

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-204				Issued on Date	21/05/2019
Assessment Reference	As Built	Prop Type Ref	GFF - Det (As)			
Property	51, St. Andrews, Botley, SOUTHAMPTON, SO32 2ST					
SAP Rating		83 B	DER	15.92	TER	19.94
Environmental		89 B	% DER<TER	20.15		
CO ₂ Emissions (t/year)		0.84	DFEE	49.06	TFEE	53.79
General Requirements Compliance		Pass	% DFEE<TFEE	8.80		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	4907-0015
Client						

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

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DWELLING AS BUILT

Ground-floor flat, total floor area 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) 19.94 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.1 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.91 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Door U-value 0.71 W/m²K
Air permeability 3.9 m³/m²h
Photovoltaic array 482.17 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	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Measured/design AP50					Yes
Infiltration rate					3.9100
Number of sides sheltered					0.3230 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2988 (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	0.3809	0.3735	0.3660	0.3287	0.3212	0.2838	0.2838	0.2764	0.2988	0.3212	0.3361	0.3511 (22b)
	0.5726	0.5697	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1600	10.8176	75.0000	5070.7500 (28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.2600	15.3010	60.0000	3531.0000 (29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.2400	4.1208	110.0000	1888.7000 (29a)
Total net area of external elements Aum, m ²			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.3425		(33)
E-FC-4			67.6100			70.0000	4732.7000 (32b)
GF - Timber			55.0400			9.0000	495.3600 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16536.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.5927 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9565 (36)
Total fabric heat loss							(33) + (36) = 49.2990 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.6370	29.4911	29.3482	28.6767	28.5511	27.9662	27.9662	27.8579	28.1915	28.5511	28.8052	29.0709 (38)
Heat transfer coeff	78.9359	78.7901	78.6471	77.9757	77.8500	77.2652	77.2652	77.1569	77.4905	77.8500	78.1042	78.3699 (39)
Average = Sum(39)m / 12 =												77.9751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1675	1.1654	1.1632	1.1533	1.1515	1.1428	1.1428	1.1412	1.1461	1.1515	1.1552	1.1591 (40)
HLP (average)												1.1533 (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												2.1867 (42)
Average daily hot water use (litres/day)												86.1349 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy content (annual)	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1355.2371 (45)
Water storage loss:	21.0764	18.4335	19.0217	16.5836	15.9124	13.7312	12.7239	14.6009	14.7753	17.2192	18.7961	20.4113 (46)

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7355	19.5967	21.6400	20.8781	21.5277	20.7797	21.4391	21.4965	20.8333	21.5935	20.9709	21.7170 (61)
Total heat required for water heating calculated for each month	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (64)
Heat gains from water heating, kWh/month	52.1532	45.7601	47.5749	41.9799	40.6544	35.6324	33.5645	37.7395	37.9602	43.5676	46.9074	50.6744 (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	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1905	17.0448	13.8618	10.4943	7.8446	6.6227	7.1561	9.3018	12.4848	15.8523	18.5020	19.7239	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.6559	193.6447	188.6330	177.9637	164.4957	151.8376	143.3813	141.3925	146.4042	157.0734	170.5415	183.1996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	(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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	(71)
Water heating gains (Table 5)	70.0983	68.0955	63.9447	58.3054	54.6429	49.4894	45.1136	50.7251	52.7226	58.5586	65.1491	68.1107	(72)
Total internal gains	339.7457	337.5860	325.2405	305.5644	285.7842	266.7507	254.4519	260.2203	270.4125	290.2853	312.9936	329.8351	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W		
North					0.9500	10.6334	0.6200	0.7000	0.7700	3.0382 (74)		
East					3.8700	19.6403	0.6200	0.7000	0.7700	22.8603 (76)		
South					0.9500	46.7521	0.6200	0.7000	0.7700	13.3582 (78)		
West					1.9200	19.6403	0.6200	0.7000	0.7700	11.3415 (80)		
Solar gains	50.5982	94.5894	147.9185	208.0418	251.1105	256.0440	244.1338	211.7686	169.1227	109.8977	62.2276	42.2014 (83)
Total gains	390.3439	432.1754	473.1590	513.6062	536.8947	522.7948	498.5858	471.9890	439.5352	400.1831	375.2213	372.0365 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1939	58.3016	58.4076	58.9105	59.0056	59.4522	59.4522	59.5356	59.2794	59.0056	58.8136	58.6142	
alpha	4.8796	4.8868	4.8938	4.9274	4.9337	4.9635	4.9635	4.9690	4.9520	4.9337	4.9209	4.9076	
util living area	0.9981	0.9966	0.9921	0.9766	0.9288	0.8083	0.6458	0.6966	0.9021	0.9841	0.9965	0.9985	(86)
MIT	19.6919	19.8193	20.0541	20.3758	20.6816	20.8982	20.9745	20.9630	20.8046	20.4125	19.9951	19.6666	(87)
Th 2	19.9461	19.9478	19.9495	19.9575	19.9590	19.9660	19.9660	19.9673	19.9633	19.9590	19.9560	19.9528	(88)
util rest of house	0.9975	0.9954	0.9891	0.9670	0.8968	0.7237	0.5116	0.5658	0.8455	0.9759	0.9951	0.9981	(89)
MIT 2	18.2013	18.3886	18.7318	19.2013	19.6249	19.8909	19.9556	19.9503	19.7919	19.2594	18.6517	18.1690	(90)
Living area fraction									fLA = Living area / (4) =			0.4791	(91)
MIT	18.9154	19.0740	19.3652	19.7640	20.1311	20.3735	20.4437	20.4355	20.2771	19.8118	19.2953	18.8865	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7654	18.9240	19.2152	19.6140	19.9811	20.2235	20.2937	20.2855	20.1271	19.6618	19.1453	18.7365	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	388.9765	429.4859	466.6800	494.5392	481.9369	390.6557	277.4592	287.5068	376.3268	389.2431	372.7625	371.0032	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1141.8392	1104.9519	1000.0169	835.4303	644.6877	434.5010	285.3980	299.7921	467.0396	705.4646	940.7859	1139.2205	(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	560.1299	453.9131	396.8026	245.4416	121.0866	0.0000	0.0000	0.0000	0.0000	235.2688	408.9768	571.5537	(98)
Space heating												2993.1732	(98)
Space heating per m2												(98) / (4) =	44.2712 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3325.7480 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	560.1299	453.9131	396.8026	245.4416	121.0866	0.0000	0.0000	0.0000	0.0000	235.2688	408.9768	571.5537	(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)	622.3665	504.3479	440.8918	272.7129	134.5407	0.0000	0.0000	0.0000	0.0000	261.4098	454.4187	635.0597	(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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926	(64)
Efficiency of water heater (217)m	89.2371	89.1890	89.0769	88.8210	88.2759	86.7000	86.7000	86.7000	86.7000	88.7602	89.1065	86.7000	(216)
Fuel for water heating, kWh/month	181.8129	159.7584	166.6555	147.9781	144.5583	129.5512	122.5668	137.0657	137.6417	153.6590	164.1610	176.7689	(219)
Water heating fuel used												1822.1775	(219)
Annual totals kWh/year													
Space heating fuel - main system												3325.7480	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												338.9105	(232)
Energy saving/generation technologies (Appendices M,N and Q)													
Total delivered energy for all uses												5561.8360	(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	3325.7480	0.2160	718.3616 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1822.1775	0.2160	393.5903 (264)
Space and water heating			1111.9519 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	338.9105	0.5190	175.8946 (268)
Energy saving/generation technologies			
PV Unit	-482.1671	0.5190	-250.2447 (269)
Total CO2, kg/year			1076.5267 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9200 (273)

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

DER		15.9200	ZC1
Total Floor Area		67.6100	
Assumed number of occupants		2.1867	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.7980	ZC2
CO2 emissions from cooking, equation (L16)		2.5363	ZC3
Total CO2 emissions		35.2543	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.2543	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	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1300	8.7893		(28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.1800	10.5930		(29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.1800	3.0906		(29a)
Total net area of external elements Aum(A, m ²)			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.7880		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2397 (36)
Total fabric heat loss						(33) + (36) =	45.0277 (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	31.0113	30.8121	30.6168	29.6997	29.5281	28.7292	28.7292	28.5813	29.0369	29.5281	29.8752	30.2381 (38)
Heat transfer coeff	76.0390	75.8398	75.6445	74.7273	74.5557	73.7569	73.7569	73.6090	74.0646	74.5557	74.9029	75.2658 (39)
Average = Sum(39)m / 12 =												74.7265 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1247	1.1217	1.1188	1.1053	1.1027	1.0909	1.0909	1.0887	1.0955	1.1027	1.1079	1.1132 (40)
HLP (average)												1.1053 (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												2.1867 (42)
Average daily hot water use (litres/day)												86.1349 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy conte	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Energy content (annual)												Total = Sum(45)m = 1355.2371 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0764	18.4335	19.0217	16.5836	15.9124	13.7312	12.7239	14.6009	14.7753	17.2192	18.7961	20.4113 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

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Combi loss	48.2827	42.0244	44.7713	41.6279	41.2598	38.2297	39.5041	41.2598	41.6279	44.7713	45.0261	48.2827 (61)
Total heat required for water heating calculated for each month	188.7918	164.9145	171.5829	152.1854	147.3423	129.7709	124.3304	138.5992	140.1299	159.5658	170.3334	184.3583 (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	188.7918	164.9145	171.5829	152.1854	147.3423	129.7709	124.3304	138.5992	140.1299	159.5658	170.3334	184.3583 (64)
Heat gains from water heating, kWh/month	58.7900	51.3671	53.3577	47.1673	45.5874	39.9949	38.0808	42.6803	43.1589	49.3620	52.9212	57.3158 (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	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1905	17.0448	13.8618	10.4943	7.8446	6.6227	7.1561	9.3018	12.4848	15.8523	18.5020	19.7239 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.6559	193.6447	188.6330	177.9637	164.4957	151.8376	143.3813	141.3925	146.4042	157.0734	170.5415	183.1996 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337 (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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693 (71)
Water heating gains (Table 5)	79.0188	76.4391	71.7173	65.5102	61.2734	55.5484	51.1838	57.3660	59.9429	66.3468	73.5017	77.0374 (72)
Total internal gains	348.6662	345.9296	333.0131	312.7692	292.4146	272.8098	260.5222	266.8612	277.6329	298.0735	321.3461	338.7618 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.9500	10.6334	0.6300	0.7000	0.7700	3.0872 (74)
East	3.8700	19.6403	0.6300	0.7000	0.7700	23.2290 (76)
South	0.9500	46.7521	0.6300	0.7000	0.7700	13.5736 (78)
West	1.9200	19.6403	0.6300	0.7000	0.7700	11.5245 (80)

Solar gains	51.4143	96.1150	150.3042	211.3973	255.1606	260.1738	248.0715	215.1842	171.8504	111.6703	63.2313	42.8821 (83)
Total gains	400.0805	442.0447	483.3174	524.1665	547.5753	532.9835	508.5936	482.0455	449.4833	409.7438	384.5775	381.6438 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.7465	61.9087	62.0685	62.8303	62.9749	63.6569	63.6569	63.7849	63.3925	62.9749	62.6830	62.3808
alpha	5.1164	5.1272	5.1379	5.1887	5.1983	5.2438	5.2438	5.2523	5.2262	5.1983	5.1789	5.1587
util living area	0.9981	0.9965	0.9916	0.9743	0.9198	0.7849	0.6148	0.6657	0.8881	0.9825	0.9964	0.9986 (86)
MIT	19.7852	19.9102	20.1373	20.4489	20.7342	20.9246	20.9834	20.9751	20.8430	20.4777	20.0790	19.7646 (87)
Th 2	19.9807	19.9831	19.9855	19.9965	19.9986	20.0083	20.0083	20.0100	20.0045	19.9986	19.9944	19.9900 (88)
util rest of house	0.9975	0.9953	0.9885	0.9638	0.8852	0.6992	0.4880	0.5402	0.8277	0.9735	0.9949	0.9981 (89)
MIT 2	18.3593	18.5436	18.8758	19.3319	19.7237	19.9543	20.0017	19.9990	19.8703	19.3792	18.7987	18.3360 (90)
Living area fraction	19.0424	19.1983	19.4801	19.8670	20.2078	20.4191	20.4720	20.4667	20.3363	19.9054	19.4120	19.0204 (92)
MIT	19.0424	19.1983	19.4801	19.8670	20.2078	20.4191	20.4720	20.4667	20.3363	19.9054	19.4120	19.0204 (93)
Temperature adjustment												0.0000
adjusted MIT	19.0424	19.1983	19.4801	19.8670	20.2078	20.4191	20.4720	20.4667	20.3363	19.9054	19.4120	19.0204 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9967	0.9940	0.9865	0.9622	0.8935	0.7373	0.5492	0.6007	0.8506	0.9724	0.9937	0.9974 (94)
Useful gains	398.7566	439.4043	476.8017	504.3343	489.2751	392.9864	279.3419	289.5545	382.3278	398.4536	382.1484	380.6497 (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	1120.9988	1084.3771	981.8761	819.5371	634.3035	429.1988	285.5849	299.3422	461.8920	693.7745	922.2053	1115.4710 (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	537.3482	433.4217	375.7754	226.9460	107.9011	0.0000	0.0000	0.0000	0.0000	219.7187	388.8409	546.7071 (98)
Space heating												2836.6590 (98)
Space heating per m2										(98) / (4) =		41.9562 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3037.1082 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.3482	433.4217	375.7754	226.9460	107.9011	0.0000	0.0000	0.0000	0.0000	219.7187	388.8409	546.7071	(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)	575.3192	464.0490	402.3291	242.9829	115.5258	0.0000	0.0000	0.0000	0.0000	235.2448	416.3179	585.3395	(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	188.7918	164.9145	171.5829	152.1854	147.3423	129.7709	124.3304	138.5992	140.1299	159.5658	170.3334	184.3583	(64)
Efficiency of water heater (217)m	87.5374	87.3711	86.9709	86.0552	84.2806	80.3000	80.3000	80.3000	80.3000	85.8569	87.0642	80.3000	(216)
Fuel for water heating, kWh/month	215.6699	188.7518	197.2877	176.8462	174.8234	161.6076	154.8323	172.6018	174.5080	185.8510	195.6411	210.4047	(219)
Water heating fuel used												2208.8255	(219)
Annual totals kWh/year													
Space heating fuel - main system												3037.1082	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												338.9105	(232)
Total delivered energy for all uses												5659.8442	(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	3037.1082	0.2160	656.0154 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2208.8255	0.2160	477.1063 (264)
Space and water heating			1133.1217 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	338.9105	0.5190	175.8946 (268)
Total CO2, kg/m2/year			1347.9412 (272)
Emissions per m2 for space and water heating			16.7597 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.6016 (272b)
Emissions per m2 for pumps and fans			0.5757 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7597 * 1.00) + 2.6016 + 0.5757, rounded to 2 d.p.			19.9400 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Measured/design AP50					Yes
Infiltration rate					3.9100
Number of sides sheltered					0.3230 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2988 (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	0.3809	0.3735	0.3660	0.3287	0.3212	0.2838	0.2838	0.2764	0.2988	0.3212	0.3361	0.3511 (22b)
Effective ac	0.5726	0.5697	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1600	10.8176	75.0000	5070.7500 (28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.2600	15.3010	60.0000	3531.0000 (29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.2400	4.1208	110.0000	1888.7000 (29a)
Total net area of external elements Aum, m ²			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.3425		(33)
E-FC-4			67.6100			30.0000	2028.3000 (32b)
GF - Timber			55.0400			9.0000	495.3600 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13832.5100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5927 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9565 (36)
Total fabric heat loss						(33) + (36) =	49.2990 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.6370	29.4911	29.3482	28.6767	28.5511	27.9662	27.9662	27.8579	28.1915	28.5511	28.8052	29.0709 (38)
Heat transfer coeff	78.9359	78.7901	78.6471	77.9757	77.8500	77.2652	77.2652	77.1569	77.4905	77.8500	78.1042	78.3699 (39)
Average = Sum(39)m / 12 =												77.9751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1675	1.1654	1.1632	1.1533	1.1515	1.1428	1.1428	1.1412	1.1461	1.1515	1.1552	1.1591 (40)
HLP (average)												1.1533 (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												2.1867 (42)
Average daily hot water use (litres/day)												86.1349 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy content (annual)	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1355.2371 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	29.8582	26.1142	26.9475	23.4935	22.5425	19.4525	18.0256	20.6846	20.9317	24.3938	26.6278	28.9161	(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	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1905	17.0448	13.8618	10.4943	7.8446	6.6227	7.1561	9.3018	12.4848	15.8523	18.5020	19.7239	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.6559	193.6447	188.6330	177.9637	164.4957	151.8376	143.3813	141.3925	146.4042	157.0734	170.5415	183.1996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	(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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	(71)
Water heating gains (Table 5)	40.1320	38.8604	36.2197	32.6298	30.2991	27.0173	24.2279	27.8019	29.0718	32.7874	36.9830	38.8657	(72)
Total internal gains	306.7794	305.3509	294.5155	276.8888	258.4404	241.2787	230.5663	234.2971	243.7617	261.5142	281.8275	297.5901	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.9500	10.6334	0.6200	0.7000	0.7700	3.0382	(74)
East	3.8700	19.6403	0.6200	0.7000	0.7700	22.8603	(76)
South	0.9500	46.7521	0.6200	0.7000	0.7700	13.3582	(78)
West	1.9200	19.6403	0.6200	0.7000	0.7700	11.3415	(80)

Solar gains	50.5982	94.5894	147.9185	208.0418	251.1105	256.0440	244.1338	211.7686	169.1227	109.8977	62.2276	42.2014	(83)
Total gains	357.3776	399.9403	442.4340	484.9306	509.5508	497.3227	474.7001	446.0658	412.8844	371.4119	344.0552	339.7915	(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	48.6770	48.7671	48.8557	49.2765	49.3560	49.7295	49.7295	49.7993	49.5850	49.3560	49.1954	49.0286		
alpha	4.2451	4.2511	4.2570	4.2851	4.2904	4.3153	4.3153	4.3200	4.3057	4.2904	4.2797	4.2686		
util living area	0.9971	0.9949	0.9891	0.9711	0.9223	0.8095	0.6582	0.7096	0.8997	0.9806	0.9950	0.9977	(86)	
MIT	19.4457	19.5925	19.8633	20.2340	20.5880	20.8507	20.9553	20.9376	20.7351	20.2777	19.7957	19.4174	(87)	
Th 2	19.9461	19.9478	19.9495	19.9575	19.9590	19.9660	19.9660	19.9673	19.9633	19.9590	19.9560	19.9528	(88)	
util rest of house	0.9963	0.9934	0.9856	0.9610	0.8919	0.7316	0.5286	0.5853	0.8482	0.9720	0.9933	0.9971	(89)	
MIT 2	18.5257	18.6734	18.9440	19.3153	19.6534	19.8836	19.9512	19.9443	19.7943	19.3630	18.8828	18.5027	(90)	
Living area fraction									fLA = Living area / (4) =			0.4791	(91)	
MIT	18.9664	19.1137	19.3844	19.7554	20.1012	20.3469	20.4322	20.4202	20.2450	19.8012	19.3202	18.9409	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9664	19.1137	19.3844	19.7554	20.1012	20.3469	20.4322	20.4202	20.2450	19.8012	19.3202	18.9409	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9953	0.9919	0.9832	0.9586	0.8967	0.7632	0.5904	0.6438	0.8645	0.9703	0.9918	0.9962	(94)
Ext temp.	355.6922	396.6966	435.0183	464.8385	456.9307	379.5635	280.2785	287.1850	356.9347	360.3893	341.2494	338.4972	(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	1157.7071	1119.8982	1013.3204	846.4604	654.0301	444.0363	296.0980	310.1825	476.1772	716.3146	954.4456	1155.2462	(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	596.6991	485.9915	430.2568	274.7678	146.6419	0.0000	0.0000	0.0000	0.0000	264.8084	441.5012	607.6613	(98)
Space heating per m2												3248.3280	(98)
										(98) / (4) =		48.0451	(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	726.2930	571.7626	586.3925	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7734	0.8521	0.8236	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	561.7506	487.2080	482.9616	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	663.5115	635.5131	603.6534	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.2679	110.3389	89.7947	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												273.4015 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												68.3504 (107)
Energy for space heating												1.0110 (108)
Energy for space cooling												48.0451 (99)
Total												1.0110 (108)
Dwelling Fabric Energy Efficiency (DFEE)												49.0560 (109)
												49.1 (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	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3775 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1300	8.7893		(28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.1800	10.5930		(29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.1800	3.0906		(29a)
Total net area of external elements Aum(A, m ²)			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7880		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2397 (36)
Total fabric heat loss						(33) + (36) =	45.0277 (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	31.0113	30.8121	30.6168	29.6997	29.5281	28.7292	28.7292	28.5813	29.0369	29.5281	29.8752	30.2381 (38)
Heat transfer coeff	76.0390	75.8398	75.6445	74.7273	74.5557	73.7569	73.7569	73.6090	74.0646	74.5557	74.9029	75.2658 (39)
Average = Sum(39)m / 12 =												74.7265 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1247	1.1217	1.1188	1.1053	1.1027	1.0909	1.0909	1.0887	1.0955	1.1027	1.1079	1.1132 (40)
HLP (average)												1.1053 (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												2.1867 (42)
Average daily hot water use (litres/day)												86.1349 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy conte	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Energy content (annual)												Total = Sum(45)m = 1355.2371 (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	29.8582	26.1142	26.9475	23.4935	22.5425	19.4525	18.0256	20.6846	20.9317	24.3938	26.6278	28.9161 (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	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	109.3366	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.1905	17.0448	13.8618	10.4943	7.8446	6.6227	7.1561	9.3018	12.4848	15.8523	18.5020	19.7239	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.6559	193.6447	188.6330	177.9637	164.4957	151.8376	143.3813	141.3925	146.4042	157.0734	170.5415	183.1996	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	33.9337	(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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	(71)
Water heating gains (Table 5)	40.1320	38.8604	36.2197	32.6298	30.2991	27.0173	24.2279	27.8019	29.0718	32.7874	36.9830	38.8657	(72)
Total internal gains	306.7794	305.3509	294.5155	276.8888	258.4404	241.2787	230.5663	234.2971	243.7617	261.5142	281.8275	297.5901	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					0.9500	10.6334	0.6300	0.7000	0.7700	3.0872 (74)		
East					3.8700	19.6403	0.6300	0.7000	0.7700	23.2290 (76)		
South					0.9500	46.7521	0.6300	0.7000	0.7700	13.5736 (78)		
West					1.9200	19.6403	0.6300	0.7000	0.7700	11.5245 (80)		
Solar gains	51.4143	96.1150	150.3042	211.3973	255.1606	260.1738	248.0715	215.1842	171.8504	111.6703	63.2313	42.8821 (83)
Total gains	358.1937	401.4659	444.8198	488.2861	513.6010	501.4525	478.6378	449.4814	415.6122	373.1845	345.0588	340.4721 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7465	61.9087	62.0685	62.8303	62.9749	63.6569	63.6569	63.7849	63.3925	62.9749	62.6830	62.3808	
alpha	5.1164	5.1272	5.1379	5.1887	5.1983	5.2438	5.2438	5.2523	5.2262	5.1983	5.1789	5.1587	
util living area	0.9989	0.9978	0.9942	0.9808	0.9355	0.8134	0.6468	0.7027	0.9124	0.9883	0.9978	0.9992	(86)
MIT	19.7272	19.8544	20.0855	20.4044	20.7017	20.9099	20.9790	20.9681	20.8150	20.4303	20.0245	19.7074	(87)
Th 2	19.9807	19.9831	19.9855	19.9965	19.9986	20.0083	20.0083	20.0100	20.0045	19.9986	19.9944	19.9900	(88)
util rest of house	0.9985	0.9970	0.9920	0.9726	0.9057	0.7310	0.5165	0.5753	0.8600	0.9820	0.9969	0.9989	(89)
MIT 2	18.8159	18.9448	19.1768	19.5003	19.7835	19.9629	20.0024	20.0000	19.8924	19.5302	19.1239	18.8036	(90)
Living area fraction									fLA = Living area / (4) =			0.4791	(91)
MIT	19.2525	19.3806	19.6122	19.9334	20.2234	20.4166	20.4703	20.4638	20.3344	19.9615	19.5554	19.2366	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2525	19.3806	19.6122	19.9334	20.2234	20.4166	20.4703	20.4638	20.3344	19.9615	19.5554	19.2366	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	357.5275	399.9998	440.8059	474.6118	469.1620	385.0824	277.4795	286.3421	365.7863	366.3407	343.7965	339.9871	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1136.9720	1098.2029	991.8632	824.4992	635.4667	429.0126	285.4604	299.1310	461.7501	697.9503	932.9444	1131.7441	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	579.9067	469.1925	409.9866	251.9189	123.7307	0.0000	0.0000	0.0000	0.0000	246.7175	424.1865	589.0672	(98)
Space heating												3094.7067	(98)
Space heating per m2												45.7729	(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	693.3151	545.8012	559.4284	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8240	0.8987	0.8727	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	571.3221	490.4955	488.1911	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	668.3385	640.1155	607.6457	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	69.8518	111.3173	88.8742	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												270.0434	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	17.4630	27.8293	22.2186	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												67.5108 (107)
Space cooling per m2												0.9985 (108)
Energy for space heating												45.7729 (99)
Energy for space cooling												0.9985 (108)
Total												46.7714 (109)
Target Fabric Energy Efficiency (TFEE)												53.8 (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	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Measured/design AP50					Yes
Infiltration rate					3.9100
Number of sides sheltered					0.3230 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2988 (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	0.3137	0.2913	0.2988	0.2838	0.2838	0.2764	0.2689	0.2614	0.2540	0.2764	0.2614	0.2764 (22b)
Effective ac	0.5492	0.5424	0.5446	0.5403	0.5403	0.5382	0.5362	0.5342	0.5322	0.5382	0.5342	0.5382 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1600	10.8176	75.0000	5070.7500 (28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.2600	15.3010	60.0000	3531.0000 (29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.2400	4.1208	110.0000	1888.7000 (29a)
Total net area of external elements Aum, m ²			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.3425		(33)
E-FC-4			67.6100			70.0000	4732.7000 (32b)
GF - Timber			55.0400			9.0000	495.3600 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16536.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.5927 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9565 (36)
Total fabric heat loss							(33) + (36) = 49.2990 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.4283	28.0774	28.1915	27.9662	27.9662	27.8579	27.7525	27.6500	27.5504	27.8579	27.6500	27.8579 (38)
Heat transfer coeff	77.7273	77.3764	77.4905	77.2652	77.2652	77.1569	77.0515	76.9490	76.8493	77.1569	76.9490	77.1569 (39)
Average = Sum(39)m / 12 =												77.1595 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1496	1.1445	1.1461	1.1428	1.1428	1.1412	1.1396	1.1381	1.1367	1.1412	1.1381	1.1412 (40)
HLP (average)												1.1418 (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	2.1867 (42)
Average daily hot water use (litres/day)	86.1349 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy conte	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Energy content (annual)										Total = Sum(45)m =		1355.2371 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0764	18.4335	19.0217	16.5836	15.9124	13.7312	12.7239	14.6009	14.7753	17.2192	18.7961	20.4113 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7355	19.5967	21.6400	20.8781	21.5277	20.7797	21.4391	21.4965	20.8333	21.5935	20.9709	21.7170 (61)
Total heat required for water heating calculated for each month	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (64)
RHI water heating demand	52.1532	45.7601	47.5749	41.9799	40.6544	35.6324	33.5645	37.7395	37.9602	43.5676	46.9074	50.6744 (65)
Heat gains from water heating, kWh/month	52.1532	45.7601	47.5749	41.9799	40.6544	35.6324	33.5645	37.7395	37.9602	43.5676	46.9074	50.6744 (65)
Solar input (sum of months) =	Sum(63)m =											0.0000 (63)
Total per year (kWh/year) =	Sum(64)m =											1609.4452 (64)
												1609 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.9763	42.6121	34.6545	26.2357	19.6115	16.5568	17.8903	23.2544	31.2120	39.6309	46.2551	49.3097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	286.0536	289.0220	281.5418	265.6175	245.5160	226.6233	214.0019	211.0335	218.5137	234.4380	254.5395	273.4322	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	(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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	(71)
Water heating gains (Table 5)	70.0983	68.0955	63.9447	58.3054	54.6429	49.4894	45.1136	50.7251	52.7226	58.5586	65.1491	68.1107	(72)
Total internal gains	501.1700	496.7713	477.1828	447.2004	416.8122	389.7113	374.0475	382.0549	399.4900	429.6691	462.9855	487.8944	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				0.9500	13.4839	0.6200	0.7000	0.7700	3.8527 (74)			
East				3.8700	25.1925	0.6200	0.7000	0.7700	29.3228 (76)			
South				0.9500	56.7559	0.6200	0.7000	0.7700	16.2165 (78)			
West				1.9200	25.1925	0.6200	0.7000	0.7700	14.5478 (80)			
Solar gains	63.9398	101.8642	160.7231	227.4222	260.7983	288.8125	273.2388	242.9460	194.0983	127.7469	78.4136	52.3991 (83)
Total gains	565.1098	598.6355	637.9059	674.6226	677.6105	678.5239	647.2863	625.0008	593.5884	557.4161	541.3991	540.2935 (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	59.0988	59.3668	59.2794	59.4522	59.4522	59.5356	59.6171	59.6965	59.7739	59.5356	59.6965	59.5356
alpha	4.9399	4.9578	4.9520	4.9635	4.9635	4.9690	4.9745	4.9798	4.9849	4.9690	4.9798	4.9690
util living area	0.9891	0.9846	0.9690	0.9239	0.8190	0.6196	0.4587	0.4736	0.7384	0.9262	0.9785	0.9907 (86)
MIT	20.0213	20.1152	20.3399	20.6246	20.8560	20.9725	20.9949	20.9942	20.9350	20.6823	20.3226	20.0102 (87)
Th 2	19.9605	19.9647	19.9633	19.9660	19.9660	19.9673	19.9686	19.9698	19.9710	19.9673	19.9698	19.9673 (88)
util rest of house	0.9856	0.9797	0.9587	0.8979	0.7591	0.5198	0.3404	0.3520	0.6465	0.8948	0.9704	0.9877 (89)
MIT 2	18.6903	18.8288	19.1493	19.5455	19.8364	19.9519	19.9671	19.9681	19.9268	19.6309	19.1331	18.6794 (90)
Living area fraction	19.3279	19.4451	19.7197	20.0625	20.3249	20.4409	20.4595	20.4597	20.4098	20.1346	19.7029	19.3169 (92)
Temperature adjustment	19.1779	19.2951	19.5697	19.9125	20.1749	20.2909	20.3095	20.3097	20.2598	19.9846	19.5529	-0.1500
adjusted MIT	19.1779	19.2951	19.5697	19.9125	20.1749	20.2909	20.3095	20.3097	20.2598	19.9846	19.5529	19.1669 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9822	0.9756	0.9539	0.8964	0.7724	0.5523	0.3801	0.3928	0.6743	0.8954	0.9662	0.9845 (94)
Useful gains	555.0389	584.0370	608.4689	604.7111	523.3809	374.7508	246.0201	245.5106	400.2415	499.1167	523.1149	531.9292 (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	1109.7859	1082.8896	974.0321	804.5232	593.0013	385.0804	247.2990	246.9832	427.2670	662.3624	896.6816	1093.0756 (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	412.7318	335.2289	271.9790	143.8647	51.7975	0.0000	0.0000	0.0000	0.0000	121.4548	268.9680	417.4929 (98)
Space heating												2023.5177 (98)
RHI space heating demand												2024 (98)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Measured/design AP50					Yes
Infiltration rate					3.9100
Number of sides sheltered					0.3230 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2988 (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	0.3809	0.3735	0.3660	0.3287	0.3212	0.2838	0.2838	0.2764	0.2988	0.3212	0.3361	0.3511 (22b)
	0.5726	0.5697	0.5670	0.5540	0.5516	0.5403	0.5403	0.5382	0.5446	0.5516	0.5565	0.5616 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1600	10.8176	75.0000	5070.7500 (28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.2600	15.3010	60.0000	3531.0000 (29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.2400	4.1208	110.0000	1888.7000 (29a)
Total net area of external elements Aum, m ²			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.3425		(33)
E-FC-4			67.6100			70.0000	4732.7000 (32b)
GF - Timber			55.0400			9.0000	495.3600 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16536.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.5927 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9565 (36)
Total fabric heat loss							(33) + (36) = 49.2990 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.6370	29.4911	29.3482	28.6767	28.5511	27.9662	27.9662	27.8579	28.1915	28.5511	28.8052	29.0709 (38)
Heat transfer coeff	78.9359	78.7901	78.6471	77.9757	77.8500	77.2652	77.2652	77.1569	77.4905	77.8500	78.1042	78.3699 (39)
Average = Sum(39)m / 12 =												77.9751 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1675	1.1654	1.1632	1.1533	1.1515	1.1428	1.1428	1.1412	1.1461	1.1515	1.1552	1.1591 (40)
HLP (average)												1.1533 (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												2.1867 (42)
Average daily hot water use (litres/day)												86.1349 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy content (annual)	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1355.2371 (45)
Water storage loss:	21.0764	18.4335	19.0217	16.5836	15.9124	13.7312	12.7239	14.6009	14.7753	17.2192	18.7961	20.4113 (46)

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Calculation Type: New Build (As Built)

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7355	19.5967	21.6400	20.8781	21.5277	20.7797	21.4391	21.4965	20.8333	21.5935	20.9709	21.7170 (61)
Total heat required for water heating calculated for each month	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (64)
Heat gains from water heating, kWh/month	52.1532	45.7601	47.5749	41.9799	40.6544	35.6324	33.5645	37.7395	37.9602	43.5676	46.9074	50.6744 (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	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.9763	42.6121	34.6545	26.2357	19.6115	16.5568	17.8903	23.2544	31.2120	39.6309	46.2551	49.3097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	286.0536	289.0220	281.5418	265.6175	245.5160	226.6233	214.0019	211.0335	218.5137	234.4380	254.5395	273.4322	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	(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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	(71)
Water heating gains (Table 5)	70.0983	68.0955	63.9447	58.3054	54.6429	49.4894	45.1136	50.7251	52.7226	58.5586	65.1491	68.1107	(72)
Total internal gains	501.1700	496.7713	477.1828	447.2004	416.8122	389.7113	374.0475	382.0549	399.4900	429.6691	462.9855	487.8944	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W		
North					0.9500	10.6334	0.6200	0.7000	0.7700	3.0382 (74)		
East					3.8700	19.6403	0.6200	0.7000	0.7700	22.8603 (76)		
South					0.9500	46.7521	0.6200	0.7000	0.7700	13.3582 (78)		
West					1.9200	19.6403	0.6200	0.7000	0.7700	11.3415 (80)		
Solar gains	50.5982	94.5894	147.9185	208.0418	251.1105	256.0440	244.1338	211.7686	169.1227	109.8977	62.2276	42.2014 (83)
Total gains	551.7682	591.3607	625.1013	655.2421	667.9226	645.7554	618.1813	593.8235	568.6127	539.5669	525.2131	530.0958 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.1939	58.3016	58.4076	58.9105	59.0056	59.4522	59.4522	59.5356	59.2794	59.0056	58.8136	58.6142	
alpha	4.8796	4.8868	4.8938	4.9274	4.9337	4.9635	4.9635	4.9690	4.9520	4.9337	4.9209	4.9076	
util living area	0.9917	0.9870	0.9755	0.9427	0.8631	0.7059	0.5369	0.5781	0.8054	0.9505	0.9853	0.9931	(86)
MIT	19.9138	20.0349	20.2519	20.5399	20.7916	20.9453	20.9885	20.9836	20.8915	20.5807	20.1978	19.8852	(87)
Th 2	19.9461	19.9478	19.9495	19.9575	19.9590	19.9660	19.9660	19.9673	19.9633	19.9590	19.9560	19.9528	(88)
util rest of house	0.9891	0.9830	0.9674	0.9227	0.8153	0.6146	0.4174	0.4580	0.7273	0.9291	0.9799	0.9909	(89)
MIT 2	18.5239	18.7005	19.0140	19.4247	19.7553	19.9293	19.9618	19.9605	19.8788	19.4887	18.9439	18.4872	(90)
Living area fraction									fLA = Living area / (4) =			0.4791	(91)
MIT	19.1898	19.3398	19.6071	19.9589	20.2518	20.4160	20.4537	20.4507	20.3640	20.0118	19.5446	19.1569	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0398	19.1898	19.4571	19.8089	20.1018	20.2660	20.3037	20.3007	20.2140	19.8618	19.3946	19.0069	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	544.0599	579.0100	601.6803	602.3888	549.4638	415.0696	282.7694	295.8038	425.4496	499.9989	512.6438	523.8770	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1163.4965	1125.8916	1019.0350	850.6301	654.0788	437.7867	286.1640	300.9621	473.7740	721.0352	960.2602	1160.4173	(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	460.8609	367.5044	310.5119	178.7337	77.8335	0.0000	0.0000	0.0000	0.0000	164.4510	322.2839	473.5860	(98)
Space heating												2355.7653	(98)
Space heating per m2										(98) / (4) =		34.8434	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2617.5170 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.8609	367.5044	310.5119	178.7337	77.8335	0.0000	0.0000	0.0000	0.0000	164.4510	322.2839	473.5860	(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)	512.0677	408.3383	345.0132	198.5930	86.4817	0.0000	0.0000	0.0000	0.0000	182.7234	358.0932	526.2066	(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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926	(64)
Efficiency of water heater (217)m	89.1168	89.0530	88.9055	88.5714	87.9213	86.7000	86.7000	86.7000	86.7000	88.4733	88.9431	86.7000	(216)
Fuel for water heating, kWh/month	182.0584	160.0023	166.9769	148.3950	145.1413	129.5512	122.5668	137.0657	137.6417	154.1573	164.4625	176.9929	(219)
Water heating fuel used												1825.0120	(219)
Annual totals kWh/year													
Space heating fuel - main system												2617.5170	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													338.9105 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4856.4396 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2617.5170	3.4800	91.0896	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1825.0120	3.4800	63.5104	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	338.9105	13.1900	44.7023	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			329.1948	(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] =	1.2278 (257)
SAP value		82.8723
SAP rating (Section 12)		83 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2617.5170	0.2160	565.3837	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1825.0120	0.2160	394.2026	(264)
Space and water heating			959.5863	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	338.9105	0.5190	175.8946	(268)
Energy saving/generation technologies				
PV Unit	-482.1671	0.5190	-250.2447	(269)
Total kg/year			924.1611	(272)
CO2 emissions per m2			13.6700	(273)
EI value			89.0030	
EI rating			89 (274)	
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8808 = 3.951$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.216 / 0.8808 = 0.2452$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	67.6100 (1b)	x 2.3200 (2b)	= 156.8552 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	67.6100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.8552 (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) = 0.1275 (8)
Measured/design AP50					Yes
Infiltration rate					3.9100
Number of sides sheltered					0.3230 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2988 (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	0.3137	0.2913	0.2988	0.2838	0.2838	0.2764	0.2689	0.2614	0.2540	0.2764	0.2614	0.2764 (22b)
Effective ac	0.5492	0.5424	0.5446	0.5403	0.5403	0.5382	0.5362	0.5342	0.5322	0.5382	0.5342	0.5382 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			2.1200	0.9000	1.9080		(26)
Windows (Uw = 1.40)			7.6900	1.3258	10.1951		(27)
APT Jet Floor Lo			67.6100	0.1600	10.8176	75.0000	5070.7500 (28a)
APT 100mm Knauf Supafil	66.5400	7.6900	58.8500	0.2600	15.3010	60.0000	3531.0000 (29a)
APT Wall to Stairwell	19.2900	2.1200	17.1700	0.2400	4.1208	110.0000	1888.7000 (29a)
Total net area of external elements Aum, m ²			153.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.3425		(33)
E-FC-4			67.6100			70.0000	4732.7000 (32b)
GF - Timber			55.0400			9.0000	495.3600 (32c)
GF - Metal Stud			40.9200			20.0000	818.4000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16536.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							244.5927 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.9565 (36)
Total fabric heat loss							(33) + (36) = 49.2990 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.4283	28.0774	28.1915	27.9662	27.9662	27.8579	27.7525	27.6500	27.5504	27.8579	27.6500	27.8579 (38)
Heat transfer coeff	77.7273	77.3764	77.4905	77.2652	77.2652	77.1569	77.0515	76.9490	76.8493	77.1569	76.9490	77.1569 (39)
Average = Sum(39)m / 12 =												77.1995 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1496	1.1445	1.1461	1.1428	1.1428	1.1412	1.1396	1.1381	1.1367	1.1412	1.1381	1.1412 (40)
HLP (average)												1.1418 (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												2.1867 (42)
Average daily hot water use (litres/day)												86.1349 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	94.7484	91.3030	87.8576	84.4122	80.9668	77.5214	77.5214	80.9668	84.4122	87.8576	91.3030	94.7484 (44)
Energy conte	140.5091	122.8902	126.8116	110.5575	106.0825	91.5411	84.8263	97.3394	98.5020	114.7946	125.3072	136.0756 (45)
Energy content (annual)										Total = Sum(45)m =		1355.2371 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.0764	18.4335	19.0217	16.5836	15.9124	13.7312	12.7239	14.6009	14.7753	17.2192	18.7961	20.4113 (46)
Water storage loss:												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.10r08



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.7355	19.5967	21.6400	20.8781	21.5277	20.7797	21.4391	21.4965	20.8333	21.5935	20.9709	21.7170 (61)
Total heat required for water heating calculated for each month	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926 (64)
Heat gains from water heating, kWh/month	52.1532	45.7601	47.5749	41.9799	40.6544	35.6324	33.5645	37.7395	37.9602	43.5676	46.9074	50.6744 (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	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	131.2039	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.9763	42.6121	34.6545	26.2357	19.6115	16.5568	17.8903	23.2544	31.2120	39.6309	46.2551	49.3097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	286.0536	289.0220	281.5418	265.6175	245.5160	226.6233	214.0019	211.0335	218.5137	234.4380	254.5395	273.4322	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	50.3071	(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)	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	-87.4693	(71)
Water heating gains (Table 5)	70.0983	68.0955	63.9447	58.3054	54.6429	49.4894	45.1136	50.7251	52.7226	58.5586	65.1491	68.1107	(72)
Total internal gains	501.1700	496.7713	477.1828	447.2004	416.8122	389.7113	374.0475	382.0549	399.4900	429.6691	462.9855	487.8944	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North				0.9500	13.4839	0.6200	0.7000	0.7700	3.8527 (74)				
East				3.8700	25.1925	0.6200	0.7000	0.7700	29.3228 (76)				
South				0.9500	56.7559	0.6200	0.7000	0.7700	16.2165 (78)				
West				1.9200	25.1925	0.6200	0.7000	0.7700	14.5478 (80)				
Solar gains	63.9398	101.8642	160.7231	227.4222	260.7983	288.8125	273.2388	242.9460	194.0983	127.7469	78.4136	52.3991	(83)
Total gains	565.1098	598.6355	637.9059	674.6226	677.6105	678.5239	647.2863	625.0008	593.5884	557.4161	541.3991	540.2935	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0988	59.3668	59.2794	59.4522	59.4522	59.5356	59.6171	59.6965	59.7739	59.5356	59.6965	59.5356	
alpha	4.9399	4.9578	4.9520	4.9635	4.9635	4.9690	4.9745	4.9798	4.9849	4.9690	4.9798	4.9690	
util living area	0.9891	0.9846	0.9690	0.9239	0.8190	0.6196	0.4587	0.4736	0.7384	0.9262	0.9785	0.9907	(86)
MIT	20.0213	20.1152	20.3399	20.6246	20.8560	20.9725	20.9949	20.9942	20.9350	20.6823	20.3226	20.0102	(87)
Th 2	19.9605	19.9647	19.9633	19.9660	19.9660	19.9673	19.9686	19.9698	19.9710	19.9673	19.9698	19.9673	(88)
util rest of house	0.9856	0.9797	0.9587	0.8979	0.7591	0.5198	0.3404	0.3520	0.6465	0.8948	0.9704	0.9877	(89)
MIT 2	18.6903	18.8288	19.1493	19.5455	19.8364	19.9519	19.9671	19.9681	19.9268	19.6309	19.1331	18.6794	(90)
Living area fraction									fLA = Living area / (4) =			0.4791	(91)
MIT	19.3279	19.4451	19.7197	20.0625	20.3249	20.4409	20.4595	20.4597	20.4098	20.1346	19.7029	19.3169	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1779	19.2951	19.5697	19.9125	20.1749	20.2909	20.3095	20.3097	20.2598	19.9846	19.5529	19.1669	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9822	0.9756	0.9539	0.8964	0.7724	0.5523	0.3801	0.3928	0.6743	0.8954	0.9662	0.9845	(94)
Useful gains	555.0389	584.0370	608.4689	604.7111	523.3809	374.7508	246.0201	245.5106	400.2415	499.1167	523.1149	531.9292	(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	1109.7859	1082.8896	974.0321	804.5232	593.0013	385.0804	247.2990	246.9832	427.2670	662.3624	896.6816	1093.0756	(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	412.7318	335.2289	271.9790	143.8647	51.7975	0.0000	0.0000	0.0000	0.0000	121.4548	268.9680	417.4929	(98)
Space heating												2023.5177	(98)
Space heating per m2										(98) / (4) =		29.9293	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2248.3530 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	412.7318	335.2289	271.9790	143.8647	51.7975	0.0000	0.0000	0.0000	0.0000	121.4548	268.9680	417.4929	(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)	458.5909	372.4766	302.1989	159.8497	57.5528	0.0000	0.0000	0.0000	0.0000	134.9498	298.8534	463.8810	(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	162.2446	142.4868	148.4516	131.4356	127.6102	112.3209	106.2654	118.8360	119.3353	136.3881	146.2781	157.7926	(64)
Efficiency of water heater (217)m	89.0436	88.9897	88.8065	88.3937	87.6276	86.7000	86.7000	86.7000	86.7000	88.2238	88.8092	86.7000	(216)
Fuel for water heating, kWh/month	182.2080	160.1161	167.1630	148.6934	145.6278	129.5512	122.5668	137.0657	137.6417	154.5934	164.7105	177.1555	(219)
Water heating fuel used												1827.0929	(219)
Annual totals kWh/year													
Space heating fuel - main system												2248.3530	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												338.9105	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												4489.3564	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2248.3530	3.9200	88.1354 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1827.0929	3.9200	71.6220 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	338.9105	16.9600	57.4792 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	16.9600	0.0000 (252)
Total energy cost			317.9567 (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	2248.3530	0.2160	485.6442 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1827.0929	0.2160	394.6521 (264)
Space and water heating			880.2963 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	338.9105	0.5190	175.8946 (268)
Energy saving/generation technologies			
PV Unit	-482.1671	0.5190	-250.2447 (269)
Total kg/year			844.8712 (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	2248.3530	1.2200	2742.9907 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1827.0929	1.2200	2229.0534 (264)
Space and water heating			4972.0440 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	338.9105	3.0700	1040.4552 (268)
Energy saving/generation technologies			
PV Unit	-482.1671	3.0700	-1480.2529 (269)
Primary energy kWh/year			4762.4964 (272)
Primary energy kWh/m2/year			70.4407 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

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

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

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

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

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

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

	Current	Potential	Saving
Electricity	£70	£70	£0
Mains gas	£248	£248	£0
Space heating	£189	£189	£0
Water heating	£72	£72	£0
Lighting	£57	£57	£0
Total cost of fuels	£318	£318	£0
Total cost of uses	£318	£318	£0
Delivered energy	66 kWh/m²	66 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.8 tonnes	0.0 tonnes
CO2 emissions per m²	12 kg/m²	12 kg/m²	0 kg/m²
Primary energy	70 kWh/m²	70 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	Detached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	244.6 (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	155.29 (P1)
Transmission heat loss coefficient	49.30 (37)
Summer heat loss coefficient	204.59 (P2)

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

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

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

Solar gains	Jun 348	Jul 324	Aug 287	(P3)
Internal gains	387	371	379	
Total summer gains	735	695	666	(P5)
Summer gain/loss ratio	3.59	3.40	3.26	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 244.6)	0.29	0.29	0.29	
Threshold temperature	19.28	20.98	20.84	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			