

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-208			Issued on Date	21/05/2019
Assessment Reference	As Built	Prop Type Ref	2FF - Det (As)		
Property	47, St. Andrews, Botley, SOUTHAMPTON, SO32 2ST				
SAP Rating	83 B	DER	14.65	TER	18.83
Environmental	90 B	% DER<TER	22.18		
CO ₂ Emissions (t/year)	0.78	DFEE	46.04	TFEE	49.81
General Requirements Compliance	Pass	% DFEE<TFEE	7.57		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client					

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

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DWELLING AS BUILT

Top-floor flat, total floor area 67 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) 18.83 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.65 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.29 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.83 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 28 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 8.48 m², No overhang
Windows facing West: 2.58 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Door U-value 0.71 W/m²K
Photovoltaic array 476.68 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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.8300
Number of sides sheltered					0.3710 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (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	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3175	0.3432	0.3689	0.3861	0.4033 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5745	0.5813 (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)			7.8500	1.3258	10.4072		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.2500	11.3575	60.0000	2725.8000 (29a)
APT Wall to Stairwell	17.9700		17.9700	0.2400	4.3128	110.0000	1976.7000 (29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892	9.0000	601.5600 (30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5276		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Metal			37.1400			20.0000	742.8000 (32c)
2F - Timber			83.7600			9.0000	753.8400 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11479.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		171.7460 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3739 (36)
Total fabric heat loss	(33) + (36) =	47.9015 (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	30.3543	30.1649	29.9792	29.1071	28.9439	28.1843	28.1843	28.0437	28.4769	28.9439	29.2740	29.6191 (38)
Heat transfer coeff	78.2558	78.0664	77.8807	77.0086	76.8454	76.0858	76.0858	75.9452	76.3784	76.8454	77.1755	77.5206 (39)
Average = Sum(39)m / 12 =												77.0078 (39)
HLP	1.1708	1.1680	1.1652	1.1521	1.1497	1.1383	1.1383	1.1362	1.1427	1.1497	1.1546	1.1598 (40)
HLP (average)												1.1521 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)										Total = Sum(45)m =		1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (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	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5400	15.5789	12.6696	9.5917	7.1699	6.0531	6.5406	8.5018	11.4111	14.4890	16.9108	18.0275	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	335.6131	333.6297	321.6288	302.3757	282.9729	264.1944	251.9549	257.5273	267.3866	286.8354	309.1503	325.7488	(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		
East				5.2700	19.6403	0.6200	0.7000	0.7700		31.1301 (76)		
West				2.5800	19.6403	0.6200	0.7000	0.7700		15.2402 (80)		
East				3.2100	19.6403	0.6200	0.7000	0.7700		18.9616 (76)		

Solar gains	65.3319	127.8031	210.4735	306.9630	376.1947	385.1022	366.6330	314.9324	244.7894	151.6491	81.4612	53.7258 (83)
Total gains	400.9450	461.4328	532.1023	609.3387	659.1677	649.2966	618.5879	572.4597	512.1760	438.4845	390.6115	379.4746 (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	40.7478	40.8466	40.9440	41.4077	41.4956	41.9099	41.9099	41.9875	41.7494	41.4956	41.3182	41.1342		
alpha	3.7165	3.7231	3.7296	3.7605	3.7664	3.7940	3.7940	3.7992	3.7833	3.7664	3.7545	3.7423		
util living area	0.9914	0.9847	0.9671	0.9192	0.8209	0.6658	0.5157	0.5701	0.8021	0.9501	0.9856	0.9930	(86)	
MIT	19.3106	19.5081	19.8566	20.3064	20.6759	20.8977	20.9704	20.9569	20.7826	20.2856	19.7173	19.2760	(87)	
Th 2	19.9434	19.9457	19.9480	19.9585	19.9605	19.9697	19.9697	19.9714	19.9661	19.9605	19.9565	19.9523	(88)	
util rest of house	0.9893	0.9810	0.9590	0.8986	0.7750	0.5841	0.4058	0.4588	0.7351	0.9332	0.9815	0.9913	(89)	
MIT 2	17.6918	17.9802	18.4846	19.1275	19.6216	19.8893	19.9549	19.9478	19.7701	19.1123	18.2934	17.6471	(90)	
Living area fraction									fLA = Living area / (4) =			0.3861	(91)	
MIT	18.3169	18.5702	19.0144	19.5827	20.0287	20.2787	20.3470	20.3375	20.1611	19.5654	18.8432	18.2761	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.1669	18.4202	18.8644	19.4327	19.8787	20.1287	20.1970	20.1875	20.0111	19.4154	18.6932	18.1261	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	394.6397	449.2589	504.3670	539.8250	508.2007	388.0490	266.6251	276.7647	378.1961	404.1071	380.6185	374.5211	(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	1085.1638	1055.4721	962.9485	811.1091	628.4987	420.6556	273.6832	287.6385	451.4793	677.4205	894.7134	1079.5587	(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	513.7499	407.3753	341.1847	195.3246	89.5017	0.0000	0.0000	0.0000	0.0000	203.3452	370.1484	524.5480	(98)	
Space heating												2645.1777	(98)	
Space heating per m2												39.5748	(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													2939.0864 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	513.7499	407.3753	341.1847	195.3246	89.5017	0.0000	0.0000	0.0000	0.0000	203.3452	370.1484	524.5480	(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)	570.8332	452.6392	379.0941	217.0273	99.4464	0.0000	0.0000	0.0000	0.0000	225.9391	411.2760	582.8311	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Efficiency of water heater (217)m	89.1882	89.1240	88.9766	88.6466	88.0342	86.7000	86.7000	86.7000	86.7000	88.6492	89.0432	86.7000	(216)
Fuel for water heating, kWh/month	181.0499	159.1198	166.0634	147.5868	144.2960	128.9738	122.0318	136.4516	137.0200	153.1428	163.5072	176.0274	(219)
Water heating fuel used												1815.2704	(219)
Annual totals kWh/year													
Space heating fuel - main system												2939.0864	(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)												309.7625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												5139.1193	(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	2939.0864	0.2160	634.8427	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1815.2704	0.2160	392.0984	(264)
Space and water heating			1026.9411	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	309.7625	0.5190	160.7667	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	0.5190	-247.3947	(269)
Total CO2, kg/year			979.2381	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6500	(273)

