.0749 (88)
util rest of house	0.9963	0.9917	0.9798	0.9426	0.8416	0.6376	0.4352	0.4730	0.7451	0.9502	0.9914	0.9972 (89)
MIT 2	18.6931	18.9076	19.2209	19.6140	19.9150	20.0694	20.0929	20.0935	20.0286	19.6626	19.1160	18.6663 (90)
Living area fraction									fLA = Living area / (4) =			0.4821 (91)
MIT	19.3098	19.4913	19.7572	20.0913	20.3563	20.4997	20.5272	20.5261	20.4588	20.1308	19.6648	19.2846 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3098	19.4913	19.7572	20.0913	20.3563	20.4997	20.5272	20.5261	20.4588	20.1308	19.6648	19.2846 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9953	0.9901	0.9777	0.9428	0.8552	0.6763	0.4871	0.5250	0.7761	0.9511	0.9900	0.9965 (94)
Ext temp.	4.2600	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	18.4305	402.1148	456.4463	436.0977	425.3221 (95)
Heat loss rate W	1078.9826	1045.5644	947.0048	787.6734	607.5487	408.6785	272.0402	285.1184	442.7238	668.9319	886.8698	1070.9958 (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	469.2543	361.5608	299.1761	167.9768	70.8161	0.0000	0.0000	0.0000	0.0000	158.0893	324.5559	480.3813 (98)
Space heating per m2										(98) / (4) =		33.1741 (99)

8c. Space cooling requirement

Not applicable

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

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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													2496.5851 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.2543	361.5608	299.1761	167.9768	70.8161	0.0000	0.0000	0.0000	0.0000	158.0893	324.5559	480.3813	(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)	502.4136	387.1100	320.3170	179.8467	75.8202	0.0000	0.0000	0.0000	0.0000	169.2605	347.4903	514.3269	(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	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	87.2120	86.9321	86.3936	85.2543	83.2836	80.3000	80.3000	80.3000	80.3000	84.9822	86.6060	87.3141	(216)
Fuel for water heating, kWh/month	220.4386	193.1788	202.2429	181.7764	180.1561	164.5669	157.6676	175.7625	177.7036	191.2021	200.2777	215.0103	(217)
Water heating fuel used												2259.9836	(219)
Annual totals kWh/year													
Space heating fuel - main system												2496.5851	(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)												347.9479	(232)
Total delivered energy for all uses												5179.5167	(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	2496.5851	0.2160	539.2624	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2259.9836	0.2160	488.1565	(264)
Space and water heating			1027.4189	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	347.9479	0.5190	180.5850	(268)
Total CO2, kg/m2/year			1246.9288	(272)
Emissions per m2 for space and water heating			14.6169	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5691	(272b)
Emissions per m2 for pumps and fans			0.5538	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6169 * 1.00) + 2.5691 + 0.5538, rounded to 2 d.p.			17.7400	(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 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.2032 (8)
Pressure test					Yes
Measured/design AP50					3.4700
Infiltration rate					0.3767 (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) = 0.3202 (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	0.4083	0.4003	0.3923	0.3523	0.3442	0.3042	0.3042	0.2962	0.3202	0.3442	0.3603	0.3763 (22b)
	0.5834	0.5801	0.5769	0.5620	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708 (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)			8.2200	1.3258	10.8977		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT Jet Floor Lo			70.2900	0.1600	11.2464	75.0000	5271.7500 (28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.2600	10.1452	60.0000	2341.2000 (29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.2400	3.7560	110.0000	1721.5000 (29a)
Total net area of external elements Aum (m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.5505		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			70.2900			30.0000	2108.7000 (32b)
GF - Timber			53.1700			9.0000	478.5300 (32c)
GF - Metal Stud			48.2600			20.0000	965.2000 (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) = 14731.5800 (34)
209.5829 (35)
7.4025 (36)
(33) + (36) = 44.9530 (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	28.4156	28.2579	28.1034	27.3775	27.2417	26.6095	26.6095	26.4925	26.8531	27.2417	27.5165	27.8037 (38)
Heat transfer coeff	73.3686	73.2110	73.0564	72.3306	72.1948	71.5626	71.5626	71.4455	71.8061	72.1948	72.4695	72.7567 (39)
Average = Sum(39)m / 12 =												72.3299 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0438	1.0416	1.0394	1.0290	1.0271	1.0181	1.0181	1.0164	1.0216	1.0271	1.0310	1.0351 (40)
HLP (average)												1.0290 (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)												
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	19.7023	17.4994	14.2314	10.7741	8.0538	6.7993	7.3469	9.5498	12.8177	16.2751	18.9954	20.2498	(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	315.3392	313.8958	302.7620	284.6281	265.6224	247.9508	236.9229	240.7108	250.4487	268.7107	289.6154	305.8623	(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
Southeast					3.2400	36.7938		0.6200		0.7000	0.7700	35.8544
Southwest					4.9800	36.7938		0.6200		0.7000	0.7700	55.1096 (77)
Solar gains	90.9641	154.9454	212.0031	262.6821	294.2259	292.0982	281.6138	258.0808	229.5545	171.2477	108.9540	77.8463 (83)
Total gains	406.3033	468.8412	514.7651	547.3102	559.8483	540.0490	518.5367	498.7916	480.0032	439.9584	398.5694	383.7085 (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	55.7746	55.8947	56.0129	56.5750	56.6815	57.1822	57.1822	57.2759	56.9883	56.6815	56.4666	56.2437		
alpha	4.7183	4.7263	4.7342	4.7717	4.7788	4.8121	4.8121	4.8184	4.7992	4.7788	4.7644	4.7496		
util living area	0.9963	0.9922	0.9829	0.9573	0.8927	0.7535	0.5844	0.6259	0.8404	0.9663	0.9927	0.9972	(86)	
MIT	19.7147	19.8817	20.1322	20.4479	20.7302	20.9195	20.9813	20.9740	20.8551	20.4879	20.0391	19.6821	(87)	
Th 2	20.0470	20.0488	20.0507	20.0592	20.0608	20.0683	20.0683	20.0697	20.0654	20.0608	20.0576	20.0542	(88)	
util rest of house	0.9953	0.9901	0.9778	0.9436	0.8565	0.6746	0.4714	0.5141	0.7773	0.9528	0.9902	0.9964	(89)	
MIT 2	18.8705	19.0381	19.2875	19.6023	19.8657	20.0257	20.0623	20.0606	19.9785	19.6460	19.2024	18.8438	(90)	
Living area fraction	19.2775	19.4448	19.6948	20.0100	20.2825	20.4566	20.5054	20.5010	20.4011	20.0519	19.6058	19.2480	(91)	
MIT	19.2775	19.4448	19.6948	20.0100	20.2825	20.4566	20.5054	20.5010	20.4011	20.0519	19.6058	19.2480	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2775	19.4448	19.6948	20.0100	20.2825	20.4566	20.5054	20.5010	20.4011	20.0519	19.6058	19.2480	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	403.9533	463.3562	502.1116	515.9708	484.8642	383.1702	272.7121	283.2450	385.0738	419.1197	394.0725	381.9909	(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	1098.8803	1064.8392	963.9650	803.5944	619.6132	419.1168	279.4804	292.9990	452.4588	682.3791	906.2905	1094.8403	(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	517.0256	404.1965	343.6189	207.0890	100.2533	0.0000	0.0000	0.0000	0.0000	195.8650	368.7969	530.3600	(98)
Space heating												2667.2052	(98)
Space heating per m2												37.9457	(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	672.6882	529.5631	542.9858	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8526	0.9168	0.9014	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	573.5595	485.4978	489.4526	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	715.8517	689.0883	667.6626	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	102.4504	151.4714	132.5882	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												386.5099 (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	25.6126	37.8678	33.1471	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												96.6275 (107)
Space cooling per m2												1.3747 (108)
Energy for space heating												37.9457 (99)
Energy for space cooling												1.3747 (108)
Total												39.3204 (109)
Dwelling Fabric Energy Efficiency (DFEE)												39.3 (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 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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) = 0.2032 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4532 (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) =	0.3853 (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	0.4912	0.4816	0.4719	0.4238	0.4141	0.3660	0.3660	0.3564	0.3853	0.4141	0.4334	0.4527 (22b)
	0.6206	0.6160	0.6114	0.5898	0.5858	0.5670	0.5670	0.5635	0.5742	0.5858	0.5939	0.6025 (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)			8.2200	1.3258	10.8977		(27)
APT Jet Floor Lo			70.2900	0.1300	9.1377		(28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.1800	7.0236		(29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.1800	2.8170		(29a)
Total net area of external elements Aum(A, m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.9960	(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)							9.6571 (36)
Total fabric heat loss						(33) + (36) =	41.6531 (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	30.2319	30.0037	29.7800	28.7295	28.5329	27.6179	27.6179	27.4484	27.9703	28.5329	28.9305	29.3462 (38)
Heat transfer coeff	71.8850	71.6568	71.4331	70.3826	70.1860	69.2710	69.2710	69.1016	69.6235	70.1860	70.5837	70.9994 (39)
Average = Sum(39)m / 12 =												70.3816 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0227	1.0194	1.0163	1.0013	0.9985	0.9855	0.9855	0.9831	0.9905	0.9985	1.0042	1.0101 (40)
HLP (average)												1.0013 (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	19.7023	17.4994	14.2314	10.7741	8.0538	6.7993	7.3469	9.5498	12.8177	16.2751	18.9954	20.2498	(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	315.3392	313.8958	302.7620	284.6281	265.6224	247.9508	236.9229	240.7108	250.4487	268.7107	289.6154	305.8623	(73)

6. Solar gains

[Jan]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		or Table 6b		or Table 6c		factor		
					W/m2						Table 6d		
Southeast	3.2400				36.7938		0.6300		0.7000		0.7700		36.4327
Southwest	4.9800				36.7938		0.6300		0.7000		0.7700		55.9985 (79)
Solar gains	92.4312	157.4446	215.4225	266.9189	298.9715	296.8094	286.1560	262.2434	233.2570	174.0098	110.7113	79.1019	(83)
Total gains	407.7705	471.3404	518.1845	551.5470	564.5939	544.7603	523.0788	502.9542	483.7057	442.7205	400.3267	384.9641	(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	67.9036	68.1198	68.3331	69.3531	69.5473	70.4660	70.4660	70.6388	70.1093	69.5473	69.1555	68.7506	
alpha	5.5269	5.5413	5.5555	5.6235	5.6365	5.6977	5.6977	5.7093	5.6740	5.6365	5.6104	5.5834	
util living area	0.9983	0.9958	0.9892	0.9676	0.9036	0.7512	0.5712	0.6142	0.8472	0.9756	0.9961	0.9988	(86)
MIT	19.9148	20.0634	20.2835	20.5633	20.8041	20.9530	20.9917	20.9877	20.9029	20.5905	20.2007	19.8918	(87)
Th 2	20.0645	20.0672	20.0698	20.0822	20.0846	20.0954	20.0954	20.0974	20.0912	20.0846	20.0799	20.0749	(88)
util rest of house	0.9977	0.9944	0.9854	0.9552	0.8663	0.6688	0.4598	0.5027	0.7808	0.9640	0.9946	0.9984	(89)
MIT 2	19.0709	19.2212	19.4416	19.7249	19.9481	20.0729	20.0932	20.0938	20.0369	19.7563	19.3688	19.0565	(90)
Living area fraction										fLA = Living area / (4) =		0.4821	(91)
MIT	19.4778	19.6273	19.8475	20.1292	20.3608	20.4972	20.5264	20.5248	20.4544	20.1585	19.7699	19.4592	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4778	19.6273	19.8475	20.1292	20.3608	20.4972	20.5264	20.5248	20.4544	20.1585	19.7699	19.4592	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	406.6600	468.3283	510.0413	527.2653	496.1755	385.3149	268.8019	280.0940	391.6874	427.2783	397.8810	384.1945	(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	1091.0534	1055.3089	953.4562	790.3369	607.8661	408.5084	271.9862	285.0287	442.4175	670.8744	894.2888	1083.3967	(96)
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	(97a)
Space heating kWh	509.1887	394.4510	329.9007	189.4116	83.0978	0.0000	0.0000	0.0000	0.0000	181.2355	357.4136	520.2064	(98)
Space heating												2564.9052	(98)
Space heating per m2												36.4903	(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	651.1475	512.6055	525.1719	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8906	0.9466	0.9341	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	579.9002	485.2152	490.5466	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	721.3584	694.3973	672.5280	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	101.8499	155.6315	135.3941	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												392.8756	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	25.4625	38.9079	33.8485	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.2189 (107)
Space cooling per m2												1.3973 (108)
Energy for space heating												36.4903 (99)
Energy for space cooling												1.3973 (108)
Total												37.8877 (109)
Target Fabric Energy Efficiency (TFEE)												43.6 (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 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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) = 0.1355 (8)
Measured/design AP50					Yes
Infiltration rate					3.4700
Number of sides sheltered					0.3090 (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) =				0.2626 (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												
	0.2758	0.2561	0.2626	0.2495	0.2495	0.2429	0.2364	0.2298	0.2232	0.2429	0.2298	0.2429 (22b)
Effective ac	0.5380	0.5328	0.5345	0.5311	0.5311	0.5295	0.5279	0.5264	0.5249	0.5295	0.5264	0.5295 (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)			8.2200	1.3258	10.8977		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT Jet Floor Lo			70.2900	0.1600	11.2464	75.0000	5271.7500 (28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.2600	10.1452	60.0000	2341.2000 (29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.2400	3.7560	110.0000	1721.5000 (29a)
Total net area of external elements Aum (m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				37.5505		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
GF - Timber			53.1700			9.0000	478.5300 (32c)
GF - Metal Stud			48.2600			20.0000	965.2000 (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) = 17543.1800 (34)
249.5829 (35)
7.4025 (36)
(33) + (36) = 44.9530 (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	26.2078	25.9526	26.0356	25.8718	25.8718	25.7930	25.7164	25.6418	25.5693	25.7930	25.6418	25.7930 (38)
Heat transfer coeff	71.1608	70.9057	70.9886	70.8248	70.8248	70.7460	70.6694	70.5948	70.5224	70.7460	70.5948	70.7460 (39)
Average = Sum(39)m / 12 =												70.7770 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0124	1.0088	1.0099	1.0076	1.0076	1.0065	1.0054	1.0043	1.0033	1.0065	1.0043	1.0065 (40)
HLP (average)												1.0069 (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)												
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)

[illegible]

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	49.2556	43.7484	35.5786	26.9353	20.1344	16.9983	18.3673	23.8745	32.0443	40.6877	47.4885	50.6246	(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	514.8281	510.3472	490.2236	459.3882	428.0934	400.1937	384.0691	392.2248	410.1554	441.1912	475.4679	501.1355	(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	
Southeast				3.2400	45.1778	0.6200		0.7000		0.7700	44.0244 (77)	
Southwest				4.9800	45.1778	0.6200		0.7000		0.7700	67.6671 (79)	
Solar gains	111.6915	161.8642	223.6942	280.5618	300.6527	325.2652	310.6982	290.1255	256.3246	193.0730	133.3173	93.9880 (83)
Total gains	626.5196	672.2114	713.9178	739.9500	728.7461	725.4589	694.7673	682.3503	666.4800	634.2642	608.7852	595.1235 (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	68.4802	68.7266	68.6463	68.8051	68.8051	68.8817	68.9564	69.0292	69.1001	68.8817	69.0292	68.8817
alpha	5.5653	5.5818	5.5764	5.5870	5.5870	5.5921	5.5971	5.6019	5.6067	5.5921	5.6019	5.5921
util living area	0.9839	0.9754	0.9498	0.8858	0.7571	0.5464	0.3953	0.4020	0.6421	0.8757	0.9649	0.9868 (86)
MIT	20.2737	20.3717	20.5664	20.7815	20.9309	20.9906	20.9987	20.9986	20.9775	20.8300	20.5363	20.2517 (87)
Th 2	20.0730	20.0760	20.0751	20.0770	20.0770	20.0779	20.0788	20.0797	20.0806	20.0779	20.0797	20.0779 (88)
util rest of house	0.9791	0.9682	0.9350	0.8534	0.6959	0.4624	0.3027	0.3080	0.5587	0.8341	0.9530	0.9827 (89)
MIT 2	19.1358	19.2778	19.5509	19.8403	20.0176	20.0728	20.0785	20.0793	20.0662	19.9072	19.5168	19.1083 (90)
Living area fraction	19.6844	19.8052	20.0405	20.2941	20.4579	20.5153	20.5222	20.5225	20.5056	20.3521	20.0083	19.4821 (91)
MIT	19.6844	19.8052	20.0405	20.2941	20.4579	20.5153	20.5222	20.5225	20.5056	20.3521	20.0083	19.6596 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5344	19.6552	19.8905	20.1441	20.3079	20.3653	20.3722	20.3725	20.3556	20.2021	19.8583	19.5096 (93)

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FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.2900 (1b)	x 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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) = 0.1355 (8)
Measured/design AP50					Yes
Infiltration rate					3.4700
Number of sides sheltered					0.3090 (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) =				0.2626 (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	0.3349	0.3283	0.3217	0.2889	0.2823	0.2495	0.2495	0.2429	0.2626	0.2823	0.2955	0.3086 (22b)
Effective ac	0.5561	0.5539	0.5518	0.5417	0.5399	0.5311	0.5311	0.5295	0.5345	0.5399	0.5437	0.5476 (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)			8.2200	1.3258	10.8977		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT Jet Floor Lo			70.2900	0.1600	11.2464	75.0000	5271.7500 (28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.2600	10.1452	60.0000	2341.2000 (29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.2400	3.7560	110.0000	1721.5000 (29a)
Total net area of external elements Aum (m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.5505		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
GF - Timber			53.1700			9.0000	478.5300 (32c)
GF - Metal Stud			48.2600			20.0000	965.2000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17543.1800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		249.5829 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.4025 (36)
Total fabric heat loss	(33) + (36) =	44.9530 (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	27.0867	26.9806	26.8767	26.3884	26.2970	25.8718	25.8718	25.7930	26.0356	26.2970	26.4818	26.6751 (38)
Heat transfer coeff	72.0397	71.9337	71.8297	71.3414	71.2501	70.8248	70.8248	70.7460	70.9886	71.2501	71.4349	71.6281 (39)
Average = Sum(39)m / 12 =												71.3410 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0249	1.0234	1.0219	1.0150	1.0137	1.0076	1.0076	1.0065	1.0099	1.0137	1.0163	1.0190 (40)
HLP (average)												1.0150 (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)

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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	49.2556	43.7484	35.5786	26.9353	20.1344	16.9983	18.3673	23.8745	32.0443	40.6877	47.4885	50.6246	(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	514.8281	510.3472	490.2236	459.3882	428.0934	400.1937	384.0691	392.2248	410.1554	441.1912	475.4679	501.1355	(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					3.2400	36.7938	0.6200	0.7000				0.7700	35.8544
Southwest					4.9800	36.7938	0.6200	0.7000				0.7700	55.1096 (77)
Solar gains	90.9641	154.9454	212.0031	262.6821	294.2259	292.0982	281.6138	258.0808	229.5545	171.2477	108.9540	77.8463	(83)
Total gains	605.7921	665.2927	702.2267	722.0703	722.3193	692.2919	665.6829	650.3055	639.7100	612.4389	584.4219	578.9817	(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	67.6447	67.7444	67.8425	68.3068	68.3944	68.8051	68.8051	68.8817	68.6463	68.3944	68.2174	68.0334		
alpha	5.5096	5.5163	5.5228	5.5538	5.5596	5.5870	5.5870	5.5921	5.5764	5.5596	5.5478	5.5356		
util living area	0.9885	0.9795	0.9600	0.9120	0.8087	0.6321	0.4645	0.4952	0.7168	0.9157	0.9776	0.9909	(86)	
MIT	20.1728	20.3063	20.4967	20.7193	20.8924	20.9785	20.9967	20.9953	20.9570	20.7528	20.4218	20.1370	(87)	
Th 2	20.0626	20.0639	20.0651	20.0709	20.0720	20.0770	20.0770	20.0779	20.0751	20.0720	20.0698	20.0675	(88)	
util rest of house	0.9851	0.9734	0.9481	0.8859	0.7564	0.5504	0.3690	0.3987	0.6388	0.8855	0.9699	0.9881	(89)	
MIT 2	18.9823	19.1749	19.4460	19.7550	19.9712	20.0632	20.0758	20.0761	20.0439	19.8056	19.3474	18.9344	(90)	
Living area fraction	19.5563	19.7204	19.9526	20.2199	20.4153	20.5045	20.5198	20.5193	20.4842	20.2623	19.8654	19.5142	(92)	
Temperature adjustment	19.4063	19.5704	19.8026	20.0699	20.2653	20.3545	20.3698	20.3693	20.3342	20.1123	19.7154	19.3642	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9820	0.9695	0.9441	0.8859	0.7681	0.5758	0.3996	0.4296	0.6618	0.8870	0.9662	0.9854	(94)
Ext temp.	594.9012	644.9932	662.9935	639.6846	554.8458	398.6035	266.0223	279.3470	423.3770	543.2442	564.6777	570.5370	(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	1088.2505	1055.2983	955.5208	796.8774	610.2810	407.5623	266.9955	280.8097	442.5542	677.7502	901.1798	1086.1834	(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	367.0519	275.7250	217.6403	113.1788	41.2438	0.0000	0.0000	0.0000	0.0000	100.0725	242.2815	383.6409	(98)
												1740.8347	(98)
												24.7665	(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													1934.2608 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	367.0519	275.7250	217.6403	113.1788	41.2438	0.0000	0.0000	0.0000	0.0000	100.0725	242.2815	383.6409	(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)	407.8354	306.3612	241.8226	125.7542	45.8264	0.0000	0.0000	0.0000	0.0000	111.1916	269.2017	426.2677	(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	88.9507	88.8359	88.6195	88.1837	87.4745	86.7000	86.7000	86.7000	86.7000	88.0543	88.7163	89.0016	(216)
Fuel for water heating, kWh/month	185.3152	162.9469	170.1566	151.3606	148.1195	131.4980	124.3708	139.1364	139.7378	157.2969	167.4905	180.1151	(219)
Water heating fuel used													1857.5442 (219)
Annual totals kWh/year													
Space heating fuel - main system													1934.2608 (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)													347.9479 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4214.7528 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1934.2608	3.4800	67.3123 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1857.5442	3.4800	64.6425 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	347.9479	13.1900	45.8943 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			307.7416 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1211 (257)
SAP value		84.3607
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	1934.2608	0.2160	417.8003 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1857.5442	0.2160	401.2295 (264)
Space and water heating			819.0299 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	347.9479	0.5190	180.5850 (268)
Energy saving/generation technologies			
PV Unit	-436.8881	0.5190	-226.7449 (269)
Total kg/year			811.7949 (272)
CO2 emissions per m2			11.5500 (273)
EI value			90.5646
EI rating			91 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, 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	$3.48 / 0.8789 = 3.960$, stars = 4
Water heating environmental impact	$0.216 / 0.8789 = 0.2458$, 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 2.1000 (2b)	= 147.6090 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 147.6090 (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) = 0.1355 (8)
Measured/design AP50					Yes
Infiltration rate					3.4700
Number of sides sheltered					0.3090 (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) =				0.2626 (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												
	0.2758	0.2561	0.2626	0.2495	0.2495	0.2429	0.2364	0.2298	0.2232	0.2429	0.2298	0.2429 (22b)
Effective ac	0.5380	0.5328	0.5345	0.5311	0.5311	0.5295	0.5279	0.5264	0.5249	0.5295	0.5264	0.5295 (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)			8.2200	1.3258	10.8977		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT Jet Floor Lo			70.2900	0.1600	11.2464	75.0000	5271.7500 (28a)
APT 100mm Knauf Supafil	47.2400	8.2200	39.0200	0.2600	10.1452	60.0000	2341.2000 (29a)
APT Wall to Stairwell	17.7700	2.1200	15.6500	0.2400	3.7560	110.0000	1721.5000 (29a)
Total net area of external elements Aum (m ²)			135.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.5505		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
GF - Timber			53.1700			9.0000	478.5300 (32c)
GF - Metal Stud			48.2600			20.0000	965.2000 (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) = 17543.1800 (34)
249.5829 (35)
7.4025 (36)
(33) + (36) = 44.9530 (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	26.2078	25.9526	26.0356	25.8718	25.8718	25.7930	25.7164	25.6418	25.5693	25.7930	25.6418	25.7930 (38)
Heat transfer coeff	71.1608	70.9057	70.9886	70.8248	70.8248	70.7460	70.6694	70.5948	70.5224	70.7460	70.5948	70.7460 (39)
Average = Sum(39)m / 12 =												70.7770 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0124	1.0088	1.0099	1.0076	1.0076	1.0065	1.0054	1.0043	1.0033	1.0065	1.0043	1.0065 (40)
HLP (average)												1.0069 (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	49.2556	43.7484	35.5786	26.9353	20.1344	16.9983	18.3673	23.8745	32.0443	40.6877	47.4885	50.6246	(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	514.8281	510.3472	490.2236	459.3882	428.0934	400.1937	384.0691	392.2248	410.1554	441.1912	475.4679	501.1355	(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					3.2400	45.1778	0.6200	0.7000			0.7700	44.0244 (77)
Southwest					4.9800	45.1778	0.6200	0.7000			0.7700	67.6671 (79)
Solar gains	111.6915	161.8642	223.6942	280.5618	300.6527	325.2652	310.6982	290.1255	256.3246	193.0730	133.3173	93.9880 (83)
Total gains	626.5196	672.2114	713.9178	739.9500	728.7461	725.4589	694.7673	682.3503	666.4800	634.2642	608.7852	595.1235 (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	68.4802	68.7266	68.6463	68.8051	68.8051	68.8817	68.9564	69.0292	69.1001	68.8817	69.0292	68.8817		
alpha	5.5653	5.5818	5.5764	5.5870	5.5870	5.5921	5.5971	5.6019	5.6067	5.5921	5.6019	5.5921		
util living area	0.9839	0.9754	0.9498	0.8858	0.7571	0.5464	0.3953	0.4020	0.6421	0.8757	0.9649	0.9868	(86)	
MIT	20.2737	20.3717	20.5664	20.7815	20.9309	20.9906	20.9987	20.9986	20.9775	20.8300	20.5363	20.2517	(87)	
Th 2	20.0730	20.0760	20.0751	20.0770	20.0770	20.0779	20.0788	20.0797	20.0806	20.0779	20.0797	20.0779	(88)	
util rest of house	0.9791	0.9682	0.9350	0.8534	0.6959	0.4624	0.3027	0.3080	0.5587	0.8341	0.9530	0.9827	(89)	
MIT 2	19.1358	19.2778	19.5509	19.8403	20.0176	20.0728	20.0785	20.0793	20.0662	19.9072	19.5168	19.1083	(90)	
Living area fraction	19.6844	19.8052	20.0405	20.2941	20.4579	20.5153	20.5222	20.5225	20.5056	20.3521	20.0083	19.6596	(92)	
Temperature adjustment	19.5344	19.6552	19.8905	20.1441	20.3079	20.3653	20.3722	20.3725	20.3556	20.2021	19.8583	19.5096	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	611.2158	648.1135	665.0560	633.3774	518.9268	354.8047	230.9143	230.6703	389.5305	533.0364	578.0386	582.9258	(94)
Ext temp.	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)
Heat loss rate W	1041.3987	1017.8644	915.0819	753.8650	552.9963	358.3510	231.2413	231.0248	398.8466	622.7158	844.1976	1026.4965	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	320.0560	248.4726	186.0193	86.7510	25.3478	0.0000	0.0000	0.0000	0.0000	66.7215	191.6344	330.0166	(98)
Space heating												1455.0192	(98)
Space heating per m ²										(98) / (4) =		20.7002	(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													1616.6880 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	320.0560	248.4726	186.0193	86.7510	25.3478	0.0000	0.0000	0.0000	0.0000	66.7215	191.6344	330.0166	(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)	355.6178	276.0806	206.6881	96.3900	28.1642	0.0000	0.0000	0.0000	0.0000	74.1350	212.9271	366.6852	(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	88.8503	88.7564	88.4920	87.9706	87.2233	86.7000	86.7000	86.7000	86.7000	87.7460	88.5284	88.8938	(216)
Fuel for water heating, kWh/month	185.5246	163.0930	170.4017	151.7271	148.5460	131.4980	124.3708	139.1364	139.7378	157.8495	167.8461	180.3336	(219)
Water heating fuel used												1860.0645	(219)
Annual totals kWh/year													
Space heating fuel - main system												1616.6880	(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)												347.9479	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3899.7004	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1616.6880	3.9200	63.3742 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1860.0645	3.9200	72.9145 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	347.9479	16.9600	59.0120 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			296.0207 (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	1616.6880	0.2160	349.2046 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1860.0645	0.2160	401.7739 (264)
Space and water heating			750.9785 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	347.9479	0.5190	180.5850 (268)
Energy saving/generation technologies			
PV Unit	-436.8881	0.5190	-226.7449 (269)
Total kg/year			743.7436 (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	1616.6880	1.2200	1972.3594 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1860.0645	1.2200	2269.2787 (264)
Space and water heating			4241.6381 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	347.9479	3.0700	1068.2001 (268)
Energy saving/generation technologies			
PV Unit	-436.8881	3.0700	-1341.2464 (269)
Primary energy kWh/year			4198.8418 (272)
Primary energy kWh/m2/year			59.7360 (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 91

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

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

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 91

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

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£72	£72	£0
Mains gas	£224	£224	£0
Space heating	£164	£164	£0
Water heating	£73	£73	£0
Lighting	£59	£59	£0
Total cost of fuels	£296	£296	£0
Total cost of uses	£296	£296	£0
Delivered energy	55 kWh/m²	55 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	60 kWh/m²	60 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	249.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	2.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	97.42 (P1)
Transmission heat loss coefficient	44.95 (37)
Summer heat loss coefficient	142.37 (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	3.2400	127.3119	0.6200	0.7000	0.9000	145.0069
South West	4.9800	127.3119	0.6200	0.7000	0.9000	222.8809
total:						367.8878

Solar gains	Jun	Jul	Aug	
	392	368	342	(P3)
Internal gains	397	381	389	
Total summer gains	789	749	732	(P5)
Summer gain/loss ratio	5.54	5.26	5.14	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 249.6)	0.25	0.25	0.25	
Threshold temperature	21.19	22.81	22.69	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			