

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	Flat 9			Issued on Date	21/06/2023
Assessment Reference	001	Prop Type Ref	9		
Property	Birchwood House, Flat 9, Northwood, HA6 2UZ				
SAP Rating	86 B	DER	7.83	TER	17.59
Environmental	93 A	% DER<TER	55.49		
CO ₂ Emissions (t/year)	0.89	DFEE	30.89	TFEE	35.66
General Requirements Compliance	Pass	% DFEE<TFEE	13.39		
Assessor Details	Mr. Zahid Ashraf, Wires & Wireless Ltd, Tel: 01793 273 981, zahid_153@yahoo.com			Assessor ID	Q076-0001
Client	Westcombe Group, Birchwood House				

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

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 144 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: Electricity (c)
Fuel factor: 1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 17.59 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 7.83 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 35.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 30.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.26 (max. 0.70)	OK
Floor (no floor)			
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.40 (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:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Community heating scheme	-
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Secondary heating system:

None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 0.50 kWh/day
Permitted by DBSCG 0.50	OK
Primary pipework insulated:	No primary pipework

6 Controls

Space heating controls:	Charging system linked to use of community heating, programmer and at least two room statsOK
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Hot water controls:	No cylinderstat
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7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system	
Specific fan power:	0.94
Maximum	1.5 OK
MVHR efficiency:	91%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing North:	14.94 m ² , No overhang	
Air change rate:	0.00 ach	
Blinds/curtains:	Dark-coloured curtain or roller blind, closed 100% of daylight hours	

10 Key features

Photovoltaic array	1.32 kW
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	388.6781 (5)

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =										0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.2500	(18)
Number of sides sheltered											3	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1938 (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	0.2470	0.2422	0.2373	0.2131	0.2083	0.1841	0.1841	0.1792	0.1938	0.2083	0.2180	0.2277 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												63.7000 (23c)
Effective ac	0.4285	0.4237	0.4188	0.3946	0.3898	0.3656	0.3656	0.3607	0.3753	0.3898	0.3995	0.4092 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
N Window (Uw = 1.40)			14.9400	1.3258	19.8068		(27)					
External Wall -Type 4	45.0500	14.9400	30.1100	0.1900	5.7209		(29a)					
Lift Wall	5.2000		5.2000	0.2600	1.3520		(29a)					
Roof Joist	17.4000		17.4000	0.1500	2.6100		(30)					
Total net area of external elements Aum(A, m2)			67.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4897		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7564 (36)					
Total fabric heat loss						(33) + (36) =	36.2462 (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	54.9650	54.3438	53.7225	50.6161	49.9948	46.8884	46.8884	46.2671	48.1310	49.9948	51.2374	52.4799 (38)
Heat transfer coeff	91.2112	90.5899	89.9686	86.8622	86.2410	83.1346	83.1346	82.5133	84.3771	86.2410	87.4835	88.7261 (39)
Average = Sum(39)m / 12 =												86.7069 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6313	0.6270	0.6227	0.6012	0.5969	0.5754	0.5754	0.5711	0.5840	0.5969	0.6055	0.6141 (40)
HLP (average)												0.6001 (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												2.9252 (42)
Average daily hot water use (litres/day)												103.6732 (43)
Daily hot water use	Jan 114.0406	Feb 109.8936	Mar 105.7467	Apr 101.5998	May 97.4528	Jun 93.3059	Jul 93.3059	Aug 97.4528	Sep 101.5998	Oct 105.7467	Nov 109.8936	Dec 114.0406 (44)
Energy conte	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Energy content (annual)										Total = Sum(45)m =		1631.1837 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.3678	22.1869	22.8949	19.9603	19.1524	16.5270	15.3147	17.5739	17.7838	20.7253	22.6233	24.5674 (46)
Water storage loss:												
Store volume												10.0000 (47)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):													0.5000 (48)
Temperature factor from Table 2b													1.0000 (49)
Enter (49) or (54) in (55)													0.5000 (55)
Total storage loss	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	(56)
If cylinder contains dedicated solar storage	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month	207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h	207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450	(64)
Heat gains from water heating, kWh/month	87.2419	77.1898	81.7602	74.2549	73.4643	66.6445	64.9576	69.9654	69.4303	76.9509	80.1578	85.4676	(65)
Total per year (kWh/year) = Sum(64)m =													(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	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2233	27.7322	22.5534	17.0744	12.7633	10.7753	11.6431	15.1341	20.3130	25.7920	30.1031	32.0911	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.4618	317.7250	309.5020	291.9962	269.8984	249.1295	235.2546	231.9915	240.2144	257.7202	279.8181	300.5870	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	(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)	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	(71)
Water heating gains (Table 5)	117.2607	114.8658	109.8927	103.1318	98.7424	92.5619	87.3086	94.0395	96.4310	103.4287	111.3303	114.8758	(72)
Total internal gains	529.8236	527.2009	508.8259	479.0802	448.2819	419.3445	401.0841	408.0429	423.8362	453.8187	488.1293	514.4317	(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				14.9400	10.6334	0.5400	0.8000		0.7700	47.5597 (74)
Solar gains	47.5597	90.8891	154.4428	248.0747	334.1793	357.7489	334.0043	264.9898	185.6902	108.1916 58.6711 39.6481 (83)
Total gains	577.3834	618.0900	663.2687	727.1549	782.4612	777.0933	735.0884	673.0327	609.5265	562.0103 546.8003 554.0798 (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	44.0035	44.3053	44.6112	46.2066	46.5395	48.2785	48.2785	48.6420	47.5675	46.5395	45.8785	45.2360	(86)
alpha	3.9336	3.9537	3.9741	4.0804	4.1026	4.2186	4.2186	4.2428	4.1712	4.1026	4.0586	4.0157	(87)
util living area	0.9862	0.9804	0.9654	0.9190	0.8138	0.6340	0.4841	0.5412	0.7877	0.9396	0.9781	0.9881	(88)
MIT	19.5622	19.7126	19.9951	20.4156	20.7472	20.9392	20.9847	20.9763	20.8430	20.4358	19.9619	19.5680	(89)
Th 2	20.4019	20.4058	20.4096	20.4290	20.4328	20.4522	20.4522	20.4561	20.4445	20.4328	20.4251	20.4174	(90)
util rest of house	0.9844	0.9778	0.9606	0.9076	0.7884	0.5905	0.4282	0.4840	0.7510	0.9289	0.9749	0.9866	(91)
MIT 2	18.4143	18.6357	19.0485	19.6654	20.1275	20.3897	20.4398	20.4359	20.2697	19.7026	19.0129	18.4330	(92)
Living area fraction	18.7362	18.9377	19.3139	19.8758	20.3013	20.5438	20.5926	20.5875	20.4305	19.9082	19.2790	18.7513	(93)
MIT	18.7362	18.9377	19.3139	19.8758	20.3013	20.5438	20.5926	20.5875	20.4305	19.9082	19.2790	18.7513	(94)
Temperature adjustment													(95)
adjusted MIT	18.7362	18.9377	19.3139	19.8758	20.3013	20.5438	20.5926	20.5875	20.4305	19.9082	19.2790	18.7513	(96)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	564.5021	599.2296	629.8240	650.7189	611.8783	464.7223	325.4594	335.2766	457.1606	515.4181	528.4138	543.3382	(97)
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	(98)
Heat loss rate W	1316.7432	1271.6717	1152.8527	953.3801	741.7868	494.1372	331.9219	345.5211	534.1481	802.7495	1065.4633	1291.0773	(99)
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	(100)
Space heating kWh	559.6674	451.8811	389.1333	217.9160	96.6519	0.0000	0.0000	0.0000	0.0000	213.7745	386.6756	556.3179	(101)
Space heating													(102)
Space heating per m2													(103)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	781.4650	615.1959	627.1011	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8997	0.9413	0.9234	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.0763	579.0777	579.0570	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1023.4633	971.9173	901.8391	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	230.6786	292.2726	240.1499	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												763.1011 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			0.6942 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	40.0323	50.7214	41.6760	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												132.4297 (107)
												0.9165 (108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2872.0177 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	3015.6186 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2087.5797 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2191.9586 (310a)
Electricity used for heat distribution	52.0758 (313)
Cooling System Energy Efficiency Ratio	6.7500 (314)
Space cooling (if there is a fixed cooling system, if not enter 0)	19.6192 (315)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.3160)	
mechanical ventilation fans (SFP = 1.3160)	624.0305 (330a)
Total electricity for the above, kWh/year	624.0305 (331)
Electricity for lighting (calculated in Appendix L)	551.4129 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 1.32 * 951 * 0.80) =	-803.0804 (333)
Total delivered energy for all uses	5599.5594 (338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1735.8591	0.5190	900.9109 (367)
Electrical energy for heat distribution	52.0758	0.5190	27.0273 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			927.9382 (373)
Space and water heating			927.9382 (376)
Space cooling	19.6192	0.5190	10.1824 (377)
Pumps and fans	624.0305	0.5190	323.8718 (378)
Energy for lighting	551.4129	0.5190	286.1833 (379)
Energy saving/generation technologies			
PV Unit	-803.0804	0.5190	-416.7987 (380)
Total CO2, kg/year			1131.3769 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			7.8300 (384)

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

DER	7.8300 ZC1
Total Floor Area	144.4900
Assumed number of occupants	2.9252
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190
CO2 emissions from appliances, equation (L14)	12.8966 ZC2
CO2 emissions from cooking, equation (L16)	1.3095 ZC3
Total CO2 emissions	22.0361 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	22.0361 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 388.6781 (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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1029 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3529 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2735 (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	0.3487	0.3419	0.3350	0.3009	0.2940	0.2598	0.2598	0.2530	0.2735	0.2940	0.3077	0.3214 (22b)
Effective ac	0.5608	0.5584	0.5561	0.5453	0.5432	0.5338	0.5338	0.5320	0.5374	0.5432	0.5473	0.5516 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			14.9400	1.3258	19.8068		(27)					
External Wall -Type 4	45.0500	14.9400	30.1100	0.1800	5.4198		(29a)					
Lift Wall	5.2000		5.2000	0.1800	0.9360		(29a)					
Roof Joist	17.4000		17.4000	0.1300	2.2620		(30)					
Total net area of external elements Aum(A, m2)			67.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.4246		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.7839 (36)					
Total fabric heat loss						(33) + (36) =	33.2085 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 71.9308	Feb 71.6279	Mar 71.3311	Apr 69.9368	May 69.6760	Jun 68.4616	Jul 68.4616	Aug 68.2367	Sep 68.9294	Oct 69.6760	Nov 70.2037	Dec 70.7554 (38)
Heat transfer coeff	105.1393	104.8365	104.5396	103.1454	102.8845	101.6701	101.6701	101.4453	102.1379	102.8845	103.4122	103.9639 (39)
Average = Sum(39)m / 12 =												103.1441 (39)
HLP	Jan 0.7277	Feb 0.7256	Mar 0.7235	Apr 0.7139	May 0.7121	Jun 0.7036	Jul 0.7036	Aug 0.7021	Sep 0.7069	Oct 0.7121	Nov 0.7157	Dec 0.7195 (40)
HLP (average)												0.7138 (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												2.9252 (42)
Average daily hot water use (litres/day)												103.6732 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	114.0406	109.8936	105.7467	101.5998	97.4528	93.3059	93.3059	97.4528	101.5998	105.7467	109.8936	114.0406 (44)
Energy conte	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Energy content (annual)										Total = Sum(45)m =		1631.1837 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3678	22.1869	22.8949	19.9603	19.1524	16.5270	15.3147	17.5739	17.7838	20.7253	22.6233	24.5674 (46)
Water storage loss:												
Store volume												10.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												0.3712 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.2005 (55)
Total storage loss												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	6.2141	5.6127	6.2141	6.0136	6.2141	6.0136	6.2141	6.2141	6.0136	6.2141	6.0136	6.2141 (56)
Primary loss	6.2141	5.6127	6.2141	6.0136	6.2141	6.0136	6.2141	6.2141	6.0136	6.2141	6.0136	6.2141 (57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Solar input	198.5954	174.5364	182.1089	161.5943	157.1590	138.7059	131.5747	146.6357	147.0841	167.6450	179.3473	193.2591 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	198.5954	174.5364	182.1089	161.5943	157.1590	138.7059	131.5747	146.6357	147.0841	167.6450	179.3473	193.2591 (64)
	79.8132	70.4800	74.3315	67.0658	66.0356	59.4555	57.5289	62.5366	62.2412	69.5222	72.9687	78.0389 (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	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1439	28.5499	23.2183	17.5778	13.1396	11.0930	11.9864	15.5803	20.9119	26.5525	30.9907	33.0372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.4618	317.7250	309.5020	291.9962	269.8984	249.1295	235.2546	231.9915	240.2144	257.7202	279.8181	300.5870	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	(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)	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	(71)
Water heating gains (Table 5)	107.2758	104.8810	99.9079	93.1470	88.7576	82.5770	77.3237	84.0546	86.4461	93.4438	101.3455	104.8910	(72)
Total internal gains	523.7594	521.0337	502.5060	472.5988	441.6734	412.6773	394.4425	401.5043	417.4503	447.5943	482.0320	508.3930	(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				14.9400	10.6334	0.6300	0.7000	0.7700		48.5506 (74)		
-----				-----								
Solar gains	48.5506	92.7826	157.6603	253.2429	341.1414	365.2020	340.9627	270.5104	189.5588	110.4456	59.8934	40.4741 (83)
Total gains	572.3099	613.8163	660.1664	725.8417	782.8147	777.8793	735.4052	672.0147	607.0091	558.0399	541.9254	548.8672 (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	95.4355	95.7112	95.9830	97.2805	97.5271	98.6920	98.6920	98.9108	98.2400	97.5271	97.0294	96.5145	
alpha	7.3624	7.3807	7.3989	7.4854	7.5018	7.5795	7.5795	7.5941	7.5493	7.5018	7.4686	7.4343	
util living area	0.9998	0.9996	0.9988	0.9927	0.9507	0.7914	0.6027	0.6805	0.9377	0.9964	0.9996	0.9999	(86)
MIT	20.1666	20.2432	20.3964	20.6275	20.8498	20.9752	20.9971	20.9934	20.9041	20.6370	20.3678	20.1552	(87)
Th 2	20.3165	20.3183	20.3201	20.3286	20.3302	20.3376	20.3376	20.3390	20.3348	20.3302	20.3270	20.3236	(88)
util rest of house	0.9998	0.9995	0.9983	0.9896	0.9300	0.7268	0.5150	0.5899	0.9031	0.9944	0.9994	0.9998	(89)
MIT 2	19.1698	19.2836	19.5092	19.8524	20.1648	20.3190	20.3363	20.3357	20.2430	19.8687	19.4728	19.1589	(90)
Living area fraction	19.4494	19.5527	19.7580	20.0698	20.3569	20.5030	20.5216	20.5201	20.4284	20.0841	19.7238	19.4383	(91)
MIT	19.4494	19.5527	19.7580	20.0698	20.3569	20.5030	20.5216	20.5201	20.4284	20.0841	19.7238	19.4383	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4494	19.5527	19.7580	20.0698	20.3569	20.5030	20.5216	20.5201	20.4284	20.0841	19.7238	19.4383	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9997	0.9993	0.9978	0.9881	0.9310	0.7439	0.5398	0.6155	0.9088	0.9935	0.9992	0.9998	(94)
Ext temp.	572.1142	613.3934	658.7330	717.2164	728.7863	578.6332	396.9406	413.6047	551.6565	554.3971	541.4791	548.7315	(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	1592.7934	1536.1371	1385.9845	1152.1102	890.6615	600.1582	398.7129	417.9690	646.3673	975.7680	1305.4571	1584.2357	(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	759.3853	620.0838	541.0751	313.1236	120.4352	0.0000	0.0000	0.0000	0.0000	313.4999	550.0641	770.4151	(98)
Space heating per m2										(98) / (4) =		27.6011	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4265.3285 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	759.3853	620.0838	541.0751	313.1236	120.4352	0.0000	0.0000	0.0000	0.0000	313.4999	550.0641	770.4151	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	812.1768	663.1912	578.6900	334.8915	128.8077	0.0000	0.0000	0.0000	0.0000	335.2941	588.3039	823.9734	(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	198.5954	174.5364	182.1089	161.5943	157.1590	138.7059	131.5747	146.6357	147.0841	167.6450	179.3473	193.2591	(64)
Efficiency of water heater (217)m	88.0524	87.9109	87.5441	86.5496	84.1147	79.8000	79.8000	79.8000	79.8000	86.4606	87.6116	88.1302	(216)
Fuel for water heating, kWh/month	225.5422	198.5378	208.0196	186.7070	186.8389	173.8170	164.8806	183.7540	184.3159	193.8975	204.7074	219.2882	(219)
Water heating fuel used												2330.3061	(219)
Annual totals kWh/year													
Space heating fuel - main system												4265.3285	(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)												567.6708	(232)
Total delivered energy for all uses												7238.3054	(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	4265.3285	0.2160	921.3110 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2330.3061	0.2160	503.3461 (264)
Space and water heating			1424.6571 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	567.6708	0.5190	294.6212 (268)
Total CO2, kg/m2/year			1758.2032 (272)
Emissions per m2 for space and water heating			9.8599 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.0390 (272b)
Emissions per m2 for pumps and fans			0.2694 (272c)
Target Carbon Dioxide Emission Rate (TER) = (9.8599 * 1.55) + 2.0390 + 0.2694, rounded to 2 d.p.			17.5900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 388.6781 (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					4 * 10 = 40.0000 (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					40.0000 / (5) = 0.1029 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3529 (18)
					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7750 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2735 (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												
	0.3487	0.3419	0.3350	0.3009	0.2940	0.2598	0.2598	0.2530	0.2735	0.2940	0.3077	0.3214 (22b)
Effective ac	0.5608	0.5584	0.5561	0.5453	0.5432	0.5338	0.5338	0.5320	0.5374	0.5432	0.5473	0.5516 (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
N Window (Uw = 1.40)			14.9400	1.3258	19.8068		(27)
External Wall -Type 4	45.0500	14.9400	30.1100	0.1900	5.7209		(29a)
Lift Wall	5.2000		5.2000	0.2600	1.3520		(29a)
Roof Joist	17.4000		17.4000	0.1500	2.6100		(30)
Total net area of external elements Aum(A, m ²)			67.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.4897		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7564 (36)
Total fabric heat loss						(33) + (36) =	36.2462 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	71.9308	71.6279	71.3311	69.9368	69.6760	68.4616	68.4616
Heat transfer coeff	108.1769	107.8741	107.5772	106.1830	105.9221	104.7078	104.7078
Average = Sum(39)m / 12 =							
	108.1769	107.8741	107.5772	106.1830	105.9221	104.7078	104.7078
HLP	0.7487	0.7466	0.7445	0.7349	0.7331	0.7247	0.7247
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												2.9252 (42)
												103.6732 (43)
Daily hot water use	114.0406	109.8936	105.7467	101.5998	97.4528	93.3059	93.3059	97.4528	101.5998	105.7467	109.8936	114.0406 (44)
Energy conte	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Energy content (annual)												1631.1837 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
35.9378 31.4314 32.4344 28.2771 27.1325 23.4133 21.6959 24.8963 25.1937 29.3608 32.0496 34.8038 (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 146.2594 146.2594 146.2594 146.2594 146.2594 146.2594 146.2594 146.2594 146.2594 146.2594 146.2594 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
31.2233 27.7322 22.5534 17.0744 12.7633 10.7753 11.6431 15.1341 20.3130 25.7920 30.1031 32.0911 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
314.4618 317.7250 309.5020 291.9962 269.8984 249.1295 235.2546 231.9915 240.2144 257.7202 279.8181 300.5870 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 37.6259 (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)
-117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 -117.0076 (71)
Water heating gains (Table 5)
48.3034 46.7729 43.5946 39.2737 36.4685 32.5185 29.1611 33.4628 34.9912 39.4634 44.5133 46.7793 (72)
Total internal gains
460.8664 459.1079 442.5278 415.2221 386.0079 359.3011 342.9366 347.4662 362.3965 389.8535 421.3123 446.3352 (73)

6. Solar gains

[Jan]
Area m2 Solar flux Table 6a W/m2 Specific data or Table 6b Specific data or Table 6c Access factor Table 6d Gains W
North 14.9400 10.6334 0.5400 0.8000 0.7700 47.5597 (74)
Solar gains 47.5597 90.8891 154.4428 248.0747 334.1793 357.7489 334.0043 264.9898 185.6902 108.1916 58.6711 39.6481 (83)
Total gains 508.4261 549.9970 596.9706 663.2968 720.1872 717.0500 676.9409 612.4560 548.0867 498.0451 479.9834 485.9833 (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 37.1023 37.2064 37.3091 37.7990 37.8921 38.3316 38.3316 38.4141 38.1611 37.8921 37.7042 37.5098
alpha 3.4735 3.4804 3.4873 3.5199 3.5261 3.5554 3.5554 3.5609 3.5441 3.5261 3.5136 3.5007
util living area 0.9912 0.9874 0.9780 0.9503 0.8824 0.7533 0.6136 0.6782 0.8744 0.9657 0.9870 0.9925 (86)
MIT 19.1292 19.2842 19.5959 20.0548 20.4948 20.8116 20.9343 20.9053 20.6431 20.1030 19.5483 19.1048 (87)
Th 2 20.2980 20.2999 20.3017 20.3101 20.3117 20.3191 20.3191 20.3205 20.3162 20.3117 20.3085 20.3052 (88)
util rest of house 0.9899 0.9856 0.9746 0.9419 0.8607 0.7055 0.5380 0.6059 0.8430 0.9585 0.9848 0.9914 (89)
MIT 2 18.5354 18.6912 19.0028 19.4627 19.8893 20.1843 20.2826 20.2645 20.0385 19.5149 18.9616 18.5164 (90)
Living area fraction fLA = Living area / (4) = 0.2804 (91)
MIT 18.7019 18.8575 19.1691 19.6287 20.0591 20.3602 20.4653 20.4442 20.2081 19.6798 19.1261 18.6814 (92)
Temperature adjustment 0.0000
adjusted MIT 18.7019 18.8575 19.1691 19.6287 20.0591 20.3602 20.4653 20.4442 20.2081 19.6798 19.1261 18.6814 (93)

8. Space heating requirement

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Utilisation 0.9861 0.9807 0.9676 0.9318 0.8517 0.7087 0.5552 0.6200 0.8373 0.9501 0.9799 0.9881 (94)
Useful gains 501.3739 539.3920 577.6389 618.0875 613.3701 508.1483 375.8143 379.7335 458.9081 473.1928 470.3137 480.1933 (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 1557.9567 1505.6536 1362.9076 1139.2075 885.4122 603.1404 404.7297 422.5534 642.4200 961.7563 1280.1783 1549.5295 (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 786.0976 649.3278 584.2399 375.2064 202.3993 0.0000 0.0000 0.0000 0.0000 363.4913 583.1025 795.5862 (98)
Space heating 4339.4510 (98)
Space heating per m2 (98) / (4) = 30.0329 (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 984.2529 774.8374 794.0699 0.0000 0.0000 0.0000 0.0000 (100)
Utilisation 0.0000 0.0000 0.0000 0.0000 0.0000 0.7721 0.8399 0.8027 0.0000 0.0000 0.0000 0.0000 (101)
Useful loss 0.0000 0.0000 0.0000 0.0000 0.0000 759.9009 650.7651 637.4057 0.0000 0.0000 0.0000 0.0000 (102)
Total gains 0.0000 0.0000 0.0000 0.0000 0.0000 963.4199 913.7698 841.2625 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 146.5337 195.6755 151.6694 0.0000 0.0000 0.0000 0.0000 (104)
Space cooling 493.8786 (104)
Cooled fraction fC = cooled area / (4) = 1.0000 (105)
Intermittency factor (Table 10b) 0.0000 0.0000 0.0000 0.0000 0.0000 0.2500 0.2500 0.2500 0.0000 0.0000 0.0000 0.0000 (106)
Space cooling kWh

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	36.6334	48.9189	37.9174	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												123.4697 (107)
Space cooling per m2												0.8545 (108)
Energy for space heating												30.0329 (99)
Energy for space cooling												0.8545 (108)
Total												30.8874 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 388.6781 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (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) =					40.0000 / (5) = 0.1029 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3529 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2735 (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	0.3487	0.3419	0.3350	0.3009	0.2940	0.2598	0.2598	0.2530	0.2735	0.2940	0.3077	0.3214 (22b)
Effective ac	0.5608	0.5584	0.5561	0.5453	0.5432	0.5338	0.5338	0.5320	0.5374	0.5432	0.5473	0.5516 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opening Type (Uw = 1.40)			14.9400	1.3258	19.8068			(27)					
External Wall -Type 4	45.0500	14.9400	30.1100	0.1800	5.4198			(29a)					
Lift Wall	5.2000		5.2000	0.1800	0.9360			(29a)					
Roof Joist	17.4000		17.4000	0.1300	2.2620			(30)					
Total net area of external elements Aum(A, m2)			67.6500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.4246			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								4.7839 (36)					
Total fabric heat loss						(33) + (36) =	33.2085	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 71.9308	Feb 71.6279	Mar 71.3311	Apr 69.9368	May 69.6760	Jun 68.4616	Jul 68.4616	Aug 68.2367	Sep 68.9294	Oct 69.6760	Nov 70.2037	Dec 70.7554	(38)
Heat transfer coeff	105.1393	104.8365	104.5396	103.1454	102.8845	101.6701	101.6701	101.4453	102.1379	102.8845	103.4122	103.9639	(39)
Average = Sum(39)m / 12 =												103.1441	(39)
HLP	Jan 0.7277	Feb 0.7256	Mar 0.7235	Apr 0.7139	May 0.7121	Jun 0.7036	Jul 0.7036	Aug 0.7021	Sep 0.7069	Oct 0.7121	Nov 0.7157	Dec 0.7195	(40)
HLP (average)												0.7138	(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												2.9252 (42)
Average daily hot water use (litres/day)												103.6732 (43)
Daily hot water use	114.0406	109.8936	105.7467	101.5998	97.4528	93.3059	93.3059	97.4528	101.5998	105.7467	109.8936	114.0406 (44)
Energy conte	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Energy content (annual)										Total = Sum(45)m =		1631.1837 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
35.9378 31.4314 32.4344 28.2771 27.1325 23.4133 21.6959 24.8963 25.1937 29.3608 32.0496 34.8038 (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	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	146.2594	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1439	28.5499	23.2183	17.5778	13.1396	11.0930	11.9864	15.5803	20.9119	26.5525	30.9907	33.0372	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.4618	317.7250	309.5020	291.9962	269.8984	249.1295	235.2546	231.9915	240.2144	257.7202	279.8181	300.5870	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	37.6259	(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)	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	(71)
Water heating gains (Table 5)	48.3034	46.7729	43.5946	39.2737	36.4685	32.5185	29.1611	33.4628	34.9912	39.4634	44.5133	46.7793	(72)
Total internal gains	461.7870	459.9256	443.1928	415.7256	386.3842	359.6188	343.2799	347.9125	362.9954	390.6139	422.1999	447.2813	(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					14.9400	10.6334	0.6300		0.7000		0.7700		48.5506 (74)
Solar gains	48.5506	92.7826	157.6603	253.2429	341.1414	365.2020	340.9627	270.5104	189.5588	110.4456	59.8934	40.4741	(83)
Total gains	510.3375	552.7082	600.8531	668.9685	727.5256	724.8208	684.2426	618.4228	552.5542	501.0595	482.0933	487.7555	(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	95.4355	95.7112	95.9830	97.2805	97.5271	98.6920	98.6920	98.9108	98.2400	97.5271	97.0294	96.5145	
alpha	7.3624	7.3807	7.3989	7.4854	7.5018	7.5795	7.5795	7.5941	7.5493	7.5018	7.4686	7.4343	
util living area	0.9999	0.9998	0.9994	0.9956	0.9660	0.8306	0.6445	0.7306	0.9607	0.9982	0.9998	0.9999	(86)
MIT	20.1230	20.2003	20.3549	20.5891	20.8206	20.9656	20.9955	20.9895	20.8770	20.5975	20.3256	20.1121	(87)
Th 2	20.3165	20.3183	20.3201	20.3286	20.3302	20.3376	20.3376	20.3390	20.3348	20.3302	20.3270	20.3236	(88)
util rest of house	0.9999	0.9998	0.9991	0.9937	0.9503	0.7690	0.5525	0.6377	0.9355	0.9972	0.9997	0.9999	(89)
MIT 2	19.4900	19.5689	19.7250	19.9657	20.1914	20.3192	20.3362	20.3353	20.2500	19.9760	19.7017	19.4854	(90)
Living area fraction									fLA = Living area / (4) =			0.2804	(91)
MIT	19.6675	19.7460	19.9017	20.1405	20.3678	20.5005	20.5211	20.5187	20.4258	20.1503	19.8767	19.6611	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6675	19.7460	19.9017	20.1405	20.3678	20.5005	20.5211	20.5187	20.4258	20.1503	19.8767	19.6611	(93)

8. Space heating requirement

Utilisation	0.9999	0.9997	0.9989	0.9930	0.9514	0.7853	0.5785	0.6641	0.9397	0.9969	0.9997	0.9999	(94)
Useful gains	510.2654	552.5370	600.1992	664.3112	692.1629	569.1922	395.8594	410.6811	519.2435	499.4839	481.9289	487.7075	(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	1615.7305	1556.3986	1401.0055	1159.4034	891.7863	599.9029	398.6594	417.8269	646.1074	982.5794	1321.2662	1607.3996	(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	822.4660	674.5950	595.7999	356.4664	148.5198	0.0000	0.0000	0.0000	0.0000	359.4231	604.3229	833.0509	(98)
Space heating												4394.6439	(98)
Space heating per m2												30.4149	(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	955.6994	752.3591	770.9840	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8912	0.9525	0.9215	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	851.6978	716.5871	710.4367	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	972.9256	922.7612	848.8307	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	87.2840	153.3936	102.9651	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												343.6427	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	21.8210	38.3484	25.7413	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												85.9107 (107)
Space cooling per m2												0.5946 (108)
Energy for space heating												30.4149 (99)
Energy for space cooling												0.5946 (108)
Total												31.0094 (109)
Target Fabric Energy Efficiency (TFEE)												35.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 388.6781 (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					0 * 10 = 0.0000 (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) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1938 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.2180	0.2083	0.2131	0.1938	0.1938	0.1792	0.1792	0.1647	0.1792	0.1889	0.1841	0.1986 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												63.7000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3995	0.3898	0.3946	0.3753	0.3753	0.3607	0.3607	0.3462	0.3607	0.3704	0.3656	0.3801 (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
N Window (Uw = 1.40)			14.9400	1.3258	19.8068		(27)
External Wall -Type 4	45.0500	14.9400	30.1100	0.1900	5.7209		(29a)
Lift Wall	5.2000		5.2000	0.2600	1.3520		(29a)
Roof Joist	17.4000		17.4000	0.1500	2.6100		(30)
Total net area of external elements Aum(A, m ²)			67.6500				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				29.4897		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7564 (36)
Total fabric heat loss	(33) + (36) =						36.2462 (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
Heat transfer coeff	51.2374	49.9948	50.6161	48.1310	48.1310	46.2671	46.2671	44.4033	46.2671	47.5097	46.8884	48.7523 (38)
Average = Sum(39)m / 12 =	87.4835	86.2410	86.8622	84.3771	84.3771	82.5133	82.5133	80.6495	82.5133	83.7559	83.1346	84.9984 (39)
												84.1183 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6055	0.5969	0.6012	0.5840	0.5840	0.5711	0.5711	0.5582	0.5711	0.5797	0.5754	0.5883 (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												2.9252 (42)
Average daily hot water use (litres/day)												103.6732 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.0406	109.8936	105.7467	101.5998	97.4528	93.3059	93.3059	97.4528	101.5998	105.7467	109.8936	114.0406 (44)
Energy content (annual)	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1631.1837 (45)
Water storage loss:	25.3678	22.1869	22.8949	19.9603	19.1524	16.5270	15.3147	17.5739	17.7838	20.7253	22.6233	24.5674 (46)
Store volume												10.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):													0.5000 (48)
Temperature factor from Table 2b													1.0000 (49)
Enter (49) or (54) in (55)													0.5000 (55)
Total storage loss													
15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	(56)
If cylinder contains dedicated solar storage													
15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month													
207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450	202.5450	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450	202.5450	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
87.2419	77.1898	81.7602	74.2549	73.4643	66.6445	64.9576	69.9654	69.4303	76.9509	80.1578	85.4676	85.4676	(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	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.0582	69.3306	56.3834	42.6859	31.9082	26.9382	29.1077	37.8353	50.7825	64.4800	75.2577	80.2277 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	469.3460	474.2164	461.9433	435.8153	402.8334	371.8350	351.1263	346.2559	358.5290	384.6570	417.6389	448.6372 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763 (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)	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076 (71)
Water heating gains (Table 5)	117.2607	114.8658	109.8927	103.1318	98.7424	92.5619	87.3086	94.0395	96.4310	103.4287	111.3303	114.8758 (72)
Total internal gains	778.6450	772.3929	742.1995	695.6131	647.4641	605.3153	581.5227	592.1108	619.7226	666.5458	718.2070	757.7209 (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					14.9400	11.9814	0.5400	0.8000			0.7700	53.5891 (74)	
Solar gains	53.5891	92.9735	159.2744	263.7874	343.5113	392.8446	363.1151	293.5351	206.0258	118.6777	66.1598	44.1337	(83)
Total gains	832.2341	865.3664	901.4739	959.4005	990.9754	998.1598	944.6377	885.6459	825.7483	785.2235	784.3668	801.8545	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.8785	46.5395	46.2066	47.5675	47.5675	48.6420	48.6420	49.7661	48.6420	47.9204	48.2785	47.2198
alpha	4.0586	4.1026	4.0804	4.1712	4.1712	4.2428	4.2428	4.3177	4.2428	4.1947	4.2186	4.1480
util living area												
	0.9490	0.9348	0.8967	0.8041	0.6424	0.4230	0.2786	0.3083	0.5701	0.8169	0.9181	0.9527 (86)
MIT	20.0437	20.1794	20.4173	20.7201	20.9150	20.9893	20.9987	20.9981	20.9624	20.7495	20.4047	20.0588 (87)
Th 2	20.4251	20.4328	20.4290	20.4445	20.4445	20.4561	20.4561	20.4678	20.4561	20.4483	20.4522	20.4406 (88)
util rest of house												
	0.9432	0.9275	0.8849	0.7831	0.6084	0.3808	0.2316	0.2606	0.5255	0.7929	0.9079	0.9474 (89)
MIT 2	19.1260	19.3264	19.6625	20.0947	20.3496	20.4467	20.4553	20.4666	20.4192	20.1431	19.6653	19.1593 (90)
Living area fraction									fLA = Living area / (4) =			0.2804 (91)
MIT	19.3834	19.5656	19.8742	20.2701	20.5081	20.5989	20.6077	20.6157	20.5715	20.3131	19.8726	19.4116 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3834	19.5656	19.8742	20.2701	20.5081	20.5989	20.6077	20.6157	20.5715	20.3131	19.8726	19.4116 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9306	0.9144	0.8719	0.7761	0.6124	0.3919	0.2448	0.2739	0.5352	0.7866	0.8956	0.9355	(94)
Ext temp.	774.4834	791.2810	785.9749	744.5974	606.8675	391.2087	231.2233	242.5460	441.9174	617.6272	702.4777	750.1385	(95)
Heat loss rate W	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	(96)
Month fracti	1275.8036	1221.6571	1092.2211	891.8720	650.3883	395.9729	231.6733	243.2121	459.7266	746.5279	1011.9671	1241.9626	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	372.9822	289.2127	227.8472	106.0378	32.3795	0.0000	0.0000	0.0000	0.0000	95.9021	222.8324	365.9171	(98)
RHI space heating demand												1713.1110	(98)
												1713	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 388.6781 (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					0 * 10 = 0.0000 (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) =				0.0000 / (5) =	0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1938 (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	0.2470	0.2422	0.2373	0.2131	0.2083	0.1841	0.1841	0.1792	0.1938	0.2083	0.2180	0.2277 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												63.7000 (23c)
Effective ac	0.4285	0.4237	0.4188	0.3946	0.3898	0.3656	0.3656	0.3607	0.3753	0.3898	0.3995	0.4092 (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
N Window (Uw = 1.40)			14.9400	1.3258	19.8068		(27)
External Wall -Type 4	45.0500	14.9400	30.1100	0.1900	5.7209		(29a)
Lift Wall	5.2000		5.2000	0.2600	1.3520		(29a)
Roof Joist	17.4000		17.4000	0.1500	2.6100		(30)
Total net area of external elements Aum(A, m ²)			67.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4897		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7564 (36)
Total fabric heat loss						(33) + (36) =	36.2462 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	54.9650	54.3438	53.7225	50.6161	49.9948	46.8884	46.8884	46.2671	48.1310	49.9948	51.2374	52.4799 (38)
Heat transfer coeff	91.2112	90.5899	89.9686	86.8622	86.2410	83.1346	83.1346	82.5133	84.3771	86.2410	87.4835	88.7261 (39)
Average = Sum(39)m / 12 =												86.7069 (39)
HLP	0.6313	0.6270	0.6227	0.6012	0.5969	0.5754	0.5754	0.5711	0.5840	0.5969	0.6055	0.6141 (40)
HLP (average)												0.6001 (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											2.9252 (42)	
Average daily hot water use (litres/day)											103.6732 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.0406	109.8936	105.7467	101.5998	97.4528	93.3059	93.3059	97.4528	101.5998	105.7467	109.8936	114.0406 (44)
Energy conte	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Energy content (annual)											Total = Sum(45)m = 1631.1837 (45)	
Distribution loss (46)m = 0.15 x (45)m												
25.3678	22.1869	22.8949	19.9603	19.1524	16.5270	15.3147	17.5739	17.7838	20.7253	22.6233	24.5674 (46)	
Water storage loss:												
Store volume												10.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												0.5000 (48)
Temperature factor from Table 2b												1.0000 (49)
Enter (49) or (54) in (55)												0.5000 (55)
Total storage loss	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	(56)
If cylinder contains dedicated solar storage	15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.0000	15.5000	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450 (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	207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450 (64)
Heat gains from water heating, kWh/month	87.2419	77.1898	81.7602	74.2549	73.4643	66.6445	64.9576	69.9654	69.4303	76.9509	80.1578	85.4676 (65)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												2087.5797 (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	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.0582	69.3306	56.3834	42.6859	31.9082	26.9382	29.1077	37.8353	50.7825	64.4800	75.2577	80.2277	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	469.3460	474.2164	461.9433	435.8153	402.8334	371.8350	351.1263	346.2559	358.5290	384.6570	417.6389	448.6372	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	(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)	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	(71)
Water heating gains (Table 5)	117.2607	114.8658	109.8927	103.1318	98.7424	92.5619	87.3086	94.0395	96.4310	103.4287	111.3303	114.8758	(72)
Total internal gains	778.6450	772.3929	742.1995	695.6131	647.4641	605.3153	581.5227	592.1108	619.7226	666.5458	718.2070	757.7209	(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					14.9400	10.6334	0.5400	0.8000			0.7700			47.5597 (74)
Solar gains	47.5597	90.8891	154.4428	248.0747	334.1793	357.7489	334.0043	264.9898	185.6902	108.1916	58.6711	39.6481	(83)	
Total gains	826.2047	863.2820	896.6423	943.6878	981.6434	963.0641	915.5269	857.1006	805.4128	774.7374	776.8781	797.3690	(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	44.0035	44.3053	44.6112	46.2066	46.5395	48.2785	48.2785	48.6420	47.5675	46.5395	45.8785	45.2360	
alpha	3.9336	3.9537	3.9741	4.0804	4.1026	4.2186	4.2186	4.2428	4.1712	4.1026	4.0586	4.0157	
util living area	0.9566	0.9446	0.9166	0.8439	0.7156	0.5313	0.3945	0.4349	0.6592	0.8581	0.9346	0.9606	(86)
MIT	19.8953	20.0288	20.2698	20.6112	20.8477	20.9685	20.9929	20.9895	20.9212	20.6449	20.2533	19.8997	(87)
Th 2	20.4019	20.4058	20.4096	20.4290	20.4328	20.4522	20.4522	20.4561	20.4445	20.4328	20.4251	20.4174	(88)
util rest of house	0.9517	0.9382	0.9069	0.8263	0.6860	0.4907	0.3471	0.3860	0.6185	0.8386	0.9263	0.9561	(89)
MIT 2	18.8953	19.0904	19.4385	19.9332	20.2542	20.4208	20.4466	20.4475	20.3607	19.9885	19.4293	18.9127	(90)
Living area fraction									fLA = Living area / (4) =			0.2804	(91)
MIT	19.1757	19.3536	19.6716	20.1233	20.4206	20.5744	20.5998	20.5995	20.5179	20.1726	19.6604	19.1895	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1757	19.3536	19.6716	20.1233	20.4206	20.5744	20.5998	20.5995	20.5179	20.1726	19.6604	19.1895	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9392	0.9248	0.8929	0.8160	0.6853	0.4999	0.3600	0.3991	0.6241	0.8287	0.9132	0.9444	(94)
Useful gains	775.9461	798.3794	800.6175	770.0531	672.7351	481.4754	329.5527	342.0500	502.6572	642.0156	709.4821	753.0358	(95)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1356.8330	1309.3463	1185.0337	974.8823	752.0754	496.6781	332.5208	346.5148	541.5239	825.5480	1098.8266	1329.9578	(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	432.1798	343.3698	286.0056	147.4770	59.0292	0.0000	0.0000	0.0000	0.0000	136.5481	280.3281	429.2300	(98)
Space heating												2114.1675	(98)
Space heating per m2												14.6319	(99)
(98) / (4) =													

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	781.4650	615.1959	627.1011	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8997	0.9413	0.9234	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	703.0763	579.0777	579.0570	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1023.4633	971.9173	901.8391	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	230.6786	292.2726	240.1499	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												763.1011 (104)
Cooled fraction									fC = cooled area / (4) =			0.6942 (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 kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.0323	50.7214	41.6760	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.4297 (107)
Space cooling per m2												0.9165 (108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (301)
Fraction of space heat from community system	1.0000 (302)
Fraction of heat from community Heat pump	1.0000 (303a)
Fraction of total space heat from community Heat pump	1.0000 (304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000 (305a)
Distribution loss factor (Table 12c) for community heating system	1.0500 (306)
Space heating:	
Annual space heating requirement	2114.1675 (98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	2219.8759 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000 (308)
Space heating fuel for secondary/supplementary system	0.0000 (309)
Water heating	
Annual water heating requirement	2087.5797 (64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2191.9586 (310a)
Electricity used for heat distribution	44.1183 (313)
Cooling System Energy Efficiency Ratio	6.7500 (314)
Space cooling (if there is a fixed cooling system, if not enter 0)	19.6192 (315)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.3160)	
mechanical ventilation fans (SFP = 1.3160)	624.0305 (330a)
Total electricity for the above, kWh/year	624.0305 (331)
Electricity for lighting (calculated in Appendix L)	551.4129 (332)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 1.32 * 951 * 0.80) =	-803.0804 (333)
Total delivered energy for all uses	4803.8167 (338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating from Heat pump	2219.8759	4.2400	94.1227 (340a)
Space heating - secondary	0.0000	0.0000	0.0000 (341)
Water heating from Heat pump	2191.9586	4.2400	92.9390 (342a)
Space cooling	19.6192	13.1900	2.5878 (348)
Mechanical ventilation fans	624.0305	13.1900	82.3096 (349)
Pumps and fans for heating	0.0000	0.0000	0.0000 (349)
Energy for lighting	551.4129	13.1900	72.7314 (350)
Additional standing charges			120.0000 (351)
Energy saving/generation technologies			
PV Unit	0.0000	0.0000	0.0000 (352)
Total energy cost			464.6905 (355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):	0.4200 (356)
Energy cost factor (ECF)	[[(255) x (256)] / [(4) + 45.0] = 1.0300 (357)
SAP value	85.6318
SAP rating (Section 12)	86 (358)
SAP band	B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1470.6115	0.5190	763.2474 (367)
Electrical energy for heat distribution	44.1183	0.5190	22.8974 (372)
Total CO2 associated with community systems			786.1448 (373)
(negative value allowed since DFEE <= TFEE)			
Space and water heating			786.1448 (376)
Space cooling	19.6192	0.5190	10.1824 (377)
Pumps and fans	624.0305	0.5190	323.8718 (378)
Energy for lighting	551.4129	0.5190	286.1833 (379)

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Energy saving/generation technologies			
PV Unit	-803.0804	0.5190	-416.7987 (380)
Total kg/year			989.5835 (383)
CO2 emissions per m2			6.8500 (384)
EI value			93.0020 (384a)
EI rating			93 (385)
EI band			A

----- Calculation of stars for heating and DHW -----

Space heating energy efficiency	$1.00 \times 4.240 \times 1.05$	
= 4.452, stars = 4		
Space heating environmental impact	$1.00 \times 0.519 \times 1.05 / 3.0000$	
= 0.1817, stars = 5		
Water heating energy efficiency		4.452, stars = 4
Water heating environmental impact		0.1817, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	144.4900 (1b)	x 2.6900 (2b)	= 388.6781 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.4900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	388.6781 (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					0 * 10 = 0.0000 (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 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1938 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.3000	4.4000	4.0000	4.0000	3.7000	3.7000	3.4000	3.7000	3.9000	3.8000	4.1000 (22)
Wind factor	1.1250	1.0750	1.1000	1.0000	1.0000	0.9250	0.9250	0.8500	0.9250	0.9750	0.9500	1.0250 (22a)
Adj infilt rate	0.2180	0.2083	0.2131	0.1938	0.1938	0.1792	0.1792	0.1647	0.1792	0.1889	0.1841	0.1986 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												63.7000 (23c)
Effective ac	0.3995	0.3898	0.3946	0.3753	0.3753	0.3607	0.3607	0.3462	0.3607	0.3704	0.3656	0.3801 (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
N Window (Uw = 1.40)			14.9400	1.3258	19.8068		(27)
External Wall -Type 4	45.0500	14.9400	30.1100	0.1900	5.7209		(29a)
Lift Wall	5.2000		5.2000	0.2600	1.3520		(29a)
Roof Joist	17.4000		17.4000	0.1500	2.6100		(30)
Total net area of external elements Aum(A, m ²)			67.6500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.4897		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.7564 (36)
Total fabric heat loss						(33) + (36) =	36.2462 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	51.2374	49.9948	50.6161	48.1310	48.1310	46.2671	46.2671	44.4033	46.2671	47.5097	46.8884	48.7523 (38)
Heat transfer coeff	87.4835	86.2410	86.8622	84.3771	84.3771	82.5133	82.5133	80.6495	82.5133	83.7559	83.1346	84.9984 (39)
Average = Sum(39)m / 12 =												84.1183 (39)
HLP	0.6055	0.5969	0.6012	0.5840	0.5840	0.5711	0.5711	0.5582	0.5711	0.5797	0.5754	Dec 0.5883 (40)
HLP (average)												0.5822 (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												2.9252 (42)
Average daily hot water use (litres/day)												103.6732 (43)
Daily hot water use	114.0406	109.8936	105.7467	101.5998	97.4528	93.3059	93.3059	97.4528	101.5998	105.7467	109.8936	114.0406 (44)
Energy conte	169.1189	147.9124	152.6324	133.0686	127.6825	110.1803	102.0982	117.1592	118.5585	138.1685	150.8217	163.7826 (45)
Energy content (annual)										Total = Sum(45)m =		1631.1837 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.3678	22.1869	22.8949	19.9603	19.1524	16.5270	15.3147	17.5739	17.7838	20.7253	22.6233	24.5674 (46)
Water storage loss:												
Store volume												10.0000 (47)

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a) If manufacturer declared loss factor is known (kWh/day):												0.5000 (48)
Temperature factor from Table 2b												1.0000 (49)
Enter (49) or (54) in (55)												0.5000 (55)
Total storage loss												
15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	15.0000	15.5000	15.0000	15.5000 (56)	
If cylinder contains dedicated solar storage												
15.5000	14.0000	15.5000	15.0000	15.5000	15.0000	15.5000	15.5000	15.0000	15.5000	15.0000	15.5000 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)	
Total heat required for water heating calculated for each month												
207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450 (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 (63)	
							Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h	207.8813	182.9236	191.3948	170.5806	166.4449	147.6923	140.8606	155.9216	156.0705	176.9309	188.3337	202.5450 (64)
							Total per year (kWh/year) = Sum(64)m =					2087.5797 (64)
Heat gains from water heating, kWh/month												
87.2419	77.1898	81.7602	74.2549	73.4643	66.6445	64.9576	69.9654	69.4303	76.9509	80.1578	85.4676 (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	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113	175.5113 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	78.0582	69.3306	56.3834	42.6859	31.9082	26.9382	29.1077	37.8353	50.7825	64.4800	75.2577	80.2277 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	469.3460	474.2164	461.9433	435.8153	402.8334	371.8350	351.1263	346.2559	358.5290	384.6570	417.6389	448.6372 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763	55.4763 (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)												
	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076	-117.0076 (71)
Water heating gains (Table 5)												
	117.2607	114.8658	109.8927	103.1318	98.7424	92.5619	87.3086	94.0395	96.4310	103.4287	111.3303	114.8758 (72)
Total internal gains												
	778.6450	772.3929	742.1995	695.6131	647.4641	605.3153	581.5227	592.1108	619.7226	666.5458	718.2070	757.7209 (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	14.9400				11.9814		0.5400		0.8000		0.7700		53.5891 (74)	

Solar gains	53.5891	92.9735	159.2744	263.7874	343.5113	392.8446	363.1151	293.5351	206.0258	118.6777	66.1598	44.1337	(83)	
Total gains	832.2341	865.3664	901.4739	959.4005	990.9754	998.1598	944.6377	885.6459	825.7483	785.2235	784.3668	801.8545	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.8785	46.5395	46.2066	47.5675	47.5675	48.6420	48.6420	49.7661	48.6420	47.9204	48.2785	47.2198	
alpha	4.0586	4.1026	4.0804	4.1712	4.1712	4.2428	4.2428	4.3177	4.2428	4.1947	4.2186	4.1480	
util living area	0.9490	0.9348	0.8967	0.8041	0.6424	0.4230	0.2786	0.3083	0.5701	0.8169	0.9181	0.9527 (86)	
MIT	20.0437	20.1794	20.4173	20.7201	20.9150	20.9893	20.9987	20.9981	20.9624	20.7495	20.4047	20.0588 (87)	
Th 2	20.4251	20.4328	20.4290	20.4445	20.4445	20.4561	20.4561	20.4678	20.4561	20.4483	20.4522	20.4406 (88)	
util rest of house													
	0.9432	0.9275	0.8849	0.7831	0.6084	0.3808	0.2316	0.2606	0.5255	0.7929	0.9079	0.9474 (89)	
MIT 2	19.1260	19.3264	19.6625	20.0947	20.3496	20.4467	20.4553	20.4666	20.4192	20.1431	19.6653	19.1593 (90)	
Living area fraction									fLA = Living area / (4) =				0.2804 (91)
MIT	19.3834	19.5656	19.8742	20.2701	20.5081	20.5989	20.6077	20.6157	20.5715	20.3131	19.8726	19.4116 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.3834	19.5656	19.8742	20.2701	20.5081	20.5989	20.6077	20.6157	20.5715	20.3131	19.8726	19.4116 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9306	0.9144	0.8719	0.7761	0.6124	0.3919	0.2448	0.2739	0.5352	0.7866	0.8956	0.9355 (94)
Useful gains	774.4834	791.2810	785.9749	744.5974	606.8675	391.2087	231.2233	242.5460	441.9174	617.6272	702.4777	750.1385 (95)
Ext temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000 (96)
Heat loss rate W												
	1275.8036	1221.6571	1092.2211	891.8720	650.3883	395.9729	231.6733	243.2121	459.7266	746.5279	1011.9671	1241.9626 (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												
	372.9822	289.2127	227.8472	106.0378	32.3795	0.0000	0.0000	0.0000	0.0000	95.9021	222.8324	365.9171 (98)
Space heating												1713.1110 (98)
Space heating per m2												(98) / (4) = 11.8563 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.8000	5.4000	7.3000	9.7000	12.8000	15.8000	17.8000	17.6000	15.0000	11.4000	7.7000	4.8000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	676.6091	511.5825	516.1566	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.9413	0.9713	0.9641	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	636.8655	496.8872	497.6026	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1064.4842	1005.9429	935.2038	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	307.8855	378.7374	325.5753	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction												1012.1982	(104)
Intermittency factor (Table 10b)												0.6942	(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	53.4309	65.7266	56.5008	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												175.6583	(107)
												1.2157	(108)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump	1.0000	(303a)
Fraction of total space heat from community Heat pump	1.0000	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating	1.0000	(305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0500	(306)
Space heating:		
Annual space heating requirement	1713.1110	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.05	1798.7666	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	(309)
Water heating		
Annual water heating requirement	2087.5797	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.05	2191.9586	(310a)
Electricity used for heat distribution	39.9073	(313)
Cooling System Energy Efficiency Ratio	6.7500	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	26.0235	(315)
Annual totals kWh/year		
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.3160)		
mechanical ventilation fans (SFP = 1.3160)	624.0305	(330a)
Total electricity for the above, kWh/year	624.0305	(331)
Electricity for lighting (calculated in Appendix L)	551.4129	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.32 * 1019 * 0.80) =	-860.5606	(333)
Total delivered energy for all uses	4331.6314	(338)

10b. Fuel costs - using BEDF prices (520)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	1798.7666	11.8800	213.6935	(340a)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2191.9586	11.8800	260.4047	(342a)
Space cooling	26.0235	36.8500	9.5896	(348)
Mechanical ventilation fans	624.0305	36.8500	229.9552	(349)
Pumps and fans for heating	0.0000	0.0000	0.0000	(349)
Energy for lighting	551.4129	36.8500	203.1956	(350)
Additional standing charges			104.0000	(351)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(352)
Total energy cost			1020.8387	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump				
Space heating from Heat pump	1330.2417	0.5190	690.3955	(367a)
Electrical energy for heat distribution	39.9073	0.5190	20.7119	(372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			711.1073	(373)
Space and water heating			711.1073	(376)
Space cooling	26.0235	0.5190	13.5062	(377)
Pumps and fans	624.0305	0.5190	323.8718	(378)
Energy for lighting	551.4129	0.5190	286.1833	(379)
Energy saving/generation technologies				
PV Unit	-860.5606	0.5190	-446.6309	(380)
Total kg/year			888.0377	(383)

13b. Primary energy - Community heating scheme

Energy Primary energy factor Primary energy

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	kWh/year	kg CO2/kWh	kWh/year
Efficiency of heat source Heat pump			300.0000 (367a)
Space heating from Heat pump	1330.2417	3.0700	4083.8421 (367)
Electrical energy for heat distribution	39.9073	3.0700	122.5153 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			4206.3574 (373)
Space and water heating			4206.3574 (376)
Space cooling	26.0235	3.0700	79.8920 (377)
Pumps and fans	624.0305	3.0700	1915.7735 (378)
Energy for lighting	551.4129	3.0700	1692.8376 (379)
Energy saving/generation technologies			
PV Unit	-860.5606	3.0700	-2641.9210 (380)
Primary energy kWh/year			5252.9395 (383)
Primary energy kWh/m2/year			36.3550 (384)

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	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 86
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 520 TEST (05 Jun 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£443	£443	£0
Community scheme	£578	£578	£0
Space heating	£548	£548	£0
Space cooling	£10	£10	£0
Water heating	£260	£260	£0
Lighting	£203	£203	£0
Total cost of fuels	£1021	£1021	£0
Total cost of uses	£1021	£1021	£0
Delivered energy	30 kWh/m²	30 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	6 kg/m²	6 kg/m²	0 kg/m²
Primary energy	36 kWh/m²	36 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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 Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	513.06 (P1)
Transmission heat loss coefficient	36.25 (37)
Summer heat loss coefficient	549.30 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type	
Orientation				
North	0.000	1.000	None	
Solar shading				
Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	0.850	0.90	1.000	0.765 (P8)
[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c
North	14.9400	81.1852	0.5400	0.8000
total:				360.7572

Solar gains	Jun	Jul	Aug	
Internal gains	390	361	293	(P3)
Total summer gains	605	582	592	
	996	942	885	(P5)
Summer gain/loss ratio	1.81	1.72	1.61	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.11	20.92	20.71	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			