

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-194				Issued on Date	25/06/2019
Assessment Reference	As Built	Prop Type Ref	GFF - Semi (As)			
Property	87, Kingsman Drive, Botley, SOUTHAMPTON, SO32 2SB					
SAP Rating	84 B	DER	14.40	TER	18.12	
Environmental	90 B	% DER<TER	20.52			
CO ₂ Emissions (t/year)	0.76	DFEE	40.37	TFEE	44.16	
General Requirements Compliance	Pass	% DFEE<TFEE	8.60			
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

Ground-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) 18.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.40 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)44.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.4 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	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: 3.71 (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 East: 0.95 m², No overhang
Windows facing South East: 3.33 m², No overhang
Windows facing South West: 0.95 m², No overhang
Windows facing North 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 3.7 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	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) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					3.7100
Number of sides sheltered					0.3262 (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) =	0.2773 (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	0.3536	0.3466	0.3397	0.3050	0.2981	0.2634	0.2634	0.2565	0.2773	0.2981	0.3120	0.3258 (22b)
	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5487	0.5531 (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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1600	10.8272	75.0000	5075.2500 (28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.2600	9.4484	60.0000	2180.4000 (29a)
APT Wall to Stairwell	18.0500		18.0500	0.2400	4.3320	110.0000	1985.5000 (29a)
Total net area of external elements Aum (m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9948		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
GF - Timber			19.7700			9.0000	177.9300 (32c)
GF - Metal Stud			38.2800			20.0000	765.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16766.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		247.7653 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6341 (36)
Total fabric heat loss	(33) + (36) =	42.6289 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.3787	26.2649	26.1534	25.6294	25.5313	25.0749	25.0749	24.9904	25.2507	25.5313	25.7296	25.9370 (38)
Heat transfer coeff	69.0076	68.8938	68.7822	68.2582	68.1602	67.7038	67.7038	67.6193	67.8796	68.1602	68.3585	68.5659 (39)
Average = Sum(39)m / 12 =												68.2577 (39)
HLP	1.0198	1.0181	1.0164	1.0087	1.0072	1.0005	1.0005	0.9993	1.0031	1.0072	1.0102	1.0132 (40)
HLP (average)												1.0087 (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)												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)

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Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.7360	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	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	19.5149	17.3329	14.0961	10.6716	7.9772	6.7347	7.2771	9.4590	12.6958	16.1203	18.8147	20.0572	(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)	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	340.2626	338.0673	325.6625	305.9191	286.0825	267.0168	254.7188	260.5244	270.7749	290.7151	313.4810	330.3539	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				0.9500	11.2829	0.6200	0.7000	0.7700	3.2238 (75)			
Southeast				3.3300	36.7938	0.6200	0.7000	0.7700	36.8504 (77)			
Southwest				0.9500	36.7938	0.6200	0.7000	0.7700	10.5129 (79)			
Northwest				1.9200	11.2829	0.6200	0.7000	0.7700	6.5155 (81)			
Solar gains	57.1026	100.5018	146.1037	195.4323	232.0466	236.1511	225.2684	197.0684	163.0472	113.3927	68.9848	48.4867 (83)
Total gains	397.3652	438.5690	471.7661	501.3514	518.1291	503.1679	479.9872	457.5928	433.8222	404.1078	382.4659	378.8406 (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	67.4897	67.6012	67.7108	68.2306	68.3288	68.7894	68.7894	68.8754	68.6112	68.3288	68.1305	67.9245		
alpha	5.4993	5.5067	5.5141	5.5487	5.5553	5.5860	5.5860	5.5917	5.5741	5.5553	5.5420	5.5283		
util living area	0.9981	0.9963	0.9914	0.9744	0.9188	0.7783	0.6035	0.6525	0.8784	0.9806	0.9961	0.9986	(86)	
MIT	19.9177	20.0371	20.2412	20.5158	20.7734	20.9401	20.9882	20.9821	20.8746	20.5513	20.1835	19.8909	(87)	
Th 2	20.0669	20.0683	20.0697	20.0761	20.0773	20.0829	20.0829	20.0840	20.0808	20.0773	20.0749	20.0723	(88)	
util rest of house	0.9975	0.9951	0.9884	0.9643	0.8854	0.6969	0.4865	0.5360	0.8184	0.9710	0.9946	0.9981	(89)	
MIT 2	18.6163	18.7915	19.0895	19.4889	19.8414	20.0396	20.0781	20.0758	19.9736	19.5442	19.0106	18.5810	(90)	
Living area fraction	19.2392	19.3877	19.6407	19.9805	20.2875	20.4706	20.5137	20.5096	20.4049	20.0263	19.5720	19.2080	(92)	
Temperature adjustment	19.0892	19.2377	19.4907	19.8305	20.1375	20.3206	20.3637	20.3596	20.2549	19.8763	19.4220	19.0580	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9936	0.9858	0.9610	0.8880	0.7197	0.5235	0.5726	0.8315	0.9683	0.9931	0.9973	(94)
Ext temp.	396.0065	435.7667	465.0825	481.7869	460.0832	362.1456	251.2845	262.0298	360.7125	391.2966	379.8237	377.8356	(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	1020.5682	987.7801	893.5304	746.0931	575.1014	387.3079	254.8174	267.7449	417.7891	632.2711	842.3124	1018.7505	(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	464.6739	370.9531	318.7652	190.3004	85.5735	0.0000	0.0000	0.0000	0.0000	179.2850	332.9919	476.8407	(98)
												2419.3838	(98)
												35.7527	(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													2688.2043 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	464.6739	370.9531	318.7652	190.3004	85.5735	0.0000	0.0000	0.0000	0.0000	179.2850	332.9919	476.8407	(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)	516.3044	412.1701	354.1836	211.4449	95.0817	0.0000	0.0000	0.0000	0.0000	199.2056	369.9910	529.8230	(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	89.1219	89.0590	88.9243	88.6217	87.9949	86.7000	86.7000	86.7000	86.7000	88.5436	88.9662	89.1560	(216)
Fuel for water heating, kWh/month	182.1148	160.0499	167.0019	148.3636	145.0711	129.5959	122.6082	137.1132	137.6898	154.0898	164.4795	177.0494	(219)
Water heating fuel used												1825.2271	(219)
Annual totals kWh/year													
Space heating fuel - main system												2688.2043	(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)												344.6387	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
Total delivered energy for all uses												4933.0700	(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	2688.2043	0.2160	580.6521 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1825.2271	0.2160	394.2490 (264)
Space and water heating			974.9012 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	344.6387	0.5190	178.8675 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	0.5190	-218.2932 (269)
Total CO2, kg/year			974.4005 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4000 (273)

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

DER		14.4000 ZC1
Total Floor Area	TFA	67.6700
Assumed number of occupants	N	2.1883
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.7956 ZC2
CO2 emissions from cooking, equation (L16)		2.5346 ZC3
Total CO2 emissions		33.7303 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		33.7303 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	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1407 (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 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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1300	8.7971		(28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.1800	6.5412		(29a)
APT Wall to Stairwell	18.0500		18.0500	0.1800	3.2490		(29a)
Total net area of external elements Aum(A, m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	30.1865	(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)							8.9494 (36)
Total fabric heat loss						(33) + (36) =	39.1359 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	27.6523	27.4890	27.3290	26.5773	26.4367	25.7820	25.7820	25.6607	26.0341	26.4367	26.7212	27.0186 (38)
Heat transfer coeff	66.7882	66.6249	66.4649	65.7132	65.5725	64.9178	64.9178	64.7966	65.1700	65.5725	65.8570	66.1545 (39)
Average = Sum(39)m / 12 =												65.7125 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9870	0.9846	0.9822	0.9711	0.9690	0.9593	0.9593	0.9575	0.9631	0.9690	0.9732	0.9776 (40)
HLP (average)												0.9711 (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)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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)
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)
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)
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	19.5149	17.3329	14.0961	10.6716	7.9772	6.7347	7.2771	9.4590	12.6958	16.1203	18.8147	20.0572 (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	349.1897	346.4173	333.4413	313.1298	292.7187	273.0813	260.7945	267.1710	278.0012	298.5095	321.8400	339.2872 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2		g	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
Northeast												0.9500	11.2829		0.6300	0.7000		0.7700		3.2758 (75)		
Southeast												3.3300	36.7938		0.6300	0.7000		0.7700		37.4448 (77)		
Southwest												0.9500	36.7938		0.6300	0.7000		0.7700		10.6824 (79)		
Northwest												1.9200	11.2829		0.6300	0.7000		0.7700		6.6206 (81)		
Solar gains	58.0236	102.1228	148.4602	198.5844	235.7893	239.9600	228.9018	200.2470	165.6770	115.2216	70.0975					49.2687 (83)						
Total gains	407.2133	448.5401	481.9014	511.7142	528.5079	513.0413	489.6963	467.4180	443.6783	413.7311	391.9374					388.5559 (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	70.3613	70.5338	70.7036	71.5124	71.6658	72.3885	72.3885	72.5240	72.1084	71.6658	71.3562	71.0353
alpha	5.6908	5.7023	5.7136	5.7675	5.7777	5.8259	5.8259	5.8349	5.8072	5.7777	5.7571	5.7357
util living area	0.9979	0.9960	0.9904	0.9704	0.9061	0.7508	0.5725	0.6201	0.8588	0.9773	0.9957	0.9984 (86)
MIT	19.9859	20.1043	20.3036	20.5717	20.8120	20.9564	20.9924	20.9882	20.9014	20.6016	20.2469	19.9634 (87)
Th 2	20.0942	20.0962	20.0982	20.1075	20.1092	20.1174	20.1174	20.1189	20.1142	20.1092	20.1057	20.1020 (88)
util rest of house	0.9973	0.9946	0.9870	0.9592	0.8699	0.6697	0.4634	0.5102	0.7954	0.9665	0.9939	0.9979 (89)
MIT 2	18.7351	18.9093	19.2004	19.5913	19.9166	20.0867	20.1143	20.1137	20.0321	19.6390	19.1250	18.7080 (90)
Living area fraction	19.3338	19.4813	19.7284	20.0606	20.3452	20.5030	20.5346	20.5323	20.4482	20.0998	19.6620	19.3089 (92)
MIT	19.3338	19.4813	19.7284	20.0606	20.3452	20.5030	20.5346	20.5323	20.4482	20.0998	19.6620	19.3089 (93)
Temperature adjustment												0.0000
adjusted MIT	19.3338	19.4813	19.7284	20.0606	20.3452	20.5030	20.5346	20.5323	20.4482	20.0998	19.6620	19.3089 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9965	0.9934	0.9852	0.9584	0.8806	0.7069	0.5159	0.5631	0.8217	0.9663	0.9928	0.9973 (94)
Useful gains	405.7860	445.5792	474.7617	490.4487	465.4081	362.6896	252.6380	263.2250	364.5590	399.7984	389.1232	387.5019 (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	1004.0800	971.4761	879.2249	733.3969	566.8871	383.2082	255.4270	267.7563	413.7100	622.9236	827.2937	999.5230 (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	445.1307	353.4027	300.9206	174.9227	75.5003	0.0000	0.0000	0.0000	0.0000	166.0052	315.4827	455.3437 (98)
Space heating												2286.7086 (98)
Space heating per m2												33.7921 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2448.2961 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	445.1307	353.4027	300.9206	174.9227	75.5003	0.0000	0.0000	0.0000	0.0000	166.0052	315.4827	455.3437	(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)	476.5853	378.3755	322.1848	187.2834	80.8355	0.0000	0.0000	0.0000	0.0000	177.7357	337.7759	487.5200	(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 (217)m	87.1351	86.9205	86.4504	85.4014	83.4583	80.3000	80.3000	80.3000	80.3000	85.1498	86.5808	80.3000	(216)
Fuel for water heating, kWh/month	216.7568	189.8100	198.5590	178.2750	176.6202	161.6755	154.8974	172.6743	174.5813	187.4730	196.8161	211.4196	(219)
Water heating fuel used												2219.5581	(219)
Annual totals kWh/year													
Space heating fuel - main system												2448.2961	(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)												344.6387	(232)
Total delivered energy for all uses												5087.4929	(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	2448.2961	0.2160	528.8320 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2219.5581	0.2160	479.4245 (264)
Space and water heating			1008.2565 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	344.6387	0.5190	178.8675 (268)
Total CO2, kg/m2/year			1226.0490 (272)
Emissions per m2 for space and water heating			14.8996 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6432 (272b)
Emissions per m2 for pumps and fans			0.5752 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8996 * 1.00) + 2.6432 + 0.5752, rounded to 2 d.p.			18.1200 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1407 (8)
Pressure test				Yes	
Measured/design AP50				3.7100	
Infiltration rate				0.3262	(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) =		0.2773 (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	0.3536	0.3466	0.3397	0.3050	0.2981	0.2634	0.2634	0.2565	0.2773	0.2981	0.3120	0.3258 (22b)
	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5487	0.5531 (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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1600	10.8272	75.0000	5075.2500 (28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.2600	9.4484	60.0000	2180.4000 (29a)
APT Wall to Stairwell	18.0500		18.0500	0.2400	4.3320	110.0000	1985.5000 (29a)
Total net area of external elements Aum(A, m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9948		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			67.6700			30.0000	2030.1000 (32b)
GF - Timber			19.7700			9.0000	177.9300 (32c)
GF - Metal Stud			38.2800			20.0000	765.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14059.4800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		207.7653 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6341 (36)
Total fabric heat loss	(33) + (36) =	42.6289 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	26.3787	26.2649	26.1534	25.6294	25.5313	25.0749	25.0749	24.9904	25.2507	25.5313	25.7296	25.9370 (38)
Heat transfer coeff	69.0076	68.8938	68.7822	68.2582	68.1602	67.7038	67.7038	67.6193	67.8796	68.1602	68.3585	68.5659 (39)
Average = Sum(39)m / 12 =												68.2577 (39)
HLP	1.0198	1.0181	1.0164	1.0087	1.0072	1.0005	1.0005	0.9993	1.0031	1.0072	1.0102	1.0132 (40)
HLP (average)												1.0087 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	29.8707	26.1251	26.9588	23.5033	22.5520	19.4607	18.0332	20.6933	20.9405	24.4041	26.6390	(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	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.5149	17.3329	14.0961	10.6716	7.9772	6.7347	7.2771	9.4590	12.6958	16.1203	18.8147	(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	(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	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-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	(72)
Total internal gains	307.2866	305.8228	294.9288	277.2356	258.7314	241.5382	230.8273	234.5945	244.1171	261.9360	282.3060	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Northeast				0.9500	11.2829		0.6200		0.7000	0.7700		3.2238 (75)
Southeast				3.3300	36.7938		0.6200		0.7000	0.7700		36.8504 (77)
Southwest				0.9500	36.7938		0.6200		0.7000	0.7700		10.5129 (79)
Northwest				1.9200	11.2829		0.6200		0.7000	0.7700		6.5155 (81)
Solar gains	57.1026	100.5018	146.1037	195.4323	232.0466	236.1511	225.2684	197.0684	163.0472	113.3927	68.9848	48.4867 (83)
Total gains	364.3891	406.3246	441.0324	472.6679	490.7780	477.6893	456.0958	431.6629	407.1644	375.3288	351.2908	346.5861 (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	56.5939	56.6874	56.7794	57.2153	57.2976	57.6838	57.6838	57.7559	57.5344	57.2976	57.1313	56.9585
alpha	4.7729	4.7792	4.7853	4.8144	4.8198	4.8456	4.8456	4.8504	4.8356	4.8198	4.8088	4.7972
util living area	0.9972	0.9948	0.9887	0.9697	0.9151	0.7862	0.6218	0.6724	0.8811	0.9775	0.9947	0.9978 (86)
MIT	19.7005	19.8386	20.0749	20.3932	20.6948	20.9045	20.9763	20.9656	20.8188	20.4353	20.0086	19.6706 (87)
Th 2	20.0669	20.0683	20.0697	20.0761	20.0773	20.0829	20.0829	20.0840	20.0808	20.0773	20.0749	20.0723 (88)
util rest of house	0.9964	0.9933	0.9852	0.9595	0.8844	0.7109	0.5066	0.5594	0.8274	0.9680	0.9929	0.9972 (89)
MIT 2	18.8730	19.0116	19.2475	19.5655	19.8511	20.0306	20.0750	20.0713	19.9666	19.6106	19.1868	18.8475 (90)
Living area fraction									fLA = Living area / (4) =			0.4786 (91)
MIT	19.2691	19.4074	19.6436	19.9617	20.2550	20.4489	20.5065	20.4994	20.3745	20.0053	19.5801	19.2415 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2691	19.4074	19.6436	19.9617	20.2550	20.4489	20.5065	20.4994	20.3745	20.0053	19.5801	19.2415 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9955	0.9919	0.9832	0.9580	0.8911	0.7432	0.5618	0.6132	0.8467	0.9671	0.9917	0.9964 (94)
Ext temp.	362.7530	403.0398	433.6348	452.8262	437.3173	355.0096	256.2144	264.6859	344.7613	362.9951	348.3754	345.3536 (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	1032.9808	999.4709	904.0441	755.0488	583.1078	395.9918	264.4815	277.1970	425.9107	641.0675	853.1242	1031.3314 (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	498.6495	400.8017	349.9845	217.6002	108.4681	0.0000	0.0000	0.0000	0.0000	206.8859	363.4191	510.3675 (98)
Space heating per m2												2656.1766 (98)
										(98) / (4) =		39.2519 (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	636.4154	501.0079	513.9063	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8317	0.9012	0.8792	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	529.3317	451.5149	451.8336	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	640.7616	613.9761	587.0749	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	80.2295	120.8712	100.6195	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												301.7202 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	20.0574	30.2178	25.1549	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												75.4300 (107)
Space cooling per m2												1.1147 (108)
Energy for space heating												39.2519 (99)
Energy for space cooling												1.1147 (108)
Total												40.3666 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.4 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3907 (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) =	0.3321 (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 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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1300	8.7971		(28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.1800	6.5412		(29a)
APT Wall to Stairwell	18.0500		18.0500	0.1800	3.2490		(29a)
Total net area of external elements Aum(A, m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.1865		(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)							8.9494 (36)
Total fabric heat loss						(33) + (36) =	39.1359 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	27.6523	27.4890	27.3290	26.5773	26.4367	25.7820	25.7820	25.6607	26.0341	26.4367	26.7212	27.0186 (38)
Heat transfer coeff	66.7882	66.6249	66.4649	65.7132	65.5725	64.9178	64.9178	64.7966	65.1700	65.5725	65.8570	66.1545 (39)
Average = Sum(39)m / 12 =												65.7125 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9870	0.9846	0.9822	0.9711	0.9690	0.9593	0.9593	0.9575	0.9631	0.9690	0.9732	0.9776 (40)
HLP (average)												0.9711 (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												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	29.8707	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	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	19.5149	17.3329	14.0961	10.6716	7.9772	6.7347	7.2771	9.4590	12.6958	16.1203	18.8147	20.0572 (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	307.2866	305.8228	294.9288	277.2356	258.7314	241.5382	230.8273	234.5945	244.1171	261.9360	282.3060	298.0994 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast												0.9500	11.2829	0.6300	0.7000	0.7700	3.2758 (75)
Southeast												3.3300	36.7938	0.6300	0.7000	0.7700	37.4448 (77)
Southwest												0.9500	36.7938	0.6300	0.7000	0.7700	10.6824 (79)
Northwest												1.9200	11.2829	0.6300	0.7000	0.7700	6.6206 (81)
Solar gains	58.0236	102.1228	148.4602	198.5844	235.7893	239.9600	228.9018	200.2470	165.6770	115.2216	70.0975	49.2687 (83)					
Total gains	365.3102	407.9456	443.3889	475.8200	494.5206	481.4982	459.7291	434.8415	409.7942	377.1577	352.4035	347.3682 (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	70.3613	70.5338	70.7036	71.5124	71.6658	72.3885	72.3885	72.5240	72.1084	71.6658	71.3562	71.0353
alpha	5.6908	5.7023	5.7136	5.7675	5.7777	5.8259	5.8259	5.8349	5.8072	5.7777	5.7571	5.7357
util living area	0.9988	0.9975	0.9936	0.9786	0.9257	0.7839	0.6060	0.6597	0.8896	0.9851	0.9975	0.9991 (86)
MIT	19.9266	20.0473	20.2510	20.5273	20.7818	20.9453	20.9899	20.9839	20.8777	20.5545	20.1913	19.9048 (87)
Th 2	20.0942	20.0962	20.0982	20.1075	20.1092	20.1174	20.1174	20.1189	20.1142	20.1092	20.1057	20.1020 (88)
util rest of house	0.9984	0.9966	0.9912	0.9699	0.8946	0.7047	0.4924	0.5461	0.8334	0.9776	0.9964	0.9988 (89)
MIT 2	19.1071	19.2292	19.4335	19.7130	19.9528	20.0902	20.1145	20.1138	20.0418	19.7435	19.3810	19.0918 (90)
Living area fraction									fLA = Living area / (4) =			0.4786 (91)
MIT	19.4993	19.6208	19.8248	20.1028	20.3496	20.4995	20.5335	20.5303	20.4419	20.1317	19.7689	19.4810 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4993	19.6208	19.8248	20.1028	20.3496	20.4995	20.5335	20.5303	20.4419	20.1317	19.7689	19.4810 (93)

8. Space heating requirement

Utilisation	0.9981	0.9961	0.9903	0.9699	0.9041	0.7411	0.5473	0.6010	0.8567	0.9779	0.9959	0.9986 (94)
Useful gains	364.6127	406.3390	439.0971	461.4934	447.1023	356.8586	251.5946	261.3409	351.0742	368.8060	350.9743	346.8700 (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	1015.1359	980.7735	885.6298	736.1698	567.1766	382.9843	255.3556	267.6289	413.3026	625.0181	834.3348	1010.9054 (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	483.9893	386.0200	332.2203	197.7670	89.3353	0.0000	0.0000	0.0000	0.0000	190.6218	348.0195	494.0423 (98)
Space heating												2522.0155 (98)
Space heating per m2										(98) / (4) =		37.2693 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	610.2276	480.3919	492.4541	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8762	0.9376	0.9192	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	534.6760	450.3938	452.6536	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	645.2135	618.2229	590.7900	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	79.5870	124.8648	102.7735	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												307.2253 (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	19.8968	31.2162	25.6934	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												76.8063 (107)
Space cooling per m2												1.1350 (108)
Energy for space heating												37.2693 (99)
Energy for space cooling												1.1350 (108)
Total												38.4043 (109)
Target Fabric Energy Efficiency (TFEE)												44.2 (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	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) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					3.7100
Number of sides sheltered					0.3262 (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) =				0.2773 (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												
	0.2912	0.2704	0.2773	0.2634	0.2634	0.2565	0.2496	0.2426	0.2357	0.2565	0.2426	0.2565 (22b)
Effective ac	0.5424	0.5366	0.5384	0.5347	0.5347	0.5329	0.5311	0.5294	0.5278	0.5329	0.5294	0.5329 (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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1600	10.8272	75.0000	5075.2500 (28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.2600	9.4484	60.0000	2180.4000 (29a)
APT Wall to Stairwell	18.0500		18.0500	0.2400	4.3320	110.0000	1985.5000 (29a)
Total net area of external elements Aum (m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9948		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
GF - Timber			19.7700			9.0000	177.9300 (32c)
GF - Metal Stud			38.2800			20.0000	765.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16766.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		247.7653 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6341 (36)
Total fabric heat loss	(33) + (36) =	42.6289 (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	25.4355	25.1617	25.2507	25.0749	25.0749	24.9904	24.9081	24.8281	24.7504	24.9904	24.8281	24.9904 (38)
Heat transfer coeff	68.0644	67.7905	67.8796	67.7038	67.7038	67.6193	67.5370	67.4570	67.3792	67.6193	67.4570	67.6193 (39)
Average = Sum(39)m / 12 =												67.6525 (39)
HLP	1.0058	1.0018	1.0031	1.0005	1.0005	0.9993	0.9980	0.9969	0.9957	0.9993	0.9969	0.9993 (40)
HLP (average)												0.9997 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.7360	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													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	131.2953	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	48.7872	43.3323	35.2402	26.6791	19.9430	16.8367	18.1926	23.6475	31.7396	40.3007	47.0368	50.1431	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
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)
	502.2622	497.7742	478.0439	447.9049	417.3881	390.2194	374.5668	382.6650	400.2411	430.5769	464.0230	488.9988	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
Northeast					0.9500	14.6176	0.6200	0.7000		0.7700	4.1766 (75)	
Southeast					3.3300	45.1778	0.6200	0.7000		0.7700	45.2473 (77)	
Southwest					0.9500	45.1778	0.6200	0.7000		0.7700	12.9084 (79)	
Northwest					1.9200	14.6176	0.6200	0.7000		0.7700	8.4412 (81)	
Solar gains	70.7734	106.2881	156.6197	212.2618	240.6358	266.4331	252.0033	225.1466	185.1210	129.6173	85.2759	59.0431 (83)
Total gains	573.0356	604.0623	634.6635	660.1667	658.0240	656.6525	626.5702	607.8116	585.3621	560.1942	549.2988	548.0419 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	68.4249	68.7013	68.6112	68.7894	68.7894	68.8754	68.9593	69.0410	69.1207	68.8754	69.0410	68.8754	68.8754	
alpha	5.5617	5.5801	5.5741	5.5860	5.5860	5.5917	5.5973	5.6027	5.6080	5.5917	5.6027	5.5917	5.5917	
util living area	0.9869	0.9812	0.9624	0.9087	0.7861	0.5743	0.4185	0.4306	0.6878	0.9033	0.9724	0.9889	0.9889	(86)
MIT	20.2386	20.3224	20.5123	20.7432	20.9163	20.9880	20.9983	20.9980	20.9686	20.7943	20.4973	20.2238	20.2238	(87)
Th 2	20.0785	20.0818	20.0808	20.0829	20.0829	20.0840	20.0850	20.0860	20.0869	20.0840	20.0860	20.0840	20.0840	(88)
util rest of house	0.9829	0.9756	0.9507	0.8806	0.7270	0.4878	0.3214	0.3309	0.6032	0.8675	0.9627	0.9854	0.9854	(89)
MIT 2	19.0904	19.2132	19.4821	19.7984	20.0092	20.0773	20.0845	20.0854	20.0661	19.8709	19.4684	19.0735	19.0735	(90)
Living area fraction									fLA = Living area / (4) =			0.4786	0.4786	(91)
MIT	19.6400	19.7441	19.9752	20.2506	20.4434	20.5132	20.5219	20.5222	20.4981	20.3128	19.9609	19.6241	19.6241	(92)
Temperature adjustment												-0.1500	-0.1500	
adjusted MIT	19.4900	19.5941	19.8252	20.1006	20.2934	20.3632	20.3719	20.3722	20.3481	20.1628	19.8109	19.4741	19.4741	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9796	0.9718	0.9468	0.8812	0.7415	0.5148	0.3520	0.3624	0.6285	0.8710	0.9591	0.9824	0.9824	(94)
Useful gains	561.3317	587.0204	600.8975	581.7635	487.9100	338.0162	220.5523	220.2506	367.9256	487.9551	526.8404	538.4112	538.4112	(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	5.0000	(96)
Heat loss rate W	993.0568	969.0064	870.5681	717.7028	527.6403	342.3704	220.9715	220.7335	380.5623	592.5362	803.4720	978.7284	978.7284	(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	1.0000	(97a)
Space heating kWh	321.2035	256.6946	200.6349	97.8763	29.5594	0.0000	0.0000	0.0000	0.0000	77.8083	199.1748	327.5960	327.5960	(98)
Space heating												1510.5478	1510.5478	(98)
RHI space heating demand												1511	1511	(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	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) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					3.7100
Number of sides sheltered					0.3262 (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) =				0.2773 (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	0.3536	0.3466	0.3397	0.3050	0.2981	0.2634	0.2634	0.2565	0.2773	0.2981	0.3120	0.3258 (22b)
	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5384	0.5444	0.5487	0.5531 (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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1600	10.8272	75.0000	5075.2500 (28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.2600	9.4484	60.0000	2180.4000 (29a)
APT Wall to Stairwell	18.0500		18.0500	0.2400	4.3320	110.0000	1985.5000 (29a)
Total net area of external elements Aum(A, m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9948		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
GF - Timber			19.7700			9.0000	177.9300 (32c)
GF - Metal Stud			38.2800			20.0000	765.6000 (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) =	16766.2800 (34)
	247.7653 (35)
	6.6341 (36)
(33) + (36) =	42.6289 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	26.3787
Heat transfer coeff	69.0076
Average = Sum(39)m / 12 =	
HLP	1.0198
HLP (average)	1.0087
Days in month	31

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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.7360	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	48.7872	43.3323	35.2402	26.6791	19.9430	16.8367	18.1926	23.6475	31.7396	40.3007	47.0368	50.1431	(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	502.2622	497.7742	478.0439	447.9049	417.3881	390.2194	374.5668	382.6650	400.2411	430.5769	464.0230	488.9988	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			0.9500		11.2829		0.6200		0.7000		0.7700		3.2238 (75)
Southeast			3.3300		36.7938		0.6200		0.7000		0.7700		36.8504 (77)
Southwest			0.9500		36.7938		0.6200		0.7000		0.7700		10.5129 (79)
Northwest			1.9200		11.2829		0.6200		0.7000		0.7700		6.5155 (81)
Solar gains	57.1026	100.5018	146.1037	195.4323	232.0466	236.1511	225.2684	197.0684	163.0472	113.3927	68.9848		48.4867 (83)
Total gains	559.3648	598.2760	624.1475	643.3371	649.4347	626.3705	599.8353	579.7335	563.2883	543.9696	533.0078		537.4855 (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	67.4897	67.6012	67.7108	68.2306	68.3288	68.7894	68.7894	68.8754	68.6112	68.3288	68.1305	67.9245		
alpha	5.4993	5.5067	5.5141	5.5487	5.5553	5.5860	5.5860	5.5917	5.5741	5.5553	5.5420	5.5283		
util living area	0.9902	0.9843	0.9704	0.9314	0.8370	0.6619	0.4916	0.5288	0.7602	0.9351	0.9818	0.9921	(86)	
MIT	20.1430	20.2547	20.4388	20.6746	20.8704	20.9731	20.9956	20.9935	20.9423	20.7127	20.3876	20.1130	(87)	
Th 2	20.0669	20.0683	20.0697	20.0761	20.0773	20.0829	20.0829	20.0840	20.0808	20.0773	20.0749	20.0723	(88)	
util rest of house	0.9873	0.9796	0.9612	0.9095	0.7881	0.5792	0.3918	0.4275	0.6840	0.9101	0.9754	0.9897	(89)	
MIT 2	18.9432	19.1055	19.3699	19.7025	19.9529	20.0652	20.0813	20.0813	20.0373	19.7600	19.3037	18.9040	(90)	
Living area fraction	19.5175	19.6556	19.8815	20.1678	20.3920	20.4998	20.5189	20.5179	20.4705	20.2160	19.8225	19.4827	(92)	
MIT	19.5175	19.6556	19.8815	20.1678	20.3920	20.4998	20.5189	20.5179	20.4705	20.2160	19.8225	19.4827	(92)	
Temperature adjustment	19.3675	19.5056	19.7315	20.0178	20.2420	20.3498	20.3689	20.3679	20.3205	20.0660	19.6725	19.3327	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9844	0.9760	0.9571	0.9079	0.7976	0.6042	0.4233	0.4594	0.7053	0.9097	0.9719	0.9871	(94)
Ext temp.	550.6649	583.9407	597.3431	584.0739	518.0021	378.4722	253.9285	266.3559	397.2822	494.8553	518.0126	530.5645	(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	1039.7708	1006.2350	910.0923	758.8823	582.2259	389.2824	255.1709	268.3081	422.2429	645.2046	859.4363	1037.5852	(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	363.8948	283.7818	232.6854	125.8620	47.7825	0.0000	0.0000	0.0000	0.0000	111.8598	245.8250	377.2234	(98)
												1788.9148	(98)
												26.4359	(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													1987.6831 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	363.8948	283.7818	232.6854	125.8620	47.7825	0.0000	0.0000	0.0000	0.0000	111.8598	245.8250	377.2234	(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)	404.3275	315.3131	258.5393	139.8467	53.0917	0.0000	0.0000	0.0000	0.0000	124.2887	273.1389	419.1371	(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	88.9556	88.8691	88.6849	88.2832	87.5746	86.7000	86.7000	86.7000	86.7000	88.1562	88.7397	89.0006	(216)
Fuel for water heating, kWh/month	182.4551	160.3920	167.4527	148.9325	145.7673	129.5959	122.6082	137.1132	137.6898	154.7669	164.8995	177.3585	(219)
Water heating fuel used												1829.0316	(219)
Annual totals kWh/year													
Space heating fuel - main system												1987.6831	(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)												344.6387	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4236.3534	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1987.6831	3.4800	69.1714 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1829.0316	3.4800	63.6503 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	344.6387	13.1900	45.4578 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			308.1720 (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] =	1.1488 (257)
SAP value		83.9746
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1987.6831	0.2160	429.3396 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1829.0316	0.2160	395.0708 (264)
Space and water heating			824.4104 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	344.6387	0.5190	178.8675 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	0.5190	-218.2932 (269)
Total kg/year			823.9097 (272)
CO2 emissions per m2			12.1800 (273)
EI value			90.2011
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

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

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

$3.48 / 0.8792 = 3.958$, stars = 4
 $0.216 / 0.8792 = 0.2457$, 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	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) = 0.1407 (8)
Measured/design AP50					Yes
Infiltration rate					3.7100
Number of sides sheltered					0.3262 (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) =	0.2773 (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												
	0.2912	0.2704	0.2773	0.2634	0.2634	0.2565	0.2496	0.2426	0.2357	0.2565	0.2426	0.2565 (22b)
Effective ac	0.5424	0.5366	0.5384	0.5347	0.5347	0.5329	0.5311	0.5294	0.5278	0.5329	0.5294	0.5329 (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)			7.1500	1.3258	9.4792		(27)
APT Jet Floor Lo			67.6700	0.1600	10.8272	75.0000	5075.2500 (28a)
APT 100mm Knauf Supafil	45.6100	9.2700	36.3400	0.2600	9.4484	60.0000	2180.4000 (29a)
APT Wall to Stairwell	18.0500		18.0500	0.2400	4.3320	110.0000	1985.5000 (29a)
Total net area of external elements Aum (m ²)			131.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9948		(33)
APT E-WM-28			16.7700	0.0000	0.0000	110.0000	1844.7000 (32)
E-FC-4			67.6700			70.0000	4736.9000 (32b)
GF - Timber			19.7700			9.0000	177.9300 (32c)
GF - Metal Stud			38.2800			20.0000	765.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16766.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		247.7653 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6341 (36)
Total fabric heat loss	(33) + (36) =	42.6289 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	25.4355	25.1617	25.2507	25.0749	25.0749	24.9904	24.9081	24.8281	24.7504	24.9904	24.8281	24.9904 (38)
Heat transfer coeff	68.0644	67.7905	67.8796	67.7038	67.7038	67.6193	67.5370	67.4570	67.3792	67.6193	67.4570	67.6193 (39)
Average = Sum(39)m / 12 =												67.6525 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0058	1.0018	1.0031	1.0005	1.0005	0.9993	0.9980	0.9969	0.9957	0.9993	0.9969	0.9993 (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												
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.7360	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	48.7872	43.3323	35.2402	26.6791	19.9430	16.8367	18.1926	23.6475	31.7396	40.3007	47.0368	50.1431	(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	502.2622	497.7742	478.0439	447.9049	417.3881	390.2194	374.5668	382.6650	400.2411	430.5769	464.0230	488.9988	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					0.9500	14.6176	0.6200	0.7000			0.7700			4.1766 (75)
Southeast					3.3300	45.1778	0.6200	0.7000			0.7700			45.2473 (77)
Southwest					0.9500	45.1778	0.6200	0.7000			0.7700			12.9084 (79)
Northwest					1.9200	14.6176	0.6200	0.7000			0.7700			8.4412 (81)
Solar gains	70.7734	106.2881	156.6197	212.2618	240.6358	266.4331	252.0033	225.1466	185.1210	129.6173	85.2759	59.0431 (83)		
Total gains	573.0356	604.0623	634.6635	660.1667	658.0240	656.6525	626.5702	607.8116	585.3621	560.1942	549.2988	548.0419 (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	68.4249	68.7013	68.6112	68.7894	68.7894	68.8754	68.9593	69.0410	69.1207	68.8754	69.0410	68.8754		
alpha	5.5617	5.5801	5.5741	5.5860	5.5860	5.5917	5.5973	5.6027	5.6080	5.5917	5.6027	5.5917		
util living area	0.9869	0.9812	0.9624	0.9087	0.7861	0.5743	0.4185	0.4306	0.6878	0.9033	0.9724	0.9889	(86)	
MIT	20.2386	20.3224	20.5123	20.7432	20.9163	20.9880	20.9983	20.9980	20.9686	20.7943	20.4973	20.2238	(87)	
Th 2	20.0785	20.0818	20.0808	20.0829	20.0829	20.0840	20.0850	20.0860	20.0869	20.0840	20.0860	20.0840	(88)	
util rest of house	0.9829	0.9756	0.9507	0.8806	0.7270	0.4878	0.3214	0.3309	0.6032	0.8675	0.9627	0.9854	(89)	
MIT 2	19.0904	19.2132	19.4821	19.7984	20.0092	20.0773	20.0845	20.0854	20.0661	19.8709	19.4684	19.0735	(90)	
Living area fraction	19.6400	19.7441	19.9752	20.2506	20.4434	20.5132	20.5219	20.5222	20.4981	20.3128	19.9609	19.6241	(92)	
Temperature adjustment	19.4900	19.5941	19.8252	20.1006	20.2934	20.3632	20.3719	20.3722	20.3481	20.1628	19.8109	-0.1500		
adjusted MIT												19.4741	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9796	0.9718	0.9468	0.8812	0.7415	0.5148	0.3520	0.3624	0.6285	0.8710	0.9591	0.9824	(94)
Ext temp.	561.3317	587.0204	600.8975	581.7635	487.9100	338.0162	220.5523	220.2506	367.9256	487.9551	526.8404	538.4112	(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	993.0568	969.0064	870.5681	717.7028	527.6403	342.3704	220.9715	220.7335	380.5623	592.5362	803.4720	978.7284	(97)
Space heating kWh	321.2035	256.6946	200.6349	97.8763	29.5594	0.0000	0.0000	0.0000	0.0000	77.8083	199.1748	327.5960	(98)
Space heating per m2												1510.5478	(98)
												22.3223	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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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													1678.3864 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	321.2035	256.6946	200.6349	97.8763	29.5594	0.0000	0.0000	0.0000	0.0000	77.8083	199.1748	327.5960 (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)	356.8928	285.2162	222.9277	108.7515	32.8437	0.0000	0.0000	0.0000	0.0000	86.4537	221.3053	363.9955 (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	88.8646	88.7933	88.5661	88.0782	87.3019	86.7000	86.7000	86.7000	86.7000	87.8701	88.5722	88.8997 (217)	
Fuel for water heating, kWh/month	182.6421	160.5288	167.6773	149.2792	146.2226	129.5959	122.6082	137.1132	137.6898	155.2709	165.2113	177.5599 (219)	
Water heating fuel used												1831.3989 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1678.3864 (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)												344.6387 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												3929.4241 (238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1678.3864	3.9200	65.7927 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1831.3989	3.9200	71.7908 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	344.6387	16.9600	58.4507 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			296.7543 (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	1678.3864	0.2160	362.5315 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.3989	0.2160	395.5822 (264)
Space and water heating			758.1136 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	344.6387	0.5190	178.8675 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	0.5190	-218.2932 (269)
Total kg/year			757.6129 (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	1678.3864	1.2200	2047.6315 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1831.3989	1.2200	2234.3067 (264)
Space and water heating			4281.9382 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	344.6387	3.0700	1058.0408 (268)
Energy saving/generation technologies			
PV Unit	-420.6035	3.0700	-1291.2526 (269)
Primary energy kWh/year			4278.9763 (272)
Primary energy kWh/m2/year			63.2330 (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 84
Current environmental impact rating: B 90

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

Recommended measures: (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 84
Potential environmental impact rating: B 90

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

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

	Current	Potential	Saving
Electricity	£71	£71	£0
Mains gas	£226	£226	£0
Space heating	£167	£167	£0
Water heating	£72	£72	£0
Lighting	£58	£58	£0
Total cost of fuels	£297	£297	£0
Total cost of uses	£297	£297	£0
Delivered energy	58 kWh/m²	58 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	11 kg/m²	11 kg/m²	0 kg/m²
Primary energy	63 kWh/m²	63 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 West
Overshading	Average or unknown
Thermal mass parameter	247.8 (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	140.69 (P1)
Transmission heat loss coefficient	42.63 (37)
Summer heat loss coefficient	183.31 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	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
North East	0.9500	106.0502	0.6200	0.7000	0.9000	35.4168
South East	3.3300	127.3119	0.6200	0.7000	0.9000	149.0348
South West	0.9500	127.3119	0.6200	0.7000	0.9000	42.5174
North West	1.9200	106.0502	0.6200	0.7000	0.9000	71.5793
total:						298.5485

Solar gains	Jun 321	Jul 299	Aug 266	(P3)
Internal gains	387	372	380	
Total summer gains	708	670	646	(P5)
Summer gain/loss ratio	3.86	3.66	3.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 247.8)	0.27	0.27	0.27	
Threshold temperature	19.53	21.22	21.09	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			