

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-198			Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	1FF - Semi (As)		
Property	95, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB				
SAP Rating	86 B	DER	11.19	TER	15.24
Environmental	93 A	% DER<TER	26.58		
CO ₂ Emissions (t/year)	0.58	DFEE	27.86	TFEE	30.46
General Requirements Compliance	Pass	% DFEE<TFEE	8.53		
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 68 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.24 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.19 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)30.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.99 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading:
Average
Windows facing South East: 6.09 m², No overhang
Windows facing North West: 2.58 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Door U-value 0.71 W/m²K
Air permeability 4.0 m³/m²h
Photovoltaic array 420.60 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	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3402 (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) =				0.2892 (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	0.3687	0.3615	0.3543	0.3181	0.3109	0.2747	0.2747	0.2675	0.2892	0.3109	0.3254	0.3398 (22b)
	0.5680	0.5653	0.5628	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.2600	7.4334	60.0000	1715.4000 (29a)
APT Wall to Stairwell	18.1300		18.1300	0.2400	4.3512	110.0000	1994.3000 (29a)
Total net area of external elements Aum (m ²)			57.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.7841		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32d)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
1F - Timber			85.6000			9.0000	770.4000 (32c)
1F - Metal			36.9100			20.0000	738.2000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16545.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.5042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4939 (36)
Total fabric heat loss						(33) + (36) =	30.2780 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.6357	26.5119	26.3906	25.8206	25.7140	25.2176	25.2176	25.1256	25.4088	25.7140	25.9297	26.1552 (38)
Heat transfer coeff	56.9137	56.7899	56.6685	56.0986	55.9920	55.4955	55.4955	55.4036	55.6868	55.9920	56.2077	56.4332 (39)
Average = Sum(39)m / 12 =												56.0981 (39)
HLP	0.8410	0.8392	0.8374	0.8290	0.8274	0.8201	0.8201	0.8187	0.8229	0.8274	0.8306	0.8339 (40)
HLP (average)												0.8290 (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												2.1883 (42)
Average daily hot water use (litres/day)												86.1711 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy conte	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Energy content (annual)												Total = Sum(45)m = 1355.8065 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.0852	18.4413	19.0297	16.5906	15.9191	13.7369	12.7293	14.6071	14.7815	17.2264	18.8040	20.4199 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7360	19.5971	21.6404	20.8785	21.5280	20.7800	21.4393	21.4968	20.8337	21.5939	20.9713	21.7175 (61)
Total heat required for water heating calculated for each month	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (64)
Heat gains from water heating, kWh/month	52.1729	45.7774	47.5927	41.9954	40.6693	35.6452	33.5764	37.7532	37.9741	43.5837	46.9250	50.6935 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1610.0190 (64)												

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.7057	16.6142	13.5116	10.2291	7.6464	6.4554	6.9753	9.0668	12.1694	15.4518	18.0346	19.2256 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	191.7990	193.7893	188.7739	178.0966	164.6185	151.9510	143.4883	141.4981	146.5135	157.1907	170.6688	183.3364 (68)
Pumps, fans	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302 (71)
Total internal gains	70.1249	68.1212	63.9687	58.3270	54.6630	49.5072	45.1296	50.7435	52.7418	58.5802	65.1736	68.1364 (72)
	339.4534	337.3485	325.0780	305.4766	285.7517	266.7375	254.4171	260.1322	270.2485	290.0466	312.7008	329.5222 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Southeast				2.8800	36.7938	0.6200	0.7000			0.7700			31.8706 (77)
Northwest				2.5800	11.2829	0.6200	0.7000			0.7700			8.7552 (81)
Southeast				3.2100	36.7938	0.6200	0.7000			0.7700			35.5225 (77)
Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243	(83)
Total gains	415.6017	469.9653	514.2545	552.8229	574.6180	558.7131	533.7494	507.6940	479.4447	438.6991	404.4385	394.3465	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	80.7539	80.9299	81.1032	81.9272	82.0832	82.8175	82.8175	82.9549	82.5331	82.0832	81.7682	81.4414
util living area	6.3836	6.3953	6.4069	6.4618	6.4722	6.5212	6.5212	6.5303	6.5022	6.4722	6.4512	6.4294
	0.9971	0.9931	0.9808	0.9372	0.8200	0.6232	0.4560	0.4992	0.7548	0.9551	0.9931	0.9979 (86)
MIT	20.1969	20.3291	20.5243	20.7587	20.9255	20.9895	20.9988	20.9979	20.9664	20.7547	20.4300	20.1680 (87)
Th 2	20.2179	20.2195	20.2210	20.2283	20.2296	20.2360	20.2360	20.2371	20.2335	20.2296	20.2269	20.2240 (88)
util rest of house	0.9962	0.9909	0.9749	0.9182	0.7745	0.5541	0.3776	0.4179	0.6879	0.9376	0.9905	0.9973 (89)
MIT 2	19.1385	19.3320	19.6145	19.9470	20.1581	20.2290	20.2355	20.2362	20.2076	19.9483	19.4854	19.1011 (90)
Living area fraction	19.5422	19.7123	19.9615	20.2566	20.4508	20.5190	20.5266	20.5267	20.4970	20.2559	19.8457	19.5080 (92)
Temperature adjustment	19.3922	19.5623	19.8115	20.1066	20.3008	20.3690	20.3766	20.3767	20.3470	20.1059	19.6957	-0.1500
adjusted MIT												19.3580 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9950	0.9886	0.9710	0.9148	0.7790	0.5664	0.3921	0.4329	0.6984	0.9342	0.9882	0.9963 (94)
Ext temp.	413.5085	464.6090	499.3217	505.7142	447.6561	316.4799	209.2978	219.7880	334.8453	409.8187	399.6842	392.8789 (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	858.9516	832.6727	754.3423	628.6730	481.5747	320.1563	209.5847	220.3240	347.8776	532.2520	707.9744	855.4167 (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	331.4097	247.3388	189.7354	88.5304	25.2355	0.0000	0.0000	0.0000	0.0000	91.0903	221.9690	344.1282 (98)
												1539.4371 (98)
												22.7492 (99)

8c. Space cooling requirement

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Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1710.4857 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	331.4097	247.3388	189.7354	88.5304	25.2355	0.0000	0.0000	0.0000	0.0000	91.0903	221.9690	344.1282	(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)	368.2330	274.8209	210.8171	98.3671	28.0394	0.0000	0.0000	0.0000	0.0000	101.2115	246.6322	382.3646	(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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502	(64)
Efficiency of water heater (217)m	88.8878	88.7648	88.5207	87.9983	87.2279	86.7000	86.7000	86.7000	86.7000	87.9917	88.6592	88.9355	(216)
Fuel for water heating, kWh/month	182.5944	160.5804	167.7633	149.4146	146.3466	129.5959	122.6082	137.1132	137.6898	155.0564	165.0490	177.4884	(219)
Water heating fuel used												1831.3002	(219)
Annual totals kWh/year													
Space heating fuel - main system												1710.4857	(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)												330.3478	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
Total delivered energy for all uses												3947.1338	(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	1710.4857	0.2160	369.4649	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1831.3002	0.2160	395.5608	(264)
Space and water heating			765.0258	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	330.3478	0.5190	171.4505	(268)
Energy saving/generation technologies				
PV Unit	-420.6035	0.5190	-218.2932	(269)
Total CO2, kg/year			757.1081	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.1900	(273)

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

DER		11.1900	ZC1
Total Floor Area		67.6700	
Assumed number of occupants	TFA	2.1883	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	16.7956	ZC2
CO2 emissions from cooking, equation (L16)		2.5346	ZC3
Total CO2 emissions		30.5203	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.5203	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	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3907 (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) =				0.3321 (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	0.4235	0.4152	0.4069	0.3653	0.3570	0.3155	0.3155	0.3072	0.3321	0.3570	0.3736	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5761 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1200	1.0000	2.1200			(26)					
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943			(27)					
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.1800	5.1462			(29a)					
APT Wall to Stairwell	18.1300		18.1300	0.1800	3.2634			(29a)					
Total net area of external elements Aum(A, m2)			57.5100					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	22.0239		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							250.0000	(35)					
Total fabric heat loss							5.9384	(36)					
							(33) + (36) =	27.9623 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 27.6523	Feb 27.4890	Mar 27.3290	Apr 26.5773	May 26.4367	Jun 25.7820	Jul 25.7820	Aug 25.6607	Sep 26.0341	Oct 26.4367	Nov 26.7212	Dec 27.0186	(38)
Heat transfer coeff	55.6146	55.4514	55.2913	54.5396	54.3990	53.7443	53.7443	53.6230	53.9965	54.3990	54.6835	54.9809	(39)
Average = Sum(39)m / 12 =												54.5390	(39)
HLP	Jan 0.8219	Feb 0.8194	Mar 0.8171	Apr 0.8060	May 0.8039	Jun 0.7942	Jul 0.7942	Aug 0.7924	Sep 0.7979	Oct 0.8039	Nov 0.8081	Dec 0.8125	(40)
HLP (average)												0.8060	(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												2.1883 (42)
Average daily hot water use (litres/day)												86.1711 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy conte	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Energy content (annual)										Total = Sum(45)m =		1355.8065 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0852	18.4413	19.0297	16.5906	15.9191	13.7369	12.7293	14.6071	14.7815	17.2264	18.8040	20.4199 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	48.3030	42.0420	44.7901	41.6454	41.2771	38.2458	39.5207	41.2771	41.6454	44.7901	45.0450	48.3030 (61)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month												
	188.8711	164.9838	171.6550	152.2493	147.4042	129.8254	124.3826	138.6575	140.1888	159.6329	170.4049	184.4357 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
	188.8711	164.9838	171.6550	152.2493	147.4042	129.8254	124.3826	138.6575	140.1888	159.6329	170.4049	184.4357 (64)
Total per year (kWh/year) = Sum (64)m =												1872.6913 (64)
Heat gains from water heating, kWh/month												
	58.8147	51.3887	53.3801	47.1872	45.6065	40.0117	38.0968	42.6982	43.1770	49.3827	52.9434	57.3399 (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	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.7057	16.6142	13.5116	10.2291	7.6464	6.4554	6.9753	9.0668	12.1694	15.4518	18.0346	19.2256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	191.7990	193.7893	188.7739	178.0966	164.6185	151.9510	143.4883	141.4981	146.5135	157.1907	170.6688	183.3364 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413 (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)												
	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302 (71)
Water heating gains (Table 5)												
	79.0520	76.4712	71.7474	65.5377	61.2991	55.5718	51.2053	57.3901	59.9681	66.3747	73.5325	77.0697 (72)
Total internal gains	348.3805	345.6986	332.8568	312.6873	292.3879	272.8020	260.4928	266.7788	277.4748	297.8411	321.0598	338.4555 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Southeast					6.0900	36.7938	0.6300	0.7000			0.7700	68.4801 (77)
Northwest					2.5800	11.2829	0.6300	0.7000			0.7700	8.8964 (81)
Solar gains	77.3765	134.7557	192.2278	251.3357	293.5254	296.6849	283.8377	251.5548	212.5703	151.0501	93.2173	65.8699 (83)
Total gains	425.7570	480.4543	525.0845	564.0231	585.9133	569.4869	544.3305	518.3336	490.0451	448.8912	414.2771	404.3254 (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	84.4976	84.7464	84.9917	86.1631	86.3859	87.4382	87.4382	87.6359	87.0299	86.3859	85.9364	85.4715
alpha	6.6332	6.6498	6.6661	6.7442	6.7591	6.8292	6.8292	6.8424	6.8020	6.7591	6.7291	6.6981
util living area	0.9969	0.9924	0.9786	0.9284	0.7992	0.5962	0.4336	0.4743	0.7283	0.9482	0.9923	0.9978 (86)
MIT	20.2556	20.3857	20.5747	20.7982	20.9442	20.9934	20.9993	20.9988	20.9767	20.7924	20.4834	20.2307 (87)
Th 2	20.2344	20.2365	20.2386	20.2482	20.2500	20.2584	20.2584	20.2599	20.2551	20.2500	20.2463	20.2425 (88)
util rest of house	0.9960	0.9901	0.9720	0.9076	0.7526	0.5305	0.3610	0.3989	0.6619	0.9285	0.9895	0.9971 (89)
MIT 2	19.2353	19.4260	19.6992	20.0160	20.1975	20.2541	20.2581	20.2594	20.2377	20.0153	19.5766	19.2053 (90)
Living area fraction	19.6245	19.7921	20.0331	20.3144	20.4823	20.5361	20.5408	20.5414	20.5196	20.3117	19.9225	19.5964 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6245	19.7921	20.0331	20.3144	20.4823	20.5361	20.5408	20.5414	20.5196	20.3117	19.9225	19.5964 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9950	0.9884	0.9699	0.9096	0.7677	0.5554	0.3887	0.4277	0.6863	0.9303	0.9879	0.9963 (94)
Useful gains	423.6122	474.8844	509.2668	513.0405	449.8149	316.3184	211.5905	221.6904	336.3163	417.6164	409.2784	402.8231 (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	852.2638	825.7850	748.2654	622.5351	477.7496	319.0296	211.7959	222.0754	346.6349	528.3067	701.1765	846.5085 (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	318.9168	235.8052	177.8150	78.8362	20.7834	0.0000	0.0000	0.0000	0.0000	82.3536	210.1666	330.1019 (98)
Space heating												1454.7786 (98)
Space heating per m2										(98) / (4) =		21.4981 (99)

8c. Space cooling requirement

Not applicable

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

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

Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1557.5788 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	318.9168	235.8052	177.8150	78.8362	20.7834	0.0000	0.0000	0.0000	0.0000	82.3536	210.1666	330.1019	(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)	341.4526	252.4681	190.3801	84.4070	22.2521	0.0000	0.0000	0.0000	0.0000	88.1730	225.0178	353.4282	(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	188.8711	164.9838	171.6550	152.2493	147.4042	129.8254	124.3826	138.6575	140.1888	159.6329	170.4049	184.4357	(64)
Efficiency of water heater	86.3598	85.9498	85.1400	83.4820	81.4242	80.3000	80.3000	80.3000	80.3000	83.4739	85.5802	80.3000	(216)
Fuel for water heating, kWh/month	218.7026	191.9536	201.6150	182.3739	181.0325	161.6755	154.8974	172.6743	174.5813	191.2368	199.1171	213.2202	(219)
Water heating fuel used												2243.0802	(219)
Annual totals kWh/year													
Space heating fuel - main system												1557.5788	(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)												330.3478	(232)
Total delivered energy for all uses												4206.0068	(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	1557.5788	0.2160	336.4370 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2243.0802	0.2160	484.5053 (264)
Space and water heating			820.9423 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.3478	0.5190	171.4505 (268)
Total CO2, kg/m2/year			1031.3179 (272)
Emissions per m2 for space and water heating			12.1316 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5336 (272b)
Emissions per m2 for pumps and fans			0.5752 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.1316 * 1.00) + 2.5336 + 0.5752, rounded to 2 d.p.			15.2400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					3.9900
Number of sides sheltered					0.3402 (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) =				0.2892 (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												
	0.3687	0.3615	0.3543	0.3181	0.3109	0.2747	0.2747	0.2675	0.2892	0.3109	0.3254	0.3398 (22b)
Effective ac	0.5680	0.5653	0.5628	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.2600	7.4334	60.0000	1715.4000 (29a)
APT Wall to Stairwell	18.1300		18.1300	0.2400	4.3512	110.0000	1994.3000 (29a)
Total net area of external elements Aum(A, m ²)			57.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.7841		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32d)
E-FC-4			67.6700			30.0000	2030.1000 (32b)
1F - Timber			85.6000			9.0000	770.4000 (32c)
1F - Metal			36.9100			20.0000	738.2000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 13838.8000 (34)
204.5042 (35)
5.4939 (36)
(33) + (36) = 30.2780 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.6357	26.5119	26.3906	25.8206	25.7140	25.2176	25.2176	25.1256	25.4088	25.7140	25.9297	26.1552 (38)
Heat transfer coeff	56.9137	56.7899	56.6685	56.0986	55.9920	55.4955	55.4955	55.4036	55.6868	55.9920	56.2077	56.4332 (39)
Average = Sum(39)m / 12 =												56.0981 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8410	0.8392	0.8374	0.8290	0.8274	0.8201	0.8201	0.8187	0.8229	0.8274	0.8306	0.8339 (40)
HLP (average)												0.8290 (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 2.1883 (42)
Average daily hot water use (litres/day) 86.1711 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy conte	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Energy content (annual)												Total = Sum(45)m = 1355.8065 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	29.8707	26.1251	26.9588	23.5033	22.5520	19.4607	18.0332	20.6933	20.9405	24.4041	26.6390	28.9282 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.7057	16.6142	13.5116	10.2291	7.6464	6.4554	6.9753	9.0668	12.1694	15.4518	18.0346	19.2256 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	191.7990	193.7893	188.7739	178.0966	164.6185	151.9510	143.4883	141.4981	146.5135	157.1907	170.6688	183.3364 (68)
Pumps, fans	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302 (71)
Total internal gains	40.1488	38.8767	36.2349	32.6435	30.3118	27.0287	24.2381	27.8136	29.0840	32.8012	36.9986	38.8820 (72)
	306.4774	305.1040	294.3442	276.7931	258.4006	241.2590	230.5256	234.2023	243.5907	261.2676	281.5258	297.2677 (73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Specific data		Specific data		factor		W	
					W/m2		or Table 6b		or Table 6c		Table 6d			
Southeast	2.8800				36.7938		0.6200		0.7000		0.7700		31.8706 (77)	
Northwest	2.5800				11.2829		0.6200		0.7000		0.7700		8.7552 (81)	
Southeast	3.2100				36.7938		0.6200		0.7000		0.7700		35.5225 (77)	
Solar gains	76.1483	132.6168	189.1765	247.3463	288.8662	291.9756	279.3323	247.5619	209.1962	148.6525	91.7377	64.8243	(83)	
Total gains	382.6256	437.7208	483.5208	524.1394	547.2669	533.2345	509.8579	481.7641	452.7869	409.9201	373.2635	362.0921	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	67.5428	67.6901	67.8350	68.5242	68.6547	69.2688	69.2688	69.3838	69.0310	68.6547	68.3912	68.1179
util living area	5.5029	5.5127	5.5223	5.5683	5.5770	5.6179	5.6179	5.6256	5.6021	5.5770	5.5594	5.5412
	0.9960	0.9909	0.9773	0.9339	0.8261	0.6417	0.4749	0.5220	0.7712	0.9536	0.9913	0.9970 (86)
MIT	20.0121	20.1658	20.3937	20.6707	20.8806	20.9774	20.9964	20.9941	20.9389	20.6668	20.2847	19.9797 (87)
Th 2	20.2179	20.2195	20.2210	20.2283	20.2296	20.2360	20.2360	20.2371	20.2335	20.2296	20.2269	20.2240 (88)
util rest of house	0.9949	0.9886	0.9713	0.9165	0.7848	0.5741	0.3944	0.4388	0.7091	0.9378	0.9887	0.9962 (89)
MIT 2	19.3065	19.4605	19.6863	19.9584	20.1459	20.2244	20.2348	20.2350	20.1978	19.9602	19.5855	19.2793 (90)
Living area fraction									fLA =	Living area / (4) =		0.3814 (91)
MIT	19.5756	19.7295	19.9561	20.2300	20.4261	20.5116	20.5253	20.5245	20.4805	20.2297	19.8522	19.5465 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5756	19.7295	19.9561	20.2300	20.4261	20.5116	20.5253	20.5245	20.4805	20.2297	19.8522	19.5465 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9939	0.9868	0.9688	0.9165	0.7960	0.5991	0.4252	0.4705	0.7303	0.9378	0.9871	0.9953 (94)
Ext temp.	380.2732	431.9382	468.4528	480.3984	435.6516	319.4791	216.7818	226.6932	330.6675	384.4053	368.4408	360.4073 (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	869.3925	842.1654	762.5372	635.5993	488.5928	328.0656	217.8358	228.5150	355.3093	539.1879	716.7697	866.0508 (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	363.9048	275.6727	218.7988	111.7446	39.3882	0.0000	0.0000	0.0000	0.0000	115.1583	250.7968	376.1988 (98)
Space heating per m2												1751.6629 (98)
										(98) / (4) =		25.8854 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	521.6582	410.6671	421.0675	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9447	0.9753	0.9665	0.0000	0.0000	0.0000	0.0000 (101)
	0.0000	0.0000	0.0000	0.0000	0.0000	492.7849	400.5164	406.9672	0.0000	0.0000	0.0000	0.0000 (102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	705.3128	676.4133	645.1126	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	153.0201	205.2673	177.1801	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												535.4676 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	38.2550	51.3168	44.2950	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.8669 (107)
Space cooling per m2												1.9782 (108)
Energy for space heating												25.8854 (99)
Energy for space cooling												1.9782 (108)
Total												27.8636 (109)
Dwelling Fabric Energy Efficiency (DFEE)												27.9 (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	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3907 (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) =				0.3321 (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	0.4235	0.4152	0.4069	0.3653	0.3570	0.3155	0.3155	0.3072	0.3321	0.3570	0.3736	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5761 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6700	1.3258	11.4943		(27)					
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.1800	5.1462		(29a)					
APT Wall to Stairwell	18.1300		18.1300	0.1800	3.2634		(29a)					
Total net area of external elements Aum(A, m2)			57.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.0239		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.9384 (36)					
Total fabric heat loss						(33) + (36) =	27.9623 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 27.6523	Feb 27.4890	Mar 27.3290	Apr 26.5773	May 26.4367	Jun 25.7820	Jul 25.7820	Aug 25.6607	Sep 26.0341	Oct 26.4367	Nov 26.7212	Dec 27.0186 (38)
Heat transfer coeff	55.6146	55.4514	55.2913	54.5396	54.3990	53.7443	53.7443	53.6230	53.9965	54.3990	54.6835	54.9809 (39)
Average = Sum(39)m / 12 =												54.5390 (39)
HLP	Jan 0.8219	Feb 0.8194	Mar 0.8171	Apr 0.8060	May 0.8039	Jun 0.7942	Jul 0.7942	Aug 0.7924	Sep 0.7979	Oct 0.8039	Nov 0.8081	Dec 0.8125 (40)
HLP (average)												0.8060 (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												2.1883 (42)
Average daily hot water use (litres/day)												86.1711 (43)
Daily hot water use	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy conte	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Energy content (annual)												1355.8065 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
29.8707 26.1251 26.9588 23.5033 22.5520 19.4607 18.0332 20.6933 20.9405 24.4041 26.6390 28.9282 (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	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	109.4128	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7057	16.6142	13.5116	10.2291	7.6464	6.4554	6.9753	9.0668	12.1694	15.4518	18.0346	19.2256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.7990	193.7893	188.7739	178.0966	164.6185	151.9510	143.4883	141.4981	146.5135	157.1907	170.6688	183.3364	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	33.9413	(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)	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	(71)
Water heating gains (Table 5)	40.1488	38.8767	36.2349	32.6435	30.3118	27.0287	24.2381	27.8136	29.0840	32.8012	36.9986	38.8820	(72)
Total internal gains	306.4774	305.1040	294.3442	276.7931	258.4006	241.2590	230.5256	234.2023	243.5907	261.2676	281.5258	297.2677	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast												6.0900	36.7938	0.6300	0.7000	0.7700	68.4801 (77)
Northwest												2.5800	11.2829	0.6300	0.7000	0.7700	8.8964 (81)
Solar gains	77.3765	134.7557	192.2278	251.3357	293.5254	296.6849	283.8377	251.5548	212.5703	151.0501	93.2173	65.8699 (83)					
Total gains	383.8538	439.8598	486.5720	528.1289	551.9260	537.9438	514.3633	485.7571	456.1610	412.3177	374.7431	363.1377 (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	84.4976	84.7464	84.9917	86.1631	86.3859	87.4382	87.4382	87.6359	87.0299	86.3859	85.9364	85.4715	
alpha	6.6332	6.6498	6.6661	6.7442	6.7591	6.8292	6.8292	6.8424	6.8020	6.7591	6.7291	6.6981	
util living area	0.9983	0.9954	0.9856	0.9459	0.8302	0.6282	0.4585	0.5054	0.7692	0.9650	0.9956	0.9988	(86)
MIT	20.1947	20.3282	20.5240	20.7626	20.9294	20.9910	20.9991	20.9982	20.9678	20.7514	20.4272	20.1705	(87)
Th 2	20.2344	20.2365	20.2386	20.2482	20.2500	20.2584	20.2584	20.2599	20.2551	20.2500	20.2463	20.2425	(88)
util rest of house	0.9978	0.9939	0.9809	0.9289	0.7860	0.5603	0.3819	0.4254	0.7035	0.9505	0.9940	0.9985	(89)
MIT 2	19.4917	19.6263	19.8214	20.0581	20.2036	20.2543	20.2581	20.2594	20.2382	20.0529	19.7337	19.4744	(90)
Living area fraction	19.7598	19.8940	20.0894	20.3268	20.4804	20.5353	20.5407	20.5412	20.5165	20.3193	19.9982	19.7399	(91)
MIT	19.7598	19.8940	20.0894	20.3268	20.4804	20.5353	20.5407	20.5412	20.5165	20.3193	19.9982	19.7399	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7598	19.8940	20.0894	20.3268	20.4804	20.5353	20.5407	20.5412	20.5165	20.3193	19.9982	19.7399	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9931	0.9798	0.9309	0.8004	0.5861	0.4112	0.4560	0.7277	0.9520	0.9933	0.9981	(94)
Useful gains	382.8420	436.8337	476.7531	491.6138	441.7535	315.2674	211.4994	221.4934	331.9385	392.5395	372.2327	362.4594	(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	859.7934	831.4366	751.3763	623.2126	477.6454	318.9892	211.7905	222.0636	346.4661	528.7195	705.3183	854.3968	(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	354.8519	265.1731	204.3196	94.7511	26.7035	0.0000	0.0000	0.0000	0.0000	101.3179	239.8217	366.0014	(98)
Space heating												1652.9403	(98)
Space heating per m2												24.4265	(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	505.1962	397.7077	407.5351	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9698	0.9893	0.9843	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	489.9533	393.4659	401.1272	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	710.8172	681.6793	649.7796	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	159.0220	214.4308	184.9974	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												558.4502	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.7555	53.6077	46.2493	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												139.6126 (107)
Space cooling per m2												2.0631 (108)
Energy for space heating												24.4265 (99)
Energy for space cooling												2.0631 (108)
Total												26.4896 (109)
Target Fabric Energy Efficiency (TFEE)												30.5 (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	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					3.9900
Number of sides sheltered					0.3402 (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) =				0.2892 (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	0.3037	0.2820	0.2892	0.2747	0.2747	0.2675	0.2603	0.2531	0.2458	0.2675	0.2531	0.2675 (22b)
Effective ac	0.5461	0.5398	0.5418	0.5377	0.5377	0.5358	0.5339	0.5320	0.5302	0.5358	0.5320	0.5358 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.2600	7.4334	60.0000	1715.4000 (29a)
APT Wall to Stairwell	18.1300		18.1300	0.2400	4.3512	110.0000	1994.3000 (29a)
Total net area of external elements Aum(A, m ²)			57.5100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				24.7841		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32d)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
1F - Timber			85.6000			9.0000	770.4000 (32c)
1F - Metal			36.9100			20.0000	738.2000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16545.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 244.5042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.4939 (36)
Total fabric heat loss (33) + (36) = 30.2780 (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	25.6098	25.3120	25.4088	25.2176	25.2176	25.1256	25.0362	24.9491	24.8646	25.1256	24.9491	25.1256 (38)
Heat transfer coeff	55.8878	55.5899	55.6868	55.4955	55.4955	55.4036	55.3141	55.2271	55.1425	55.4036	55.2271	55.4036 (39)
Average = Sum(39)m / 12 =												55.4398 (39)
HLP	0.8259	0.8215	0.8229	0.8201	0.8201	0.8187	0.8174	0.8161	0.8149	0.8187	0.8161	0.8187 (40)
HLP (average)												0.8193 (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											2.1883 (42)	
Average daily hot water use (litres/day)											86.1711 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy conte	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Energy content (annual)											Total = Sum(45)m = 1355.8065 (45)	
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.0852	18.4413	19.0297	16.5906	15.9191	13.7369	12.7293	14.6071	14.7815	17.2264	18.8040	20.4199 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7360	19.5971	21.6404	20.8785	21.5280	20.7800	21.4393	21.4968	20.8337	21.5939	20.9713	21.7175 (61)
Total heat required for water heating calculated for each month	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	52.1729	45.7774	47.5927	41.9954	40.6693	35.6452	33.5764	37.7532	37.9741	43.5837	46.9250	50.6935 (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	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.7642	41.5355	33.7789	25.5728	19.1160	16.1385	17.4382	22.6669	30.4235	38.6296	45.0864	48.0639 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	286.2672	289.2378	281.7521	265.8159	245.6993	226.7926	214.1617	211.1911	218.6768	234.6130	254.7296	273.6364 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178 (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)	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302 (71)
Water heating gains (Table 5)	70.1249	68.1212	63.9687	58.3270	54.6630	49.5072	45.1296	50.7435	52.7418	58.5802	65.1736	68.1364 (72)
Total internal gains	500.2392	495.9774	476.5826	446.7986	416.5612	389.5212	373.8125	381.6844	398.9250	428.9058	462.0725	486.9196 (73)

6. Solar gains

[Jan]												
			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast			2.8800	45.1778		0.6200		0.7000		0.7700		39.1328 (77)
Northwest			2.5800	14.6176		0.6200		0.7000		0.7700		11.3428 (81)
Southeast			3.2100	45.1778		0.6200		0.7000		0.7700		43.6168 (77)
Solar gains	94.0923	139.7058	201.8193	267.3530	298.3409	328.2459	311.3002	281.5449	236.3425	169.1918	113.0290	78.7177 (83)
Total gains	594.3315	635.6832	678.4019	714.1516	714.9021	717.7671	685.1127	663.2293	635.2675	598.0975	575.1016	565.6372 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	82.2362	82.6768	82.5331	82.8175	82.8175	82.9549	83.0891	83.2200	83.3476	82.9549	83.2200	82.9549
alpha	6.4824	6.5118	6.5022	6.5212	6.5212	6.5303	6.5393	6.5480	6.5565	6.5303	6.5480	6.5303
util living area	0.9758	0.9620	0.9188	0.8137	0.6442	0.4388	0.3148	0.3246	0.5421	0.8113	0.9446	0.9801 (86)
MIT	20.5194	20.6071	20.7650	20.9141	20.9832	20.9987	20.9999	20.9999	20.9954	20.9298	20.7286	20.5003 (87)
Th 2	20.2310	20.2348	20.2335	20.2360	20.2360	20.2371	20.2383	20.2394	20.2405	20.2371	20.2394	20.2371 (88)
util rest of house	0.9694	0.9524	0.8997	0.7773	0.5917	0.3807	0.2534	0.2614	0.4789	0.7670	0.9289	0.9746 (89)
MIT 2	19.6133	19.7396	19.9548	20.1462	20.2221	20.2364	20.2382	20.2393	20.2376	20.1691	19.9146	19.5915 (90)
Living area fraction									fLA = Living area / (4) =			0.3814 (91)
MIT	19.9589	20.0705	20.2639	20.4391	20.5124	20.5272	20.5287	20.5294	20.5266	20.4592	20.2251	19.9381 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.8089	19.9205	20.1139	20.2891	20.3624	20.3772	20.3787	20.3794	20.3766	20.3092	20.0751	19.7881 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	573.6105	602.4831	608.1170	557.0039	429.3630	280.9175	181.3380	181.0855	311.4833	461.4122	531.9281	549.0384 (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	833.2236	812.7506	730.2682	598.7471	436.3272	281.2949	181.3604	181.1123	313.0234	493.6036	672.3947	819.3164 (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	193.1521	141.2998	90.8805	30.0551	5.1814	0.0000	0.0000	0.0000	0.0000	23.9504	101.1360	201.0869 (98)
Space heating												786.7422 (98)
RHI space heating demand												787 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3402 (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) = 0.2892 (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	0.3687	0.3615	0.3543	0.3181	0.3109	0.2747	0.2747	0.2675	0.2892	0.3109	0.3254	0.3398 (22b)
	0.5680	0.5653	0.5628	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.2600	7.4334	60.0000	1715.4000 (29a)
APT Wall to Stairwell	18.1300		18.1300	0.2400	4.3512	110.0000	1994.3000 (29a)
Total net area of external elements Aum (A, m ²)			57.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.7841		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32d)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
1F - Timber			85.6000			9.0000	770.4000 (32c)
1F - Metal			36.9100			20.0000	738.2000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16545.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.5042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4939 (36)
Total fabric heat loss							(33) + (36) = 30.2780 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.6357	26.5119	26.3906	25.8206	25.7140	25.2176	25.2176	25.1256	25.4088	25.7140	25.9297	26.1552 (38)
Heat transfer coeff	56.9137	56.7899	56.6685	56.0986	55.9920	55.4955	55.4955	55.4036	55.6868	55.9920	56.2077	56.4332 (39)
Average = Sum(39)m / 12 =												56.0981 (39)
HLP	0.8410	0.8392	0.8374	0.8290	0.8274	0.8201	0.8201	0.8187	0.8229	0.8274	0.8306	0.8339 (40)
HLP (average)												0.8290 (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												2.1883 (42)
Average daily hot water use (litres/day)												86.1711 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy content (annual)	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Distribution loss (46)m = 0.15 x (45)m												1355.8065 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.0852	18.4413	19.0297	16.5906	15.9191	13.7369	12.7293	14.6071	14.7815	17.2264	18.8040	20.4199 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7360	19.5971	21.6404	20.8785	21.5280	20.7800	21.4393	21.4968	20.8337	21.5939	20.9713	21.7175 (61)
Total heat required for water heating calculated for each month	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (64)
Heat gains from water heating, kWh/month	52.1729	45.7774	47.5927	41.9954	40.6693	35.6452	33.5764	37.7532	37.9741	43.5837	46.9250	50.6935 (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	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.7642	41.5355	33.7789	25.5728	19.1160	16.1385	17.4382	22.6669	30.4235	38.6296	45.0864	48.0639	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	286.2672	289.2378	281.7521	265.8159	245.6993	226.7926	214.1617	211.1911	218.6768	234.6130	254.7296	273.6364	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	(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)	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	(71)
Water heating gains (Table 5)	70.1249	68.1212	63.9687	58.3270	54.6630	49.5072	45.1296	50.7435	52.7418	58.5802	65.1736	68.1364	(72)
Total internal gains	500.2392	495.9774	476.5826	446.7986	416.5612	389.5212	373.8125	381.6844	398.9250	428.9058	462.0725	486.9196	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast																	
Northwest																	
Southeast																	
Solar gains																	
Total gains																	

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	80.7539	80.9299	81.1032	81.9272	82.0832	82.8175	82.8175	82.9549	82.5331	82.0832	81.7682	81.4414	
alpha	6.3836	6.3953	6.4069	6.4618	6.4722	6.5212	6.5212	6.5303	6.5022	6.4722	6.4512	6.4294	
util living area	0.9834	0.9696	0.9376	0.8561	0.7079	0.5176	0.3735	0.4044	0.6197	0.8697	0.9657	0.9869	(86)
MIT	20.4253	20.5432	20.7039	20.8731	20.9680	20.9963	20.9996	20.9994	20.9889	20.8798	20.6300	20.3945	(87)
Th 2	20.2179	20.2195	20.2210	20.2283	20.2296	20.2360	20.2360	20.2371	20.2335	20.2296	20.2269	20.2240	(88)
util rest of house	0.9790	0.9618	0.9222	0.8249	0.6585	0.4574	0.3088	0.3377	0.5558	0.8346	0.9556	0.9833	(89)
MIT 2	19.4681	19.6369	19.8617	20.0899	20.2009	20.2336	20.2358	20.2369	20.2257	20.1039	19.7681	19.4291	(90)
Living area fraction	19.8332	19.9826	20.1830	20.3886	20.4935	20.5245	20.5271	20.5277	20.5168	20.3998	20.0969	19.7973	(91)
MIT	19.8332	19.9826	20.1830	20.3886	20.4935	20.5245	20.5271	20.5277	20.5168	20.3998	20.0969	19.7973	(92)
Temperature adjustment	19.6832	19.8326	20.0330	20.2386	20.3435	20.3745	20.3771	20.3777	20.3668	20.2498	19.9469	-0.1500	(93)
adjusted MIT	19.6832	19.8326	20.0330	20.2386	20.3435	20.3745	20.3771	20.3777	20.3668	20.2498	19.9469	19.6473	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9752	0.9572	0.9179	0.8253	0.6661	0.4684	0.3208	0.3500	0.5671	0.8356	0.9512	0.9799	(94)
Ext temp.	562.0764	601.6870	611.1053	572.9013	469.8593	319.2176	209.5282	220.2272	344.8944	482.6218	526.7610	540.6763	(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	875.5143	848.0191	766.8928	636.0794	483.9642	320.4605	209.6142	220.3788	348.9761	540.3131	722.0929	871.7420	(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	233.1978	165.5352	115.9059	45.4882	10.4941	0.0000	0.0000	0.0000	0.0000	42.9223	140.6390	246.3129	(98)
												1000.4952	(98)
												14.7849	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1111.6614 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	233.1978	165.5352	115.9059	45.4882	10.4941	0.0000	0.0000	0.0000	0.0000	42.9223	140.6390	246.3129 (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)	259.1086	183.9280	128.7843	50.5425	11.6601	0.0000	0.0000	0.0000	0.0000	47.6914	156.2655	273.6810 (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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (64)	
Efficiency of water heater (217)m	88.6158	88.4425	88.1163	87.5249	86.9422	86.7000	86.7000	86.7000	86.7000	87.4675	88.2865	88.6817 (217)	
Fuel for water heating, kWh/month	183.1548	161.1656	168.5333	150.2228	146.8276	129.5959	122.6082	137.1132	137.6898	155.9856	165.7459	177.9964 (219)	
Water heating fuel used												1836.6390 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1111.6614 (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)												330.3478 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3353.6483 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1111.6614	3.4800	38.6858 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1836.6390	3.4800	63.9150 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	330.3478	13.1900	43.5729 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			276.0662 (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] =	1.0291 (257)
SAP value		85.6442
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1111.6614	0.2160	240.1189 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1836.6390	0.2160	396.7140 (264)
Space and water heating			636.8329 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.3478	0.5190	171.4505 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	0.5190	-218.2932 (269)
Total kg/year			628.9152 (272)
CO2 emissions per m2			9.2900 (273)
EI value			92.5202
EI rating			93 (274)
EI band			A

Calculation of stars for heating and DHW

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency
Water heating environmental impact

$3.48 / 0.8757 = 3.974$, stars = 4
 $0.216 / 0.8757 = 0.2467$, 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	67.6700 (1b)	x 2.1000 (2b)	= 142.1070 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 142.1070 (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) = 0.1407 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3402 (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) =				0.2892 (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	0.3037	0.2820	0.2892	0.2747	0.2747	0.2675	0.2603	0.2531	0.2458	0.2675	0.2531	0.2675 (22b)
Effective ac	0.5461	0.5398	0.5418	0.5377	0.5377	0.5358	0.5339	0.5320	0.5302	0.5358	0.5320	0.5358 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			5.4600	1.3258	7.2386		(27)
French Door (Uw = 1.40)			3.2100	1.3258	4.2557		(27)
DTS			2.1200	0.7100	1.5052		(26)
APT 100mm Knauf Supafil	39.3800	10.7900	28.5900	0.2600	7.4334	60.0000	1715.4000 (29a)
APT Wall to Stairwell	18.1300		18.1300	0.2400	4.3512	110.0000	1994.3000 (29a)
Total net area of external elements Aum (A, m ²)			57.5100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				24.7841		(33)
APT E-WM-28			16.8500	0.0000	0.0000	110.0000	1853.5000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32d)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
1F - Timber			85.6000			9.0000	770.4000 (32c)
1F - Metal			36.9100			20.0000	738.2000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16545.6000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 244.5042 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.4939 (36)
Total fabric heat loss (33) + (36) = 30.2780 (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	25.6098	25.3120	25.4088	25.2176	25.2176	25.1256	25.0362	24.9491	24.8646	25.1256	24.9491	25.1256 (38)
Heat transfer coeff	55.8878	55.5899	55.6868	55.4955	55.4955	55.4036	55.3141	55.2271	55.1425	55.4036	55.2271	55.4036 (39)
Average = Sum(39)m / 12 =												55.4398 (39)
HLP	0.8259	0.8215	0.8229	0.8201	0.8201	0.8187	0.8174	0.8161	0.8149	0.8187	0.8161	0.8187 (40)
HLP (average)												0.8193 (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												2.1883 (42)
Average daily hot water use (litres/day)												86.1711 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7882	91.3413	87.8945	84.4476	81.0008	77.5540	77.5540	81.0008	84.4476	87.8945	91.3413	94.7882 (44)
Energy conte	140.5681	122.9418	126.8649	110.6039	106.1271	91.5796	84.8620	97.3803	98.5434	114.8428	125.3599	136.1327 (45)
Energy content (annual)												Total = Sum(45)m = 1355.8065 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

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

	21.0852	18.4413	19.0297	16.5906	15.9191	13.7369	12.7293	14.6071	14.7815	17.2264	18.8040	20.4199 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7360	19.5971	21.6404	20.8785	21.5280	20.7800	21.4393	21.4968	20.8337	21.5939	20.9713	21.7175 (61)
Total heat required for water heating calculated for each month	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502 (64)
Heat gains from water heating, kWh/month	52.1729	45.7774	47.5927	41.9954	40.6693	35.6452	33.5764	37.7532	37.9741	43.5837	46.9250	50.6935 (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	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.7642	41.5355	33.7789	25.5728	19.1160	16.1385	17.4382	22.6669	30.4235	38.6296	45.0864	48.0639	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	286.2672	289.2378	281.7521	265.8159	245.6993	226.7926	214.1617	211.1911	218.6768	234.6130	254.7296	273.6364	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	50.3178	(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)	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	-87.5302	(71)
Water heating gains (Table 5)	70.1249	68.1212	63.9687	58.3270	54.6630	49.5072	45.1296	50.7435	52.7418	58.5802	65.1736	68.1364	(72)
Total internal gains	500.2392	495.9774	476.5826	446.7986	416.5612	389.5212	373.8125	381.6844	398.9250	428.9058	462.0725	486.9196	(73)

6. Solar gains

[Jan]												Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W																		
															Southeast		2.8800		45.1778		0.6200		0.7000		0.7700		39.1328 (77)													
															Northwest		2.5800		14.6176		0.6200		0.7000		0.7700		11.3428 (81)													
															Southeast		3.2100		45.1778		0.6200		0.7000		0.7700		43.6168 (77)													
															Solar gains		94.0923		139.7058		201.8193		267.3530		298.3409		328.2459		311.3002		281.5449		236.3425		169.1918		113.0290		78.7177 (83)	
															Total gains		594.3315		635.6832		678.4019		714.1516		714.9021		717.7671		685.1127		663.2293		635.2675		598.0975		575.1016		565.6372 (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	82.2362	82.6768	82.5331	82.8175	82.8175	82.9549	83.0891	83.2200	83.3476	82.9549	83.2200	82.9549	
alpha	6.4824	6.5118	6.5022	6.5212	6.5212	6.5303	6.5393	6.5480	6.5565	6.5303	6.5480	6.5303	
util living area	0.9758	0.9620	0.9188	0.8137	0.6442	0.4388	0.3148	0.3246	0.5421	0.8113	0.9446	0.9801	(86)
MIT	20.5194	20.6071	20.7650	20.9141	20.9832	20.9987	20.9999	20.9999	20.9954	20.9298	20.7286	20.5003	(87)
Th 2	20.2310	20.2348	20.2335	20.2360	20.2360	20.2371	20.2383	20.2394	20.2405	20.2371	20.2394	20.2371	(88)
util rest of house	0.9694	0.9524	0.8997	0.7773	0.5917	0.3807	0.2534	0.2614	0.4789	0.7670	0.9289	0.9746	(89)
MIT 2	19.6133	19.7396	19.9548	20.1462	20.2221	20.2364	20.2382	20.2393	20.2376	20.1691	19.9146	19.5915	(90)
Living area fraction	19.9589	20.0705	20.2639	20.4391	20.5124	20.5272	20.5287	20.5294	20.5266	20.4592	20.2251	19.9381	(92)
Temperature adjustment	19.8089	19.9205	20.1139	20.2891	20.3624	20.3772	20.3787	20.3794	20.3766	20.3092	20.0751	-0.1500	
adjusted MIT												19.7881	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9651	0.9478	0.8964	0.7800	0.6006	0.3914	0.2647	0.2730	0.4903	0.7715	0.9249	0.9707	(94)
Ext temp.	573.6105	602.4831	608.1170	557.0039	429.3630	280.9175	181.3380	181.0855	311.4833	461.4122	531.9281	549.0384	(95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Month fracti	833.2236	812.7506	730.2682	598.7471	436.3272	281.2949	181.3604	181.1123	313.0234	493.6036	672.3947	819.3164	(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	193.1521	141.2998	90.8805	30.0551	5.1814	0.0000	0.0000	0.0000	0.0000	23.9504	101.1360	201.0869	(98)
												786.7422	(98)
												11.6262	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													874.1580 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	193.1521	141.2998	90.8805	30.0551	5.1814	0.0000	0.0000	0.0000	0.0000	23.9504	101.1360	201.0869	(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)	214.6135	156.9998	100.9784	33.3946	5.7571	0.0000	0.0000	0.0000	0.0000	26.6116	112.3733	223.4299	(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	162.3041	142.5389	148.5053	131.4824	127.6551	112.3596	106.3013	118.8772	119.3770	136.4367	146.3312	157.8502	(64)
Efficiency of water heater (217)m	88.4626	88.3120	87.9239	87.2955	86.8242	86.7000	86.7000	86.7000	86.7000	87.1773	88.0190	88.5183	(216)
Fuel for water heating, kWh/month	183.4721	161.4038	168.9020	150.6175	147.0271	129.5959	122.6082	137.1132	137.6898	156.5048	166.2496	178.3249	(219)
Water heating fuel used												1839.5089	(219)
Annual totals kWh/year													
Space heating fuel - main system												874.1580	(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)													330.3478 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3119.0148 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	874.1580	3.9200	34.2670 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1839.5089	3.9200	72.1088 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	330.3478	16.9600	56.0270 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			263.1227 (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	874.1580	0.2160	188.8181 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1839.5089	0.2160	397.3339 (264)
Space and water heating			586.1521 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.3478	0.5190	171.4505 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	0.5190	-218.2932 (269)
Total kg/year			578.2344 (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	874.1580	1.2200	1066.4727 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1839.5089	1.2200	2244.2009 (264)
Space and water heating			3310.6736 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	330.3478	3.0700	1014.1679 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	3.0700	-1291.2526 (269)
Primary energy kWh/year			3263.8389 (272)
Primary energy kWh/m2/year			48.2317 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

SAP 2012 EPC IMPROVEMENTS

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

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

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

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

Total Savings £0 0.00 kg/m²

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

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

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

	Current	Potential	Saving
Electricity	£69	£69	£0
Mains gas	£194	£194	£0
Space heating	£135	£135	£0
Water heating	£72	£72	£0
Lighting	£56	£56	£0
Total cost of fuels	£263	£263	£0
Total cost of uses	£263	£263	£0
Delivered energy	46 kWh/m²	46 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	48 kWh/m²	48 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	244.5 (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	281.37 (P1)
Transmission heat loss coefficient	30.28 (37)
Summer heat loss coefficient	311.65 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	2.8800	127.3119	0.6200	0.7000	0.9000	128.8950
North West	2.5800	106.0502	0.6200	0.7000	0.9000	96.1847
South East	3.2100	127.3119	0.6200	0.7000	0.9000	143.6642
total:						368.7439

	Jun	Jul	Aug	
Solar gains	395	369	332	(P3)
Internal gains	387	371	379	
Total summer gains	782	740	711	(P5)

Summer gain/loss ratio	2.51	2.37	2.28	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 244.5)	0.29	0.29	0.29	
Threshold temperature	18.20	19.96	19.87	(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