

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-202				Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	2FF - Semi (As)			
Property	103, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB					
SAP Rating		84 B	DER	13.92	TER	17.72
Environmental		90 B	% DER<TER	21.44		
CO ₂ Emissions (t/year)		0.74	DFEE	39.54	TFEE	42.88
General Requirements Compliance		Pass	% DFEE<TFEE	7.81		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

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

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DWELLING AS BUILT

Top-floor flat, total floor area 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) 17.72 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)42.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.30 (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): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 6.09 m², No overhang
Windows facing North 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 415.44 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	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					4.3000
Infiltration rate					0.3445 (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) =		0.2929 (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	0.3734	0.3661	0.3587	0.3221	0.3148	0.2782	0.2782	0.2709	0.2929	0.3148	0.3295	0.3441 (22b)
	0.5697	0.5670	0.5643	0.5519	0.5496	0.5387	0.5387	0.5367	0.5429	0.5496	0.5543	0.5592 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.2500	7.7800	60.0000	1867.2000 (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 (m ²)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7815		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Timber			84.4500			9.0000	760.0500 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12453.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		186.3122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2824 (36)
Total fabric heat loss	(33) + (36) =	41.0639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	29.0279	28.8900	28.7548	28.1198	28.0010	27.4479	27.4479	27.3455	27.6610	28.0010	28.2413	28.4926 (38)
Heat transfer coeff	70.0918	69.9538	69.8187	69.1837	69.0649	68.5118	68.5118	68.4094	68.7248	69.0649	69.3052	69.5565 (39)
Average = Sum(39)m / 12 =												69.1831 (39)
HLP	1.0487	1.0466	1.0446	1.0351	1.0333	1.0250	1.0250	1.0235	1.0282	1.0333	1.0369	1.0406 (40)
HLP (average)												1.0351 (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	(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	(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	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745 (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	336.5344	334.4480	322.2943	302.8795	283.3496	264.5124	252.2985	257.9739	267.9860	287.5964	310.0386	326.6957 (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		
Southeast				6.0900	36.7938			0.6200	0.7000	0.7700		67.3931 (77)
Northwest				2.5800	11.2829			0.6200	0.7000	0.7700		8.7552 (81)
Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243 (83)
Total gains	412.6827	467.0648	511.4708	550.2258	572.2158	556.4879	531.6308	505.5357	477.1822	436.2489	401.7762	391.5201 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.3524	49.4497	49.5455	50.0002	50.0862	50.4905	50.4905	50.5661	50.3340	50.0862	49.9125	49.7322
alpha	4.2902	4.2966	4.3030	4.3333	4.3391	4.3660	4.3660	4.3711	4.3556	4.3391	4.3275	4.3155
util living area	0.9926	0.9865	0.9731	0.9377	0.8564	0.7061	0.5454	0.5904	0.8107	0.9515	0.9866	0.9940 (86)
MIT	19.6296	19.8009	20.0722	20.4198	20.7248	20.9176	20.9792	20.9706	20.8419	20.4520	19.9761	19.5937 (87)
Th 2	20.0430	20.0447	20.0464	20.0542	20.0557	20.0625	20.0625	20.0638	20.0599	20.0557	20.0527	20.0496 (88)
util rest of house	0.9907	0.9832	0.9661	0.9207	0.8161	0.6283	0.4388	0.4839	0.7465	0.9348	0.9827	0.9926 (89)
MIT 2	18.2107	18.4606	18.8538	19.3527	19.7643	19.9973	20.0521	20.0478	19.9184	19.4064	18.7226	18.1631 (90)
Living area fraction	18.7588	18.9784	19.3244	19.7649	20.1353	20.3528	20.4102	20.4043	20.2752	19.8103	19.2068	18.7157 (92)
Temperature adjustment	18.6088	18.8284	19.1744	19.6149	19.9853	20.2028	20.2602	20.2543	20.1252	19.6603	19.0568	18.5657 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	407.2522	456.5264	489.8895	501.2628	465.0444	356.6110	245.6976	256.1084	358.6039	403.9220	392.5580	387.3151 (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	1002.9302	974.3430	884.9128	741.2941	572.2245	383.8562	250.7690	263.6695	414.0775	625.7481	828.6691	999.2283 (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	443.1844	347.9727	293.8974	172.8225	79.7420	0.0000	0.0000	0.0000	0.0000	165.0387	314.0000	455.2634 (98)
Space heating												2271.9212 (98)
Space heating per m ²										(98) / (4) =		33.9904 (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													2524.3568 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	443.1844	347.9727	293.8974	172.8225	79.7420	0.0000	0.0000	0.0000	0.0000	165.0387	314.0000	455.2634	(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)	492.4272	386.6363	326.5526	192.0250	88.6022	0.0000	0.0000	0.0000	0.0000	183.3763	348.8889	505.8482	(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	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	89.0944	89.0190	88.8684	88.5479	87.9436	86.7000	86.7000	86.7000	86.7000	88.4800	88.9277	89.1299	(216)
Fuel for water heating, kWh/month	181.2405	159.3077	166.2656	147.7513	144.4448	128.9738	122.0318	136.4516	137.0200	153.4355	163.7195	176.2006	(219)
Water heating fuel used												1816.8425	(219)
Annual totals kWh/year													
Space heating fuel - main system												2524.3568	(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)												326.0333	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
Total delivered energy for all uses												4742.2326	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	2524.3568	0.2160	545.2611 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1816.8425	0.2160	392.4380 (264)
Space and water heating			937.6991 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.0333	0.5190	169.2113 (268)
Energy saving/generation technologies			
PV Unit	-415.4446	0.5190	-215.6157 (269)
Total CO ₂ , kg/year			930.2196 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9200 (273)

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

DER			13.9200 ZC1
Total Floor Area		TFA	66.8400
Assumed number of occupants		N	2.1670
CO ₂ emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO ₂ emissions from appliances, equation (L14)			16.8281 ZC2
CO ₂ emissions from cooking, equation (L16)			2.5585 ZC3
Total CO ₂ emissions			33.3066 ZC4
Residual CO ₂ emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO ₂ emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO ₂ emissions			33.3066 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	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					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3226 (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	0.4113	0.4033	0.3952	0.3549	0.3468	0.3065	0.3065	0.2984	0.3226	0.3468	0.3629	0.3791 (22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5601	0.5470	0.5470	0.5445	0.5520	0.5601	0.5659	0.5718 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.1800	5.6016		(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)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.1397	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5137 (36)
Total fabric heat loss						(33) + (36) =	37.6534 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.7862	29.6188	29.4548	28.6842	28.5401	27.8689	27.8689	27.7446	28.1274	28.5401	28.8317	29.1366 (38)
Heat transfer coeff	67.4396	67.2722	67.1082	66.3376	66.1935	65.5223	65.5223	65.3981	65.7809	66.1935	66.4851	66.7900 (39)
Average = Sum(39)m / 12 =												66.3369 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0090	1.0065	1.0040	0.9925	0.9903	0.9803	0.9803	0.9784	0.9842	0.9903	0.9947	0.9993 (40)
HLP (average)												0.9925 (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)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Combi loss	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	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745 (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	345.3689	342.7087	329.9870	310.0074	289.9060	270.5004	258.2976	264.5407	275.1292	295.3045	318.3080	335.5363 (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					6.0900	36.7938	0.6300	0.7000			0.7700	68.4801 (77)
Northwest					2.5800	11.2829	0.6300	0.7000			0.7700	8.8964 (81)

Solar gains	77.3765	134.7557	192.2278	251.3357	293.5254	296.6849	283.8377	251.5548	212.5703	151.0501	93.2173	65.8699 (83)
Total gains	422.7453	477.4645	522.2148	561.3431	583.4314	567.1853	542.1353	516.0955	487.6995	446.3546	411.5253	401.4062 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	68.8270	68.9982	69.1669	69.9703	70.1227	70.8410	70.8410	70.9756	70.5626	70.1227	69.8151	69.4964
alpha	5.5885	5.5999	5.6111	5.6647	5.6748	5.7227	5.7227	5.7317	5.7042	5.6748	5.6543	5.6331
util living area	0.9974	0.9943	0.9857	0.9563	0.8720	0.6999	0.5250	0.5716	0.8186	0.9682	0.9943	0.9980 (86)
MIT	19.9839	20.1223	20.3384	20.6154	20.8454	20.9676	20.9947	20.9915	20.9208	20.6291	20.2553	19.9577 (87)
Th 2	20.0759	20.0779	20.0800	20.0896	20.0914	20.0998	20.0998	20.1013	20.0966	20.0914	20.0878	20.0840 (88)
util rest of house	0.9965	0.9924	0.9807	0.9407	0.8285	0.6172	0.4212	0.4658	0.7481	0.9537	0.9920	0.9974 (89)
MIT 2	18.7185	18.9216	19.2361	19.6357	19.9386	20.0779	20.0977	20.0978	20.0337	19.6620	19.1236	18.6862 (90)
Living area fraction									fLA = Living area / (4) =			0.3863 (91)
MIT	19.2073	19.3854	19.6619	20.0142	20.2889	20.4216	20.4442	20.4430	20.3764	20.0356	19.5608	19.1774 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2073	19.3854	19.6619	20.0142	20.2889	20.4216	20.4442	20.4430	20.3764	20.0356	19.5608	19.1774 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9954	0.9905	0.9779	0.9392	0.8390	0.6481	0.4615	0.5069	0.7719	0.9526	0.9903	0.9965 (94)
Useful gains	420.8044	472.9409	510.6727	527.2055	489.4800	367.5816	250.1946	261.5847	376.4498	425.1794	407.5246	400.0003 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.4000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1005.3417	974.4650	883.2714	737.2875	568.5300	381.4458	251.8820	264.4058	412.8666	624.5739	828.4568	1000.3401 (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	434.8957	337.0242	277.2134	151.2590	58.8132	0.0000	0.0000	0.0000	0.0000	148.3495	303.0711	446.6528 (98)
Space heating												2157.2790 (98)
Space heating per m2										(98) / (4) =		32.2753 (99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2309.7205	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	434.8957	337.0242	277.2134	151.2590	58.8132	0.0000	0.0000	0.0000	0.0000	148.3495	303.0711	446.6528	(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)													
	465.6271	360.8396	296.8024	161.9476	62.9692	0.0000	0.0000	0.0000	0.0000	158.8324	324.4873	478.2150	(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													
(217)m	87.0965	86.8251	86.2657	85.0495	82.9544	80.3000	80.3000	80.3000	80.3000	84.8819	86.4991	87.2076	(216)
Fuel for water heating, kWh/month													
	215.5843	188.9072	197.8202	177.9654	176.6537	160.7298	153.9914	171.6643	173.5601	186.9646	195.8498	210.2533	(219)
Water heating fuel used													
												2209.9441	(219)
Annual totals kWh/year													
Space heating fuel - main system												2309.7205	(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)												326.0333	(232)
Total delivered energy for all uses												4920.6979	(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	2309.7205	0.2160	498.8996 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2209.9441	0.2160	477.3479 (264)
Space and water heating			976.2476 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.0333	0.5190	169.2113 (268)
Total CO2, kg/m2/year			1184.3838 (272)
Emissions per m2 for space and water heating			14.6057 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5316 (272b)
Emissions per m2 for pumps and fans			0.5824 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6057 * 1.00) + 2.5316 + 0.5824, rounded to 2 d.p.			17.7200 (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	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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.3000
Number of sides sheltered					0.3445 (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) =				0.2929 (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	0.3734	0.3661	0.3587	0.3221	0.3148	0.2782	0.2782	0.2709	0.2929	0.3148	0.3295	0.3441 (22b)
	0.5697	0.5670	0.5643	0.5519	0.5496	0.5387	0.5387	0.5367	0.5429	0.5496	0.5543	0.5592 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.2500	7.7800	60.0000	1867.2000 (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 (m ²)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7815		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Timber			84.4500			9.0000	760.0500 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12453.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		186.3122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2824 (36)
Total fabric heat loss	(33) + (36) =	41.0639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	29.0279	28.8900	28.7548	28.1198	28.0010	27.4479	27.4479	27.3455	27.6610	28.0010	28.2413	28.4926 (38)
Heat transfer coeff	70.0918	69.9538	69.8187	69.1837	69.0649	68.5118	68.5118	68.4094	68.7248	69.0649	69.3052	69.5565 (39)
Average = Sum(39)m / 12 =												69.1831 (39)
HLP	1.0487	1.0466	1.0446	1.0351	1.0333	1.0250	1.0250	1.0235	1.0282	1.0333	1.0369	1.0406 (40)
HLP (average)												1.0351 (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	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745	(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	303.6933	302.3341	291.6822	274.3056	256.1000	239.1243	228.4882	232.1372	241.4257	258.9274	278.9878	294.5719	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast					6.0900	36.7938		0.6200		0.7000	0.7700	67.3931
Northwest					2.5800	11.2829		0.6200		0.7000	0.7700	(77) 8.7552
Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243
Total gains	379.8415	434.9509	480.8587	521.6519	544.9663	531.0999	507.8205	479.6991	450.6219	407.5799	370.7254	(83) 359.3963

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	49.3524	49.4497	49.5455	50.0002	50.0862	50.4905	50.4905	50.5661	50.3340	50.0862	49.9125	49.7322		
alpha	4.2902	4.2966	4.3030	4.3333	4.3391	4.3660	4.3660	4.3711	4.3556	4.3391	4.3275	4.3155		
util living area	0.9946	0.9896	0.9783	0.9472	0.8728	0.7285	0.5673	0.6161	0.8334	0.9611	0.9901	0.9957	(86)	
MIT	19.5722	19.7462	20.0230	20.3803	20.6988	20.9066	20.9758	20.9653	20.8215	20.4098	19.9231	19.5372	(87)	
Th 2	20.0430	20.0447	20.0464	20.0542	20.0557	20.0625	20.0625	20.0638	20.0599	20.0557	20.0527	20.0496	(88)	
util rest of house	0.9932	0.9870	0.9725	0.9322	0.8352	0.6514	0.4580	0.5074	0.7725	0.9471	0.9871	0.9946	(89)	
MIT 2	18.7351	18.9093	19.1843	19.5386	19.8353	20.0113	20.0541	20.0507	19.9486	19.5730	19.0924	18.7054	(90)	
Living area fraction	19.0585	19.2326	19.5083	19.8637	20.1689	20.3572	20.4102	20.4040	fLA = Living area / (4) =				0.3863	(91)
MIT	19.0585	19.2326	19.5083	19.8637	20.1689	20.3572	20.4102	20.4040	20.2858	19.8963	19.4133	19.0267	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0585	19.2326	19.5083	19.8637	20.1689	20.3572	20.4102	20.4040	20.2858	19.8963	19.4133	19.0267	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9842	0.9684	0.9286	0.8403	0.6773	0.5000	0.5488	0.7888	0.9442	0.9845	0.9931	(94)
Useful gains	376.5578	428.0601	465.6743	484.4320	457.9132	359.7040	253.8978	263.2400	355.4724	384.8510	364.9743	356.9107	(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	1034.4473	1002.6184	908.2218	758.5105	584.9013	394.4330	261.0413	273.9131	425.1194	642.0445	853.3738	1031.2919	(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	489.4698	386.1032	329.2554	197.3365	94.4791	0.0000	0.0000	0.0000	0.0000	191.3520	351.6476	501.7396	(98)
Space heating												2541.3832	(98)
Space heating per m2												(98) / (4) =	38.0219 (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	644.0110	506.9874	519.9114	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8469	0.9084	0.8884	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	545.4432	460.5620	461.8784	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	702.0219	673.2525	641.8934	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	112.7367	158.2417	133.9311	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												404.9096 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	28.1842	39.5604	33.4828	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												101.2274 (107)
Space cooling per m2												1.5145 (108)
Energy for space heating												38.0219 (99)
Energy for space cooling												1.5145 (108)
Total												39.5364 (109)
Dwelling Fabric Energy Efficiency (DFEE)												39.5 (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	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					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3226 (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												
	0.4113	0.4033	0.3952	0.3549	0.3468	0.3065	0.3065	0.2984	0.3226	0.3468	0.3629	0.3791 (22b)
Effective ac	0.5846	0.5813	0.5781	0.5630	0.5601	0.5470	0.5470	0.5445	0.5520	0.5601	0.5659	0.5718 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.1800	5.6016		(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)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.1397	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5137 (36)
Total fabric heat loss						(33) + (36) =	37.6534 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.7862	29.6188	29.4548	28.6842	28.5401	27.8689	27.8689	27.7446	28.1274	28.5401	28.8317	29.1366 (38)
Heat transfer coeff	67.4396	67.2722	67.1082	66.3376	66.1935	65.5223	65.5223	65.3981	65.7809	66.1935	66.4851	66.7900 (39)
Average = Sum(39)m / 12 =												66.3369 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0090	1.0065	1.0040	0.9925	0.9903	0.9803	0.9803	0.9784	0.9842	0.9903	0.9947	0.9993 (40)
HLP (average)												0.9925 (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												
	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	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	18.4614	16.3972	13.3351	10.0955	7.5465	6.3711	6.8842	8.9483	12.0104	15.2500	17.7990	18.9745	(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	303.6933	302.3341	291.6822	274.3056	256.1000	239.1243	228.4882	232.1372	241.4257	258.9274	278.9878	294.5719	(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												6.0900	36.7938	0.6300	0.7000	0.7700	68.4801 (77)
Northwest												2.5800	11.2829	0.6300	0.7000	0.7700	8.8964 (81)
Solar gains	77.3765	134.7557	192.2278	251.3357	293.5254	296.6849	283.8377	251.5548	212.5703	151.0501	93.2173	65.8699 (83)					
Total gains	381.0697	437.0898	483.9100	525.6413	549.6254	535.8092	512.3259	483.6920	453.9960	409.9776	372.2051	360.4418 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.8270	68.9982	69.1669	69.9703	70.1227	70.8410	70.8410	70.9756	70.5626	70.1227	69.8151	69.4964	
alpha	5.5885	5.5999	5.6111	5.6647	5.6748	5.7227	5.7227	5.7317	5.7042	5.6748	5.6543	5.6331	
util living area	0.9984	0.9963	0.9899	0.9666	0.8939	0.7308	0.5534	0.6058	0.8507	0.9780	0.9965	0.9989	(86)
MIT	19.9245	20.0656	20.2869	20.5739	20.8201	20.9597	20.9930	20.9887	20.9020	20.5840	20.2000	19.8990	(87)
Th 2	20.0759	20.0779	20.0800	20.0896	20.0914	20.0998	20.0998	20.1013	20.0966	20.0914	20.0878	20.0840	(88)
util rest of house	0.9979	0.9950	0.9863	0.9541	0.8546	0.6481	0.4451	0.4957	0.7851	0.9673	0.9951	0.9985	(89)
MIT 2	19.0900	19.2323	19.4535	19.7413	19.9673	20.0808	20.0979	20.0980	20.0415	19.7561	19.3747	19.0712	(90)
Living area fraction									fLA = Living area / (4) =			0.3863	(91)
MIT	19.4123	19.5542	19.7754	20.0629	20.2968	20.4203	20.4437	20.4421	20.3739	20.0759	19.6935	19.3910	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4123	19.5542	19.7754	20.0629	20.2968	20.4203	20.4437	20.4421	20.3739	20.0759	19.6935	19.3910	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9941	0.9849	0.9536	0.8645	0.6791	0.4872	0.5386	0.8074	0.9671	0.9943	0.9981	(94)
Useful gains	380.0910	434.5187	476.5820	501.2731	475.1732	363.8801	249.6304	260.5221	366.5739	396.4724	370.0839	359.7582	(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	1019.1710	985.8202	890.8896	740.5208	569.0496	381.3618	251.8493	264.3436	412.7017	627.2424	837.2826	1014.6065	(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	475.4756	370.4746	308.2448	172.2583	69.8440	0.0000	0.0000	0.0000	0.0000	171.6929	336.3830	487.2071	(98)
Space heating												2391.5804	(98)
Space heating per m2											(98) / (4) =	35.7807	(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	615.9100	484.8653	497.0253	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9034	0.9534	0.9383	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	556.4291	462.2808	466.3479	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	707.5263	678.5185	646.5604	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	108.7900	160.8809	134.0781	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												403.7490	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	27.1975	40.2202	33.5195	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												100.9372 (107)
Space cooling per m2												1.5101 (108)
Energy for space heating												35.7807 (99)
Energy for space cooling												1.5101 (108)
Total												37.2908 (109)
Target Fabric Energy Efficiency (TFEE)												42.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.3000
Infiltration rate					0.3445 (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) =				0.2929 (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												
Effective ac	0.3075	0.2855	0.2929	0.2782	0.2782	0.2709	0.2636	0.2562	0.2489	0.2709	0.2562	0.2709 (22b)
	0.5473	0.5408	0.5429	0.5387	0.5387	0.5367	0.5347	0.5328	0.5310	0.5367	0.5328	0.5367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.2500	7.7800	60.0000	1867.2000 (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 (m ²)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7815		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Timber			84.4500			9.0000	760.0500 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12453.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		186.3122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2824 (36)
Total fabric heat loss	(33) + (36) =	41.0639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	27.8849	27.5531	27.6610	27.4479	27.4479	27.3455	27.2458	27.1489	27.0547	27.3455	27.1489	27.3455 (38)
Heat transfer coeff	68.9488	68.6170	68.7248	68.5118	68.5118	68.4094	68.3097	68.2128	68.1185	68.4094	68.2128	68.4094 (39)
Average = Sum(39)m / 12 =												68.4497 (39)
HLP	1.0315	1.0266	1.0282	1.0250	1.0250	1.0235	1.0220	1.0205	1.0191	1.0235	1.0205	1.0235 (40)
HLP (average)												1.0241 (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	46.1534	40.9930	33.3378	25.2388	18.8663	15.9277	17.2105	22.3708	30.0261	38.1250	44.4976	47.4361	(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	495.7206	491.5081	472.3165	442.8379	412.9147	386.1398	370.5705	378.3720	395.4220	425.0962	457.9316	482.5265	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	Specific data	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	W/m2	or Table 6c	factor	W						
						Table 6d							
Southeast	6.0900	45.1778	0.6200	0.7000	0.7700	82.7495	(77)						
Northwest	2.5800	14.6176	0.6200	0.7000	0.7700	11.3428	(81)						
Solar gains	94.0923	139.7058	201.8193	267.3530	298.3409	328.2459	311.3002	281.5449	236.3425	169.1918	113.0290	78.7177	(83)
Total gains	589.8129	631.2139	674.1358	710.1909	711.2556	714.3856	681.8707	659.9169	631.7645	594.2880	570.9606	561.2441	(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	50.1705	50.4132	50.3340	50.4905	50.4905	50.5661	50.6399	50.7119	50.7820	50.5661	50.7119	50.5661		
alpha	4.3447	4.3609	4.3556	4.3660	4.3660	4.3711	4.3760	4.3808	4.3855	4.3711	4.3808	4.3711		
util living area	0.9689	0.9573	0.9253	0.8533	0.7246	0.5275	0.3868	0.3986	0.6336	0.8521	0.9443	0.9730	(86)	
MIT	20.0261	20.1437	20.3877	20.6706	20.8787	20.9763	20.9952	20.9946	20.9477	20.7276	20.3574	20.0063	(87)	
Th 2	20.0571	20.0612	20.0599	20.0625	20.0625	20.0638	20.0650	20.0663	20.0674	20.0638	20.0663	20.0638	(88)	
util rest of house	0.9619	0.9480	0.9087	0.8212	0.6678	0.4480	0.2960	0.3054	0.5554	0.8127	0.9300	0.9668	(89)	
MIT 2	18.7919	18.9621	19.3047	19.6900	19.9480	20.0484	20.0632	20.0642	20.0282	19.7727	19.2726	18.7691	(90)	
Living area fraction									fLA = Living area / (4) =			0.3863	(91)	
MIT	19.2687	19.4186	19.7231	20.0688	20.3075	20.4068	20.4232	20.4236	20.3834	20.1416	19.6917	19.2470	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.1187	19.2686	19.5731	19.9188	20.1575	20.2568	20.2732	20.2736	20.2334	19.9916	19.5417	19.0970	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9531	0.9382	0.8986	0.8157	0.6739	0.4649	0.3164	0.3264	0.5700	0.8093	0.9203	0.9585	(94)	
Useful gains	562.1449	592.1905	605.7845	579.3061	479.3303	332.1081	215.7770	215.3735	360.0965	480.9484	525.4297	537.9560	(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	980.3597	958.4808	864.0810	713.8102	524.6320	339.0941	216.7603	216.4781	376.9265	587.7454	794.1092	964.3700	(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	311.1518	246.1471	192.1726	96.8430	33.7045	0.0000	0.0000	0.0000	0.0000	79.4569	193.4493	317.2521	(98)	
Space heating												1470.1772	(98)	
RHI space heating demand												1470	(98)	

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	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) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.3000
Number of sides sheltered					0.3445 (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) =				0.2929 (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	0.3734	0.3661	0.3587	0.3221	0.3148	0.2782	0.2782	0.2709	0.2929	0.3148	0.3295	0.3441 (22b)
	0.5697	0.5670	0.5643	0.5519	0.5496	0.5387	0.5387	0.5367	0.5429	0.5496	0.5543	0.5592 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.2500	7.7800	60.0000	1867.2000 (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 (m ²)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7815		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Timber			84.4500			9.0000	760.0500 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12453.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		186.3122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2824 (36)
Total fabric heat loss	(33) + (36) =	41.0639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	29.0279	28.8900	28.7548	28.1198	28.0010	27.4479	27.4479	27.3455	27.6610	28.0010	28.2413	28.4926 (38)
Heat transfer coeff	70.0918	69.9538	69.8187	69.1837	69.0649	68.5118	68.5118	68.4094	68.7248	69.0649	69.3052	69.5565 (39)
Average = Sum(39)m / 12 =												69.1831 (39)
HLP	1.0487	1.0466	1.0446	1.0351	1.0333	1.0250	1.0250	1.0235	1.0282	1.0333	1.0369	1.0406 (40)
HLP (average)												1.0351 (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)

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	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	46.1534	40.9930	33.3378	25.2388	18.8663	15.9277	17.2105	22.3708	30.0261	38.1250	44.4976	47.4361	(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	495.7206	491.5081	472.3165	442.8379	412.9147	386.1398	370.5705	378.3720	395.4220	425.0962	457.9316	482.5265	(73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				6.0900	36.7938	0.6200		0.7000		0.7700		67.3931
Northwest				2.5800	11.2829	0.6200		0.7000		0.7700		8.7552 (77)
Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243 (83)
Total gains	571.8688	624.1248	661.4931	690.1842	701.7810	678.1153	649.9028	625.9339	604.6181	573.7487	549.6692	547.3508 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.3524	49.4497	49.5455	50.0002	50.0862	50.4905	50.4905	50.5661	50.3340	50.0862	49.9125	49.7322	
alpha	4.2902	4.2966	4.3030	4.3333	4.3391	4.3660	4.3660	4.3711	4.3556	4.3391	4.3275	4.3155	
util living area	0.9758	0.9631	0.9380	0.8817	0.7751	0.6089	0.4550	0.4901	0.7036	0.8913	0.9601	0.9795	(86)
MIT	19.8968	20.0537	20.2935	20.5870	20.8222	20.9537	20.9896	20.9856	20.9117	20.6261	20.2133	19.8588	(87)
Th 2	20.0430	20.0447	20.0464	20.0542	20.0557	20.0625	20.0625	20.0638	20.0599	20.0557	20.0527	20.0496	(88)
util rest of house	0.9704	0.9550	0.9241	0.8549	0.7258	0.5326	0.3622	0.3960	0.6317	0.8612	0.9499	0.9749	(89)
MIT 2	18.5960	18.8217	19.1630	19.5734	19.8765	20.0279	20.0576	20.0565	19.9866	19.6350	19.0593	18.5462	(90)
Living area fraction	19.0985	19.2976	19.5997	19.9650	20.2418	20.3856	20.4176	20.4154	20.3440	20.0178	19.5051	19.0533	(91)
MIT	18.9485	19.1476	19.4497	19.8150	20.0918	20.2356	20.2676	20.2654	20.1940	19.8678	19.3551	18.9033	(92)
Temperature adjustment												-0.1500	
adjusted MIT													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9623	0.9454	0.9136	0.8471	0.7279	0.5473	0.3829	0.4168	0.6427	0.8543	0.9405	0.9675	(94)
Ext temp.	550.3201	590.0459	604.3199	584.6668	510.8200	371.1552	248.8293	260.8608	388.5720	490.1438	516.9459	529.5726	(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	1026.7405	996.6742	904.1328	755.1370	579.5775	386.1017	251.2765	264.4287	418.8063	640.0820	849.3424	1022.7082	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating	354.4568	273.2542	223.0608	122.7385	51.1556	0.0000	0.0000	0.0000	0.0000	111.5540	239.3255	366.8929	(99)
Space heating per m ²													(98) / (4) =

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													1936.0425 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	354.4568	273.2542	223.0608	122.7385	51.1556	0.0000	0.0000	0.0000	0.0000	111.5540	239.3255	366.8929	(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)	393.8409	303.6158	247.8453	136.3761	56.8395	0.0000	0.0000	0.0000	0.0000	123.9489	265.9172	407.6588	(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	88.9405	88.8446	88.6554	88.2666	87.6224	86.7000	86.7000	86.7000	86.7000	88.1580	88.7227	88.9848	(216)
(217)m	88.9405	88.8446	88.6554	88.2666	87.6224	86.7000	86.7000	86.7000	86.7000	88.1580	88.7227	88.9848	(217)
Fuel for water heating, kWh/month	181.5541	159.6203	166.6650	148.2222	144.9743	128.9738	122.0318	136.4516	137.0200	153.9959	164.0979	176.4879	(219)
Water heating fuel used												1820.0946	(219)
Annual totals kWh/year													
Space heating fuel - main system												1936.0425	(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)												326.0333	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4157.1704	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1936.0425	3.4800	67.3743 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1820.0946	3.4800	63.3393 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	326.0333	13.1900	43.0038 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			303.6099 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1402 (257)
SAP value	84.0947
SAP rating (Section 12)	84 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1936.0425	0.2160	418.1852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1820.0946	0.2160	393.1404 (264)
Space and water heating			811.3256 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.0333	0.5190	169.2113 (268)
Energy saving/generation technologies			
PV Unit	-415.4446	0.5190	-215.6157 (269)
Total kg/year			803.8461 (272)
CO2 emissions per m2			12.0300 (273)
EI value			90.3688
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	$3.48 / 0.8792 = 3.958$, stars = 4
Water heating environmental impact	$0.216 / 0.8792 = 0.2457$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1295 (8)
Measured/design AP50					Yes
Infiltration rate					4.3000
Number of sides sheltered					0.3445 (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) =				0.2929 (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												
	0.3075	0.2855	0.2929	0.2782	0.2782	0.2709	0.2636	0.2562	0.2489	0.2709	0.2562	0.2709 (22b)
Effective ac	0.5473	0.5408	0.5429	0.5387	0.5387	0.5367	0.5347	0.5328	0.5310	0.5367	0.5328	0.5367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			8.6700	1.3258	11.4943		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT2F 100mm Knauf Supafil	41.9100	10.7900	31.1200	0.2500	7.7800	60.0000	1867.2000 (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 (m ²)			126.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7815		(33)
APT E-WM-28			16.7000	0.0000	0.0000	110.0000	1837.0000 (32)
E-FC-4			66.8400			70.0000	4678.8000 (32d)
2F - Timber			84.4500			9.0000	760.0500 (32c)
2F - Metal			36.5900			20.0000	731.8000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12453.1100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		186.3122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2824 (36)
Total fabric heat loss	(33) + (36) =	41.0639 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	27.8849	27.5531	27.6610	27.4479	27.4479	27.3455	27.2458	27.1489	27.0547	27.3455	27.1489	27.3455 (38)
Heat transfer coeff	68.9488	68.6170	68.7248	68.5118	68.5118	68.4094	68.3097	68.2128	68.1185	68.4094	68.2128	68.4094 (39)
Average = Sum(39)m / 12 =												68.4497 (39)
HLP	1.0315	1.0266	1.0282	1.0250	1.0250	1.0235	1.0220	1.0205	1.0191	1.0235	1.0205	1.0235 (40)
HLP (average)												1.0241 (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)

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	46.1534	40.9930	33.3378	25.2388	18.8663	15.9277	17.2105	22.3708	30.0261	38.1250	44.4976	47.4361	(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	495.7206	491.5081	472.3165	442.8379	412.9147	386.1398	370.5705	378.3720	395.4220	425.0962	457.9316	482.5265	(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												6.0900	45.1778	0.6200	0.7000	0.7700	82.7495
Northwest												2.5800	14.6176	0.6200	0.7000	0.7700	11.3428 (77)
Solar gains	94.0923	139.7058	201.8193	267.3530	298.3409	328.2459	311.3002	281.5449	236.3425	169.1918	113.0290	78.7177	(83)				
Total gains	589.8129	631.2139	674.1358	710.1909	711.2556	714.3856	681.8707	659.9169	631.7645	594.2880	570.9606	561.2441	(84)				

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	50.1705	50.4132	50.3340	50.4905	50.4905	50.5661	50.6399	50.7119	50.7820	50.5661	50.7119	50.5661	
alpha	4.3447	4.3609	4.3556	4.3660	4.3660	4.3711	4.3760	4.3808	4.3855	4.3711	4.3808	4.3711	
util living area	0.9689	0.9573	0.9253	0.8533	0.7246	0.5275	0.3868	0.3986	0.6336	0.8521	0.9443	0.9730	(86)
MIT	20.0261	20.1437	20.3877	20.6706	20.8787	20.9763	20.9952	20.9946	20.9477	20.7276	20.3574	20.0063	(87)
Th 2	20.0571	20.0612	20.0599	20.0625	20.0625	20.0638	20.0650	20.0663	20.0674	20.0638	20.0663	20.0638	(88)
util rest of house	0.9619	0.9480	0.9087	0.8212	0.6678	0.4480	0.2960	0.3054	0.5554	0.8127	0.9300	0.9668	(89)
MIT 2	18.7919	18.9621	19.3047	19.6900	19.9480	20.0484	20.0632	20.0642	20.0282	19.7727	19.2726	18.7691	(90)
Living area fraction	19.2687	19.4186	19.7231	20.0688	20.3075	20.4068	20.4232	20.4236	20.3834	20.1416	19.6917	19.2470	(92)
MIT	19.1187	19.2686	19.5731	19.9188	20.1575	20.2568	20.2732	20.2736	20.2334	19.9916	19.5417	19.0970	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9531	0.9382	0.8986	0.8157	0.6739	0.4649	0.3164	0.3264	0.5700	0.8093	0.9203	0.9585	(94)
Ext temp.	562.1449	592.1905	605.7845	579.3061	479.3303	332.1081	215.7770	215.3735	360.0965	480.9484	525.4297	537.9560	(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	980.3597	958.4808	864.0810	713.8102	524.6320	339.0941	216.7603	216.4781	376.9265	587.7454	794.1092	964.3700	(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	311.1518	246.1471	192.1726	96.8430	33.7045	0.0000	0.0000	0.0000	0.0000	79.4569	193.4493	317.2521	(98)
												1470.1772	(98)
												21.9955	(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													1633.5302 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	311.1518	246.1471	192.1726	96.8430	33.7045	0.0000	0.0000	0.0000	0.0000	79.4569	193.4493	317.2521	(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)	345.7242	273.4968	213.5251	107.6033	37.4494	0.0000	0.0000	0.0000	0.0000	88.2855	214.9436	352.5023	(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	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	88.8447	88.7650	88.5352	88.0736	87.3718	86.7000	86.7000	86.7000	86.7000	87.8898	88.5526	88.7000	(216)
Fuel for water heating, kWh/month	181.7499	159.7634	166.8912	148.5469	145.3901	128.9738	122.0318	136.4516	137.0200	154.4659	164.4131	176.6962	(219)
Water heating fuel used												1822.3939	(219)
Annual totals kWh/year													
Space heating fuel - main system												1633.5302	(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)												326.0333	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3856.9574	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1633.5302	3.9200	64.0344 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1822.3939	3.9200	71.4378 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	326.0333	16.9600	55.2952 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			291.4875 (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	1633.5302	0.2160	352.8425 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1822.3939	0.2160	393.6371 (264)
Space and water heating			746.4796 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.0333	0.5190	169.2113 (268)
Energy saving/generation technologies			
PV Unit	-415.4446	0.5190	-215.6157 (269)
Total kg/year			739.0001 (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	1633.5302	1.2200	1992.9068 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1822.3939	1.2200	2223.3206 (264)
Space and water heating			4216.2274 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	326.0333	3.0700	1000.9221 (268)
Energy saving/generation technologies			
PV Unit	-415.4446	3.0700	-1275.4149 (269)
Primary energy kWh/year			4171.9847 (272)
Primary energy kWh/m2/year			62.4175 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Current energy efficiency rating: B 84
Current environmental impact rating: B 90

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

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

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

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 90

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

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

	Current	Potential	Saving
Electricity	£68	£68	£0
Mains gas	£223	£223	£0
Space heating	£165	£165	£0
Water heating	£71	£71	£0
Lighting	£55	£55	£0
Total cost of fuels	£291	£291	£0
Total cost of uses	£291	£291	£0
Delivered energy	58 kWh/m²	58 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	62 kWh/m²	62 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	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	186.3 (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	41.06 (37)
Summer heat loss coefficient	346.78 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South East	0.000	1.000	None
North 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)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	6.0900	127.3119	0.6200	0.7000	0.9000	272.5592
North West	2.5800	106.0502	0.6200	0.7000	0.9000	96.1847
total:						368.7439

	Jun	Jul	Aug	
Solar gains	395	369	332	(P3)
Internal gains	383	368	375	
Total summer gains	778	736	708	(P5)

Summer gain/loss ratio	2.24	2.12	2.04	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 186.3)	0.70	0.70	0.70	
Threshold temperature	18.34	20.12	20.04	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant