

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-197			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	1FF - Semi (As)		
Property	93, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	86 B	DER	11.01	TER	15.40
Environmental	93 A	% DER<TER	28.50		
CO ₂ Emissions (t/year)	0.59	DFEE	28.30	TFEE	31.65
General Requirements Compliance	Pass	% DFEE<TFEE	10.61		
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

Mid-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) 15.40 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.01 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)31.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)28.3 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	(no floor)		
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:	3.37 (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
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6 Controls

Space heating controls:	Time and temperature zone control	OK
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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
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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
Air permeability	3.4 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					3.3700
Number of sides sheltered					0.3040 (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) =				0.2584 (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												
	0.3295	0.3230	0.3165	0.2842	0.2778	0.2455	0.2455	0.2390	0.2584	0.2778	0.2907	0.3036 (22b)
Effective ac	0.5543	0.5522	0.5501	0.5404	0.5386	0.5301	0.5301	0.5286	0.5334	0.5386	0.5423	0.5461 (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)			5.7100	1.3258	7.5701		(27)
French Door (Uw = 1.40)			2.4300	1.3258	3.2216		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.2600	9.6668	60.0000	2230.8000 (29a)
APT Wall to Stairwell	17.8500		17.8500	0.2400	4.2840	110.0000	1963.5000 (29a)
Total net area of external elements Aum(A, m ²)			65.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2477		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
1F - Timber			56.1500			9.0000	505.3500 (32c)
1F - Metal			43.7600			20.0000	875.2000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17268.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.6815 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4767 (36)
Total fabric heat loss							(33) + (36) = 31.7244 (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	26.9990	26.8964	26.7957	26.3231	26.2347	25.8231	25.8231	25.7469	25.9816	26.2347	26.4136	26.6006 (38)
Heat transfer coeff	58.7234	58.6207	58.5201	58.0475	57.9591	57.5475	57.5475	57.4712	57.7060	57.9591	58.1380	58.3250 (39)
Average = Sum(39)m / 12 =												58.0471 (39)
HLP	0.8354	0.8340	0.8326	0.8258	0.8246	0.8187	0.8187	0.8176	0.8210	0.8246	0.8271	0.8298 (40)
HLP (average)												0.8258 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												

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	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)
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)
								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	160.3054 (64)
								Total per year (kWh/year) = Sum(64)m =				1634.4541 (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			
				1.2600	36.7938	0.6200	0.7000	0.7700	13.9434 (77)			
				4.4500	36.7938	0.6200	0.7000	0.7700	49.2445 (77)			
				2.4300	36.7938	0.6200	0.7000	0.7700	26.8908 (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, 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	81.6869	81.8300	81.9706	82.6380	82.7641	83.3561	83.3561	83.4666	83.1271	82.7641	82.5094	82.2449
alpha	6.4458	6.4553	6.4647	6.5092	6.5176	6.5571	6.5571	6.5644	6.5418	6.5176	6.5006	6.4830
util living area	0.9969	0.9921	0.9790	0.9371	0.8293	0.6396	0.4672	0.5031	0.7465	0.9498	0.9923	0.9978 (86)
MIT	20.2188	20.3559	20.5451	20.7628	20.9219	20.9881	20.9986	20.9978	20.9691	20.7711	20.4493	20.1863 (87)
Th 2	20.2227	20.2240	20.2252	20.2310	20.2321	20.2371	20.2371	20.2381	20.2352	20.2321	20.2299	20.2276 (88)
util rest of house	0.9959	0.9898	0.9725	0.9182	0.7847	0.5695	0.3872	0.4213	0.6793	0.9306	0.9895	0.9971 (89)
MIT 2	19.1738	19.3740	19.6471	19.9548	20.1566	20.2292	20.2366	20.2371	20.2116	19.9719	19.5152	19.1303 (90)
Living area fraction	19.6776	19.8474	20.0801	20.3443	20.5256	20.5951	20.6040	20.6039	20.5769	20.3572	19.9656	19.6395 (92)
MIT	19.6776	19.8474	20.0801	20.3443	20.5256	20.5951	20.6040	20.6039	20.5769	20.3572	19.9656	19.6395 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.5276	19.6974	19.9301	20.1943	20.3756	20.4451	20.4540	20.4539	20.4269	20.2072	19.8156	19.4895 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9877	0.9696	0.9171	0.7936	0.5891	0.4100	0.4447	0.6970	0.9299	0.9876	0.9962 (94)
Useful gains	436.5645	493.8680	527.2805	526.2502	463.9843	331.6520	221.4060	232.3384	351.8044	434.6564	423.7705	414.0696 (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	894.2184	867.4368	785.9296	655.6080	502.8299	336.3718	221.7888	232.9830	365.0980	556.8260	739.2561	891.7570 (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	340.4946	251.0382	192.4349	93.1376	28.9011	0.0000	0.0000	0.0000	0.0000	90.8942	227.1496	355.3994 (98)
Space heating												1579.4497 (98)
Space heating per m2												22.4705 (99)

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1754.9441 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	340.4946	251.0382	192.4349	93.1376	28.9011	0.0000	0.0000	0.0000	0.0000	90.8942	227.1496	355.3994 (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)	378.3273	278.9314	213.8166	103.4863	32.1124	0.0000	0.0000	0.0000	0.0000	100.9935	252.3885	394.8882 (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 (217)m	88.8963	88.7643	88.5198	88.0266	87.2837	86.7000	86.7000	86.7000	86.7000	87.9782	88.6654	88.9476 (217)	
Fuel for water heating, kWh/month	185.4288	163.0784	170.3483	151.6307	148.4432	131.4980	124.3708	139.1364	139.7378	157.4329	167.5867	180.2245 (219)	
Water heating fuel used												1858.9164 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1754.9441 (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												4037.5593 (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	1754.9441	0.2160	379.0679 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1858.9164	0.2160	401.5259 (264)	
Space and water heating			780.5939 (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			773.7486 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			11.0100 (273)	

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

DER			11.0100 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			30.1624 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			30.1624 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 2.1000 (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	0 * 40 =	0.0000 (6a)
Number of open flues	0	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) =	0.2032 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.4532	(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) =		0.3853 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.1400	1.3258	10.7917		(27)					
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.1800	6.6924		(29a)					
APT Wall to Stairwell	17.8500		17.8500	0.1800	3.2130		(29a)					
Total net area of external elements Aum(A, m2)			65.2900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.8171	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.5092 (36)				
Total fabric heat loss						(33) + (36) =	29.3263 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 30.2319	Feb 30.0037	Mar 29.7800	Apr 28.7295	May 28.5329	Jun 27.6179	Jul 27.6179	Aug 27.4484	Sep 27.9703	Oct 28.5329	Nov 28.9305	Dec 29.3462 (38)
Heat transfer coeff	59.5581	59.3300	59.1063	58.0557	57.8592	56.9442	56.9442	56.7747	57.2966	57.8592	58.2568	58.6725 (39)
Average = Sum(39)m / 12 =												58.0548 (39)
HLP	Jan 0.8473	Feb 0.8441	Mar 0.8409	Apr 0.8259	May 0.8231	Jun 0.8101	Jul 0.8101	Aug 0.8077	Sep 0.8151	Oct 0.8231	Nov 0.8288	Dec 0.8347 (40)
HLP (average)												0.8259 (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)
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	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)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)
Solar input (sum of months) = Sum (63)m =												
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)
Total per year (kWh/year) = Sum (64)m =												
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		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	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, Thl (C)												
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	81.9577	82.2729	82.5843	84.0787	84.3643	85.7199	85.7199	85.9758	85.1927	84.3643	83.7885	83.1948
alpha	6.4638	6.4849	6.5056	6.6052	6.6243	6.7147	6.7147	6.7317	6.6795	6.6243	6.5859	6.5463
util living area	0.9968	0.9919	0.9783	0.9333	0.8203	0.6237	0.4537	0.4875	0.7316	0.9458	0.9918	0.9977 (86)
MIT	20.2271	20.3657	20.5556	20.7784	20.9304	20.9907	20.9990	20.9984	20.9745	20.7877	20.4694	20.2054 (87)
Th 2	20.2125	20.2153	20.2180	20.2309	20.2333	20.2446	20.2446	20.2466	20.2402	20.2333	20.2284	20.2233 (88)
util rest of house	0.9957	0.9894	0.9715	0.9133	0.7746	0.5550	0.3765	0.4087	0.6642	0.9253	0.9888	0.9969 (89)
MIT 2	19.1767	19.3802	19.6553	19.9749	20.1669	20.2385	20.2442	20.2460	20.2211	19.9943	19.5419	19.1534 (90)
Living area fraction									fLA = Living area / (4) =			0.4821 (91)
MIT	19.6832	19.8554	20.0894	20.3623	20.5350	20.6012	20.6081	20.6088	20.5844	20.3768	19.9891	19.6606 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6832	19.8554	20.0894	20.3623	20.5350	20.6012	20.6081	20.6088	20.5844	20.3768	19.9891	19.6606 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9949	0.9880	0.9702	0.9171	0.7935	0.5879	0.4138	0.4468	0.6957	0.9296	0.9876	0.9962 (94)
Useful gains	447.2055	504.9549	538.7065	536.9330	473.1005	337.3999	227.8778	238.3595	358.9133	444.5739	434.0310	424.4967 (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	916.1920	887.3003	803.2175	665.4522	511.1876	341.7321	228.2389	238.9523	371.5315	565.6785	750.8769	907.1123 (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	348.9259	256.9361	196.7961	92.5338	28.3368	0.0000	0.0000	0.0000	0.0000	90.1018	228.1291	359.0660 (98)