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

DER		14.6500	ZC1
Total Floor Area		66.8400	
Assumed number of occupants		2.1670	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.8281	ZC2
CO2 emissions from cooking, equation (L16)		2.5585	ZC3
Total CO2 emissions		34.0366	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		34.0366	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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1295 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3795 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3511 (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	0.4476	0.4388	0.4301	0.3862	0.3774	0.3335	0.3335	0.3247	0.3511	0.3774	0.3950	0.4125 (22b)
Effective ac	0.6002	0.5963	0.5925	0.5746	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5780	0.5851 (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)			11.0600	1.3258	14.6629		(27)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.1800	8.1774		(29a)
APT Wall to Stairwell	17.9700		17.9700	0.1800	3.2346		(29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892		(30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.8841	(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)							7.0366 (36)
Total fabric heat loss						(33) + (36) =	43.9207 (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	30.5804	30.3822	30.1879	29.2753	29.1046	28.3098	28.3098	28.1626	28.6160	29.1046	29.4500	29.8111 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	74.5010	74.3028	74.1086	73.1960	73.0253	72.2305	72.2305	72.0833	72.5366	73.0253	73.3707	73.7318 (39)
												73.1952 (39)
HLP	1.1146	1.1117	1.1087	1.0951	1.0925	1.0806	1.0806	1.0784	1.0852	1.0925	1.0977	1.1031 (40)
HLP (average)												1.0951 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy content (annual)	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (46)
Total storage loss												
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 (56)
	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	48.0205	41.7961	44.5281	41.4018	41.0357	38.0221	39.2895	41.0357	41.4018	44.5281	44.7816	48.0205 (61)
Total heat required for water heating calculated for each month	187.7664	164.0188	170.6509	151.3588	146.5420	129.0660	123.6551	137.8464	139.3688	158.6991	169.4082	183.3569 (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	187.7664	164.0188	170.6509	151.3588	146.5420	129.0660	123.6551	137.8464	139.3688	158.6991	169.4082	183.3569 (64)
Heat gains from water heating, kWh/month	58.4706	51.0881	53.0679	46.9111	45.3398	39.7776	37.8739	42.4485	42.9245	49.0939	52.6337	57.0045 (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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5400	15.5789	12.6696	9.5917	7.1699	6.0531	6.5406	8.5018	11.4111	14.4890	16.9108	18.0275 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352 (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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813 (71)
Water heating gains (Table 5)	78.5896	76.0239	71.3278	65.1544	60.9406	55.2467	50.9058	57.0544	59.6173	65.9864	73.1024	76.6189 (72)
Total internal gains	344.4475	341.8904	329.3215	309.5035	289.5294	270.1825	257.9541	264.0942	274.5298	294.5435	317.4198	334.5894 (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	
East				8.4800	19.6403	0.6300	0.7000			0.7700	50.8997 (76)	
West				2.5800	19.6403	0.6300	0.7000			0.7700	15.4860 (80)	
Solar gains	66.3857	129.8644	213.8682	311.9140	382.2624	391.3136	372.5465	320.0119	248.7376	154.0951	82.7751	54.5923 (83)
Total gains	410.8332	471.7548	543.1897	621.4176	671.7918	661.4961	630.5005	584.1061	523.2674	448.6386	400.1949	389.1817 (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	62.3034	62.4696	62.6333	63.4142	63.5625	64.2619	64.2619	64.3931	63.9906	63.5625	63.2632	62.9534
alpha	5.1536	5.1646	5.1756	5.2276	5.2375	5.2841	5.2841	5.2929	5.2660	5.2375	5.2175	5.1969
util living area	0.9978	0.9950	0.9853	0.9474	0.8442	0.6634	0.4973	0.5551	0.8211	0.9730	0.9954	0.9983 (86)
MIT	19.8202	19.9715	20.2364	20.5786	20.8410	20.9667	20.9939	20.9895	20.8993	20.5414	20.1183	19.7952 (87)
Th 2	19.9889	19.9913	19.9937	20.0048	20.0069	20.0167	20.0167	20.0185	20.0129	20.0069	20.0027	19.9983 (88)
util rest of house	0.9970	0.9933	0.9801	0.9288	0.7940	0.5758	0.3897	0.4431	0.7468	0.9599	0.9935	0.9978 (89)
MIT 2	18.4163	18.6386	19.0241	19.5149	19.8546	19.9951	20.0145	20.0142	19.9336	19.4739	18.8619	18.3865 (90)
Living area fraction									fLA = Living area / (4) =			0.3861 (91)
MIT	18.9584	19.1533	19.4922	19.9256	20.2355	20.3703	20.3927	20.3908	20.3065	19.8862	19.3470	18.9304 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9584	19.1533	19.4922	19.9256	20.2355	20.3703	20.3927	20.3908	20.3065	19.8862	19.3470	18.9304 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	409.1673	467.7110	530.5864	576.0563	541.9013	402.5827	272.0434	284.1941	403.5451	429.7584	396.9117	387.9743 (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	1092.0682	1059.0616	962.8357	807.0334	623.3069	416.7894	273.9465	287.6722	450.1973	678.1243	898.5732	1086.1008 (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	508.0783	397.3876	321.5935	166.3035	60.5658	0.0000	0.0000	0.0000	0.0000	184.7842	361.1963	519.4061 (98)
Space heating												2519.3154 (98)
Space heating per m2										(98) / (4) =		37.6917 (99)

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2697.3398 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	508.0783	397.3876	321.5935	166.3035	60.5658	0.0000	0.0000	0.0000	0.0000	184.7842	361.1963	519.4061	(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)	543.9810	425.4685	344.3186	178.0551	64.8456	0.0000	0.0000	0.0000	0.0000	197.8418	386.7198	556.1094	(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	187.7664	164.0188	170.6509	151.3588	146.5420	129.0660	123.6551	137.8464	139.3688	158.6991	169.4082	183.3569	(64)
Efficiency of water heater	87.4325	87.1958	86.6228	85.2886	83.0122	80.3000	80.3000	80.3000	80.3000	85.4351	86.9099	80.3000	(216)
(217)m	87.4325	87.1958	86.6228	85.2886	83.0122	80.3000	80.3000	80.3000	80.3000	85.4351	86.9099	87.5276	(217)
Fuel for water heating, kWh/month	214.7557	188.1040	197.0046	177.4666	176.5306	160.7298	153.9914	171.6643	173.5601	185.7540	194.9240	209.4846	(219)
Water heating fuel used												2203.9697	(219)
Annual totals kWh/year													
Space heating fuel - main system												2697.3398	(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)												309.7625	(232)
Total delivered energy for all uses												5286.0720	(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	2697.3398	0.2160	582.6254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2203.9697	0.2160	476.0575 (264)
Space and water heating			1058.6829 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	309.7625	0.5190	160.7667 (268)
Total CO2, kg/m2/year			1258.3746 (272)
Emissions per m2 for space and water heating			15.8391 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4052 (272b)
Emissions per m2 for pumps and fans			0.5824 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8391 * 1.00) + 2.4052 + 0.5824, rounded to 2 d.p.			18.8300 (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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.8300
Number of sides sheltered					0.3710 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (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	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3175	0.3432	0.3689	0.3861	0.4033 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5745	0.5813 (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)			7.8500	1.3258	10.4072		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.2500	11.3575	60.0000	2725.8000 (29a)
APT Wall to Stairwell	17.9700		17.9700	0.2400	4.3128	110.0000	1976.7000 (29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892	9.0000	601.5600 (30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5276		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Metal			37.1400			20.0000	742.8000 (32c)
2F - Timber			83.7600			9.0000	753.8400 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11479.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		171.7460 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3739 (36)
Total fabric heat loss	(33) + (36) =	47.9015 (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	30.3543	30.1649	29.9792	29.1071	28.9439	28.1843	28.1843	28.0437	28.4769	28.9439	29.2740	29.6191 (38)
Heat transfer coeff	78.2558	78.0664	77.8807	77.0086	76.8454	76.0858	76.0858	75.9452	76.3784	76.8454	77.1755	77.5206 (39)
Average = Sum(39)m / 12 =												77.0078 (39)
HLP	1.1708	1.1680	1.1652	1.1521	1.1497	1.1383	1.1383	1.1362	1.1427	1.1497	1.1546	1.1598 (40)
HLP (average)												1.1521 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)										Total = Sum(45)m =		1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	29.6960	25.9723	26.8011	23.3659	22.4201	19.3468	17.9277	20.5723	20.8180	24.2613	26.4832	28.7590	(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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5400	15.5789	12.6696	9.5917	7.1699	6.0531	6.5406	8.5018	11.4111	14.4890	16.9108	18.0275	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	39.9140	38.6493	36.0230	32.4526	30.1345	26.8706	24.0964	27.6509	28.9139	32.6093	36.7822	38.6546	(72)
Total internal gains	302.7720	301.5158	291.0167	273.8018	255.7234	238.8064	228.1446	231.6906	240.8264	258.1664	278.0995	293.6250	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	5.2700	19.6403	0.6200	0.7000	0.7700	31.1301	(76)
West	2.5800	19.6403	0.6200	0.7000	0.7700	15.2402	(80)
East	3.2100	19.6403	0.6200	0.7000	0.7700	18.9616	(76)

Solar gains	65.3319	127.8031	210.4735	306.9630	376.1947	385.1022	366.6330	314.9324	244.7894	151.6491	81.4612	53.7258	(83)
Total gains	368.1039	429.3189	501.4902	580.7648	631.9181	623.9086	594.7776	546.6230	485.6157	409.8155	359.5607	347.3508	(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	40.7478	40.8466	40.9440	41.4077	41.4956	41.9099	41.9099	41.9875	41.7494	41.4956	41.3182	41.1342		
alpha	3.7165	3.7231	3.7296	3.7605	3.7664	3.7940	3.7940	3.7992	3.7833	3.7664	3.7545	3.7423		
util living area	0.9935	0.9879	0.9725	0.9288	0.8358	0.6842	0.5332	0.5914	0.8220	0.9589	0.9890	0.9948	(86)	
MIT	19.2516	19.4519	19.8065	20.2678	20.6518	20.8876	20.9669	20.9512	20.7609	20.2415	19.6625	19.2178	(87)	
Th 2	19.9434	19.9457	19.9480	19.9585	19.9605	19.9697	19.9697	19.9714	19.9661	19.9605	19.9565	19.9523	(88)	
util rest of house	0.9919	0.9849	0.9655	0.9101	0.7920	0.6026	0.4208	0.4781	0.7580	0.9445	0.9858	0.9935	(89)	
MIT 2	18.3475	18.5482	18.9004	19.3556	19.7097	19.9087	19.9582	19.9529	19.8166	19.3401	18.7670	18.3205	(90)	
Living area fraction									fLA = Living area / (4) =			0.3861	(91)	
MIT	18.6966	18.8972	19.2503	19.7078	20.0735	20.2867	20.3477	20.3384	20.1812	19.6882	19.1128	18.6670	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6966	18.8972	19.2503	19.7078	20.0735	20.2867	20.3477	20.3384	20.1812	19.6882	19.1128	18.6670	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9894	0.9810	0.9597	0.9047	0.7973	0.6294	0.4636	0.5206	0.7730	0.9398	0.9823	0.9914	(94)
Ext temp.	364.2056	421.1758	481.2678	525.4318	503.8217	392.6815	275.7486	284.5924	375.3725	385.1294	353.2069	344.3548	(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	1126.6186	1092.7088	992.9990	832.2964	643.4627	432.6750	285.1502	299.0996	464.4729	698.3839	927.0958	1121.4896	(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	567.2353	451.2702	380.7280	220.9425	103.8929	0.0000	0.0000	0.0000	0.0000	233.0614	413.2000	578.1883	(98)
												2948.5186	(98)
												44.1131	(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	715.2069	563.0352	577.1833	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8376	0.8960	0.8688	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	599.0713	504.4797	501.4801	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	810.0764	774.4334	719.5217	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	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	151.9236	200.8456	162.2229	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												514.9922 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												128.7480 (107)
Energy for space heating												1.9262 (108)
Energy for space cooling												44.1131 (99)
Total												1.9262 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.0393 (109)
												46.0 (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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (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) =				20.0000 / (5) = 0.1295 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3795 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3511 (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	0.4476	0.4388	0.4301	0.3862	0.3774	0.3335	0.3335	0.3247	0.3511	0.3774	0.3950	0.4125 (22b)
	0.6002	0.5963	0.5925	0.5746	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5780	0.5851 (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)			11.0600	1.3258	14.6629		(27)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.1800	8.1774		(29a)
APT Wall to Stairwell	17.9700		17.9700	0.1800	3.2346		(29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892		(30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.8841	(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)							7.0366 (36)
Total fabric heat loss						(33) + (36) =	43.9207 (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	30.5804	30.3822	30.1879	29.2753	29.1046	28.3098	28.3098	28.1626	28.6160	29.1046	29.4500	29.8111 (38)
Heat transfer coeff												
74.5010	74.3028	74.1086	73.1960	73.0253	72.2305	72.2305	72.0833	72.5366	73.0253	73.3707	73.7318 (39)	73.1952 (39)
Average = Sum(39)m / 12 =												
HLP	1.1146	1.1117	1.1087	1.0951	1.0925	1.0806	1.0806	1.0784	1.0852	1.0925	1.0977	1.1031 (40)
HLP (average)												1.0951 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)	
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)												Total = Sum(45)m = 1347.8761 (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	29.6960	25.9723	26.8011	23.3659	22.4201	19.3468	17.9277	20.5723	20.8180	24.2613	26.4832	(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	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	108.3517	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5400	15.5789	12.6696	9.5917	7.1699	6.0531	6.5406	8.5018	11.4111	14.4890	16.9108	18.0275	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	189.8124	191.7821	186.8186	176.2520	162.9135	150.3771	142.0021	140.0325	144.9959	155.5626	168.9011	181.4374	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	33.8352	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	39.9140	38.6493	36.0230	32.4526	30.1345	26.8706	24.0964	27.6509	28.9139	32.6093	36.7822	38.6546	(72)
Total internal gains	302.7720	301.5158	291.0167	273.8018	255.7234	238.8064	228.1446	231.6906	240.8264	258.1664	278.0995	293.6250	(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		
East					8.4800	19.6403	0.6300	0.7000	0.7700	50.8997 (76)		
West					2.5800	19.6403	0.6300	0.7000	0.7700	15.4860 (80)		

Solar gains	66.3857	129.8644	213.8682	311.9140	382.2624	391.3136	372.5465	320.0119	248.7376	154.0951	82.7751	54.5923 (83)
Total gains	369.1576	431.3802	504.8850	585.7158	637.9858	630.1200	600.6911	551.7026	489.5639	412.2615	360.8746	348.2173 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	62.3034	62.4696	62.6333	63.4142	63.5625	64.2619	64.2619	64.3931	63.9906	63.5625	63.2632	62.9534		
alpha	5.1536	5.1646	5.1756	5.2276	5.2375	5.2841	5.2841	5.2929	5.2660	5.2375	5.2175	5.1969		
util living area	0.9987	0.9967	0.9893	0.9578	0.8647	0.6893	0.5203	0.5841	0.8495	0.9809	0.9971	0.9990	(86)	
MIT	19.7619	19.9157	20.1858	20.5392	20.8190	20.9602	20.9925	20.9867	20.8797	20.4958	20.0637	19.7375	(87)	
Th 2	19.9889	19.9913	19.9937	20.0048	20.0069	20.0167	20.0167	20.0185	20.0129	20.0069	20.0027	19.9983	(88)	
util rest of house	0.9982	0.9956	0.9854	0.9421	0.8178	0.6009	0.4086	0.4680	0.7801	0.9712	0.9960	0.9987	(89)	
MIT 2	18.8571	19.0124	19.2823	19.6344	19.8864	19.9988	20.0148	20.0147	19.9461	19.6001	19.1696	18.8403	(90)	
Living area fraction									fLA = Living area / (4) =			0.3861	(91)	
MIT	19.2064	19.3612	19.6312	19.9838	20.2465	20.3700	20.3923	20.3901	20.3066	19.9460	19.5149	19.1868	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2064	19.3612	19.6312	19.9838	20.2465	20.3700	20.3923	20.3901	20.3066	19.9460	19.5149	19.1868	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	368.3121	429.0547	496.6021	551.5670	529.7246	399.6112	271.5535	283.1625	393.2255	400.0905	359.1303	347.6265	(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	1110.5457	1074.5063	973.1333	811.2872	624.1128	416.7717	273.9212	287.6172	450.2066	682.4913	910.8870	1105.0025	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	552.2218	433.7434	354.5392	186.9985	70.2248	0.0000	0.0000	0.0000	0.0000	210.1062	397.2648	563.4878	(98)	
Space heating												2768.5866	(98)	
Space heating per m2												41.4211	(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	678.9667	534.5057	547.8332	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9077	0.9532	0.9332	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	616.2923	509.4943	511.2450	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	817.3364	781.3452	725.4588	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	144.7517	202.2571	159.3751	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												506.3838	(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

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	36.1879	50.5643	39.8438	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												126.5960 (107)
Energy for space heating												1.8940 (108)
Energy for space cooling												41.4211 (99)
Total												1.8940 (108)
Target Fabric Energy Efficiency (TFEE)												43.3151 (109)
												49.8 (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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.8300
Number of sides sheltered					0.3710 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (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												
	0.3604	0.3346	0.3432	0.3260	0.3260	0.3175	0.3089	0.3003	0.2917	0.3175	0.3003	0.3175 (22b)
Effective ac	0.5649	0.5560	0.5589	0.5532	0.5532	0.5504	0.5477	0.5451	0.5426	0.5504	0.5451	0.5504 (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)			7.8500	1.3258	10.4072		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.2500	11.3575	60.0000	2725.8000 (29a)
APT Wall to Stairwell	17.9700		17.9700	0.2400	4.3128	110.0000	1976.7000 (29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892	9.0000	601.5600 (30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5276		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Metal			37.1400			20.0000	742.8000 (32c)
2F - Timber			83.7600			9.0000	753.8400 (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) = 11479.5000 (34)
171.7460 (35)
7.3739 (36)
(33) + (36) = 47.9015 (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	28.7845	28.3287	28.4769	28.1843	28.1843	28.0437	27.9067	27.7736	27.6442	28.0437	27.7736	28.0437 (38)
Heat transfer coeff	76.6860	76.2303	76.3784	76.0858	76.0858	75.9452	75.8083	75.6751	75.5457	75.9452	75.6751	75.9452 (39)
Average = Sum(39)m / 12 =												76.0005 (39)
HLP	1.1473	1.1405	1.1427	1.1383	1.1383	1.1362	1.1342	1.1322	1.1302	1.1362	1.1322	1.1362 (40)
HLP (average)												1.1371 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)	Total = Sum(45)m =											1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 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	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
RHI water heating demand	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(65)
Heat gains from water heating, kWh/month													
	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.8501	38.9473	31.6740	23.9793	17.9248	15.1329	16.3516	21.2544	28.5276	36.2224	42.2769	45.0688	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.3022	286.2419	278.8338	263.0626	243.1544	224.4435	211.9435	209.0037	216.4118	232.1830	252.0912	270.8021	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	493.4173	489.4623	470.6528	441.5784	411.9732	385.3449	369.7116	377.2556	393.9235	423.1936	455.7109	480.1592	(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
East				5.2700	25.1925		0.6200		0.7000		0.7700		39.9306 (76)
West				2.5800	25.1925		0.6200		0.7000		0.7700		19.5486 (80)
East				3.2100	25.1925		0.6200		0.7000		0.7700		24.3220 (76)
Solar gains	83.8012	139.4448	230.8722	337.3368	391.6939	435.0404	411.1320	362.7447	283.1290	178.3807	104.1469		67.7393 (83)
Total gains	577.2184	628.9071	701.5250	778.9152	803.6670	820.3853	780.8436	740.0003	677.0525	601.5743	559.8578		547.8985 (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)														
tau	41.5819	41.8305	41.7494	41.9099	41.9099	41.9875	42.0634	42.1374	42.2096	41.9875	42.1374	41.9875	41.9875	
alpha	3.7721	3.7887	3.7833	3.7940	3.7940	3.7992	3.8042	3.8092	3.8140	3.7992	3.8092	3.7992	3.7992	
util living area	0.9689	0.9566	0.9195	0.8348	0.6982	0.5046	0.3727	0.3915	0.6363	0.8602	0.9472	0.9728	0.9728	(86)
MIT	19.7382	19.8861	20.2064	20.5791	20.8397	20.9646	20.9914	20.9898	20.9153	20.6036	20.1355	19.7221	19.7221	(87)
Th 2	19.9624	19.9679	19.9661	19.9697	19.9697	19.9714	19.9730	19.9746	19.9762	19.9714	19.9746	19.9714	19.9714	(88)
util rest of house	0.9621	0.9472	0.9020	0.8002	0.6385	0.4221	0.2774	0.2920	0.5539	0.8216	0.9338	0.9666	0.9666	(89)
MIT 2	18.3212	18.5359	18.9867	19.4944	19.8183	19.9481	19.9697	19.9706	19.9114	19.5415	18.9009	18.3048	18.3048	(90)
Living area fraction	18.8684	19.0573	19.4577	19.9132	20.2127	20.3406	20.3642	20.3642	20.2991	19.9516	19.3776	18.8521	18.8521	(91)
MIT	18.8684	19.0573	19.4577	19.9132	20.2127	20.3406	20.3642	20.3642	20.2991	19.9516	19.3776	18.8521	18.8521	(92)
Temperature adjustment	18.7184	18.9073	19.3077	19.7632	20.0627	20.1906	20.2142	20.2142	20.1491	19.8016	19.2276	18.7021	18.7021	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9513	0.9349	0.8887	0.7924	0.6443	0.4403	0.3001	0.3157	0.5687	0.8143	0.9214	0.9566	(94)
Ext temp.	549.0983	587.9914	623.4470	617.2163	517.7940	361.1764	234.3361	233.6041	385.0380	489.8458	515.8578	524.1264	(95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Month fracti	1059.6764	1037.2857	940.0415	780.8873	575.4171	371.4176	236.0811	235.6679	411.6549	638.0611	857.2186	1040.6092	(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	379.8701	301.9257	235.5463	117.8431	42.8716	0.0000	0.0000	0.0000	0.0000	110.2722	245.7798	384.2632	(98)
RHI space heating demand												1818.3719	(98)
												1818	(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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.8300
Number of sides sheltered					0.3710 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (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												
	0.4376	0.4290	0.4204	0.3775	0.3689	0.3260	0.3260	0.3175	0.3432	0.3689	0.3861	0.4033 (22b)
Effective ac	0.5957	0.5920	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5745	0.5813 (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)			7.8500	1.3258	10.4072		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.2500	11.3575	60.0000	2725.8000 (29a)
APT Wall to Stairwell	17.9700		17.9700	0.2400	4.3128	110.0000	1976.7000 (29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892	9.0000	601.5600 (30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5276		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Metal			37.1400			20.0000	742.8000 (32c)
2F - Timber			83.7600			9.0000	753.8400 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11479.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		171.7460 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3739 (36)
Total fabric heat loss	(33) + (36) =	47.9015 (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	30.3543	30.1649	29.9792	29.1071	28.9439	28.1843	28.1843	28.0437	28.4769	28.9439	29.2740	29.6191 (38)
Heat transfer coeff	78.2558	78.0664	77.8807	77.0086	76.8454	76.0858	76.0858	75.9452	76.3784	76.8454	77.1755	77.5206 (39)
Average = Sum(39)m / 12 =												77.0078 (39)
HLP	1.1708	1.1680	1.1652	1.1521	1.1497	1.1383	1.1383	1.1362	1.1427	1.1497	1.1546	1.1598 (40)
HLP (average)												1.1521 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)	Total = Sum(45)m =											1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474 (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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474 (64)
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271 (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	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.8501	38.9473	31.6740	23.9793	17.9248	15.1329	16.3516	21.2544	28.5276	36.2224	42.2769	45.0688 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.3022	286.2419	278.8338	263.0626	243.1544	224.4435	211.9435	209.0037	216.4118	232.1830	252.0912	270.8021 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692 (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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813 (71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784 (72)
Total internal gains	493.4173	489.4623	470.6528	441.5784	411.9732	385.3449	369.7116	377.2556	393.9235	423.1936	455.7109	480.1592 (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		
East				5.2700	19.6403	0.6200	0.7000	0.7700		31.1301 (76)		
West				2.5800	19.6403	0.6200	0.7000	0.7700		15.2402 (80)		
East				3.2100	19.6403	0.6200	0.7000	0.7700		18.9616 (76)		

Solar gains	65.3319	127.8031	210.4735	306.9630	376.1947	385.1022	366.6330	314.9324	244.7894	151.6491	81.4612	53.7258 (83)
Total gains	558.7492	617.2654	681.1263	748.5414	788.1679	770.4471	736.3446	692.1879	638.7129	574.8427	537.1721	533.8850 (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	40.7478	40.8466	40.9440	41.4077	41.4956	41.9099	41.9099	41.9875	41.7494	41.4956	41.3182	41.1342
alpha	3.7165	3.7231	3.7296	3.7605	3.7664	3.7940	3.7940	3.7992	3.7833	3.7664	3.7545	3.7423
util living area	0.9752	0.9627	0.9337	0.8667	0.7499	0.5862	0.4419	0.4854	0.7091	0.8975	0.9614	0.9787 (86)
MIT	19.5844	19.7681	20.0823	20.4718	20.7692	20.9338	20.9824	20.9749	20.8615	20.4711	19.9624	19.5474 (87)
Th 2	19.9434	19.9457	19.9480	19.9585	19.9605	19.9697	19.9697	19.9714	19.9661	19.9605	19.9565	19.9523 (88)
util rest of house	0.9698	0.9546	0.9192	0.8376	0.6976	0.5067	0.3440	0.3850	0.6344	0.8685	0.9516	0.9740 (89)
MIT 2	18.0869	18.3520	18.8002	19.3446	19.7281	19.9199	19.9612	19.9583	19.8488	19.3586	18.6425	18.0396 (90)
Living area fraction									fLA = Living area / (4) =			0.3861 (91)
MIT	18.6652	18.8988	19.2953	19.7799	20.1301	20.3114	20.3556	20.3509	20.2398	19.7882	19.1522	18.6218 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5152	18.7488	19.1453	19.6299	19.9801	20.1614	20.2056	20.2009	20.0898	19.6382	19.0022	18.4718 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	536.3628	581.8918	616.7762	619.1081	550.6743	402.3307	270.2317	282.4998	411.4283	493.0549	504.8967	515.2212 (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	1112.4182	1081.1255	984.8229	826.2909	636.2894	423.1431	274.3319	288.6593	457.4933	694.5460	918.5557	1106.3601 (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	428.5852	335.4850	273.8268	149.1716	63.6976	0.0000	0.0000	0.0000	0.0000	149.9094	297.8345	439.8074 (98)
Space heating												2138.3174 (98)
Space heating per m ²												(98) / (4) = 31.9916 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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													2375.9083 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	428.5852	335.4850	273.8268	149.1716	63.6976	0.0000	0.0000	0.0000	0.0000	149.9094	297.8345	439.8074	(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)	476.2058	372.7611	304.2520	165.7462	70.7751	0.0000	0.0000	0.0000	0.0000	166.5660	330.9272	488.6748	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Efficiency of water heater (217)m	89.0722	88.9936	88.8152	88.4274	87.7749	86.7000	86.7000	86.7000	86.7000	88.4010	88.8891	86.7000	(216)
Fuel for water heating, kWh/month	181.2856	159.3531	166.3651	147.9527	144.7224	128.9738	122.0318	136.4516	137.0200	153.5727	163.7906	176.2447	(219)
Water heating fuel used												1817.7641	(219)
Annual totals kWh/year													
Space heating fuel - main system												2375.9083	(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)												309.7625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4578.4349	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2375.9083	3.4800	82.6816	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1817.7641	3.4800	63.2582	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	309.7625	13.1900	40.8577	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			316.6900	(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] =	1.1893 (257)
SAP value		83.4095
SAP rating (Section 12)		83 (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	2375.9083	0.2160	513.1962	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1817.7641	0.2160	392.6370	(264)
Space and water heating			905.8332	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	309.7625	0.5190	160.7667	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	0.5190	-247.3947	(269)
Total kg/year			858.1303	(272)
CO2 emissions per m2			12.8400	(273)
EI value			89.7184	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8802 = 3.953$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8802 = 0.2454$, 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	66.8400 (1b)	x 2.3100 (2b)	= 154.4004 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	66.8400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 154.4004 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.8300
Number of sides sheltered					0.3710 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3432 (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												
	0.3604	0.3346	0.3432	0.3260	0.3260	0.3175	0.3089	0.3003	0.2917	0.3175	0.3003	0.3175 (22b)
Effective ac	0.5649	0.5560	0.5589	0.5532	0.5532	0.5504	0.5477	0.5451	0.5426	0.5504	0.5451	0.5504 (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)			7.8500	1.3258	10.4072		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	58.6100	13.1800	45.4300	0.2500	11.3575	60.0000	2725.8000 (29a)
APT Wall to Stairwell	17.9700		17.9700	0.2400	4.3128	110.0000	1976.7000 (29a)
APT External Plane Ceiling	66.8400		66.8400	0.1300	8.6892	9.0000	601.5600 (30)
Total net area of external elements Aum(A, m ²)			143.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5276		(33)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Metal			37.1400			20.0000	742.8000 (32c)
2F - Timber			83.7600			9.0000	753.8400 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11479.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		171.7460 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3739 (36)
Total fabric heat loss	(33) + (36) =	47.9015 (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	28.7845	28.3287	28.4769	28.1843	28.1843	28.0437	27.9067	27.7736	27.6442	28.0437	27.7736	28.0437 (38)
Heat transfer coeff	76.6860	76.2303	76.3784	76.0858	76.0858	75.9452	75.8083	75.6751	75.5457	75.9452	75.6751	75.9452 (39)
Average = Sum(39)m / 12 =												76.0005 (39)
HLP	1.1473	1.1405	1.1427	1.1383	1.1383	1.1362	1.1342	1.1322	1.1302	1.1362	1.1322	1.1362 (40)
HLP (average)												1.1371 (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												2.1670 (42)
Average daily hot water use (litres/day)												85.6670 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.2337	90.8071	87.3804	83.9537	80.5270	77.1003	77.1003	80.5270	83.9537	87.3804	90.8071	94.2337 (44)
Energy conte	139.7459	122.2227	126.1228	109.9570	105.5063	91.0439	84.3656	96.8107	97.9670	114.1711	124.6266	135.3365 (45)
Energy content (annual)	Total = Sum(45)m =											1347.8761 (45)
Distribution loss (46)m = 0.15 x (45)m	20.9619	18.3334	18.9184	16.4935	15.8259	13.6566	12.6548	14.5216	14.6950	17.1257	18.6940	20.3005 (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	21.7292	19.5913	21.6347	20.8737	21.5236	20.7764	21.4360	21.4928	20.8294	21.5887	20.9654	21.7109	(61)
Total heat required for water heating calculated for each month	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Heat gains from water heating, kWh/month	51.8978	45.5369	47.3445	41.7791	40.4617	35.4662	33.4105	37.5628	37.7814	43.3591	46.6797	50.4271	(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	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	130.0220	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.8501	38.9473	31.6740	23.9793	17.9248	15.1329	16.3516	21.2544	28.5276	36.2224	42.2769	45.0688	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	283.3022	286.2419	278.8338	263.0626	243.1544	224.4435	211.9435	209.0037	216.4118	232.1830	252.0912	270.8021	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	50.1692	(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)	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	-86.6813	(71)
Water heating gains (Table 5)	69.7551	67.7632	63.6351	58.0265	54.3841	49.2586	44.9066	50.4876	52.4741	58.2783	64.8329	67.7784	(72)
Total internal gains	493.4173	489.4623	470.6528	441.5784	411.9732	385.3449	369.7116	377.2556	393.9235	423.1936	455.7109	480.1592	(73)

6. Solar gains													
[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
East	5.2700	25.1925	0.6200	0.7000	0.7700	39.9306	(76)						
West	2.5800	25.1925	0.6200	0.7000	0.7700	19.5486	(80)						
East	3.2100	25.1925	0.6200	0.7000	0.7700	24.3220	(76)						
Solar gains	83.8012	139.4448	230.8722	337.3368	391.6939	435.0404	411.1320	362.7447	283.1290	178.3807	104.1469	67.7393	(83)
Total gains	577.2184	628.9071	701.5250	778.9152	803.6670	820.3853	780.8436	740.0003	677.0525	601.5743	559.8578	547.8985	(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	41.5819	41.8305	41.7494	41.9099	41.9099	41.9875	42.0634	42.1374	42.2096	41.9875	42.1374	41.9875	
alpha	3.7721	3.7887	3.7833	3.7940	3.7940	3.7992	3.8042	3.8092	3.8140	3.7992	3.8092	3.7992	
util living area	0.9689	0.9566	0.9195	0.8348	0.6982	0.5046	0.3727	0.3915	0.6363	0.8602	0.9472	0.9728	(86)
MIT	19.7382	19.8861	20.2064	20.5791	20.8397	20.9646	20.9914	20.9898	20.9153	20.6036	20.1355	19.7221	(87)
Th 2	19.9624	19.9679	19.9661	19.9697	19.9697	19.9714	19.9730	19.9746	19.9762	19.9714	19.9746	19.9714	(88)
util rest of house	0.9621	0.9472	0.9020	0.8002	0.6385	0.4221	0.2774	0.2920	0.5539	0.8216	0.9338	0.9666	(89)
MIT 2	18.3212	18.5359	18.9867	19.4944	19.8183	19.9481	19.9697	19.9706	19.9114	19.5415	18.9009	18.3048	(90)
Living area fraction									fLA = Living area / (4) =			0.3861	(91)
MIT	18.8684	19.0573	19.4577	19.9132	20.2127	20.3406	20.3642	20.3642	20.2991	19.9516	19.3776	18.8521	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7184	18.9073	19.3077	19.7632	20.0627	20.1906	20.2142	20.2142	20.1491	19.8016	19.2276	18.7021	(93)

8. Space heating requirement													
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9513	0.9349	0.8887	0.7924	0.6443	0.4403	0.3001	0.3157	0.5687	0.8143	0.9214	0.9566	(94)
Useful gains	549.0983	587.9914	623.4470	617.2163	517.7940	361.1764	234.3361	233.6041	385.0380	489.8458	515.8578	524.1264	(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	1059.6764	1037.2857	940.0415	780.8873	575.4171	371.4176	236.0811	235.6679	411.6549	638.0611	857.2186	1040.6092	(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	379.8701	301.9257	235.5463	117.8431	42.8716	0.0000	0.0000	0.0000	0.0000	110.2722	245.7798	384.2632	(98)
Space heating												1818.3719	(98)
Space heating per m2												27.2048	(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													2020.4132 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	379.8701	301.9257	235.5463	117.8431	42.8716	0.0000	0.0000	0.0000	0.0000	110.2722	245.7798	384.2632	(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)	422.0779	335.4730	261.7181	130.9368	47.6351	0.0000	0.0000	0.0000	0.0000	122.5246	273.0886	426.9591	(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	161.4751	141.8140	147.7575	130.8306	127.0299	111.8203	105.8015	118.3035	118.7964	135.7598	145.5921	157.0474	(64)
Efficiency of water heater (217)m	88.9897	88.9184	88.6986	88.2331	87.5097	86.7000	86.7000	86.7000	86.7000	88.1486	88.7435	86.7000	(216)
Fuel for water heating, kWh/month	181.4538	159.4879	166.5839	148.2784	145.1610	128.9738	122.0318	136.4516	137.0200	154.0123	164.0595	176.4240	(219)
Water heating fuel used												1819.9378	(219)
Annual totals kWh/year													
Space heating fuel - main system												2020.4132	(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)												309.7625	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4225.1135	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2020.4132	3.9200	79.2002	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1819.9378	3.9200	71.3416	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	309.7625	16.9600	52.5357	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	16.9600	0.0000	(252)
Total energy cost			303.7975	(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	2020.4132	0.2160	436.4092	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1819.9378	0.2160	393.1066	(264)
Space and water heating			829.5158	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	309.7625	0.5190	160.7667	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	0.5190	-247.3947	(269)
Total kg/year			781.8129	(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	2020.4132	1.2200	2464.9041	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1819.9378	1.2200	2220.3242	(264)
Space and water heating			4685.2282	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	309.7625	3.0700	950.9709	(268)
Energy saving/generation technologies				
PV Unit	-476.6757	3.0700	-1463.3945	(269)
Primary energy kWh/year			4403.0546	(272)
Primary energy kWh/m2/year			65.8745	(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 83
Current environmental impact rating: B 90

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

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

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

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 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	£65	£65	£0
Mains gas	£239	£239	£0
Space heating	£180	£180	£0
Water heating	£71	£71	£0
Lighting	£53	£53	£0
Total cost of fuels	£304	£304	£0
Total cost of uses	£304	£304	£0
Delivered energy	63 kWh/m²	63 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	66 kWh/m²	66 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	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	171.7 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	305.71 (P1)
Transmission heat loss coefficient	47.90 (37)
Summer heat loss coefficient	353.61 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
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
East	5.2700	125.2818	0.6200	0.7000	0.9000	232.0990
West	2.5800	125.2818	0.6200	0.7000	0.9000	113.6272
East	3.2100	125.2818	0.6200	0.7000	0.9000	141.3734

total: 487.0996

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	524	487	428	
Total summer gains	382	367	374	
	906	854	803	(P5)

Summer gain/loss ratio	2.56	2.41	2.27	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 171.7)	0.80	0.80	0.80	
Threshold temperature	18.76	20.51	20.37	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight