

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-196			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	1FF - Semi (As)		
Property	91, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	82 B	DER	18.99	TER	21.26
Environmental	88 B	% DER<TER	10.68		
CO ₂ Emissions (t/year)	0.81	DFEE	55.98	TFEE	55.13
General Requirements Compliance	Fail	% DFEE<TFEE	-1.55		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 52 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) 21.26 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.0 kWh/m²/yrFail
Excess energy =0.9 kWh/m²/yr (1.6%)

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.25 (max. 0.25)	0.25 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.24 (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:	4.11 (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
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5 Cylinder insulation

Hot water storage	No cylinder
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6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	No cylinder
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Boiler interlock	Yes	OK
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7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England):	Not significant	OK
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Based on:

Overshading:	Average
Windows facing North East:	3.02 m ² , No overhang
Windows facing South West:	3.83 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Door U-value	0.90 W/m ² K
Door U-value	0.71 W/m ² K
Photovoltaic array	322.83 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	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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) = 0.1834 (8)
Measured/design AP50					Yes
Infiltration rate					4.1100
Number of sides sheltered					0.3889 (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) =				0.3305 (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												
	0.4214	0.4132	0.4049	0.3636	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3718	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754 (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)			6.8500	1.3258	9.0814		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT E-FC-4 Over Bin Store			51.9400	0.2500	12.9850	40.0000	2077.6000 (28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.2600	7.3450	60.0000	1695.0000 (29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.2400	3.4728	110.0000	1591.7000 (29a)
Total net area of external elements Aum, m ²			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.3894		(33)
APT E-WM-28			15.2600	0.0000	0.0000	110.0000	1678.6000 (32)
E-FC-4			51.9400			70.0000	3635.8000 (32b)
1F - Timber			84.9100			9.0000	764.1900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11442.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							220.3098 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4305 (36)
Total fabric heat loss							(33) + (36) = 48.8199 (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	21.1936	21.0694	20.9478	20.3763	20.2694	19.7717	19.7717	19.6796	19.9634	20.2694	20.4857	20.7118 (38)
Heat transfer coeff												
	70.0134	69.8893	69.7677	69.1962	69.0893	68.5916	68.5916	68.4995	68.7833	69.0893	69.3056	69.5317 (39)
Average = Sum(39)m / 12 =												69.1957 (39)
HLP	1.3480	1.3456	1.3432	1.3322	1.3302	1.3206	1.3206	1.3188	1.3243	1.3302	1.3343	1.3387 (40)
HLP (average)												1.3322 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												

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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	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Total heat required for water heating calculated for each month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
Heat gains from water heating, kWh/month	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (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	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7557	13.1059	10.6584	8.0691	6.0318	5.0923	5.5024	7.1522	9.5996	12.1890	14.2263	15.1658 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365 (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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920 (71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989 (72)
Total internal gains	281.6805	279.8520	269.7770	253.7573	237.8025	222.2791	212.1262	217.1255	225.3090	241.5016	260.0286	273.6260 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2		Specific data g or Table 6b		Specific data FF or Table 6c		Access factor Table 6d		Gains W	
Northeast												3.0200	11.2829		0.6200		0.7000		0.7700		10.2483 (75)	
Southwest												3.8300	36.7938		0.6200		0.7000		0.7700		42.3835 (79)	
Solar gains	52.6318	93.0555	136.3644	184.1176	220.0603	224.5537	213.9616	186.2165	152.7551	105.2841	63.6607											
Total gains	334.3123	372.9075	406.1414	437.8749	457.8629	446.8328	426.0878	403.3419	378.0641	346.7857	323.6893											

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	45.3996	45.4802	45.5595	45.9357	46.0068	46.3407	46.3407	46.4030	46.2115	46.0068	45.8633	45.7141
alpha	4.0266	4.0320	4.0373	4.0624	4.0671	4.0894	4.0894	4.0935	4.0808	4.0671	4.0576	4.0476
util living area	0.9954	0.9922	0.9848	0.9644	0.9117	0.7963	0.6473	0.6943	0.8826	0.9726	0.9920	0.9962 (86)
MIT	19.3947	19.5499	19.8251	20.2011	20.5665	20.8396	20.9499	20.9323	20.7283	20.2658	19.7642	19.3637 (87)
Th 2	19.8035	19.8053	19.8071	19.8157	19.8173	19.8247	19.8247	19.8261	19.8219	19.8173	19.8140	19.8106 (88)
util rest of house	0.9939	0.9897	0.9797	0.9510	0.8747	0.7065	0.5014	0.5536	0.8190	0.9597	0.9891	0.9951 (89)
MIT 2	17.6864	17.9137	18.3146	18.8602	19.3651	19.7042	19.8034	19.7938	19.5848	18.9598	18.2330	17.6459 (90)
Living area fraction									fLA = Living area / (4) =			0.4476 (91)
MIT	18.4511	18.6462	18.9907	19.4604	19.9029	20.2124	20.3166	20.3035	20.0967	19.5444	18.9184	18.4149 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3011	18.4962	18.8407	19.3104	19.7529	20.0624	20.1666	20.1535	19.9467	19.3944	18.7684	18.2649 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9913	0.9859	0.9740	0.9436	0.8723	0.7272	0.5473	0.5968	0.8272	0.9534	0.9853	0.9928 (94)
Ext temp.	331.4033	367.6446	395.5713	413.1617	399.3749	324.9348	233.1854	240.6980	312.7231	330.6309	318.9156	315.9758 (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	980.2658	950.2259	860.9833	720.3628	556.3682	374.6753	244.6387	257.1108	402.1546	607.5997	808.6844	977.9558 (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	482.7537	391.4946	346.2665	221.1848	116.8030	0.0000	0.0000	0.0000	0.0000	206.0648	352.6335	492.5131 (98)
Space heating per m2										(98) / (4) =		50.2448 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2899.6822 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	482.7537	391.4946	346.2665	221.1848	116.8030	0.0000	0.0000	0.0000	0.0000	206.0648	352.6335	492.5131	(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)	536.3930	434.9940	384.7405	245.7609	129.7811	0.0000	0.0000	0.0000	0.0000	228.9609	391.8150	547.2367	(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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759	(64)
Efficiency of water heater (217)m	89.2153	89.1663	89.0594	88.8242	88.3344	86.7000	86.7000	86.7000	86.7000	88.7415	89.0817	86.7000	(216)
Fuel for water heating, kWh/month	162.6252	142.9739	149.3103	132.7864	129.8144	116.6762	110.6362	123.3713	123.7798	137.9040	147.0344	158.1923	(219)
Water heating fuel used												1635.1046	(219)
Annual totals kWh/year													
Space heating fuel - main system												2899.6822	(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)												260.5902	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4870.3769	(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	2899.6822	0.2160	626.3313	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1635.1046	0.2160	353.1826	(264)
Space and water heating			979.5139	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	260.5902	0.5190	135.2463	(268)
Energy saving/generation technologies				
PV Unit	-322.8335	0.5190	-167.5506	(269)
Total CO2, kg/year			986.1346	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.9900	(273)

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

DER			18.9900	ZC1
Total Floor Area		TFA	51.9400	
Assumed number of occupants		N	1.7473	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.3724	ZC2
CO2 emissions from cooking, equation (L16)			3.0985	ZC3
Total CO2 emissions			39.4609	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			39.4609	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	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (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) = 0.1834 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4334 (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) =				0.3684 (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	0.4697	0.4604	0.4512	0.4052	0.3960	0.3499	0.3499	0.3407	0.3684	0.3960	0.4144	0.4328 (22b)
Effective ac	0.6103	0.6060	0.6018	0.5821	0.5784	0.5612	0.5612	0.5580	0.5678	0.5784	0.5859	0.5937 (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)			6.8500	1.3258	9.0814		(27)
APT E-FC-4 Over Bin Store			51.9400	0.1300	6.7522		(28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.1800	5.0850		(29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.1800	2.6046		(29a)
Total net area of external elements Aum(A, m ²)			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.6432		(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)							14.4235 (36)
Total fabric heat loss						(33) + (36) =	40.0667 (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	21.9670	21.8128	21.6617	20.9520	20.8192	20.2011	20.2011	20.0866	20.4392	20.8192	21.0879	21.3687 (38)
Heat transfer coeff	62.0337	61.8796	61.7285	61.0188	60.8860	60.2678	60.2678	60.1534	60.5059	60.8860	61.1546	61.4354 (39)
Average = Sum(39)m / 12 =												61.0181 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1943	1.1914	1.1885	1.1748	1.1722	1.1603	1.1603	1.1581	1.1649	1.1722	1.1774	1.1828 (40)
HLP (average)												1.1748 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (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	42.4326	36.9325	39.3466	36.5841	36.2606	33.5976	34.7176	36.2606	36.5841	39.3466	39.5706	42.4326 (61)
Total heat required for water heating calculated for each month	165.9170	144.9328	150.7931	133.7459	129.4896	114.0472	109.2659	121.8059	123.1511	140.2321	149.6950	162.0206 (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	165.9170	144.9328	150.7931	133.7459	129.4896	114.0472	109.2659	121.8059	123.1511	140.2321	149.6950	162.0206 (64)
Heat gains from water heating, kWh/month	51.6667	45.1432	46.8926	41.4523	40.0638	35.1489	33.4667	37.5090	37.9296	43.3811	46.5090	50.3712 (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	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7557	13.1059	10.6584	8.0691	6.0318	5.0923	5.5024	7.1522	9.5996	12.1890	14.2263	15.1658 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365 (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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920 (71)
Water heating gains (Table 5)	69.4445	67.1774	63.0277	57.5727	53.8492	48.8179	44.9822	50.4153	52.6800	58.3079	64.5959	67.7032 (72)
Total internal gains	288.6800	286.3432	275.7643	259.2432	242.7820	226.7544	216.6102	222.1131	230.8070	247.5010	266.5266	280.6302 (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	
Northeast				3.0200	11.2829	0.6300		0.7000	0.7700		10.4136 (75)	
Southwest				3.8300	36.7938	0.6300		0.7000	0.7700		43.0671 (79)	
Solar gains	53.4807	94.5564	138.5639	187.0873	223.6097	228.1756	217.4126	189.2199	155.2189	106.9822	64.6875	45.3607 (83)
Total gains	342.1607	380.8996	414.3281	446.3305	466.3917	454.9300	434.0228	411.3330	386.0258	354.4832	331.2141	325.9910 (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	58.1449	58.2898	58.4324	59.1121	59.2410	59.8486	59.8486	59.9625	59.6131	59.2410	58.9808	58.7112
alpha	4.8763	4.8860	4.8955	4.9408	4.9494	4.9899	4.9899	4.9975	4.9742	4.9494	4.9321	4.9141
util living area	0.9970	0.9943	0.9875	0.9654	0.9014	0.7577	0.5895	0.6392	0.8635	0.9743	0.9941	0.9976 (86)
MIT	19.7537	19.8918	20.1275	20.4466	20.7374	20.9260	20.9832	20.9751	20.8482	20.4816	20.0630	19.7294 (87)
Th 2	19.9245	19.9269	19.9292	19.9402	19.9423	19.9519	19.9519	19.9536	19.9482	19.9423	19.9381	19.9338 (88)
util rest of house	0.9960	0.9924	0.9829	0.9517	0.8609	0.6665	0.4599	0.5100	0.7944	0.9614	0.9918	0.9968 (89)
MIT 2	18.2735	18.4764	18.8202	19.2840	19.6776	19.9007	19.9455	19.9431	19.8235	19.3409	18.7348	18.2446 (90)
Living area fraction									fLA = Living area / (4) =			0.4476 (91)
MIT	18.9361	19.1100	19.4054	19.8044	20.1520	20.3597	20.4100	20.4051	20.2822	19.8515	19.3294	18.9092 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9361	19.1100	19.4054	19.8044	20.1520	20.3597	20.4100	20.4051	20.2822	19.8515	19.3294	18.9092 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9946	0.9904	0.9800	0.9495	0.8700	0.7046	0.5184	0.5683	0.8192	0.9600	0.9899	0.9957 (94)
Ext temp.	340.3262	377.2504	406.0505	423.7948	405.7825	320.5260	225.0084	233.7405	316.2473	340.3041	327.8648	324.5979 (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	907.9294	879.3060	796.6297	665.3734	514.6078	347.1229	229.6212	240.9197	374.0613	563.2865	747.8824	903.6673 (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	422.2968	337.3814	290.5909	173.9366	80.9660	0.0000	0.0000	0.0000	0.0000	165.8989	302.4127	430.8276 (98)
Space heating per m2												2204.3110 (98)
										(98) / (4) =		42.4396 (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												2360.0760	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	422.2968	337.3814	290.5909	173.9366	80.9660	0.0000	0.0000	0.0000	0.0000	165.8989	302.4127	430.8276	(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)	452.1379	361.2221	311.1252	186.2276	86.6874	0.0000	0.0000	0.0000	0.0000	177.6219	323.7824	461.2715	(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	165.9170	144.9328	150.7931	133.7459	129.4896	114.0472	109.2659	121.8059	123.1511	140.2321	149.6950	162.0206	(64)
Efficiency of water heater	87.3027	87.1077	86.6755	85.7137	83.9065	80.3000	80.3000	80.3000	80.3000	85.4752	86.7857	87.3958	(216)
(217)m	87.3027	87.1077	86.6755	85.7137	83.9065	80.3000	80.3000	80.3000	80.3000	85.4752	86.7857	87.3958	(217)
Fuel for water heating, kWh/month	190.0480	166.3834	173.9743	156.0380	154.3260	142.0265	136.0722	151.6886	153.3638	164.0617	172.4880	185.3871	(219)
Water heating fuel used												1945.8577	(219)
Annual totals kWh/year													
Space heating fuel - main system												2360.0760	(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)												260.5902	(232)
Total delivered energy for all uses												4641.5239	(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	2360.0760	0.2160	509.7764 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1945.8577	0.2160	420.3053 (264)
Space and water heating			930.0817 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	260.5902	0.5190	135.2463 (268)
Total CO2, kg/m2/year			1104.2530 (272)
Emissions per m2 for space and water heating			17.9068 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6039 (272b)
Emissions per m2 for pumps and fans			0.7494 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9068 * 1.00) + 2.6039 + 0.7494, rounded to 2 d.p.			21.2600 (273)

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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	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (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) = 0.1834 (8)
Pressure test					Yes
Measured/design AP50					4.1100
Infiltration rate					0.3889 (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) =				0.3305 (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	0.4214	0.4132	0.4049	0.3636	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3718	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754 (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)			6.8500	1.3258	9.0814		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT E-FC-4 Over Bin Store			51.9400	0.2500	12.9850	40.0000	2077.6000 (28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.2600	7.3450	60.0000	1695.0000 (29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.2400	3.4728	110.0000	1591.7000 (29a)
Total net area of external elements Aum, m ²			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.3894		(33)
APT E-WM-28			15.2600	0.0000	0.0000	110.0000	1678.6000 (32)
E-FC-4			51.9400			30.0000	1558.2000 (32b)
1F - Timber			84.9100			9.0000	764.1900 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9365.2900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.3098 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4305 (36)
Total fabric heat loss						(33) + (36) =	48.8199 (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	21.1936	21.0694	20.9478	20.3763	20.2694	19.7717	19.7717	19.6796	19.9634	20.2694	20.4857	20.7118 (38)
Heat transfer coeff	70.0134	69.8893	69.7677	69.1962	69.0893	68.5916	68.5916	68.4995	68.7833	69.0893	69.3056	69.5317 (39)
Average = Sum(39)m / 12 =												69.1957 (39)
HLP	1.3480	1.3456	1.3432	1.3322	1.3302	1.3206	1.3206	1.3188	1.3243	1.3302	1.3343	1.3387 (40)
HLP (average)												1.3322 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (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:												

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	26.2404	22.9500	23.6824	20.6469	19.8112	17.0955	15.8415	18.1784	18.3955	21.4382	23.4014	25.4125 (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	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7557	13.1059	10.6584	8.0691	6.0318	5.0923	5.5024	7.1522	9.5996	12.1890	14.2263	15.1658	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	145.5517	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	35.2694	34.1519	31.8312	28.6762	26.6279	23.7438	21.2924	24.4333	25.5493	28.8148	32.5020	34.1565	(72)
Total internal gains	251.5049	250.3176	241.5677	227.3467	212.5607	198.6803	189.9204	193.1311	200.6763	215.0078	231.4327	244.0836	(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	
Northeast			3.0200	11.2829			0.6200	0.7000		0.7700	10.2483 (75)		
Southwest			3.8300	36.7938			0.6200	0.7000		0.7700	42.3835 (79)		
Solar gains	52.6318	93.0555	136.3644	184.1176	220.0603	224.5537	213.9616	186.2165	152.7551	105.2841	63.6607	44.6407 (83)	
Total gains	304.1367	343.3731	377.9322	411.4644	432.6211	423.2341	403.8820	379.3475	353.4314	320.2919	295.0934	288.7243 (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	37.1567	37.2227	37.2876	37.5955	37.6537	37.9269	37.9269	37.9780	37.8212	37.6537	37.5362	37.4141	
alpha	3.4771	3.4815	3.4858	3.5064	3.5102	3.5285	3.5285	3.5319	3.5214	3.5102	3.5024	3.4943	
util living area	0.9931	0.9888	0.9795	0.9561	0.9021	0.7932	0.6550	0.7022	0.8772	0.9666	0.9889	0.9943	(86)
MIT	19.0777	19.2574	19.5766	20.0126	20.4385	20.7696	20.9169	20.8913	20.6332	20.0899	19.5069	19.0429	(87)
Th 2	19.8035	19.8053	19.8071	19.8157	19.8173	19.8247	19.8247	19.8261	19.8219	19.8173	19.8140	19.8106	(88)
util rest of house	0.9913	0.9858	0.9737	0.9421	0.8667	0.7104	0.5160	0.5699	0.8187	0.9534	0.9855	0.9928	(89)
MIT 2	18.0656	18.2456	18.5635	18.9978	19.4037	19.6960	19.7962	19.7848	19.5896	19.0796	18.5014	18.0363	(90)
Living area fraction									fLA = Living area / (4) =			0.4476	(91)
MIT	18.5187	18.6985	19.0170	19.4520	19.8669	20.1766	20.2979	20.2801	20.0568	19.5318	18.9515	18.4869	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5187	18.6985	19.0170	19.4520	19.8669	20.1766	20.2979	20.2801	20.0568	19.5318	18.9515	18.4869	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	300.6990	337.2426	366.0883	385.4651	375.7302	312.4336	232.8358	237.4948	294.2267	304.0332	289.7983	285.9835	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	995.4983	964.3700	873.2813	730.1610	564.2455	382.5091	253.6436	265.7848	409.7267	617.0941	821.3741	993.3898	(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	516.9307	421.4296	377.3516	248.1810	140.2554	0.0000	0.0000	0.0000	0.0000	232.9173	382.7345	526.3103	(98)
Space heating												2846.1104	(98)
Space heating per m2												54.7961	(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	644.7612	507.5780	520.5958	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7222	0.8008	0.7711	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	465.6767	406.4767	401.4382	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	561.1688	537.3345	509.8123	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	68.7543	97.3582	80.6303	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												246.7428 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
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	17.1886	24.3395	20.1576	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												61.6857 (107)
Energy for space heating												1.1876 (108)
Energy for space cooling												54.7961 (99)
Total												1.1876 (108)
Dwelling Fabric Energy Efficiency (DFEE)												55.9838 (109)
												56.0 (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	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (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) = 0.1834 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4334 (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) =	0.3684 (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												
	0.4697	0.4604	0.4512	0.4052	0.3960	0.3499	0.3499	0.3407	0.3684	0.3960	0.4144	0.4328 (22b)
Effective ac	0.6103	0.6060	0.6018	0.5821	0.5784	0.5612	0.5612	0.5580	0.5678	0.5784	0.5859	0.5937 (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)			6.8500	1.3258	9.0814		(27)
APT E-FC-4 Over Bin Store			51.9400	0.1300	6.7522		(28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.1800	5.0850		(29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.1800	2.6046		(29a)
Total net area of external elements Aum(A, m ²)			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.6432		(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)							14.4235 (36)
Total fabric heat loss						(33) + (36) =	40.0667 (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	21.9670	21.8128	21.6617	20.9520	20.8192	20.2011	20.2011	20.0866	20.4392	20.8192	21.0879	21.3687 (38)
Heat transfer coeff	62.0337	61.8796	61.7285	61.0188	60.8860	60.2678	60.2678	60.1534	60.5059	60.8860	61.1546	61.4354 (39)
Average = Sum(39)m / 12 =												61.0181 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1943	1.1914	1.1885	1.1748	1.1722	1.1603	1.1603	1.1581	1.1649	1.1722	1.1774	1.1828 (40)
HLP (average)												1.1748 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)												Total = Sum(45)m = 1191.0305 (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	26.2404	22.9500	23.6824	20.6469	19.8112	17.0955	15.8415	18.1784	18.3955	21.4382	23.4014	25.4125 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	87.3650	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.7557	13.1059	10.6584	8.0691	6.0318	5.0923	5.5024	7.1522	9.5996	12.1890	14.2263	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	152.2703	153.8504	149.8686	141.3919	130.6915	120.6347	113.9162	112.3361	116.3179	124.7946	135.4949	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	31.7365	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	35.2694	34.1519	31.8312	28.6762	26.6279	23.7438	21.2924	24.4333	25.5493	28.8148	32.5020	(72)
Total internal gains	251.5049	250.3176	241.5677	227.3467	212.5607	198.6803	189.9204	193.1311	200.6763	215.0078	231.4327	244.0836 (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
Northeast												3.0200	11.2829	0.6300	0.7000	0.7700	10.4136
Southwest												3.8300	36.7938	0.6300	0.7000	0.7700	43.0671
Solar gains	53.4807	94.5564	138.5639	187.0873	223.6097	228.1756	217.4126	189.2199	155.2189	106.9822	64.6875	45.3607	(83)				
Total gains	304.9856	344.8740	380.1316	414.4340	436.1704	426.8559	407.3330	382.3510	355.8952	321.9900	296.1202	289.4443	(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	58.1449	58.2898	58.4324	59.1121	59.2410	59.8486	59.8486	59.9625	59.6131	59.2410	58.9808	58.7112
alpha	4.8763	4.8860	4.8955	4.9408	4.9494	4.9899	4.9899	4.9975	4.9742	4.9494	4.9321	4.9141
util living area	0.9982	0.9963	0.9913	0.9739	0.9199	0.7882	0.6221	0.6773	0.8915	0.9824	0.9964	0.9986 (86)
MIT	19.6879	19.8287	20.0694	20.3975	20.7029	20.9111	20.9788	20.9680	20.8193	20.4293	20.0015	19.6644 (87)
Th 2	19.9245	19.9269	19.9292	19.9402	19.9423	19.9519	19.9519	19.9536	19.9482	19.9423	19.9381	19.9338 (88)
util rest of house	0.9976	0.9950	0.9880	0.9630	0.8845	0.6995	0.4883	0.5452	0.8302	0.9731	0.9949	0.9981 (89)
MIT 2	18.7317	18.8740	19.1151	19.4460	19.7333	19.9087	19.9462	19.9440	19.8429	19.4822	19.0556	18.7156 (90)
Living area fraction									fLA = Living area / (4) =			0.4476 (91)
MIT	19.1597	19.3014	19.5423	19.8719	20.1673	20.3574	20.4084	20.4024	20.2800	19.9062	19.4790	19.1403 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1597	19.3014	19.5423	19.8719	20.1673	20.3574	20.4084	20.4024	20.2800	19.9062	19.4790	19.1403 (93)

8. Space heating requirement

Utilisation	0.9970	0.9940	0.9864	0.9622	0.8932	0.7368	0.5490	0.6050	0.8525	0.9727	0.9940	0.9976 (94)
Useful gains	304.0565	342.8214	374.9769	398.7621	389.5845	314.4999	223.6102	231.3330	303.3983	313.2086	294.3538	288.7612 (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	921.8039	891.1502	805.0807	669.4935	515.5397	346.9845	229.5254	240.7569	373.9242	566.6145	757.0334	917.8656 (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	459.6041	368.4770	319.9972	194.9266	93.7107	0.0000	0.0000	0.0000	0.0000	188.5340	333.1293	468.0537 (98)
Space heating												2426.4325 (98)
Space heating per m2										(98) / (4) =		46.7161 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	566.5178	445.9821	457.1657	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8322	0.9025	0.8776	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	471.4732	402.4868	401.2009	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	565.4021	541.3681	513.3228	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	67.6288	103.3277	83.4187	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												254.3752 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												

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	16.9072	25.8319	20.8547	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												63.5938 (107)
Energy for space heating												1.2244 (108)
Energy for space cooling												46.7161 (99)
Total												1.2244 (108)
Target Fabric Energy Efficiency (TFEE)												47.9404 (109)
												55.1 (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	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (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) = 0.1834 (8)
Pressure test					Yes
Measured/design AP50					4.1100
Infiltration rate					0.3889 (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) =				0.3305 (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	0.3471	0.3223	0.3305	0.3140	0.3140	0.3057	0.2975	0.2892	0.2810	0.3057	0.2892	0.3057 (22b)
Effective ac	0.5602	0.5519	0.5546	0.5493	0.5493	0.5467	0.5442	0.5418	0.5395	0.5467	0.5418	0.5467 (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)			6.8500	1.3258	9.0814		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT E-FC-4 Over Bin Store			51.9400	0.2500	12.9850	40.0000	2077.6000 (28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.2600	7.3450	60.0000	1695.0000 (29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.2400	3.4728	110.0000	1591.7000 (29a)
Total net area of external elements Aum, (m ²)			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.3894		(33)
APT E-WM-28			15.2600	0.0000	0.0000	110.0000	1678.6000 (32)
E-FC-4			51.9400			70.0000	3635.8000 (32b)
1F - Timber			84.9100			9.0000	764.1900 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11442.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							220.3098 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4305 (36)
Total fabric heat loss						(33) + (36) =	48.8199 (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	20.1650	19.8664	19.9634	19.7717	19.7717	19.6796	19.5899	19.5026	19.4178	19.6796	19.5026	19.6796 (38)
Heat transfer coeff	68.9849	68.6862	68.7833	68.5916	68.5916	68.4995	68.4097	68.3225	68.2377	68.4995	68.3225	68.4995 (39)
Average = Sum(39)m / 12 =												68.5357 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3282	1.3224	1.3243	1.3206	1.3206	1.3188	1.3171	1.3154	1.3138	1.3188	1.3154	1.3188 (40)
HLP (average)												1.3195 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												

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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	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Total heat required for water heating calculated for each month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
RHI water heating demand	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (65)
Heat gains from water heating, kWh/month	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (65)
Total per year (kWh/year) = Sum(63)m =												1444.0579 (64)
												1444 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.8892	32.7647	26.6460	20.1728	15.0794	12.7306	13.7559	17.8805	23.9991	30.4724	35.5658	37.9145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.2691	229.6275	223.6845	211.0327	195.0620	180.0518	170.0241	167.6658	173.6087	186.2606	202.2312	217.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	411.7805	408.2555	392.5481	368.4693	344.1882	322.3022	309.4553	316.1511	329.9670	354.2186	381.0720	401.0319	(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	
Northeast				3.0200	14.6176	0.6200	0.7000			0.7700	13.2772 (75)	
Southwest				3.8300	45.1778	0.6200	0.7000			0.7700	52.0412 (79)	
Solar gains	65.3184	98.5772	146.4719	200.3614	228.5718	253.7001	239.7101	213.1358	173.7885	120.5679	78.8064	54.4259 (83)
Total gains	477.0989	506.8327	539.0200	568.8307	572.7600	576.0023	549.1654	529.2869	503.7555	474.7866	459.8784	455.4578 (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	46.0765	46.2768	46.2115	46.3407	46.3407	46.4030	46.4639	46.5232	46.5810	46.4030	46.5232	46.4030	
alpha	4.0718	4.0851	4.0808	4.0894	4.0894	4.0935	4.0976	4.1015	4.1054	4.0935	4.1015	4.0935	
util living area	0.9815	0.9752	0.9565	0.9096	0.8106	0.6263	0.4725	0.4880	0.7358	0.9095	0.9672	0.9838 (86)	
MIT	19.7624	19.8735	20.1374	20.4764	20.7709	20.9427	20.9859	20.9842	20.8855	20.5642	20.1305	19.7495 (87)	
Th 2	19.8188	19.8233	19.8219	19.8247	19.8247	19.8261	19.8275	19.8288	19.8301	19.8261	19.8288	19.8261 (88)	
util rest of house	0.9761	0.9680	0.9432	0.8805	0.7477	0.5177	0.3371	0.3491	0.6385	0.8734	0.9559	0.9789 (89)	
MIT 2	18.2289	18.3914	18.7671	19.2389	19.6151	19.7926	19.8233	19.8240	19.7497	19.3668	18.7669	18.2157 (90)	
Living area fraction	18.9153	19.0548	19.3805	19.7928	20.1325	20.3074	20.3437	20.3434	20.2581	19.9028	19.3773	18.9022 (92)	
Temperature adjustment	18.7653	18.9048	19.2305	19.6428	19.9825	20.1574	20.1937	20.1934	20.1081	19.7528	19.2273	18.7522 (93)	
adjusted MIT	18.7653	18.9048	19.2305	19.6428	19.9825	20.1574	20.1937	20.1934	20.1081	19.7528	19.2273	18.7522 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9696	0.9607	0.9348	0.8751	0.7571	0.5502	0.3806	0.3937	0.6640	0.8707	0.9484	0.9730	(94)
Useful gains	462.5915	486.8911	503.8724	497.8060	433.6557	316.8994	209.0045	208.3787	334.4751	413.4021	436.1413	443.1435	(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	956.4971	934.4621	841.2546	695.7135	513.2341	332.7311	211.6392	211.3464	369.0392	572.1632	773.9101	942.0216	(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	367.4658	300.7677	251.0123	142.4934	59.2063	0.0000	0.0000	0.0000	0.0000	118.1183	243.1936	371.1653	(98)
Space heating												1853.4227	(98)
RHI space heating demand												1853	(98)

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

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (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) = 0.1834 (8)
Measured/design AP50					Yes
Infiltration rate					4.1100
Number of sides sheltered					0.3889 (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) =				0.3305 (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												
	0.4214	0.4132	0.4049	0.3636	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3718	0.3884 (22b)
Effective ac	0.5888	0.5854	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754 (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)			6.8500	1.3258	9.0814		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT E-FC-4 Over Bin Store			51.9400	0.2500	12.9850	40.0000	2077.6000 (28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.2600	7.3450	60.0000	1695.0000 (29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.2400	3.4728	110.0000	1591.7000 (29a)
Total net area of external elements Aum, m ²			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.3894		(33)
APT E-WM-28			15.2600	0.0000	0.0000	110.0000	1678.6000 (32)
E-FC-4			51.9400			70.0000	3635.8000 (32b)
1F - Timber			84.9100			9.0000	764.1900 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11442.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							220.3098 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4305 (36)
Total fabric heat loss						(33) + (36) =	48.8199 (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	21.1936	21.0694	20.9478	20.3763	20.2694	19.7717	19.7717	19.6796	19.9634	20.2694	20.4857	20.7118 (38)
Heat transfer coeff												
	70.0134	69.8893	69.7677	69.1962	69.0893	68.5916	68.5916	68.4995	68.7833	69.0893	69.3056	69.5317 (39)
Average = Sum(39)m / 12 =												69.1957 (39)
HLP	1.3480	1.3456	1.3432	1.3322	1.3302	1.3206	1.3206	1.3188	1.3243	1.3302	1.3343	1.3387 (40)
HLP (average)												1.3322 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												

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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	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Total heat required for water heating calculated for each month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
Heat gains from water heating, kWh/month	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (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	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.8892	32.7647	26.6460	20.1728	15.0794	12.7306	13.7559	17.8805	23.9991	30.4724	35.5658	37.9145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.2691	229.6275	223.6845	211.0327	195.0620	180.0518	170.0241	167.6658	173.6087	186.2606	202.2312	217.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	411.7805	408.2555	392.5481	368.4693	344.1882	322.3022	309.4553	316.1511	329.9670	354.2186	381.0720	401.0319	(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			
Northeast				3.0200	11.2829	0.6200	0.7000	0.7700	10.2483 (75)			
Southwest				3.8300	36.7938	0.6200	0.7000	0.7700	42.3835 (79)			
Solar gains	52.6318	93.0555	136.3644	184.1176	220.0603	224.5537	213.9616	186.2165	152.7551	105.2841	63.6607	44.6407 (83)
Total gains	464.4123	501.3110	528.9125	552.5870	564.2486	546.8559	523.4169	502.3675	482.7221	459.5027	444.7327	445.6727 (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	45.3996	45.4802	45.5595	45.9357	46.0068	46.3407	46.3407	46.4030	46.2115	46.0068	45.8633	45.7141	
alpha	4.0266	4.0320	4.0373	4.0624	4.0671	4.0894	4.0894	4.0935	4.0808	4.0671	4.0576	4.0476	
util living area	0.9852	0.9783	0.9638	0.9284	0.8511	0.7070	0.5493	0.5890	0.7963	0.9347	0.9761	0.9874	(86)
MIT	19.6342	19.7812	20.0360	20.3758	20.6874	20.8989	20.9724	20.9630	20.8261	20.4434	19.9816	19.6002	(87)
Th 2	19.8035	19.8053	19.8071	19.8157	19.8173	19.8247	19.8247	19.8261	19.8219	19.8173	19.8140	19.8106	(88)
util rest of house	0.9810	0.9721	0.9528	0.9051	0.8002	0.6099	0.4153	0.4559	0.7139	0.9087	0.9681	0.9838	(89)
MIT 2	18.0330	18.2463	18.6130	19.0962	19.5090	19.7546	19.8139	19.8101	19.6837	19.1988	18.5441	17.9888	(90)
Living area fraction	18.7497	18.9334	19.2500	19.6690	20.0365	20.2668	20.3325	20.3262	20.1951	19.7559	19.1876	18.7101	(91)
MIT	18.5997	18.7834	19.1000	19.5190	19.8865	20.1168	20.1825	20.1762	20.0451	19.6059	19.0376	18.5601	(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	0.9752	0.9650	0.9445	0.8980	0.8036	0.6361	0.4579	0.4978	0.7316	0.9029	0.9611	0.9785	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1001.1736	970.2995	879.0706	734.7945	565.5979	378.4086	245.7294	258.6653	408.9207	622.2130	827.3415	998.4816	(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	407.9341	326.9444	282.3640	171.7800	83.4500	0.0000	0.0000	0.0000	0.0000	154.2578	287.9485	418.4236	(98)
Space heating												2133.1024	(98)
Space heating per m2													(98) / (4) = 41.0686 (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												2370.1138	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	407.9341	326.9444	282.3640	171.7800	83.4500	0.0000	0.0000	0.0000	0.0000	154.2578	287.9485	418.4236	(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)	453.2601	363.2716	313.7378	190.8667	92.7222	0.0000	0.0000	0.0000	0.0000	171.3976	319.9427	464.9151	(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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759	(64)
Efficiency of water heater	89.1102	89.0491	88.9165	88.6267	88.0600	86.7000	86.7000	86.7000	86.7000	88.5097	88.9416	86.7000	(216)
(217)m	89.1102	89.0491	88.9165	88.6267	88.0600	86.7000	86.7000	86.7000	86.7000	88.5097	88.9416	89.1440	(217)
Fuel for water heating, kWh/month	162.8171	143.1620	149.5504	133.0823	130.2188	116.6762	110.6362	123.3713	123.7798	138.2651	147.2661	158.3684	(219)
Water heating fuel used												1637.1938	(219)
Annual totals kWh/year													
Space heating fuel - main system												2370.1138	(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)												260.5902	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4342.8977	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2370.1138	3.4800	82.4800 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1637.1938	3.4800	56.9743 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	260.5902	13.1900	34.3718 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			303.7186 (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] = 1.3159 (257)
SAP value	81.6434
SAP rating (Section 12)	82 (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	2370.1138	0.2160	511.9446 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1637.1938	0.2160	353.6339 (264)
Space and water heating			865.5784 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	260.5902	0.5190	135.2463 (268)
Energy saving/generation technologies			
PV Unit	-322.8335	0.5190	-167.5506 (269)
Total kg/year			872.1991 (272)
CO2 emissions per m2			16.7900 (273)
EI value			87.9436
EI rating			88 (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	$3.48 / 0.8810 = 3.950$, stars = 4
Water heating environmental impact	$0.216 / 0.8810 = 0.2452$, 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	51.9400 (1b)	x 2.1000 (2b)	= 109.0740 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 109.0740 (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) = 0.1834 (8)
Pressure test					Yes
Measured/design AP50					4.1100
Infiltration rate					0.3889 (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) =				0.3305 (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												
	0.3471	0.3223	0.3305	0.3140	0.3140	0.3057	0.2975	0.2892	0.2810	0.3057	0.2892	0.3057 (22b)
Effective ac	0.5602	0.5519	0.5546	0.5493	0.5493	0.5467	0.5442	0.5418	0.5395	0.5467	0.5418	0.5467 (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)			6.8500	1.3258	9.0814		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT E-FC-4 Over Bin Store			51.9400	0.2500	12.9850	40.0000	2077.6000 (28b)
APT 100mm Knauf Supafil	35.1000	6.8500	28.2500	0.2600	7.3450	60.0000	1695.0000 (29a)
APT Wall to Stairwell	16.5900	2.1200	14.4700	0.2400	3.4728	110.0000	1591.7000 (29a)
Total net area of external elements Aum, (m ²)			103.6300				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				34.3894		(33)
APT E-WM-28			15.2600	0.0000	0.0000	110.0000	1678.6000 (32)
E-FC-4			51.9400			70.0000	3635.8000 (32b)
1F - Timber			84.9100			9.0000	764.1900 (32c)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						11442.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							220.3098 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4305 (36)
Total fabric heat loss	(33) + (36) =						48.8199 (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	20.1650	19.8664	19.9634	19.7717	19.7717	19.6796	19.5899	19.5026	19.4178	19.6796	19.5026	19.6796 (38)
Heat transfer coeff	68.9849	68.6862	68.7833	68.5916	68.5916	68.4995	68.4097	68.3225	68.2377	68.4995	68.3225	68.4995 (39)
Average = Sum(39)m / 12 =												68.5357 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3282	1.3224	1.3243	1.3206	1.3206	1.3188	1.3171	1.3154	1.3138	1.3188	1.3154	1.3188 (40)
HLP (average)												1.3195 (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												1.7473 (42)
Average daily hot water use (litres/day)												75.6984 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	83.2682	80.2403	77.2124	74.1844	71.1565	68.1286	68.1286	71.1565	74.1844	77.2124	80.2403	83.2682 (44)
Energy conte	123.4844	108.0002	111.4466	97.1618	93.2291	80.4496	74.5484	85.5454	86.5670	100.8855	110.1245	119.5880 (45)
Energy content (annual)										Total = Sum(45)m =		1191.0305 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.5227	16.2000	16.7170	14.5743	13.9844	12.0674	11.1823	12.8318	12.9851	15.1328	16.5187	17.9382 (46)
Water storage loss:												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	21.6022	19.4843	21.5284	20.7846	21.4416	20.7087	21.3732	21.4176	20.7501	21.4925	20.8563	21.5879 (61)
Total heat required for water heating calculated for each month	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759 (64)
Heat gains from water heating, kWh/month	46.4591	40.7812	42.4381	37.5025	36.3591	31.9267	30.1306	33.7982	33.9711	38.9176	41.8305	45.1600 (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	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	104.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.8892	32.7647	26.6460	20.1728	15.0794	12.7306	13.7559	17.8805	23.9991	30.4724	35.5658	37.9145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.2691	229.6275	223.6845	211.0327	195.0620	180.0518	170.0241	167.6658	173.6087	186.2606	202.2312	217.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	47.2311	(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)	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	-69.8920	(71)
Water heating gains (Table 5)	62.4450	60.6862	57.0404	52.0868	48.8697	44.3426	40.4982	45.4277	47.1820	52.3086	58.0979	60.6989	(72)
Total internal gains	411.7805	408.2555	392.5481	368.4693	344.1882	322.3022	309.4553	316.1511	329.9670	354.2186	381.0720	401.0319	(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	
Northeast				3.0200	14.6176	0.6200		0.7000		0.7700		13.2772 (75)	
Southwest				3.8300	45.1778	0.6200		0.7000		0.7700		52.0412 (79)	
Solar gains	65.3184	98.5772	146.4719	200.3614	228.5718	253.7001	239.7101	213.1358	173.7885	120.5679	78.8064	54.4259	(83)
Total gains	477.0989	506.8327	539.0200	568.8307	572.7600	576.0023	549.1654	529.2869	503.7555	474.7866	459.8784	455.4578	(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	46.0765	46.2768	46.2115	46.3407	46.3407	46.4030	46.4639	46.5232	46.5810	46.4030	46.5232	46.4030	
alpha	4.0718	4.0851	4.0808	4.0894	4.0894	4.0935	4.0976	4.1015	4.1054	4.0935	4.1015	4.0935	
util living area	0.9815	0.9752	0.9565	0.9096	0.8106	0.6263	0.4725	0.4880	0.7358	0.9095	0.9672	0.9838	(86)
MIT	19.7624	19.8735	20.1374	20.4764	20.7709	20.9427	20.9859	20.9842	20.8855	20.5642	20.1305	19.7495	(87)
Th 2	19.8188	19.8233	19.8219	19.8247	19.8247	19.8261	19.8275	19.8288	19.8301	19.8261	19.8288	19.8261	(88)
util rest of house	0.9761	0.9680	0.9432	0.8805	0.7477	0.5177	0.3371	0.3491	0.6385	0.8734	0.9559	0.9789	(89)
MIT 2	18.2289	18.3914	18.7671	19.2389	19.6151	19.7926	19.8233	19.8240	19.7497	19.3668	18.7669	18.2157	(90)
Living area fraction	18.9153	19.0548	19.3805	19.7928	20.1325	20.3074	20.3437	20.3434	20.2581	19.9028	19.3773	18.9022	(91)
MIT	18.7653	18.9048	19.2305	19.6428	19.9825	20.1574	20.1937	20.1934	20.1081	19.7528	19.2273	18.7522	(92)
Temperature adjustment												-0.1500	
adjusted MIT												18.7522	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9696	0.9607	0.9348	0.8751	0.7571	0.5502	0.3806	0.3937	0.6640	0.8707	0.9484	0.9730	(94)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	956.4971	934.4621	841.2546	695.7135	513.2341	332.7311	211.6392	211.3464	369.0392	572.1632	773.9101	942.0216	(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	367.4658	300.7677	251.0123	142.4934	59.2063	0.0000	0.0000	0.0000	0.0000	118.1183	243.1936	371.1653	(98)
Space heating												1853.4227	(98)
Space heating per m2												35.6839	(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													2059.3585 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	367.4658	300.7677	251.0123	142.4934	59.2063	0.0000	0.0000	0.0000	0.0000	118.1183	243.1936	371.1653	(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)	408.2953	334.1864	278.9026	158.3260	65.7848	0.0000	0.0000	0.0000	0.0000	131.2425	270.2151	412.4059	(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	145.0866	127.4845	132.9749	117.9465	114.6707	101.1583	95.9216	106.9629	107.3171	122.3780	130.9808	141.1759	(64)
Efficiency of water heater (217)m	89.0407	88.9917	88.8291	88.4749	87.7962	86.7000	86.7000	86.7000	86.7000	88.2900	88.8166	86.7000	(216)
Fuel for water heating, kWh/month	162.9442	143.2545	149.6974	133.3106	130.6102	116.6762	110.6362	123.3713	123.7798	138.6092	147.4732	158.5073	(219)
Water heating fuel used													
Annual totals kWh/year													1638.8702 (219)
Space heating fuel - main system													2059.3585 (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)													260.5902 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4033.8189 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2059.3585	3.9200	80.7269 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1638.8702	3.9200	64.2437 (247)	
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)	
Energy for lighting	260.5902	16.9600	44.1961 (250)	
Additional standing charges			88.0000 (251)	
Energy saving/generation technologies				
PV Unit	0.0000	16.9600	0.0000 (252)	
Total energy cost			289.8867 (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	2059.3585	0.2160	444.8214 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1638.8702	0.2160	353.9960 (264)	
Space and water heating			798.8174 (265)	
Pumps and fans	75.0000	0.5190	38.9250 (267)	
Energy for lighting	260.5902	0.5190	135.2463 (268)	
Energy saving/generation technologies				
PV Unit	-322.8335	0.5190	-167.5506 (269)	
Total kg/year			805.4381 (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	2059.3585	1.2200	2512.4174 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1638.8702	1.2200	1999.4216 (264)	
Space and water heating			4511.8390 (265)	
Pumps and fans	75.0000	3.0700	230.2500 (267)	
Energy for lighting	260.5902	3.0700	800.0118 (268)	
Energy saving/generation technologies				
PV Unit	-322.8335	3.0700	-991.0989 (269)	
Primary energy kWh/year			4551.0019 (272)	
Primary energy kWh/m2/year			87.6204 (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 82
Current environmental impact rating: B 88

(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 82
Potential environmental impact rating: B 88

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	£57	£57	£0
Mains gas	£233	£233	£0
Space heating	£181	£181	£0
Water heating	£64	£64	£0
Lighting	£44	£44	£0
Total cost of fuels	£290	£290	£0
Total cost of uses	£289	£289	£0
Delivered energy	78 kWh/m²	78 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	88 kWh/m²	88 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	South East
Overshading	Average or unknown
Thermal mass parameter	220.3 (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	215.97 (P1)
Transmission heat loss coefficient	48.82 (37)
Summer heat loss coefficient	264.79 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.0200	106.0502	0.6200	0.7000	0.9000	112.5883
South West	3.8300	127.3119	0.6200	0.7000	0.9000	171.4125
total:						284.0008

	Jun	Jul	Aug	
Solar gains	306	284	252	(P3)
Internal gains	319	306	313	
Total summer gains	625	590	565	(P5)

	2.36	2.23	2.13	
Summer gain/loss ratio	2.36	2.23	2.13	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 220.3)	0.46	0.46	0.46	
Threshold temperature	18.22	19.99	19.89	(P7)

Likelihood of high internal temperature	Not significant	Not significant	Not significant
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Assessment of likelihood of high internal temperature: Not significant