Space heating												1600.8257 (98)
Space heating per m2										(98) / (4) =		22.7746 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1713.9461 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	348.9259	256.9361	196.7961	92.5338	28.3368	0.0000	0.0000	0.0000	0.0000	90.1018	228.1291	359.0660	(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)	373.5824	275.0922	210.7025	99.0726	30.3392	0.0000	0.0000	0.0000	0.0000	96.4688	244.2495	384.4390	(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	86.5335	86.1186	85.3512	83.8004	81.7510	80.3000	80.3000	80.3000	80.3000	83.6331	85.7419	86.6578	(216)
Fuel for water heating, kWh/month	222.1671	195.0037	204.7129	184.9302	183.5335	164.5669	157.6676	175.7625	177.7036	194.2865	202.2960	216.6387	(219)
Water heating fuel used												2279.2692	(219)
Annual totals kWh/year													
Space heating fuel - main system												1713.9461	(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												4416.9141	(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	1713.9461	0.2160	370.2124 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2279.2692	0.2160	492.3222 (264)
Space and water heating			862.5345 (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			1082.4342 (272)
Emissions per m2 for space and water heating			12.2711 (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) = (12.2711 * 1.00) + 2.5747 + 0.5538, rounded to 2 d.p.			15.4000 (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)
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					3.3700
Number of sides sheltered					0.3717 (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) =				0.3160 (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	0.4029	0.3950	0.3871	0.3476	0.3397	0.3002	0.3002	0.2923	0.3160	0.3397	0.3555	0.3713 (22b)
	0.5812	0.5780	0.5749	0.5604	0.5577	0.5451	0.5451	0.5427	0.5499	0.5577	0.5632	0.5689 (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)			5.7100	1.3258	7.5701		(27)
French Door (Uw = 1.40)			2.4300	1.3258	3.2216		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.2600	9.6668	60.0000	2230.8000 (29a)
APT Wall to Stairwell	17.8500		17.8500	0.2400	4.2840	110.0000	1963.5000 (29a)
Total net area of external elements Aum (A, m ²)			65.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2477		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
E-FC-4			70.2900			30.0000	2108.7000 (32b)
1F - Timber			56.1500			9.0000	505.3500 (32c)
1F - Metal			43.7600			20.0000	875.2000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 14457.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							205.6815 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4767 (36)
Total fabric heat loss							(33) + (36) = 31.7244 (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	28.3085	28.1550	28.0046	27.2979	27.1656	26.5501	26.5501	26.4361	26.7872	27.1656	27.4331	27.7128 (38)
Heat transfer coeff	60.0329	59.8794	59.7289	59.0222	58.8900	58.2745	58.2745	58.1605	58.5116	58.8900	59.1575	59.4371 (39)
Average = Sum(39)m / 12 =												59.0216 (39)
HLP	0.8541	0.8519	0.8498	0.8397	0.8378	0.8291	0.8291	0.8274	0.8324	0.8378	0.8416	0.8456 (40)
HLP (average)												0.8397 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water 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 (46)
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	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	1.2600	36.7938	0.6200	0.7000	0.7700	13.9434 (77)
Southwest	4.4500	36.7938	0.6200	0.7000	0.7700	49.2445 (79)
Southeast	2.4300	36.7938	0.6200	0.7000	0.7700	26.8908 (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, 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	66.8955	67.0670	67.2359	68.0410	68.1938	68.9141	68.9141	69.0491	68.6348	68.1938	67.8854	67.5660	
alpha	5.4597	5.4711	5.4824	5.5361	5.5463	5.5943	5.5943	5.6033	5.5757	5.5463	5.5257	5.5044	
util living area	0.9957	0.9901	0.9762	0.9361	0.8400	0.6639	0.4920	0.5311	0.7685	0.9499	0.9906	0.9968	(86)
MIT	20.0073	20.1685	20.3934	20.6604	20.8672	20.9729	20.9956	20.9934	20.9391	20.6737	20.2877	19.9756	(87)
Th 2	20.2067	20.2086	20.2104	20.2191	20.2207	20.2282	20.2282	20.2296	20.2253	20.2207	20.2174	20.2140	(88)
util rest of house	0.9946	0.9875	0.9698	0.9190	0.7998	0.5949	0.4083	0.4460	0.7057	0.9330	0.9877	0.9960	(89)
MIT 2	19.2922	19.4537	19.6767	19.9406	20.1270	20.2142	20.2268	20.2273	20.1899	19.9584	19.5801	19.2666	(90)
Living area fraction									fLA = Living area / (4) =			0.4821	(91)
MIT	19.6370	19.7983	20.0222	20.2876	20.4839	20.5800	20.5975	20.5967	20.5512	20.3033	19.9213	19.6084	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6370	19.7983	20.0222	20.2876	20.4839	20.5800	20.5975	20.5967	20.5512	20.3033	19.9213	19.6084	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	402.8700	460.7945	496.3670	501.5676	453.5300	336.9443	231.4476	241.7343	350.4315	409.8499	392.1413	381.1522	(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	920.7226	892.1042	807.6690	672.1243	517.2833	348.4810	232.9520	244.0818	377.4675	571.4280	758.4744	915.8335	(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	385.2824	289.8401	231.6087	122.8008	47.4325	0.0000	0.0000	0.0000	0.0000	120.2141	263.7599	397.8029	(98)
Space heating												1858.7414	(98)
Space heating per m2												26.4439	(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	547.7800	431.2311	442.0197	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9355	0.9710	0.9635	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	512.4551	418.7089	425.8806	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	144.0796	198.8083	177.7399	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												520.6278 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	36.0199	49.7021	44.4350	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												130.1569 (107)
Space cooling per m2												1.8517 (108)
Energy for space heating												26.4439 (99)
Energy for space cooling												1.8517 (108)
Total												28.2956 (109)
Dwelling Fabric Energy Efficiency (DFEE)												28.3 (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												
	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.1400	1.3258	10.7917		(27)					
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.1800	6.6924		(29a)					
APT Wall to Stairwell	17.8500		17.8500	0.1800	3.2130		(29a)					
Total net area of external elements Aum(A, m2)			65.2900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			22.8171	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.5092 (36)				
Total fabric heat loss						(33) + (36) =	29.3263 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 30.2319	Feb 30.0037	Mar 29.7800	Apr 28.7295	May 28.5329	Jun 27.6179	Jul 27.6179	Aug 27.4484	Sep 27.9703	Oct 28.5329	Nov 28.9305	Dec 29.3462 (38)
Heat transfer coeff	59.5581	59.3300	59.1063	58.0557	57.8592	56.9442	56.9442	56.7747	57.2966	57.8592	58.2568	58.6725 (39)
Average = Sum(39)m / 12 =												58.0548 (39)
HLP	Jan 0.8473	Feb 0.8441	Mar 0.8409	Apr 0.8259	May 0.8231	Jun 0.8101	Jul 0.8101	Aug 0.8077	Sep 0.8151	Oct 0.8231	Nov 0.8288	Dec 0.8347 (40)
HLP (average)												0.8259 (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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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
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	81.9577	82.2729	82.5843	84.0787	84.3643	85.7199	85.7199	85.9758	85.1927	84.3643	83.7885	83.1948	
alpha	6.4638	6.4849	6.5056	6.6052	6.6243	6.7147	6.7147	6.7317	6.6795	6.6243	6.5859	6.5463	
util living area	0.9982	0.9949	0.9850	0.9494	0.8495	0.6564	0.4797	0.5187	0.7706	0.9624	0.9952	0.9987	(86)
MIT	20.1679	20.3098	20.5063	20.7426	20.9134	20.9876	20.9986	20.9978	20.9654	20.7481	20.4147	20.1467	(87)
Th 2	20.2125	20.2153	20.2180	20.2309	20.2333	20.2446	20.2446	20.2466	20.2402	20.2333	20.2284	20.2233	(88)
util rest of house	0.9976	0.9932	0.9801	0.9330	0.8067	0.5858	0.3984	0.4355	0.7041	0.9468	0.9933	0.9983	(89)
MIT 2	19.4464	19.5899	19.7862	20.0241	20.1756	20.2389	20.2442	20.2460	20.2220	20.0347	19.7059	19.4344	(90)
Living area fraction	19.7942	19.9370	20.1334	20.3705	20.5313	20.5999	20.6079	20.6084	fLA = Living area / (4) =	20.5804	20.3787	20.0477	0.4821 (91)
MIT	19.7942	19.9370	20.1334	20.3705	20.5313	20.5999	20.6079	20.6084	20.5804	20.3787	20.0477	19.7779	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7942	19.9370	20.1334	20.3705	20.5313	20.5999	20.6079	20.6084	20.5804	20.3787	20.0477	19.7779	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9925	0.9795	0.9363	0.8243	0.6197	0.4377	0.4757	0.7352	0.9502	0.9928	0.9980	(94)
Useful gains	405.7671	466.3397	505.5187	513.9992	463.0197	335.7860	227.7214	238.0692	353.9683	419.0925	396.4186	383.4711	(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	922.8084	892.1450	805.8213	665.9281	510.9738	341.6567	228.2286	238.9333	371.3068	565.7875	754.2898	913.9919	(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	384.6788	286.1412	223.4251	109.3888	35.6778	0.0000	0.0000	0.0000	0.0000	109.1411	257.6672	394.7075	(98)
Space heating												1800.8274	(98)
Space heating per m2												25.6200	(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	535.2751	421.3867	431.4878	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9605	0.9856	0.9809	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	514.1239	415.3233	423.2465	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	146.8042	205.2387	183.2843	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												535.3272	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	36.7011	51.3097	45.8211	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.8318 (107)
Space cooling per m2												1.9040 (108)
Energy for space heating												25.6200 (99)
Energy for space cooling												1.9040 (108)
Total												27.5240 (109)
Target Fabric Energy Efficiency (TFEE)												31.7 (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					3.3700
Number of sides sheltered					0.3040 (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) =				0.2584 (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												
	0.2713	0.2519	0.2584	0.2455	0.2455	0.2390	0.2326	0.2261	0.2196	0.2390	0.2261	0.2390 (22b)
Effective ac	0.5368	0.5317	0.5334	0.5301	0.5301	0.5286	0.5270	0.5256	0.5241	0.5286	0.5256	0.5286 (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)			5.7100	1.3258	7.5701		(27)
French Door (Uw = 1.40)			2.4300	1.3258	3.2216		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.2600	9.6668	60.0000	2230.8000 (29a)
APT Wall to Stairwell	17.8500		17.8500	0.2400	4.2840	110.0000	1963.5000 (29a)
Total net area of external elements Aum(A, m ²)			65.2900				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				26.2477		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
1F - Timber			56.1500			9.0000	505.3500 (32c)
1F - Metal			43.7600			20.0000	875.2000 (32c)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						17268.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.6815 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4767 (36)
Total fabric heat loss	(33) + (36) =						31.7244 (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	26.1483	25.9013	25.9816	25.8231	25.8231	25.7469	25.6727	25.6005	25.5304	25.7469	25.6005	25.7469 (38)
Heat transfer coeff	57.8727	57.6257	57.7060	57.5475	57.5475	57.4712	57.3970	57.3249	57.2547	57.4712	57.3249	57.4712 (39)
Average = Sum(39)m / 12 =												57.5012 (39)
HLP	0.8233	0.8198	0.8210	0.8187	0.8187	0.8176	0.8166	0.8155	0.8146	0.8176	0.8155	0.8176 (40)
HLP (average)												0.8181 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:	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)
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)
RHI water heating demand	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)
Heat gains from water heating, kWh/month												1634 (64)
												1634 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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				1.2600	45.1778	0.6200	0.7000	0.7700	17.1206 (77)			
Southwest				4.4500	45.1778	0.6200	0.7000	0.7700	60.4656 (79)			
Southeast				2.4300	45.1778	0.6200	0.7000	0.7700	33.0183 (77)			
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, 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	82.8876	83.2429	83.1271	83.3561	83.3561	83.4666	83.5745	83.6797	83.7822	83.4666	83.6797	83.4666
alpha	6.5258	6.5495	6.5418	6.5571	6.5571	6.5644	6.5716	6.5786	6.5855	6.5644	6.5786	6.5644
util living area	0.9743	0.9593	0.9155	0.8165	0.6565	0.4521	0.3234	0.3288	0.5387	0.8018	0.9407	0.9791 (86)
MIT	20.5354	20.6231	20.7747	20.9137	20.9818	20.9986	20.9999	20.9999	20.9957	20.9356	20.7410	20.5127 (87)
Th 2	20.2331	20.2362	20.2352	20.2371	20.2371	20.2381	20.2390	20.2399	20.2407	20.2381	20.2399	20.2381 (88)
util rest of house	0.9675	0.9492	0.8959	0.7802	0.6035	0.3924	0.2604	0.2648	0.4758	0.7568	0.9242	0.9734 (89)
MIT 2	19.6374	19.7627	19.9690	20.1470	20.2220	20.2373	20.2390	20.2398	20.2380	20.1762	19.9314	19.6097 (90)
Living area fraction									fLA = Living area / (4) =			0.4821 (91)
MIT	20.0704	20.1776	20.3575	20.5167	20.5883	20.6043	20.6058	20.6063	20.6033	20.5423	20.3218	20.0451 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.9204	20.0276	20.2075	20.3667	20.4383	20.4543	20.4558	20.4563	20.4533	20.3923	20.1718	19.8951 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	603.1726	634.4836	637.1502	580.0437	448.4473	295.7225	192.5832	192.3638	327.7566	484.7439	560.4941	576.6392 (95)
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	869.2705	848.6859	762.1499	625.3494	456.8304	296.2257	192.6143	192.3980	329.4053	516.8009	703.4774	856.0390 (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	197.9769	143.9439	92.9998	32.6201	6.2370	0.0000	0.0000	0.0000	0.0000	23.8504	102.9480	207.8735 (98)
Space heating												808.4496 (98)
RHI space heating demand												808 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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 2.1000 (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					3.3700
Number of sides sheltered					0.3040 (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) =				0.2584 (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												
	0.3295	0.3230	0.3165	0.2842	0.2778	0.2455	0.2455	0.2390	0.2584	0.2778	0.2907	0.3036 (22b)
Effective ac	0.5543	0.5522	0.5501	0.5404	0.5386	0.5301	0.5301	0.5286	0.5334	0.5386	0.5423	0.5461 (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)			5.7100	1.3258	7.5701		(27)
French Door (Uw = 1.40)			2.4300	1.3258	3.2216		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.2600	9.6668	60.0000	2230.8000 (29a)
APT Wall to Stairwell	17.8500		17.8500	0.2400	4.2840	110.0000	1963.5000 (29a)
Total net area of external elements Aum(A, m ²)			65.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2477		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
1F - Timber			56.1500			9.0000	505.3500 (32c)
1F - Metal			43.7600			20.0000	875.2000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17268.9500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							245.6815 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4767 (36)
Total fabric heat loss							(33) + (36) = 31.7244 (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	26.9990	26.8964	26.7957	26.3231	26.2347	25.8231	25.8231	25.7469	25.9816	26.2347	26.4136	26.6006 (38)
Heat transfer coeff	58.7234	58.6207	58.5201	58.0475	57.9591	57.5475	57.5475	57.4712	57.7060	57.9591	58.1380	58.3250 (39)
Average = Sum(39)m / 12 =												58.0471 (39)
HLP	0.8354	0.8340	0.8326	0.8258	0.8246	0.8187	0.8187	0.8176	0.8210	0.8246	0.8271	0.8298 (40)
HLP (average)												0.8258 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:	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)
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)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1634.4541 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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				1.2600	36.7938	0.6200	0.7000		0.7700		13.9434 (77)	
Southwest				4.4500	36.7938	0.6200	0.7000		0.7700		49.2445 (79)	
Southeast				2.4300	36.7938	0.6200	0.7000		0.7700		26.8908 (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	81.6869	81.8300	81.9706	82.6380	82.7641	83.3561	83.3561	83.4666	83.1271	82.7641	82.5094	82.2449
alpha	6.4458	6.4553	6.4647	6.5092	6.5176	6.5571	6.5571	6.5644	6.5418	6.5176	6.5006	6.4830
util living area	0.9825	0.9670	0.9337	0.8561	0.7169	0.5301	0.3815	0.4074	0.6134	0.8611	0.9634	0.9863 (86)
MIT	20.4445	20.5658	20.7198	20.8756	20.9665	20.9959	20.9996	20.9994	20.9898	20.8894	20.6456	20.4105 (87)
Th 2	20.2227	20.2240	20.2252	20.2310	20.2321	20.2371	20.2371	20.2381	20.2352	20.2321	20.2299	20.2276 (88)
util rest of house	0.9778	0.9586	0.9176	0.8249	0.6675	0.4687	0.3156	0.3403	0.5500	0.8249	0.9526	0.9826 (89)
MIT 2	19.4993	19.6721	19.8866	20.0956	20.2020	20.2345	20.2370	20.2378	20.2280	20.1174	19.7920	19.4546 (90)
Living area fraction	19.9550	20.1030	20.2883	20.4717	20.5706	20.6016	20.6047	20.6050	20.5953	20.4896	20.2036	19.9155 (92)
Temperature adjustment	19.8050	19.9530	20.1383	20.3217	20.4206	20.4516	20.4547	20.4550	20.4453	20.3396	20.0536	-0.1500
adjusted MIT	19.8050	19.9530	20.1383	20.3217	20.4206	20.4516	20.4547	20.4550	20.4453	20.3396	20.0536	19.7655 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9747	0.9552	0.9156	0.8288	0.6800	0.4861	0.3344	0.3594	0.5677	0.8304	0.9497	0.9798 (94)
Ext temp.	589.7216	634.1214	641.1167	596.3974	489.2457	335.1710	221.7140	232.8641	361.9558	507.2666	554.1245	566.6504 (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	910.5062	882.4189	798.1164	662.9984	505.4370	336.7467	221.8265	233.0457	366.1622	564.4977	753.0942	907.8569 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	238.6637	166.8559	116.8077	47.9527	12.0463	0.0000	0.0000	0.0000	0.0000	42.5799	143.2582	253.8576 (98)
(98) / (4) = 14.5401 (99)												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1135.5802 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	238.6637	166.8559	116.8077	47.9527	12.0463	0.0000	0.0000	0.0000	0.0000	42.5799	143.2582	253.8576	(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)	265.1819	185.3954	129.7864	53.2808	13.3848	0.0000	0.0000	0.0000	0.0000	47.3110	159.1758	282.0640	(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	88.6220	88.4363	88.1102	87.5485	86.9713	86.7000	86.7000	86.7000	86.7000	87.4540	88.2891	88.6933	(216)
Fuel for water heating, kWh/month	186.0027	163.6833	171.1401	152.4588	148.9765	131.4980	124.3708	139.1364	139.7378	158.3765	168.3010	180.7412	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1135.5802 (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													3423.7019 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1135.5802	3.4800	39.5182 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1864.4229	3.4800	64.8819 (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			280.2860 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0211 (257)
SAP value		85.7560
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1135.5802	0.2160	245.2853 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1864.4229	0.2160	402.7153 (264)
Space and water heating			648.0007 (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			641.1554 (272)
CO2 emissions per m2			9.1200 (273)
EI value			92.5479
EI rating			93 (274)
EI band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8758 = 3.974$, stars = 4
 $0.216 / 0.8758 = 0.2466$, stars = 4

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					3.3700
Number of sides sheltered					0.3040 (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) =				0.2584 (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												
	0.2713	0.2519	0.2584	0.2455	0.2455	0.2390	0.2326	0.2261	0.2196	0.2390	0.2261	0.2390 (22b)
Effective ac	0.5368	0.5317	0.5334	0.5301	0.5301	0.5286	0.5270	0.5256	0.5241	0.5286	0.5256	0.5286 (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)			5.7100	1.3258	7.5701		(27)
French Door (Uw = 1.40)			2.4300	1.3258	3.2216		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	47.4400	10.2600	37.1800	0.2600	9.6668	60.0000	2230.8000 (29a)
APT Wall to Stairwell	17.8500		17.8500	0.2400	4.2840	110.0000	1963.5000 (29a)
Total net area of external elements Aum(A, m ²)			65.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.2477		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			70.2900			70.0000	4920.3000 (32d)
E-FC-4			70.2900			70.0000	4920.3000 (32b)
1F - Timber			56.1500			9.0000	505.3500 (32c)
1F - Metal			43.7600			20.0000	875.2000 (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) = 17268.9500 (34)
245.6815 (35)
5.4767 (36)
(33) + (36) = 31.7244 (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	26.1483	25.9013	25.9816	25.8231	25.8231	25.7469	25.6727	25.6005	25.5304	25.7469	25.6005	25.7469 (38)
Heat transfer coeff	57.8727	57.6257	57.7060	57.5475	57.5475	57.4712	57.3970	57.3249	57.2547	57.4712	57.3249	57.4712 (39)
Average = Sum(39)m / 12 =												57.5012 (39)
HLP	0.8233	0.8198	0.8210	0.8187	0.8187	0.8176	0.8166	0.8155	0.8146	0.8176	0.8155	0.8176 (40)
HLP (average)												0.8181 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water storage loss:	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)
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												1.2600	45.1778	0.6200	0.7000	0.7700	17.1206 (77)
Southwest												4.4500	45.1778	0.6200	0.7000	0.7700	60.4656 (79)
Southeast												2.4300	45.1778	0.6200	0.7000	0.7700	33.0183 (77)
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, 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	82.8876	83.2429	83.1271	83.3561	83.3561	83.4666	83.5745	83.6797	83.7822	83.4666	83.6797	83.4666
alpha	6.5258	6.5495	6.5418	6.5571	6.5571	6.5644	6.5716	6.5786	6.5855	6.5644	6.5786	6.5644
util living area	0.9743	0.9593	0.9155	0.8165	0.6565	0.4521	0.3234	0.3288	0.5387	0.8018	0.9407	0.9791 (86)
MIT	20.5354	20.6231	20.7747	20.9137	20.9818	20.9986	20.9999	20.9999	20.9957	20.9356	20.7410	20.5127 (87)
Th 2	20.2331	20.2362	20.2352	20.2371	20.2371	20.2381	20.2390	20.2399	20.2407	20.2381	20.2399	20.2381 (88)
util rest of house	0.9675	0.9492	0.8959	0.7802	0.6035	0.3924	0.2604	0.2648	0.4758	0.7568	0.9242	0.9734 (89)
MIT 2	19.6374	19.7627	19.9690	20.1470	20.2220	20.2373	20.2390	20.2398	20.2380	20.1762	19.9314	19.6097 (90)
Living area fraction	20.0704	20.1776	20.3575	20.5167	20.5883	20.6043	20.6058	20.6063	20.6033	20.5423	20.3218	20.0451 (92)
Temperature adjustment	19.9204	20.0276	20.2075	20.3667	20.4383	20.4543	20.4558	20.4563	20.4533	20.3923	20.1718	-0.1500
adjusted MIT												19.8951 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	603.1726	634.4836	637.1502	580.0437	448.4473	295.7225	192.5832	192.3638	327.7566	484.7439	560.4941	576.6392 (95)
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	869.2705	848.6859	762.1499	625.3494	456.8304	296.2257	192.6143	192.3980	329.4053	516.8009	703.4774	856.0390 (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	197.9769	143.9439	92.9998	32.6201	6.2370	0.0000	0.0000	0.0000	0.0000	23.8504	102.9480	207.8735 (98)
Space heating												808.4496 (98)
Space heating per m2										(98) / (4) =		11.5016 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													898.2773 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	197.9769	143.9439	92.9998	32.6201	6.2370	0.0000	0.0000	0.0000	0.0000	23.8504	102.9480	207.8735	(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)	219.9743	159.9377	103.3331	36.2446	6.9300	0.0000	0.0000	0.0000	0.0000	26.5004	114.3866	230.9705	(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 (217)m	88.4701	88.3145	87.9299	87.3289	86.8462	86.7000	86.7000	86.7000	86.7000	87.1695	88.0209	88.5328	(216)
Fuel for water heating, kWh/month	186.3220	163.9090	171.4910	152.8421	149.1909	131.4980	124.3708	139.1364	139.7378	158.8934	168.8138	181.0689	(219)
Water heating fuel used												1867.2740	(219)
Annual totals kWh/year													
Space heating fuel - main system												898.2773	(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												3189.2502	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	898.2773	3.9200	35.2125 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1867.2740	3.9200	73.1971 (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			268.2689 (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	898.2773	0.2160	194.0279 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1867.2740	0.2160	403.3312 (264)
Space and water heating			597.3591 (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			590.5139 (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	898.2773	1.2200	1095.8983 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1867.2740	1.2200	2278.0743 (264)
Space and water heating			3373.9727 (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			3333.4816 (272)
Primary energy kWh/m2/year			47.4247 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: A 93

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

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

Recommended measures (none) Typical annual savings Energy efficiency Environmental impact

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 86
Potential environmental impact rating: A 93

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	£196	£196	£0
Space heating	£136	£136	£0
Water heating	£73	£73	£0
Lighting	£59	£59	£0
Total cost of fuels	£268	£268	£0
Total cost of uses	£268	£268	£0
Delivered energy	45 kWh/m²	45 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	47 kWh/m²	47 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	245.7 (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	194.84 (P1)
Transmission heat loss coefficient	31.72 (37)
Summer heat loss coefficient	226.57 (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	1.2600	127.3119	0.6200	0.7000	0.9000	56.3916
South West	4.4500	127.3119	0.6200	0.7000	0.9000	199.1607
South East	2.4300	127.3119	0.6200	0.7000	0.9000	108.7552

total: 364.3074

	Jun	Jul	Aug	
Solar gains	388	364	339	(P3)
Internal gains	397	381	389	
Total summer gains	785	745	728	(P5)

Summer gain/loss ratio	3.46	3.29	3.21	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 245.7)	0.28	0.28	0.28	
Threshold temperature	19.14	20.87	20.79	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight