

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-205			Issued on Date	21/05/2019
Assessment Reference	As Built	Prop Type Ref	GFF - Det (As)		
Property	50, St. Andrews, Botley, SOUTHAMPTON, SO32 2ST				
SAP Rating	83 B	DER	16.12	TER	20.12
Environmental	89 B	% DER<TER	19.88		
CO ₂ Emissions (t/year)	0.85	DFEE	49.83	TFEE	54.67
General Requirements Compliance	Pass	% DFEE<TFEE	8.85		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	4907-0015
Client					

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

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DWELLING AS BUILT

Ground-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) 20.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.12 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.29 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.75 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 0.95 m², No overhang
Windows facing East: 3.87 m², No overhang
Windows facing South: 0.95 m², No overhang
Windows facing West: 1.92 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Door U-value 0.71 W/m²K
Air permeability 3.8 m³/m²h
Photovoltaic array 480.95 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1278 (8)
Measured/design AP50					Yes
Infiltration rate					3.7500
Number of sides sheltered					0.3153 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2917 (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	0.3719	0.3646	0.3573	0.3208	0.3136	0.2771	0.2771	0.2698	0.2917	0.3136	0.3281	0.3427 (22b)
	0.5692	0.5665	0.5638	0.5515	0.5492	0.5384	0.5384	0.5364	0.5425	0.5492	0.5538	0.5587 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1600	10.7904	75.0000	5058.0000 (28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.2600	15.7066	60.0000	3624.6000 (29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.2400	4.4496	110.0000	2039.4000 (29a)
Total net area of external elements Aum, m2)			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.0497		(33)
E-FC-4			67.4400			70.0000	4720.8000 (32b)
GF - Timber			51.4600			9.0000	463.1400 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16724.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							247.9884 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1490 (36)
Total fabric heat loss						(33) + (36) =	50.1987 (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	29.3864	29.2478	29.1119	28.4736	28.3542	27.7982	27.7982	27.6953	28.0124	28.3542	28.5958	28.8483 (38)
Heat transfer coeff	79.5851	79.4465	79.3106	78.6723	78.5529	77.9969	77.9969	77.8940	78.2111	78.5529	78.7945	79.0470 (39)
Average = Sum(39)m / 12 =												78.6717 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1801	1.1780	1.1760	1.1666	1.1648	1.1565	1.1565	1.1550	1.1597	1.1648	1.1684	1.1721 (40)
HLP (average)												1.1665 (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												2.1824 (42)
Average daily hot water use (litres/day)												86.0321 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy content (annual)	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1353.6205 (45)
	21.0512	18.4115	18.9991	16.5638	15.8934	13.7148	12.7088	14.5835	14.7577	17.1986	18.7737	20.3870 (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	21.7341	19.5955	21.6388	20.8771	21.5268	20.7790	21.4384	21.4957	20.8325	21.5925	20.9697	21.7157 (61)
Total heat required for water heating calculated for each month	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (64)
Heat gains from water heating, kWh/month	52.0971	45.7111	47.5243	41.9358	40.6121	35.5959	33.5307	37.7007	37.9210	43.5218	46.8574	50.6201 (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	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1393	16.9993	13.8248	10.4663	7.8237	6.6051	7.1370	9.2769	12.4515	15.8100	18.4526	19.6712	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.2500	193.2346	188.2335	177.5868	164.1473	151.5160	143.0776	141.0930	146.0941	156.7407	170.1803	182.8115	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	(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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	(71)
Water heating gains (Table 5)	70.0230	68.0225	63.8767	58.2442	54.5861	49.4387	45.0682	50.6730	52.6680	58.4970	65.0797	68.0377	(72)
Total internal gains	339.1483	336.9925	324.6711	305.0333	285.2931	266.2959	254.0188	259.7790	269.9496	289.7839	312.4487	329.2566	(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				
North				0.9500	10.6334	0.6200	0.7000	0.7700	3.0382 (74)				
East				3.8700	19.6403	0.6200	0.7000	0.7700	22.8603 (76)				
South				0.9500	46.7521	0.6200	0.7000	0.7700	13.3582 (78)				
West				1.9200	19.6403	0.6200	0.7000	0.7700	11.3415 (80)				
Solar gains	50.5982	94.5894	147.9185	208.0418	251.1105	256.0440	244.1338	211.7686	169.1227	109.8977	62.2276	42.2014	(83)
Total gains	389.7465	431.5819	472.5895	513.0751	536.4036	522.3399	498.1527	471.5476	439.0723	399.6816	374.6763	371.4580	(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	58.3733	58.4752	58.5754	59.0507	59.1404	59.5620	59.5620	59.6407	59.3989	59.1404	58.9591	58.7707	
alpha	4.8916	4.8983	4.9050	4.9367	4.9427	4.9708	4.9708	4.9760	4.9599	4.9427	4.9306	4.9180	
util living area	0.9982	0.9968	0.9924	0.9776	0.9313	0.8131	0.6512	0.7022	0.9053	0.9849	0.9967	0.9986	(86)
MIT	19.6898	19.8163	20.0501	20.3708	20.6772	20.8958	20.9737	20.9619	20.8011	20.4083	19.9918	19.6641	(87)
Th 2	19.9360	19.9376	19.9392	19.9469	19.9483	19.9549	19.9549	19.9562	19.9524	19.9483	19.9454	19.9424	(88)
util rest of house	0.9976	0.9956	0.9896	0.9682	0.8997	0.7281	0.5149	0.5695	0.8490	0.9768	0.9953	0.9982	(89)
MIT 2	18.1894	18.3753	18.7171	19.1849	19.6098	19.8783	19.9443	19.9388	19.7783	19.2442	18.6376	18.1563	(90)
Living area fraction									fLA = Living area / (4) =			0.4801	(91)
MIT	18.9098	19.0672	19.3572	19.7543	20.1223	20.3668	20.4386	20.4300	20.2694	19.8032	19.2878	18.8803	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7598	18.9172	19.2072	19.6043	19.9723	20.2168	20.2886	20.2800	20.1194	19.6532	19.1378	18.7303	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9967	0.9941	0.9869	0.9643	0.9006	0.7519	0.5610	0.6139	0.8598	0.9738	0.9938	0.9974	(94)
Useful gains	388.4527	429.0278	466.4038	494.7416	483.0624	392.7556	279.4505	289.4741	377.5326	389.1946	372.3417	370.4814	(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	1150.7836	1113.6182	1007.8119	842.1305	649.8113	438.0943	287.6966	302.2314	470.7836	711.1511	948.5119	1148.5751	(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	567.1742	460.0448	402.8076	250.1200	124.0612	0.0000	0.0000	0.0000	0.0000	239.5356	414.8426	578.9017	(98)
Space heating												3037.4877	(98)
Space heating per m2												(98) / (4) =	45.0399 (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													3374.9863 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	567.1742	460.0448	402.8076	250.1200	124.0612	0.0000	0.0000	0.0000	0.0000	239.5356	414.8426	578.9017	(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)	630.1936	511.1608	447.5640	277.9111	137.8457	0.0000	0.0000	0.0000	0.0000	266.1507	460.9362	643.2242	(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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289	(64)
Efficiency of water heater (217)m	89.2450	89.1978	89.0875	88.8360	88.2968	86.7000	86.7000	86.7000	86.7000	88.7749	89.1164	86.7000	(216)
Fuel for water heating, kWh/month	181.6074	159.5769	166.4645	147.8035	144.3799	129.4244	122.4493	136.9308	137.5052	153.4782	163.9737	176.5700	(219)
Water heating fuel used												1820.1638	(219)
Annual totals kWh/year													
Space heating fuel - main system												3374.9863	(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)												338.0058	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												5608.1559	(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	3374.9863	0.2160	728.9970	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1820.1638	0.2160	393.1554	(264)
Space and water heating			1122.1524	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	338.0058	0.5190	175.4250	(268)
Energy saving/generation technologies				
PV Unit	-480.9547	0.5190	-249.6155	(269)
Total CO2, kg/year			1086.8870	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.1200	(273)

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

DER		16.1200	ZC1
Total Floor Area		67.4400	
Assumed number of occupants		2.1824	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.8047	ZC2
CO2 emissions from cooking, equation (L16)		2.5412	ZC3
Total CO2 emissions		35.4659	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		35.4659	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	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (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) = 0.1278 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3778 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3495 (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	0.4456	0.4369	0.4281	0.3844	0.3757	0.3320	0.3320	0.3233	0.3495	0.3757	0.3932	0.4107 (22b)
Effective ac	0.5993	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5523	0.5611	0.5706	0.5773	0.5843 (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)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1300	8.7672		(28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.1800	10.8738		(29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.1800	3.3372		(29a)
Total net area of external elements Aum(A, m ²)			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2933		(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)							10.5063 (36)
Total fabric heat loss						(33) + (36) =	45.7996 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.9421	30.7430	30.5479	29.6315	29.4600	28.6619	28.6619	28.5140	28.9693	29.4600	29.8069	30.1695 (38)
Heat transfer coeff	76.7416	76.5426	76.3475	75.4311	75.2596	74.4614	74.4614	74.3136	74.7689	75.2596	75.6065	75.9691 (39)
Average = Sum(39)m / 12 =												75.4302 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1379	1.1350	1.1321	1.1185	1.1159	1.1041	1.1041	1.1019	1.1087	1.1159	1.1211	1.1265 (40)
HLP (average)												1.1185 (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												2.1824 (42)
Average daily hot water use (litres/day)												86.0321 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy conte	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Energy content (annual)												Total = Sum(45)m = 1353.6205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0512	18.4115	18.9991	16.5638	15.8934	13.7148	12.7088	14.5835	14.7577	17.1986	18.7737	20.3870 (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	48.2251	41.9743	44.7179	41.5783	41.2106	38.1841	39.4569	41.2106	41.5783	44.7179	44.9724	48.2251 (61)
Total heat required for water heating calculated for each month	188.5666	164.7178	171.3782	152.0038	147.1665	129.6161	124.1821	138.4339	139.9628	159.3755	170.1302	184.1384 (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	188.5666	164.7178	171.3782	152.0038	147.1665	129.6161	124.1821	138.4339	139.9628	159.3755	170.1302	184.1384 (64)
Heat gains from water heating, kWh/month	58.7198	51.3058	53.2940	47.1111	45.5330	39.9472	38.0353	42.6294	43.1074	49.3031	52.8581	57.2474 (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	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1393	16.9993	13.8248	10.4663	7.8237	6.6051	7.1370	9.2769	12.4515	15.8100	18.4526	19.6712 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.2500	193.2346	188.2335	177.5868	164.1473	151.5160	143.0776	141.0930	146.0941	156.7407	170.1803	182.8115 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120 (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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962 (71)
Water heating gains (Table 5)	78.9245	76.3479	71.6318	65.4320	61.2003	55.4822	51.1228	57.2976	59.8714	66.2676	73.4140	76.9455 (72)
Total internal gains	348.0499	345.3179	332.4261	312.2212	291.9073	272.3393	260.0734	266.4036	277.1530	297.5545	320.7830	338.1643 (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	
North					0.9500	10.6334	0.6300	0.7000	0.7700		3.0872 (74)	
East					3.8700	19.6403	0.6300	0.7000	0.7700		23.2290 (76)	
South					0.9500	46.7521	0.6300	0.7000	0.7700		13.5736 (78)	
West					1.9200	19.6403	0.6300	0.7000	0.7700		11.5245 (80)	

Solar gains	51.4143	96.1150	150.3042	211.3973	255.1606	260.1738	248.0715	215.1842	171.8504	111.6703	63.2313	42.8821 (83)
Total gains	399.4641	441.4329	482.7304	523.6185	547.0679	532.5131	508.1449	481.5878	449.0035	409.2248	384.0143	381.0464 (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	61.0273	61.1860	61.3423	62.0876	62.2291	62.8961	62.8961	63.0212	62.6375	62.2291	61.9436	61.6479	
alpha	5.0685	5.0791	5.0895	5.1392	5.1486	5.1931	5.1931	5.2014	5.1758	5.1486	5.1296	5.1099	
util living area	0.9981	0.9965	0.9917	0.9746	0.9213	0.7887	0.6197	0.6705	0.8903	0.9828	0.9964	0.9985 (86)	
MIT	19.7678	19.8934	20.1221	20.4364	20.7255	20.9205	20.9821	20.9734	20.8370	20.4668	20.0644	19.7472 (87)	
Th 2	19.9700	19.9724	19.9747	19.9858	19.9878	19.9975	19.9975	19.9993	19.9938	19.9878	19.9836	19.9793 (88)	
util rest of house	0.9975	0.9953	0.9886	0.9643	0.8870	0.7027	0.4911	0.5435	0.8301	0.9738	0.9949	0.9980 (89)	
MIT 2	18.3263	18.5114	18.8461	19.3061	19.7036	19.9405	19.9904	19.9875	19.8541	19.3557	18.7697	18.3028 (90)	
Living area fraction									fLA = Living area / (4) =			0.4801 (91)	
MIT	19.0184	19.1750	19.4588	19.8488	20.1942	20.4110	20.4665	20.4608	20.3260	19.8891	19.3913	18.9963 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0184	19.1750	19.4588	19.8488	20.1942	20.4110	20.4665	20.4608	20.3260	19.8891	19.3913	18.9963 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9967	0.9940	0.9866	0.9625	0.8950	0.7409	0.5533	0.6049	0.8528	0.9727	0.9937	0.9974 (94)
Useful gains	398.1314	438.7864	476.2378	503.9965	489.6435	394.5481	281.1793	291.2898	382.9200	398.0398	381.5823	380.0438 (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	1129.5166	1092.6419	989.3695	825.8804	639.2710	432.6976	287.9078	301.7756	465.5137	699.0963	929.3031	1124.0590 (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	544.1506	439.3909	381.7700	231.7564	111.3229	0.0000	0.0000	0.0000	0.0000	223.9860	394.3590	553.5473 (98)
Space heating												2880.2831 (98)
Space heating per m2										(98) / (4) =		42.7088 (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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3083.8149 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.1506	439.3909	381.7700	231.7564	111.3229	0.0000	0.0000	0.0000	0.0000	223.9860	394.3590	553.5473	(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)	582.6024	470.4400	408.7473	248.1332	119.1894	0.0000	0.0000	0.0000	0.0000	239.8137	422.2259	592.6630	(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	188.5666	164.7178	171.3782	152.0038	147.1665	129.6161	124.1821	138.4339	139.9628	159.3755	170.1302	184.1384	(64)
Efficiency of water heater (217)m	87.5656	87.4025	87.0093	86.1100	84.3591	80.3000	80.3000	80.3000	80.3000	85.9079	87.0983	80.3000	(216)
Fuel for water heating, kWh/month	215.3434	188.4589	196.9653	176.5228	174.4525	161.4148	154.6477	172.3959	174.2998	185.5191	195.3313	210.0881	(219)
Water heating fuel used												2205.4396	(219)
Annual totals kWh/year													
Space heating fuel - main system												3083.8149	(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)												338.0058	(232)
Total delivered energy for all uses												5702.2603	(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	3083.8149	0.2160	666.1040 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2205.4396	0.2160	476.3749 (264)
Space and water heating			1142.4790 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	338.0058	0.5190	175.4250 (268)
Total CO2, kg/m2/year			1356.8290 (272)
Emissions per m2 for space and water heating			16.9407 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6012 (272b)
Emissions per m2 for pumps and fans			0.5772 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.9407 * 1.00) + 2.6012 + 0.5772, rounded to 2 d.p.			20.1200 (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	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (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) = 0.1278 (8)
Measured/design AP50					Yes
Infiltration rate					3.7500
Number of sides sheltered					0.3153 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2917 (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	0.3719	0.3646	0.3573	0.3208	0.3136	0.2771	0.2771	0.2698	0.2917	0.3136	0.3281	0.3427 (22b)
	0.5692	0.5665	0.5638	0.5515	0.5492	0.5384	0.5384	0.5364	0.5425	0.5492	0.5538	0.5587 (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
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1600	10.7904	75.0000	5058.0000 (28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.2600	15.7066	60.0000	3624.6000 (29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.2400	4.4496	110.0000	2039.4000 (29a)
Total net area of external elements Sum(A, m ²)			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.0497		(33)
E-FC-4			67.4400			30.0000	2023.2000 (32b)
GF - Timber			51.4600			9.0000	463.1400 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14026.7400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							207.9884 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1490 (36)
Total fabric heat loss						(33) + (36) =	50.1987 (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	29.3864	29.2478	29.1119	28.4736	28.3542	27.7982	27.7982	27.6953	28.0124	28.3542	28.5958	28.8483 (38)
Heat transfer coeff	79.5851	79.4465	79.3106	78.6723	78.5529	77.9969	77.9969	77.8940	78.2111	78.5529	78.7945	79.0470 (39)
Average = Sum(39)m / 12 =												78.6717 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1801	1.1780	1.1760	1.1666	1.1648	1.1565	1.1565	1.1550	1.1597	1.1648	1.1684	1.1721 (40)
HLP (average)												1.1665 (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												2.1824 (42)
Average daily hot water use (litres/day)												86.0321 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy content (annual)	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1353.6205 (45)
	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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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	29.8226	26.0830	26.9153	23.4654	22.5156	19.4293	18.0041	20.6600	20.9067	24.3647	26.5960	28.8816 (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	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1393	16.9993	13.8248	10.4663	7.8237	6.6051	7.1370	9.2769	12.4515	15.8100	18.4526	19.6712	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.2500	193.2346	188.2335	177.5868	164.1473	151.5160	143.0776	141.0930	146.0941	156.7407	170.1803	182.8115	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	(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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	(71)
Water heating gains (Table 5)	40.0841	38.8140	36.1765	32.5909	30.2630	26.9851	24.1990	27.7688	29.0371	32.7483	36.9389	38.8193	(72)
Total internal gains	306.2095	304.7840	293.9709	276.3800	257.9700	240.8423	230.1497	233.8748	243.3187	261.0352	281.3079	297.0381	(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	
North	0.9500	10.6334	0.6200	0.7000	0.7700	3.0382	(74)
East	3.8700	19.6403	0.6200	0.7000	0.7700	22.8603	(76)
South	0.9500	46.7521	0.6200	0.7000	0.7700	13.3582	(78)
West	1.9200	19.6403	0.6200	0.7000	0.7700	11.3415	(80)

Solar gains	50.5982	94.5894	147.9185	208.0418	251.1105	256.0440	244.1338	211.7686	169.1227	109.8977	62.2276	42.2014	(83)
Total gains	356.8076	399.3734	441.8893	484.4218	509.0805	496.8863	474.2835	445.6434	412.4414	370.9329	343.5356	339.2395	(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	48.9578	49.0433	49.1273	49.5259	49.6012	49.9548	49.9548	50.0208	49.8180	49.6012	49.4491	49.2911	
alpha	4.2639	4.2696	4.2752	4.3017	4.3067	4.3303	4.3303	4.3347	4.3212	4.3067	4.2966	4.2861	
util living area	0.9973	0.9952	0.9896	0.9724	0.9250	0.8143	0.6636	0.7150	0.9030	0.9815	0.9953	0.9979	(86)
MIT	19.4469	19.5925	19.8617	20.2304	20.5843	20.8483	20.9544	20.9364	20.7320	20.2750	19.7949	19.4183	(87)
Th 2	19.9360	19.9376	19.9392	19.9469	19.9483	19.9549	19.9549	19.9562	19.9524	19.9483	19.9454	19.9424	(88)
util rest of house	0.9965	0.9938	0.9863	0.9625	0.8949	0.7359	0.5321	0.5891	0.8518	0.9732	0.9936	0.9972	(89)
MIT 2	18.5175	18.6639	18.9329	19.3022	19.6404	19.8716	19.9400	19.9329	19.7818	19.3505	18.8723	18.4940	(90)
Living area fraction									fLA = Living area / (4) =			0.4801	(91)
MIT	18.9637	19.1097	19.3788	19.7478	20.0936	20.3405	20.4270	20.4147	20.2380	19.7944	19.3152	18.9378	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9637	19.1097	19.3788	19.7478	20.0936	20.3405	20.4270	20.4147	20.2380	19.7944	19.3152	18.9378	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9956	0.9923	0.9840	0.9602	0.8998	0.7678	0.5950	0.6486	0.8681	0.9716	0.9923	0.9964	(94)
Ext temp.	355.2211	396.3056	434.8304	465.1359	458.0621	381.5238	282.2214	289.0552	358.0460	360.3935	340.8829	338.0230	(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	1167.0164	1128.9138	1021.4290	853.4243	659.3397	447.7430	298.4964	312.7206	480.0630	722.2454	962.4924	1164.9781	(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	603.9757	492.3127	436.4294	279.5677	149.7506	0.0000	0.0000	0.0000	0.0000	269.2178	447.5589	615.2546	(98)
												3294.0672	(98)
										(98) / (4) =		48.8444	(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	733.1710	577.1771	591.9941	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7693	0.8489	0.8200	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	564.0300	489.9835	485.4063	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	662.8383	634.8664	602.9944	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	71.1420	107.7928	87.4855	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												266.4203 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												66.6051 (107)
Energy for space heating												0.9876 (108)
Energy for space cooling												48.8444 (99)
Total												0.9876 (108)
Dwelling Fabric Energy Efficiency (DFEE)												49.8320 (109)
												49.8 (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	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (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) = 0.1278 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3778 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3495 (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	0.4456	0.4369	0.4281	0.3844	0.3757	0.3320	0.3320	0.3233	0.3495	0.3757	0.3932	0.4107 (22b)
Effective ac	0.5993	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5523	0.5611	0.5706	0.5773	0.5843 (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)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1300	8.7672		(28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.1800	10.8738		(29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.1800	3.3372		(29a)
Total net area of external elements Aum(A, m ²)			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2933		(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)							10.5063 (36)
Total fabric heat loss						(33) + (36) =	45.7996 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	30.9421	30.7430	30.5479	29.6315	29.4600	28.6619	28.6619	28.5140	28.9693	29.4600	29.8069	30.1695 (38)
Heat transfer coeff	76.7416	76.5426	76.3475	75.4311	75.2596	74.4614	74.4614	74.3136	74.7689	75.2596	75.6065	75.9691 (39)
Average = Sum(39)m / 12 =												75.4302 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1379	1.1350	1.1321	1.1185	1.1159	1.1041	1.1041	1.1019	1.1087	1.1159	1.1211	1.1265 (40)
HLP (average)												1.1185 (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												2.1824 (42)
Average daily hot water use (litres/day)												86.0321 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy conte	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Energy content (annual)												Total = Sum(45)m = 1353.6205 (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	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	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	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	29.8226	26.0830	26.9153	23.4654	22.5156	19.4293	18.0041	20.6600	20.9067	24.3647	26.5960	28.8816 (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	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	109.1203	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1393	16.9993	13.8248	10.4663	7.8237	6.6051	7.1370	9.2769	12.4515	15.8100	18.4526	19.6712	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.2500	193.2346	188.2335	177.5868	164.1473	151.5160	143.0776	141.0930	146.0941	156.7407	170.1803	182.8115	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	33.9120	(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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	(71)
Water heating gains (Table 5)	40.0841	38.8140	36.1765	32.5909	30.2630	26.9851	24.1990	27.7688	29.0371	32.7483	36.9389	38.8193	(72)
Total internal gains	306.2095	304.7840	293.9709	276.3800	257.9700	240.8423	230.1497	233.8748	243.3187	261.0352	281.3079	297.0381	(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			
North				0.9500	10.6334	0.6300	0.7000	0.7700	3.0872 (74)			
East				3.8700	19.6403	0.6300	0.7000	0.7700	23.2290 (76)			
South				0.9500	46.7521	0.6300	0.7000	0.7700	13.5736 (78)			
West				1.9200	19.6403	0.6300	0.7000	0.7700	11.5245 (80)			
Solar gains	51.4143	96.1150	150.3042	211.3973	255.1606	260.1738	248.0715	215.1842	171.8504	111.6703	63.2313	42.8821 (83)
Total gains	357.6237	400.8990	444.2751	487.7773	513.1306	501.0161	478.2212	449.0590	415.1692	372.7055	344.5392	339.9202 (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	61.0273	61.1860	61.3423	62.0876	62.2291	62.8961	62.8961	63.0212	62.6375	62.2291	61.9436	61.6479	
alpha	5.0685	5.0791	5.0895	5.1392	5.1486	5.1931	5.1931	5.2014	5.1758	5.1486	5.1296	5.1099	
util living area	0.9989	0.9977	0.9942	0.9810	0.9366	0.8168	0.6516	0.7073	0.9141	0.9884	0.9978	0.9991	(86)
MIT	19.7099	19.8377	20.0704	20.3918	20.6927	20.9055	20.9775	20.9660	20.8086	20.4194	20.0100	19.6900	(87)
Th 2	19.9700	19.9724	19.9747	19.9858	19.9878	19.9975	19.9975	19.9993	19.9938	19.9878	19.9836	19.9793	(88)
util rest of house	0.9985	0.9970	0.9920	0.9729	0.9071	0.7343	0.5197	0.5787	0.8620	0.9821	0.9969	0.9989	(89)
MIT 2	18.7900	18.9195	19.1532	19.4792	19.7661	19.9497	19.9912	19.9886	19.8776	19.5107	19.1008	18.7776	(90)
Living area fraction									fLA = Living area / (4) =				0.4801 (91)
MIT	19.2317	19.3604	19.5936	19.9174	20.2110	20.4086	20.4648	20.4579	20.3246	19.9470	19.5373	19.2157	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2317	19.3604	19.5936	19.9174	20.2110	20.4086	20.4648	20.4579	20.3246	19.9470	19.5373	19.2157	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	356.9506	399.4250	440.2665	474.2316	469.3518	386.4068	279.2089	287.9163	366.1441	365.9116	343.2709	339.4291	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1145.8819	1106.8328	999.6616	831.0538	640.5318	432.5183	287.7763	301.5543	465.4063	703.4522	940.3433	1140.7278	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	586.9649	475.3780	416.1900	256.9120	127.3579	0.0000	0.0000	0.0000	0.0000	251.1302	429.8921	596.1662	(98)
Space heating												3139.9914	(98)
Space heating per m2												46.5598	(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	699.9374	551.0146	564.7835	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8181	0.8940	0.8674	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	572.6229	492.6028	489.8834	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	667.6653	639.4688	606.9867	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	68.4305	109.2683	87.1249	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												264.8237	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	17.1076	27.3171	21.7812	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												66.2059 (107)
Space cooling per m2												0.9817 (108)
Energy for space heating												46.5598 (99)
Energy for space cooling												0.9817 (108)
Total												47.5415 (109)
Target Fabric Energy Efficiency (TFEE)												54.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (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) = 0.1278 (8)
Pressure test					Yes
Measured/design AP50					3.7500
Infiltration rate					0.3153 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2917 (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	0.3063	0.2844	0.2917	0.2771	0.2771	0.2698	0.2625	0.2552	0.2479	0.2698	0.2552	0.2698 (22b)
	0.5469	0.5404	0.5425	0.5384	0.5384	0.5364	0.5345	0.5326	0.5307	0.5364	0.5326	0.5364 (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
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1600	10.7904	75.0000	5058.0000 (28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.2600	15.7066	60.0000	3624.6000 (29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.2400	4.4496	110.0000	2039.4000 (29a)
Total net area of external elements Aum, m ²			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.0497		(33)
E-FC-4			67.4400			70.0000	4720.8000 (32b)
GF - Timber			51.4600			9.0000	463.1400 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16724.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.9884 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1490 (36)
Total fabric heat loss						(33) + (36) =	50.1987 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.2375	27.9039	28.0124	27.7982	27.7982	27.6953	27.5951	27.4976	27.4029	27.6953	27.4976	27.6953 (38)
Heat transfer coeff	78.4362	78.1026	78.2111	77.9969	77.9969	77.8940	77.7938	77.6963	77.6016	77.8940	77.6963	77.8940 (39)
Average = Sum(39)m / 12 =												77.9345 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1631	1.1581	1.1597	1.1565	1.1565	1.1550	1.1535	1.1521	1.1507	1.1550	1.1521	1.1550 (40)
HLP (average)												1.1556 (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		2.1824 (42)
Average daily hot water use (litres/day)		86.0321 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy conte	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Energy content (annual)										Total = Sum(45)m =		1353.6205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0512	18.4115	18.9991	16.5638	15.8934	13.7148	12.7088	14.5835	14.7577	17.1986	18.7737	20.3870 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 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	21.7341	19.5955	21.6388	20.8771	21.5268	20.7790	21.4384	21.4957	20.8325	21.5925	20.9697	21.7157 (61)
Total heat required for water heating calculated for each month	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (64)
RHI water heating demand	52.0971	45.7111	47.5243	41.9358	40.6121	35.5959	33.5307	37.7007	37.9210	43.5218	46.8574	50.6201 (65)
Heat gains from water heating, kWh/month	52.0971	45.7111	47.5243	41.9358	40.6121	35.5959	33.5307	37.7007	37.9210	43.5218	46.8574	50.6201 (65)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												1607.8163 (64)
												1608 (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	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8482	42.4984	34.5620	26.1657	19.5591	16.5126	17.8425	23.1924	31.1287	39.5251	46.1316	49.1781 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.4477	288.4098	280.9455	265.0549	244.9959	226.1433	213.5486	210.5866	218.0508	233.9414	254.0004	272.8530 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768 (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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962 (71)
Water heating gains (Table 5)	70.0230	68.0225	63.8767	58.2442	54.5861	49.4387	45.0682	50.6730	52.6680	58.4970	65.0797	68.0377 (72)
Total internal gains	500.2439	495.8556	476.3092	446.3897	416.0661	389.0196	373.3842	381.3768	398.7725	428.8884	462.1366	486.9938 (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
North												0.9500	13.4839	0.6200	0.7000	0.7700	3.8527 (74)
East												3.8700	25.1925	0.6200	0.7000	0.7700	29.3228 (76)
South												0.9500	56.7559	0.6200	0.7000	0.7700	16.2165 (78)
West												1.9200	25.1925	0.6200	0.7000	0.7700	14.5478 (80)
Solar gains	63.9398	101.8642	160.7231	227.4222	260.7983	288.8125	273.2388	242.9460	194.0983	127.7469	78.4136	52.3991	(83)				
Total gains	564.1836	597.7199	637.0322	673.8119	676.8644	677.8322	646.6230	624.3228	592.8708	556.6354	540.5503	539.3929	(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)												
tau	59.2284	59.4814	59.3989	59.5620	59.5620	59.6407	59.7175	59.7924	59.8654	59.6407	59.7924	59.6407
alpha	4.9486	4.9654	4.9599	4.9708	4.9708	4.9760	4.9812	4.9862	4.9910	4.9760	4.9862	4.9760
util living area	0.9897	0.9853	0.9703	0.9267	0.8238	0.6251	0.4634	0.4785	0.7440	0.9290	0.9796	0.9912 (86)
MIT	20.0150	20.1082	20.3329	20.6185	20.8525	20.9716	20.9947	20.9940	20.9330	20.6770	20.3159	20.0035 (87)
Th 2	19.9497	19.9537	19.9524	19.9549	19.9549	19.9562	19.9574	19.9585	19.9597	19.9562	19.9585	19.9562 (88)
util rest of house	0.9863	0.9806	0.9603	0.9010	0.7636	0.5237	0.3427	0.3544	0.6512	0.8979	0.9717	0.9882 (89)
MIT 2	18.6719	18.8092	19.1301	19.5278	19.8225	19.9404	19.9559	19.9568	19.9143	19.6144	19.1138	18.6602 (90)
Living area fraction	19.3168	19.4329	19.7076	20.0515	20.3170	20.4355	20.4547	20.4548	20.4034	20.1246	19.6910	19.3051 (92)
MIT	19.3168	19.4329	19.7076	20.0515	20.3170	20.4355	20.4547	20.4548	20.4034	20.1246	19.6910	19.3051 (92)
Temperature adjustment	19.1668	19.2829	19.5576	19.9015	20.1670	20.2855	20.3047	20.3048	20.2534	19.9746	19.5410	-0.1500
adjusted MIT	19.1668	19.2829	19.5576	19.9015	20.1670	20.2855	20.3047	20.3048	20.2534	19.9746	19.5410	19.1551 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9830	0.9767	0.9556	0.8995	0.7771	0.5570	0.3835	0.3964	0.6795	0.8986	0.9676	0.9852 (94)
Useful gains	554.5809	583.7688	608.7428	606.0935	525.9952	377.5807	247.9706	247.4644	402.8426	500.1958	523.0449	531.4290 (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	1119.0308	1092.1015	982.1462	811.2836	598.0044	388.3411	249.3037	249.0006	430.9543	667.9092	904.4608	1102.5994 (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	419.9507	341.5996	277.8121	147.7369	53.5748	0.0000	0.0000	0.0000	0.0000	124.7788	274.6194	424.9508 (98)
Space heating												2065.0231 (98)
RHI space heating demand												2065 (98)

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Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1278 (8)
Measured/design AP50					Yes
Infiltration rate					3.7500
Number of sides sheltered					0.3153 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2917 (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	0.3719	0.3646	0.3573	0.3208	0.3136	0.2771	0.2771	0.2698	0.2917	0.3136	0.3281	0.3427 (22b)
	0.5692	0.5665	0.5638	0.5515	0.5492	0.5384	0.5384	0.5364	0.5425	0.5492	0.5538	0.5587 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1600	10.7904	75.0000	5058.0000 (28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.2600	15.7066	60.0000	3624.6000 (29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.2400	4.4496	110.0000	2039.4000 (29a)
Total net area of external elements Sum(A, m2)			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.0497		(33)
E-FC-4			67.4400			70.0000	4720.8000 (32b)
GF - Timber			51.4600			9.0000	463.1400 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16724.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							247.9884 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1490 (36)
Total fabric heat loss						(33) + (36) =	50.1987 (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	29.3864	29.2478	29.1119	28.4736	28.3542	27.7982	27.7982	27.6953	28.0124	28.3542	28.5958	28.8483 (38)
Heat transfer coeff	79.5851	79.4465	79.3106	78.6723	78.5529	77.9969	77.9969	77.8940	78.2111	78.5529	78.7945	79.0470 (39)
Average = Sum(39)m / 12 =												78.6717 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1801	1.1780	1.1760	1.1666	1.1648	1.1565	1.1565	1.1550	1.1597	1.1648	1.1684	1.1721 (40)
HLP (average)												1.1665 (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												2.1824 (42)
Average daily hot water use (litres/day)												86.0321 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy conte	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Energy content (annual)										Total = Sum(45)m =		1353.6205 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0512	18.4115	18.9991	16.5638	15.8934	13.7148	12.7088	14.5835	14.7577	17.1986	18.7737	20.3870 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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	21.7341	19.5955	21.6388	20.8771	21.5268	20.7790	21.4384	21.4957	20.8325	21.5925	20.9697	21.7157 (61)
Total heat required for water heating calculated for each month	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (64)
Heat gains from water heating, kWh/month	52.0971	45.7111	47.5243	41.9358	40.6121	35.5959	33.5307	37.7007	37.9210	43.5218	46.8574	50.6201 (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	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8482	42.4984	34.5620	26.1657	19.5591	16.5126	17.8425	23.1924	31.1287	39.5251	46.1316	49.1781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.4477	288.4098	280.9455	265.0549	244.9959	226.1433	213.5486	210.5866	218.0508	233.9414	254.0004	272.8530	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	(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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	(71)
Water heating gains (Table 5)	70.0230	68.0225	63.8767	58.2442	54.5861	49.4387	45.0682	50.6730	52.6680	58.4970	65.0797	68.0377	(72)
Total internal gains	500.2439	495.8556	476.3092	446.3897	416.0661	389.0196	373.3842	381.3768	398.7725	428.8884	462.1366	486.9938	(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				
North				0.9500	10.6334	0.6200	0.7000	0.7700	3.0382 (74)				
East				3.8700	19.6403	0.6200	0.7000	0.7700	22.8603 (76)				
South				0.9500	46.7521	0.6200	0.7000	0.7700	13.3582 (78)				
West				1.9200	19.6403	0.6200	0.7000	0.7700	11.3415 (80)				
Solar gains	50.5982	94.5894	147.9185	208.0418	251.1105	256.0440	244.1338	211.7686	169.1227	109.8977	62.2276	42.2014	(83)
Total gains	550.8421	590.4450	624.2276	654.4315	667.1766	645.0637	617.5181	593.1454	567.8952	538.7862	524.3643	529.1952	(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	58.3733	58.4752	58.5754	59.0507	59.1404	59.5620	59.5620	59.6407	59.3989	59.1404	58.9591	58.7707	
alpha	4.8916	4.8983	4.9050	4.9367	4.9427	4.9708	4.9708	4.9760	4.9599	4.9427	4.9306	4.9180	
util living area	0.9921	0.9877	0.9765	0.9449	0.8671	0.7114	0.5420	0.5836	0.8103	0.9525	0.9860	0.9935	(86)
MIT	19.9092	20.0296	20.2462	20.5339	20.7875	20.9436	20.9881	20.9830	20.8888	20.5754	20.1924	19.8802	(87)
Th 2	19.9360	19.9376	19.9392	19.9469	19.9483	19.9549	19.9549	19.9562	19.9524	19.9483	19.9454	19.9424	(88)
util rest of house	0.9896	0.9837	0.9686	0.9252	0.8193	0.6191	0.4203	0.4613	0.7318	0.9315	0.9808	0.9914	(89)
MIT 2	18.5084	18.6840	18.9970	19.4074	19.7409	19.9173	19.9506	19.9492	19.8661	19.4724	18.9269	18.4709	(90)
Living area fraction									fLA = Living area / (4) =			0.4801	(91)
MIT	19.1810	19.3301	19.5968	19.9483	20.2434	20.4101	20.4487	20.4456	20.3571	20.0020	19.5345	19.1475	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0310	19.1801	19.4468	19.7983	20.0934	20.2601	20.2987	20.2956	20.2071	19.8520	19.3845	18.9975	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	543.4983	578.6407	601.7315	603.3247	551.5989	417.8640	284.9548	298.0664	427.6500	500.5901	512.3488	523.2797	(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	1172.3659	1134.5026	1026.8150	857.3945	659.3264	441.4689	288.4900	303.4416	477.6437	726.7705	967.9481	1169.7007	(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	467.8775	373.5393	316.2621	182.9303	80.1492	0.0000	0.0000	0.0000	0.0000	168.2782	328.0315	480.9372	(98)
Space heating												2398.0052	(98)
Space heating per m2												(98) / (4) =	35.5576 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2664.4503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	467.8775	373.5393	316.2621	182.9303	80.1492	0.0000	0.0000	0.0000	0.0000	168.2782	328.0315	480.9372	(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)	519.8638	415.0436	351.4023	203.2559	89.0547	0.0000	0.0000	0.0000	0.0000	186.9757	364.4795	534.3747	(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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289	(64)
Efficiency of water heater (217)m	89.1272	89.0646	88.9196	88.5910	87.9448	86.7000	86.7000	86.7000	86.7000	88.4930	88.9565	86.7000	(216)
Fuel for water heating, kWh/month	181.8475	159.8155	166.7790	148.2122	144.9577	129.4244	122.4493	136.9308	137.5052	153.9671	164.2684	176.7888	(219)
Water heating fuel used												1822.9459	(219)
Annual totals kWh/year													
Space heating fuel - main system												2664.4503	(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)												338.0058	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4900.4020	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2664.4503	3.4800	92.7229 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1822.9459	3.4800	63.4385 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	338.0058	13.1900	44.5830 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			330.6369 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2350 (257)
SAP value		82.7712
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2664.4503	0.2160	575.5213 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1822.9459	0.2160	393.7563 (264)
Space and water heating			969.2776 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	338.0058	0.5190	175.4250 (268)
Energy saving/generation technologies			
PV Unit	-480.9547	0.5190	-249.6155 (269)
Total kg/year			934.0121 (272)
CO2 emissions per m2			13.8500 (273)
EI value			88.8689
EI rating			89 (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	$3.48 / 0.8809 = 3.951$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8809 = 0.2452$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.4400 (1b)	x 2.3200 (2b)	= 156.4608 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.4608 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1278 (8)
Measured/design AP50					Yes
Infiltration rate					3.7500
Number of sides sheltered					0.3153 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2917 (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	0.3063	0.2844	0.2917	0.2771	0.2771	0.2698	0.2625	0.2552	0.2479	0.2698	0.2552	0.2698 (22b)
	0.5469	0.5404	0.5425	0.5384	0.5384	0.5364	0.5345	0.5326	0.5307	0.5364	0.5326	0.5364 (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
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.4400	0.1600	10.7904	75.0000	5058.0000 (28a)
APT 100mm Knauf Supafil	68.1000	7.6900	60.4100	0.2600	15.7066	60.0000	3624.6000 (29a)
APT Wall to Stairwell	20.6600	2.1200	18.5400	0.2400	4.4496	110.0000	2039.4000 (29a)
Total net area of external elements Aum, m ²			156.2000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.0497		(33)
E-FC-4			67.4400			70.0000	4720.8000 (32b)
GF - Timber			51.4600			9.0000	463.1400 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16724.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							247.9884 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.1490 (36)
Total fabric heat loss						(33) + (36) =	50.1987 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.2375	27.9039	28.0124	27.7982	27.7982	27.6953	27.5951	27.4976	27.4029	27.6953	27.4976	27.6953 (38)
Heat transfer coeff	78.4362	78.1026	78.2111	77.9969	77.9969	77.8940	77.7938	77.6963	77.6016	77.8940	77.6963	77.8940 (39)
Average = Sum(39)m / 12 =												77.9345 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1631	1.1581	1.1597	1.1565	1.1565	1.1550	1.1535	1.1521	1.1507	1.1550	1.1521	1.1550 (40)
HLP (average)												1.1556 (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												2.1824 (42)
Average daily hot water use (litres/day)												86.0321 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.6354	91.1941	87.7528	84.3115	80.8702	77.4289	77.4289	80.8702	84.3115	87.7528	91.1941	94.6354 (44)
Energy content (annual)	140.3415	122.7436	126.6604	110.4256	105.9560	91.4319	84.7251	97.2233	98.3845	114.6576	125.1578	135.9132 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1353.6205 (45)
Water storage loss:	21.0512	18.4115	18.9991	16.5638	15.8934	13.7148	12.7088	14.5835	14.7577	17.1986	18.7737	20.3870 (46)

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	21.7341	19.5955	21.6388	20.8771	21.5268	20.7790	21.4384	21.4957	20.8325	21.5925	20.9697	21.7157 (61)
Total heat required for water heating calculated for each month	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289 (64)
Heat gains from water heating, kWh/month	52.0971	45.7111	47.5243	41.9358	40.6121	35.5959	33.5307	37.7007	37.9210	43.5218	46.8574	50.6201 (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	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	130.9443	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.8482	42.4984	34.5620	26.1657	19.5591	16.5126	17.8425	23.1924	31.1287	39.5251	46.1316	49.1781	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.4477	288.4098	280.9455	265.0549	244.9959	226.1433	213.5486	210.5866	218.0508	233.9414	254.0004	272.8530	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	50.2768	(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)	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	-87.2962	(71)
Water heating gains (Table 5)	70.0230	68.0225	63.8767	58.2442	54.5861	49.4387	45.0682	50.6730	52.6680	58.4970	65.0797	68.0377	(72)
Total internal gains	500.2439	495.8556	476.3092	446.3897	416.0661	389.0196	373.3842	381.3768	398.7725	428.8884	462.1366	486.9938	(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				
North				0.9500	13.4839	0.6200	0.7000	0.7700	3.8527 (74)				
East				3.8700	25.1925	0.6200	0.7000	0.7700	29.3228 (76)				
South				0.9500	56.7559	0.6200	0.7000	0.7700	16.2165 (78)				
West				1.9200	25.1925	0.6200	0.7000	0.7700	14.5478 (80)				
Solar gains	63.9398	101.8642	160.7231	227.4222	260.7983	288.8125	273.2388	242.9460	194.0983	127.7469	78.4136	52.3991	(83)
Total gains	564.1836	597.7199	637.0322	673.8119	676.8644	677.8322	646.6230	624.3228	592.8708	556.6354	540.5503	539.3929	(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	59.2284	59.4814	59.3989	59.5620	59.5620	59.6407	59.7175	59.7924	59.8654	59.6407	59.7924	59.6407	
alpha	4.9486	4.9654	4.9599	4.9708	4.9708	4.9760	4.9812	4.9862	4.9910	4.9760	4.9862	4.9760	
util living area	0.9897	0.9853	0.9703	0.9267	0.8238	0.6251	0.4634	0.4785	0.7440	0.9290	0.9796	0.9912	(86)
MIT	20.0150	20.1082	20.3329	20.6185	20.8525	20.9716	20.9947	20.9940	20.9330	20.6770	20.3159	20.0035	(87)
Th 2	19.9497	19.9537	19.9524	19.9549	19.9549	19.9562	19.9574	19.9585	19.9597	19.9562	19.9585	19.9562	(88)
util rest of house	0.9863	0.9806	0.9603	0.9010	0.7636	0.5237	0.3427	0.3544	0.6512	0.8979	0.9717	0.9882	(89)
MIT 2	18.6719	18.8092	19.1301	19.5278	19.8225	19.9404	19.9559	19.9568	19.9143	19.6144	19.1138	18.6602	(90)
Living area fraction									fLA = Living area / (4) =			0.4801	(91)
MIT	19.3168	19.4329	19.7076	20.0515	20.3170	20.4355	20.4547	20.4548	20.4034	20.1246	19.6910	19.3051	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1668	19.2829	19.5576	19.9015	20.1670	20.2855	20.3047	20.3048	20.2534	19.9746	19.5410	19.1551	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	554.5809	583.7688	608.7428	606.0935	525.9952	377.5807	247.9706	247.4644	402.8426	500.1958	523.0449	531.4290	(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	1119.0308	1092.1015	982.1462	811.2836	598.0044	388.3411	249.3037	249.0006	430.9543	667.9092	904.4608	1102.5994	(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	419.9507	341.5996	277.8121	147.7369	53.5748	0.0000	0.0000	0.0000	0.0000	124.7788	274.6194	424.9508	(98)
Space heating												2065.0231	(98)
Space heating per m2												(98) / (4) =	30.6202 (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													2294.4701 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	419.9507	341.5996	277.8121	147.7369	53.5748	0.0000	0.0000	0.0000	0.0000	124.7788	274.6194	424.9508	(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)	466.6119	379.5551	308.6801	164.1521	59.5275	0.0000	0.0000	0.0000	0.0000	138.6431	305.1327	472.1676	(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	162.0756	142.3391	148.2992	131.3027	127.4827	112.2109	106.1635	118.7190	119.2170	136.2501	146.1275	157.6289	(64)
Efficiency of water heater (217)m	89.0561	89.0036	88.8234	88.4164	87.6510	86.7000	86.7000	86.7000	86.7000	88.2468	88.8258	86.7000	(216)
Fuel for water heating, kWh/month	181.9928	159.9251	166.9596	148.5049	145.4436	129.4244	122.4493	136.9308	137.5052	154.3967	164.5102	176.9470	(219)
Water heating fuel used												1824.9894	(219)
Annual totals kWh/year													
Space heating fuel - main system												2294.4701	(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)													338.0058 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4532.4654 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2294.4701	3.9200	89.9432 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1824.9894	3.9200	71.5396 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	338.0058	16.9600	57.3258 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			319.5286 (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	2294.4701	0.2160	495.6055 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1824.9894	0.2160	394.1977 (264)
Space and water heating			889.8033 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	338.0058	0.5190	175.4250 (268)
Energy saving/generation technologies			
PV Unit	-480.9547	0.5190	-249.6155 (269)
Total kg/year			854.5378 (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	2294.4701	1.2200	2799.2535 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1824.9894	1.2200	2226.4871 (264)
Space and water heating			5025.7407 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	338.0058	3.0700	1037.6779 (268)
Energy saving/generation technologies			
PV Unit	-480.9547	3.0700	-1476.5309 (269)
Primary energy kWh/year			4817.1377 (272)
Primary energy kWh/m2/year			71.4285 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Current energy efficiency rating: B 83
Current environmental impact rating: B 89

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

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

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

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£70	£70	£0
Mains gas	£249	£249	£0
Space heating	£191	£191	£0
Water heating	£72	£72	£0
Lighting	£57	£57	£0
Total cost of fuels	£319	£319	£0
Total cost of uses	£320	£320	£0
Delivered energy	67 kWh/m²	67 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	71 kWh/m²	71 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	248.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	154.90 (P1)
Transmission heat loss coefficient	50.20 (37)
Summer heat loss coefficient	205.09 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.9500	87.1704	0.6200	0.7000	0.9000	29.1117
East	3.8700	125.2818	0.6200	0.7000	0.9000	170.4408
South	0.9500	118.5567	0.6200	0.7000	0.9000	39.5935
West	1.9200	125.2818	0.6200	0.7000	0.9000	84.5598
total:						323.7059

Solar gains	Jun 348	Jul 324	Aug 287	(P3)
Internal gains	386	370	378	
Total summer gains	734	694	665	(P5)
Summer gain/loss ratio	3.58	3.38	3.24	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 248.0)	0.26	0.26	0.26	
Threshold temperature	19.24	20.95	20.81	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			