

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	74278-08			Issued on Date	30/03/2023
Assessment Reference	001	Prop Type Ref	HT 2B3P (Mid)		
Property	Flat 8, 32 Brookstone Close, MANCHESTER, M21 7AE				
SAP Rating	87 B	DER	23.84	TER	23.93
Environmental	84 B	% DER<TER	0.38		
CO ₂ Emissions (t/year)	1.17	DFEE	30.83	TFEE	37.54
General Requirements Compliance	Pass	% DFEE<TFEE	17.85		
Assessor Details	Mr. Paul Goddard, Anderson Goddard Limited, Tel: 01925 733 942, paul.goddard@andersongoddard.com			Assessor ID	B342-0001
Client					

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

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DWELLING AS BUILT

Mid-floor flat, total floor area 61 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
 Fuel factor: 1.55 (electricity)
 Target Carbon Dioxide Emission Rate (TER) 23.93 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 23.84 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 37.5 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE) 30.8 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.35 (max. 2.00)	1.35 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.103

3 Air permeability

Air permeability at 50 pascals: 3.32 (measured in this dwelling)
 Maximum 10.0 OK

4 Heating efficiency

Main heating system: Electric storage heaters with radiators or underfloor - Electric
 High heat retention storage heaters

Secondary heating system: None

5 Cylinder insulation

Hot water storage: Measured store loss: 1.13 kWh/day
 Permitted by DBSCG 2.10 OK
 Primary pipework insulated: No primary pipework

6 Controls

Space heating controls: Controls for high heat retention storage heaters OK

Hot water controls: Cylinderstat OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system
 Specific fan power: 0.32
 Maximum 0.7 OK

9 Summertime temperature

Overheating risk (West Pennines (England)): Slight OK

Based on:

Overshading: Average
 Windows facing North East: 4.74 m², No overhang
 Windows facing South West: 5.19 m², No overhang
 Windows facing North West: 2.02 m², No overhang
 Air change rate: 4.00 ach
 Blinds/curtains: None

10 Key features

Party wall U-value: 0.00 W/m²K
 Air permeability: 3.3 m³/m²h
 Photovoltaic array: 488.00 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	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					3.3200
Infiltration rate					0.1660 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1411 (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	0.1799	0.1764	0.1728	0.1552	0.1517	0.1340	0.1340	0.1305	0.1411	0.1517	0.1587	0.1658 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.35)			11.9500	1.2808	15.3060		(27)
Main	58.3000	11.9500	46.3500	0.1800	8.3430	110.0000	5098.5000 (29a)
Total net area of external elements Aum(A, m ²)			58.3000				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				23.6490		(33)
Party Wall 1			19.3200	0.0000	0.0000	45.0000	869.4000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11302.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		185.2207 (35)
Thermal bridges (User defined value 0.103 * total exposed area)		6.0049 (36)
Total fabric heat loss	(33) + (36) =	29.6539 (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	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Average = Sum(39)m / 12 =	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178 (39)
HLP	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820 (40)
HLP (average)												0.8820 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy content (annual)	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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Independent Energy Specialists, SAP, SBEM, EPC's, U-Value & Condensation Risk, 2D & 3D Thermal Modelling

Water storage loss:												150.0000 (47)	
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6780 (55)	
Total storage loss													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(56)
If cylinder contains dedicated solar storage													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(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	(58)
Total heat required for water heating calculated for each month													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(59)
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													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Total per year (kWh/year) = Sum(64)m =													
												1536.7864	(64)
Heat gains from water heating, kWh/month													
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7940	14.0281	11.4084	8.6369	6.4562	5.4506	5.8896	7.6555	10.2752	13.0467	15.2274	16.2330 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9371	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516 (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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains	326.8010	324.9635	313.8234	295.9374	277.9536	260.4710	249.0136	254.2785	263.3780	281.4512	302.2110	317.6109 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				4.7400	11.2829	0.6700	0.7000	0.7700	17.3823 (75)			
Southwest				5.1900	36.7938	0.6700	0.7000	0.7700	62.0652 (79)			
Northwest				2.0200	11.2829	0.6700	0.7000	0.7700	7.4076 (81)			
Solar gains	86.8552	156.1807	235.5648	328.5362	401.4495	413.2650	392.3064	335.6596	267.4063	178.5100	105.5320	73.3596 (83)
Total gains	413.6562	481.1441	549.3882	624.4736	679.4031	673.7361	641.3200	589.9381	530.7843	459.9612	407.7430	390.9705 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356
alpha	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890
util living area												
	0.9877	0.9741	0.9391	0.8471	0.6845	0.5016	0.3674	0.4161	0.6579	0.9004	0.9759	0.9905 (86)
MIT	20.1469	20.2994	20.5193	20.7540	20.8971	20.9450	20.9537	20.9522	20.9191	20.7155	20.3779	20.1029 (87)
Th 2	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829 (88)
util rest of house												
	0.9849	0.9685	0.9262	0.8184	0.6370	0.4411	0.3001	0.3438	0.5931	0.8740	0.9697	0.9883 (89)
MIT 2	19.0369	19.2564	19.5681	19.8854	20.0605	20.1100	20.1169	20.1161	20.0875	19.8430	19.3719	18.9731 (90)
Living area fraction									fLA = Living area / (4) =			0.4012 (91)
MIT	19.4822	19.6748	19.9497	20.2339	20.3961	20.4450	20.4526	20.4515	20.4211	20.1930	19.7755	19.4263 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4822	19.6748	19.9497	20.2339	20.3961	20.4450	20.4526	20.4515	20.4211	20.1930	19.7755	19.4263 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9820	0.9643	0.9220	0.8203	0.6499	0.4608	0.3224	0.3678	0.6127	0.8743	0.9659	0.9858 (94)
Useful gains	406.1954	463.9550	506.5586	512.2486	441.5174	310.4685	206.7772	216.9808	325.2196	402.1566	393.8214	385.4125 (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	817.0733	795.1482	723.8326	609.9648	468.0074	314.5634	207.3397	218.0425	340.1888	516.2746	682.1668	819.4484 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	305.6932	222.5618	161.6519	70.3557	19.7085	0.0000	0.0000	0.0000	0.0000	84.9038	207.6087	322.9227 (98)
Space heating												1395.4063 (98)
Space heating per m2												22.8680 (99)
										(98) / (4) =		

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1395.4063 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	305.6932	222.5618	161.6519	70.3557	19.7085	0.0000	0.0000	0.0000	0.0000	84.9038	207.6087	322.9227	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	305.6932	222.5618	161.6519	70.3557	19.7085	0.0000	0.0000	0.0000	0.0000	84.9038	207.6087	322.9227	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(219)
Water heating fuel used													1536.7864 (219)
Annual totals kWh/year													
Space heating fuel - main system													1395.4063 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.4480)													
mechanical ventilation fans (SFP = 0.4480)													80.0426 (230a)
Total electricity for the above, kWh/year													80.0426 (231)
Electricity for lighting (calculated in Appendix L)													278.9274 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													3291.1627 (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	1395.4063	0.5190	724.2159	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	0.5190	797.5921	(264)
Space and water heating			1521.8080	(265)
Pumps and fans	80.0426	0.5190	41.5421	(267)
Energy for lighting	278.9274	0.5190	144.7633	(268)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	0.5190	-253.2720	(269)
Total CO2, kg/year			1454.8414	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			23.8400	(273)

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

DER		23.8400	ZC1
Total Floor Area		61.0200	
Assumed number of occupants		2.0103	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		17.0444	ZC2
CO2 emissions from cooking, equation (L16)		2.7409	ZC3
Total CO2 emissions		43.6252	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		43.6252	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	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1366 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3866 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3286 (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	0.4189	0.4107	0.4025	0.3614	0.3532	0.3122	0.3122	0.3039	0.3286	0.3532	0.3697	0.3861 (22b)
Effective ac	0.5878	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745 (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)			11.9500	1.3258	15.8428			(27)				
Main	58.3000	11.9500	46.3500	0.1800	8.3430			(29a)				
Total net area of external elements Aum(A, m2)			58.3000					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			24.1858		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								5.7873 (36)				
Total fabric heat loss						(33) + (36) =		29.9731 (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	28.4050	28.2403	28.0789	27.3207	27.1788	26.5184	26.5184	26.3961	26.7728	27.1788	27.4658	27.7658 (38)
Heat transfer coeff	58.3781	58.2134	58.0520	57.2938	57.1519	56.4915	56.4915	56.3693	56.7459	57.1519	57.4389	57.7389 (39)
Average = Sum(39)m / 12 =												57.2931 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9567	0.9540	0.9514	0.9389	0.9366	0.9258	0.9258	0.9238	0.9300	0.9366	0.9413	0.9462 (40)
HLP (average)												0.9389 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)										Total = Sum(45)m =		1289.3164 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												

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Primary loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	180.2694	158.9983	167.2382	150.2716	147.5174	132.1803	127.2951	139.1996	138.8025	155.8057	164.3040	176.0515 (62)
	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								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Heat gains from water heating, kWh/month	180.2694	158.9983	167.2382	150.2716	147.5174	132.1803	127.2951	139.1996	138.8025	155.8057	164.3040	176.0515 (64)
	81.7227	72.5420	77.3898	71.0457	70.8327	65.0304	64.1088	68.0670	67.2323	73.5885	75.7115	80.3203 (65)
								Total per year (kWh/year) =	Sum (64)m =			1837.9338 (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)
(66)m	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7940	14.0281	11.4084	8.6369	6.4562	5.4506	5.8896	7.6555	10.2752	13.0467	15.2274	16.2330	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	(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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	(71)
Water heating gains (Table 5)	109.8423	107.9494	104.0186	98.6746	95.2052	90.3200	86.1677	91.4879	93.3782	98.9093	105.1549	107.9573	(72)
Total internal gains	357.3031	355.4655	344.3255	326.4395	308.4557	290.9731	279.5157	284.7805	293.8800	311.9532	332.7131	348.1130	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.7400	11.2829	0.6300	0.7000	0.7700	16.3445 (75)			
Southwest				5.1900	36.7938	0.6300	0.7000	0.7700	58.3599 (79)			
Northwest				2.0200	11.2829	0.6300	0.7000	0.7700	6.9654 (81)			
Solar gains	81.6698	146.8565	221.5012	308.9221	377.4824	388.5925	368.8851	315.6202	251.4417	167.8527	99.2316	68.9799 (83)
Total gains	438.9729	502.3220	565.8267	635.3615	685.9380	679.5656	648.4008	600.4007	545.3218	479.8059	431.9447	417.0929 (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	72.5872	72.7925	72.9949	73.9609	74.1445	75.0112	75.0112	75.1740	74.6750	74.1445	73.7740	73.3907	
alpha	5.8391	5.8528	5.8663	5.9307	5.9430	6.0007	6.0007	6.0116	5.9783	5.9430	5.9183	5.8927	
util living area	0.9948	0.9878	0.9659	0.8902	0.7287	0.5263	0.3826	0.4303	0.6870	0.9302	0.9877	0.9960	(86)
MIT	20.1414	20.2960	20.5285	20.7957	20.9493	20.9938	20.9992	20.9985	20.9729	20.7629	20.4052	20.1136	(87)
Th 2	20.1196	20.1218	20.1241	20.1345	20.1365	20.1456	20.1456	20.1473	20.1421	20.1365	20.1325	20.1284	(88)
util rest of house	0.9931	0.9840	0.9556	0.8612	0.6748	0.4586	0.3087	0.3514	0.6136	0.9045	0.9833	0.9948	(89)
MIT 2	18.9804	19.2059	19.5389	19.9083	20.0912	20.1418	20.1454	20.1467	20.1227	19.8760	19.3737	18.9467	(90)
Living area fraction	19.4462	19.6433	19.9360	20.2643	20.4355	20.4836	20.4879	20.4884	20.4638	20.2318	19.7875	19.4148	(91)
MIT	19.4462	19.6433	19.9360	20.2643	20.4355	20.4836	20.4879	20.4884	20.4638	20.2318	19.7875	19.4148	(92)
Temperature adjustment	19.4462	19.6433	19.9360	20.2643	20.4355	20.4836	20.4879	20.4884	20.4638	20.2318	19.7875	19.4148	(93)
adjusted MIT	19.4462	19.6433	19.9360	20.2643	20.4355	20.4836	20.4879	20.4884	20.4638	20.2318	19.7875	19.4148	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	435.2375	493.0245	539.2599	550.2066	476.1327	330.0348	219.4146	230.0122	350.1195	435.5269	423.7642	414.3587	(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	884.2036	858.2550	779.9837	651.1052	499.2485	332.3737	219.6339	230.4619	361.1181	550.4769	728.7560	878.4861	(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	334.0308	245.4349	179.0985	72.6470	17.1981	0.0000	0.0000	0.0000	0.0000	85.5228	219.5941	345.3108	(98)
Space heating												1498.8369	(98)
Space heating per m2												24.5630	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1603.0341 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	334.0308	245.4349	179.0985	72.6470	17.1981	0.0000	0.0000	0.0000	0.0000	85.5228	219.5941	345.3108 (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)	357.2521	262.4972	191.5492	77.6973	18.3937	0.0000	0.0000	0.0000	0.0000	91.4682	234.8600	369.3164 (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	180.2694	158.9983	167.2382	150.2716	147.5174	132.1803	127.2951	139.1996	138.8025	155.8057	164.3040	176.0515 (64)
Efficiency of water heater (217)m	86.4375	85.9683	84.9967	82.9980	80.7974	79.8000	79.8000	79.8000	79.8000	83.2898	85.5883	79.8000 (216)
Fuel for water heating, kWh/month	208.5545	184.9500	196.7584	181.0546	182.5769	165.6395	159.5177	174.4356	173.9380	187.0646	191.9700	203.3400 (219)
Water heating fuel used												2209.7998 (219)
Annual totals kWh/year												1603.0341 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
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)												278.9274 (232)
Total delivered energy for all uses												4166.7613 (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	1603.0341	0.2160	346.2554 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2209.7998	0.2160	477.3167 (264)
Space and water heating			823.5721 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	278.9274	0.5190	144.7633 (268)
Total CO2, kg/m2/year			1007.2604 (272)
Emissions per m2 for space and water heating			13.4968 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3724 (272b)
Emissions per m2 for pumps and fans			0.6379 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.4968 * 1.55) + 2.3724 + 0.6379, rounded to 2 d.p.			23.9300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.1366 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3026 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2572 (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	0.3279	0.3215	0.3150	0.2829	0.2765	0.2443	0.2443	0.2379	0.2572	0.2765	0.2893	0.3022 (22b)
Effective ac	0.5538	0.5517	0.5496	0.5400	0.5382	0.5298	0.5298	0.5283	0.5331	0.5382	0.5419	0.5457 (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
Window (Uw = 1.35)			11.9500	1.2808	15.3060		(27)
Main	58.3000	11.9500	46.3500	0.1800	8.3430	110.0000	5098.5000 (29a)
Total net area of external elements Aum(A, m ²)			58.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	23.6490		(33)
Party Wall 1			19.3200	0.0000	0.0000	45.0000	869.4000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			20.0000	1200.4000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10701.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							175.3846 (35)
Thermal bridges (User defined value 0.103 * total exposed area)							6.0049 (36)
Total fabric heat loss					(33) + (36) =		29.6539 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.7621	26.6612	26.5623	26.0978	26.0109	25.6064	25.6064	25.5314	25.7622	26.0109	26.1867	26.3705 (38)
Heat transfer coeff	56.4160	56.3151	56.2162	55.7517	55.6648	55.2602	55.2602	55.1853	55.4161	55.6648	55.8406	56.0244 (39)
Average = Sum(39)m / 12 =												55.7513 (39)
HLP	0.9245	0.9229	0.9213	0.9137	0.9122	0.9056	0.9056	0.9044	0.9082	0.9122	0.9151	0.9181 (40)
HLP (average)												0.9137 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy content (annual)	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1289.3164 (45)
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	28.4058	24.8439	25.6367	22.3507	21.4460	18.5063	17.1488	19.6785	19.9135	23.2073	25.3326	(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	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7940	14.0281	11.4084	8.6369	6.4562	5.4506	5.8896	7.6555	10.2752	13.0467	15.2274	16.2330	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	(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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	(71)
Water heating gains (Table 5)	38.1799	36.9701	34.4579	31.0426	28.8253	25.7032	23.0495	26.4496	27.6577	31.1926	35.1841	36.9752	(72)
Total internal gains	282.6406	281.4862	271.7648	255.8074	239.0758	223.3563	213.3975	216.7422	225.1595	241.2365	259.7424	274.1308	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				4.7400	11.2829		0.6700	0.7000	0.7700		17.3823 (75)	
Southwest				5.1900	36.7938		0.6700	0.7000	0.7700		62.0652 (79)	
Northwest				2.0200	11.2829		0.6700	0.7000	0.7700		7.4076 (81)	
Solar gains	86.8552	156.1807	235.5648	328.5362	401.4495	413.2650	392.3064	335.6596	267.4063	178.5100	105.5320	73.3596 (83)
Total gains	369.4958	437.6669	507.3296	584.3436	640.5253	636.6213	605.7038	552.4018	492.5658	419.7466	365.2743	347.4904 (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	52.6937	52.7882	52.8810	53.3216	53.4048	53.7958	53.7958	53.8689	53.6445	53.4048	53.2367	53.0620		
alpha	4.5129	4.5192	4.5254	4.5548	4.5603	4.5864	4.5864	4.5913	4.5763	4.5603	4.5491	4.5375		
util living area	0.9911	0.9804	0.9524	0.8735	0.7236	0.5382	0.3977	0.4525	0.7042	0.9238	0.9826	0.9931	(86)	
MIT	19.7739	19.9829	20.2927	20.6495	20.8843	20.9764	20.9952	20.9916	20.9241	20.5918	20.1096	19.7289	(87)	
Th 2	20.1467	20.1481	20.1495	20.1559	20.1571	20.1627	20.1627	20.1638	20.1606	20.1571	20.1547	20.1521	(88)	
util rest of house	0.9890	0.9761	0.9420	0.8479	0.6766	0.4738	0.3238	0.3734	0.6392	0.9022	0.9780	0.9915	(89)	
MIT 2	19.0215	19.2291	19.5328	19.8740	20.0773	20.1505	20.1611	20.1607	20.1157	19.8298	19.3614	18.9812	(90)	
Living area fraction														
MIT	19.3233	19.5315	19.8377	20.1851	20.4010	20.4818	20.4957	20.4940	20.4400	20.1355	19.6616	19.2812	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.3233	19.5315	19.8377	20.1851	20.4010	20.4818	20.4957	20.4940	20.4400	20.1355	19.6616	19.2812	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	364.5271	425.5374	475.6661	496.0437	442.4786	317.5685	214.0681	223.7128	326.0310	378.4364	356.0303	343.8331	(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	847.5563	823.9763	749.7941	629.1649	484.3416	325.0310	215.2792	225.9300	351.3382	530.7904	701.4456	844.9135	(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	359.3737	267.7509	203.9513	95.8472	31.1461	0.0000	0.0000	0.0000	0.0000	113.3514	248.6990	372.8038	(98)
Space heating												1692.9235	(98)
Space heating per m2												27.7437	(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	519.4462	408.9257	419.4084	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9509	0.9749	0.9634	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	493.9173	398.6568	404.0454	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	819.1792	781.5675	720.4536	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	234.1886	284.8855	235.4077	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												754.4818 (104)
Cooled Fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	58.5471	71.2214	58.8519	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												188.6205 (107)
Space cooling per m2												3.0911 (108)
Energy for space heating												27.7437 (99)
Energy for space cooling												3.0911 (108)
Total												30.8349 (109)
Dwelling Fabric Energy Efficiency (DFEE)												30.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1366 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3866 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3286 (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	0.4189	0.4107	0.4025	0.3614	0.3532	0.3122	0.3122	0.3039	0.3286	0.3532	0.3697	0.3861 (22b)
Effective ac	0.5878	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745 (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)			11.9500	1.3258	15.8428			(27)					
Main	58.3000	11.9500	46.3500	0.1800	8.3430			(29a)					
Total net area of external elements Aum(A, m2)			58.3000					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			24.1858		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.7873	(36)					
Total fabric heat loss						(33) + (36) =	29.9731	(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	28.4050	28.2403	28.0789	27.3207	27.1788	26.5184	26.5184	26.3961	26.7728	27.1788	27.4658	27.7658	(38)
Heat transfer coeff	58.3781	58.2134	58.0520	57.2938	57.1519	56.4915	56.4915	56.3693	56.7459	57.1519	57.4389	57.7389	(39)
Average = Sum(39)m / 12 =												57.2931	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9567	0.9540	0.9514	0.9389	0.9366	0.9258	0.9258	0.9238	0.9300	0.9366	0.9413	0.9462	(40)
HLP (average)												0.9389	(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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)											Total = Sum(45)m =	1289.3164 (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)
Heat gains from water heating, kWh/month												
	28.4058	24.8439	25.6367	22.3507	21.4460	18.5063	17.1488	19.6785	19.9135	23.2073	25.3326	27.5095 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	100.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.7940	14.0281	11.4084	8.6369	6.4562	5.4506	5.8896	7.6555	10.2752	13.0467	15.2274	16.2330	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5119	177.3331	172.7436	162.9731	150.6395	139.0477	131.3036	129.4823	134.0719	143.8424	156.1760	167.7678	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	33.0516	(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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	(71)
Water heating gains (Table 5)	38.1799	36.9701	34.4579	31.0426	28.8253	25.7032	23.0495	26.4496	27.6577	31.1926	35.1841	36.9752	(72)
Total internal gains	282.6406	281.4862	271.7648	255.8074	239.0758	223.3563	213.3975	216.7422	225.1595	241.2365	259.7424	274.1308	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				4.7400	11.2829	0.6300	0.7000	0.7700	16.3445 (75)				
Southwest				5.1900	36.7938	0.6300	0.7000	0.7700	58.3599 (79)				
Northwest				2.0200	11.2829	0.6300	0.7000	0.7700	6.9654 (81)				
Solar gains	81.6698	146.8565	221.5012	308.9221	377.4824	388.5925	368.8851	315.6202	251.4417	167.8527	99.2316	68.9799	(83)
Total gains	364.3104	428.3427	493.2660	564.7295	616.5582	611.9488	582.2826	532.3624	476.6013	409.0893	358.9739	343.1108	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

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	72.5872	72.7925	72.9949	73.9609	74.1445	75.0112	75.0112	75.1740	74.6750	74.1445	73.7740	73.3907	
alpha	5.8391	5.8528	5.8663	5.9307	5.9430	6.0007	6.0007	6.0116	5.9783	5.9430	5.9183	5.8927	
util living area	0.9980	0.9944	0.9815	0.9276	0.7855	0.5803	0.4254	0.4837	0.7609	0.9634	0.9951	0.9986	(86)
MIT	20.0248	20.1840	20.4290	20.7288	20.9244	20.9896	20.9986	20.9972	20.9537	20.6793	20.2942	19.9972	(87)
Th 2	20.1196	20.1218	20.1241	20.1345	20.1365	20.1456	20.1456	20.1473	20.1421	20.1365	20.1325	20.1284	(88)
util rest of house	0.9973	0.9926	0.9755	0.9053	0.7337	0.5074	0.3436	0.3959	0.6881	0.9475	0.9932	0.9981	(89)
MIT 2	19.2259	19.3861	19.6294	19.9226	20.0888	20.1412	20.1453	20.1465	20.1182	19.8844	19.5053	19.2057	(90)
Living area fraction									fLA = Living area / (4) =			0.4012	(91)
MIT	19.5464	19.7062	19.9502	20.2460	20.4240	20.4816	20.4876	20.4878	20.4533	20.2033	19.8218	19.5232	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5464	19.7062	19.9502	20.2460	20.4240	20.4816	20.4876	20.4878	20.4533	20.2033	19.8218	19.5232	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9915	0.9740	0.9085	0.7519	0.5365	0.3765	0.4312	0.7159	0.9490	0.9924	0.9977	(94)
Useful gains	363.1395	424.7148	480.4407	513.0727	463.5752	328.3153	219.2240	229.5722	341.2224	388.2114	356.2334	342.3187	(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	890.0566	861.9200	780.8100	650.0569	498.5960	332.2589	219.6179	230.4257	360.5266	548.8480	730.7251	884.7473	(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	392.0263	293.8019	223.4748	98.6286	26.0555	0.0000	0.0000	0.0000	0.0000	119.5136	269.6340	403.5669	(98)
Space heating												1826.7017	(98)
Space heating per m2												29.9361	(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	531.0205	418.0374	428.4063	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9678	0.9869	0.9786	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	513.9406	412.5482	419.2553	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	790.3412	754.1920	697.0309	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	199.0085	254.1830	206.6651	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												659.8565	(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													

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	49.7521	63.5458	51.6663	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													164.9641 (107)
Space cooling per m2													2.7034 (108)
Energy for space heating													29.9361 (99)
Energy for space cooling													2.7034 (108)
Total													32.6396 (109)
Target Fabric Energy Efficiency (TFEE)													37.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					3.3200
Infiltration rate					0.1660 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1411 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.1517	0.1482	0.1482	0.1376	0.1411	0.1199	0.1164	0.1164	0.1199	0.1340	0.1340	0.1376 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.35)			11.9500	1.2808	15.3060		(27)
Main	58.3000	11.9500	46.3500	0.1800	8.3430	110.0000	5098.5000 (29a)
Total net area of external elements Aum (m ²)			58.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.6490		(33)
Party Wall 1			19.3200	0.0000	0.0000	45.0000	869.4000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11302.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		185.2207 (35)
Thermal bridges (User defined value 0.103 * total exposed area)		6.0049 (36)
Total fabric heat loss	(33) + (36) =	29.6539 (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	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Average = Sum(39)m / 12 =	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178 (39)
HLP	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820 (40)
HLP (average)												0.8820 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy content (annual)	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6780 (55)	
Total storage loss													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	(56)	
If cylinder contains dedicated solar storage													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	20.3400	21.0180	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Total heat required for water heating calculated for each month													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746 (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													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746 (64)	
								Total per year (kWh/year) = Sum(64)m =					1536.7864 (64)
												1537 (64)	
RHI water heating demand													
Heat gains from water heating, kWh/month													
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.4851	35.0703	28.5211	21.5923	16.1405	13.6265	14.7239	19.1387	25.6879	32.6167	38.0685	40.5825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.9580	264.6763	257.8263	243.2434	224.8350	207.5338	195.9755	193.2572	200.1073	214.6902	233.0985	250.3997 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723 (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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains	473.0621	469.4727	452.1426	425.2870	397.9574	373.2569	358.6438	365.6604	380.9500	407.9928	438.0985	460.7162 (73)

[Jan]																		
			Area	Solar flux			g		FF		Access		Gains					
			m2	Table 6a			Specific data		Specific data		factor		W					
				W/m2			or Table 6b		or Table 6c		Table 6d							
Northeast			4.7400	9.9768			0.6700		0.7000		0.7700		15.3701 (75)					
Southwest			5.1900	32.4665			0.6700		0.7000		0.7700		54.7658 (79)					
Northwest			2.0200	9.9768			0.6700		0.7000		0.7700		6.5501 (81)					
Solar gains			76.6860	141.4778	223.0159	317.3617	378.3206	398.7170	369.3761	311.9754	260.1625	170.1311	95.7590	66.2428 (83)				
Total gains			549.7480	610.9505	675.1585	742.6487	776.2779	771.9739	728.0198	677.6358	641.1125	578.1239	533.8575	526.9590 (84)				

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	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356
alpha	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890
util living area												
	0.9546	0.9260	0.8619	0.7293	0.5464	0.3677	0.2732	0.3090	0.5175	0.7852	0.9226	0.9628 (86)
MIT	20.4186	20.5394	20.7081	20.8636	20.9362	20.9533	20.9552	20.9548	20.9436	20.8433	20.6051	20.3720 (87)
Th 2	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829 (88)
util rest of house												
	0.9454	0.9119	0.8379	0.6904	0.4959	0.3118	0.2130	0.2446	0.4546	0.7430	0.9055	0.9550 (89)
MIT 2	19.4252	19.5936	19.8225	20.0196	20.1009	20.1165	20.1177	20.1175	20.1091	20.0006	19.6886	19.3595 (90)
Living area fraction										fLA = Living area / (4) =		0.4012 (91)
MIT	19.8237	19.9730	20.1778	20.3582	20.4360	20.4522	20.4537	20.4534	20.4439	20.3387	20.0563	19.7657 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8237	19.9730	20.1778	20.3582	20.4360	20.4522	20.4537	20.4534	20.4439	20.3387	20.0563	19.7657 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					3.3200
Infiltration rate					0.1660 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.1411 (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	0.1799	0.1764	0.1728	0.1552	0.1517	0.1340	0.1340	0.1305	0.1411	0.1517	0.1587	0.1658 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.35)			11.9500	1.2808	15.3060		(27)
Main	58.3000	11.9500	46.3500	0.1800	8.3430	110.0000	5098.5000 (29a)
Total net area of external elements Aum(A, m ²)			58.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.6490		(33)
Party Wall 1			19.3200	0.0000	0.0000	45.0000	869.4000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11302.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		185.2207 (35)
Thermal bridges (User defined value 0.103 * total exposed area)		6.0049 (36)
Total fabric heat loss	(33) + (36) =	29.6539 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Heat transfer coeff	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178 (39)
Average = Sum(39)m / 12 =												53.8178 (39)
HLP	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820 (40)
HLP (average)												0.8820 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy conte	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Energy content (annual)										Total = Sum(45)m =		1289.3164 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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Water storage loss:													
Store volume												150.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)	
Temperature factor from Table 2b												0.6000 (49)	
Enter (49) or (54) in (55)												0.6780 (55)	
Total storage loss													
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(56)
If cylinder contains dedicated solar storage	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180	(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)
Total heat required for water heating calculated for each month													
	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
								Total per year (kWh/year) = Sum(64)m =				1536.7864	(64)
Heat gains from water heating, kWh/month													
	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.4851	35.0703	28.5211	21.5923	16.1405	13.6265	14.7239	19.1387	25.6879	32.6167	38.0685	40.5825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.9580	264.6763	257.8263	243.2434	224.8350	207.5338	195.9755	193.2572	200.1073	214.6902	233.0985	250.3997 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723 (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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains	473.0621	469.4727	452.1426	425.2870	397.9574	373.2569	358.6438	365.6604	380.9500	407.9928	438.0985	460.7162 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.7400	11.2829	0.6700	0.7000	0.7700	17.3823 (75)			
Southwest				5.1900	36.7938	0.6700	0.7000	0.7700	62.0652 (79)			
Northwest				2.0200	11.2829	0.6700	0.7000	0.7700	7.4076 (81)			
Solar gains	86.8552	156.1807	235.5648	328.5362	401.4495	413.2650	392.3064	335.6596	267.4063	178.5100	105.5320	73.3596 (83)
Total gains	559.9172	625.6534	687.7074	753.8231	799.4068	786.5220	750.9501	701.3200	648.3563	586.5029	543.6305	534.0758 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356
alpha	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890
util living area	0.9603	0.9337	0.8781	0.7643	0.6008	0.4335	0.3146	0.3516	0.5561	0.8102	0.9323	0.9673 (86)
MIT	20.3599	20.4899	20.6644	20.8318	20.9222	20.9499	20.9547	20.9540	20.9378	20.8162	20.5576	20.3163 (87)
Th 2	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829 (88)
util rest of house	0.9525	0.9215	0.8573	0.7300	0.5546	0.3799	0.2565	0.2898	0.4959	0.7728	0.9177	0.9607 (89)
MIT 2	19.3410	19.5235	19.7630	19.9802	20.0861	20.1138	20.1174	20.1170	20.1037	19.9668	19.6220	19.2792 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.4012 (91)
MIT	19.7498	19.9112	20.1247	20.3218	20.4215	20.4492	20.4533	20.4528	20.4383	20.3076	19.9973	19.6953 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7498	19.9112	20.1247	20.3218	20.4215	20.4492	20.4533	20.4528	20.4383	20.3076	19.9973	19.6953 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9476	0.9169	0.8557	0.7361	0.5684	0.3975	0.2758	0.3103	0.5151	0.7789	0.9139	0.9561 (94)
Useful gains	530.6023	573.6709	588.4457	554.8638	454.3751	312.6355	207.0969	217.6136	333.9540	456.8146	496.8489	510.6377 (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	831.4732	807.8701	733.2493	614.6984	469.3726	314.7916	207.3751	218.1118	341.1146	522.4402	694.1067	833.9224 (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	223.8479	157.3818	107.7339	43.0809	11.1581	0.0000	0.0000	0.0000	0.0000	48.8255	142.0257	240.5238 (98)
Space heating												974.5776 (98)
Space heating per m2										(98) / (4) =		15.9714 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 100.0000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 974.5776 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	223.8479	157.3818	107.7339	43.0809	11.1581	0.0000	0.0000	0.0000	0.0000	48.8255	142.0257	240.5238	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	223.8479	157.3818	107.7339	43.0809	11.1581	0.0000	0.0000	0.0000	0.0000	48.8255	142.0257	240.5238	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(219)
Water heating fuel used												1536.7864	(219)
Annual totals kWh/year													
Space heating fuel - main system												974.5776	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
 (MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.4480)
 mechanical ventilation fans (SFP = 0.4480) 80.0426 (230a)
 Total electricity for the above, kWh/year 80.0426 (231)
 Electricity for lighting (calculated in Appendix L) 278.9274 (232)
 Energy saving/generation technologies (Appendices M ,N and Q)
 Total delivered energy for all uses 2870.3339 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.00*15.29 + 1.00*5.50)	974.5776	5.5000	53.6018	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.0993	(243)
Low-rate fraction			0.9007	(244)
High-rate cost	152.6495	15.2900	23.3401	(245)
Low-rate cost	1384.1369	5.5000	76.1275	(246)
Mechanical ventilation fans (0.71*15.29 + 0.29*5.50)	80.0426	12.4509	9.9660	(249)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	0.0000	0.0000	0.0000	(249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	278.9274	14.3110	39.9173	(250)
Additional standing charges			24.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	0.0000	13.7505	0.0000	(252)
Total energy cost			226.9527	(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] = 0.8991 (257)
 SAP value 87.4579
 SAP rating (Section 12) 87 (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	974.5776	0.5190	505.8058	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	0.5190	797.5921	(264)
Space and water heating			1303.3979	(265)
Pumps and fans	80.0426	0.5190	41.5421	(267)
Energy for lighting	278.9274	0.5190	144.7633	(268)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	0.5190	-253.2720	(269)
Total kg/year			1236.4313	(272)
CO2 emissions per m2			20.2600	(273)
EI value			84.3726	
EI rating			84 (274)	
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$5.50 \times (1 + 0.29 \times 0.20) / 1.0000 = 5.819$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.20) / 1.0000 = 0.5491$, stars = 2
Water heating energy efficiency	$6.47 / 1.0000 = 6.472$, stars = 3
Water heating environmental impact	$0.519 / 1.0000 = 0.5190$, stars = 2

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	61.0200 (1b)	x 2.4000 (2b)	= 146.4480 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 146.4480 (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					3.3200
Infiltration rate					0.1660 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.1411 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.2000	4.2000	3.9000	4.0000	3.4000	3.3000	3.3000	3.4000	3.8000	3.8000	3.9000 (22)
Wind factor	1.0750	1.0500	1.0500	0.9750	1.0000	0.8500	0.8250	0.8250	0.8500	0.9500	0.9500	0.9750 (22a)
Adj infilt rate	0.1517	0.1482	0.1482	0.1376	0.1411	0.1199	0.1164	0.1164	0.1199	0.1340	0.1340	0.1376 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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
Window (Uw = 1.35)			11.9500	1.2808	15.3060		(27)
Main	58.3000	11.9500	46.3500	0.1800	8.3430	110.0000	5098.5000 (29a)
Total net area of external elements Aum(A, m ²)			58.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.6490		(33)
Party Wall 1			19.3200	0.0000	0.0000	45.0000	869.4000 (32)
Party Floor 1			61.0200			40.0000	2440.8000 (32d)
Party Ceilings 1			60.0200			30.0000	1800.6000 (32b)
Internal Wall 1			121.4300			9.0000	1092.8700 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11302.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		185.2207 (35)
Thermal bridges (User defined value 0.103 * total exposed area)		6.0049 (36)
Total fabric heat loss	(33) + (36) =	29.6539 (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	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639	24.1639 (38)
Average = Sum(39)m / 12 =	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178	53.8178 (39)
HLP	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820	0.8820 (40)
HLP (average)												0.8820 (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												2.0103 (42)
Average daily hot water use (litres/day)												81.9452 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	90.1397	86.8619	83.5841	80.3063	77.0284	73.7506	73.7506	77.0284	80.3063	83.5841	86.8619	90.1397 (44)
Energy content (annual)	133.6745	116.9126	120.6433	105.1798	100.9225	87.0884	80.7002	92.6047	93.7107	109.2108	119.2121	129.4566 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0512	17.5369	18.0965	15.7770	15.1384	13.0633	12.1050	13.8907	14.0566	16.3816	17.8818	19.4185 (46)

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Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1300 (48)
Temperature factor from Table 2b												0.6000 (49)
Enter (49) or (54) in (55)												0.6780 (55)
Total storage loss												
	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180 (56)
If cylinder contains dedicated solar storage	21.0180	18.9840	21.0180	20.3400	21.0180	20.3400	21.0180	21.0180	20.3400	21.0180	20.3400	21.0180 (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)
Total heat required for water heating calculated for each month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746 (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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746 (64)
								Total per year (kWh/year) = Sum(64)m =				1536.7864 (64)
Heat gains from water heating, kWh/month	61.2612	54.0606	56.9283	51.2443	50.3711	45.2289	43.6472	47.6055	47.4308	53.1270	55.9100	59.8587 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193	120.6193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.4851	35.0703	28.5211	21.5923	16.1405	13.6265	14.7239	19.1387	25.6879	32.6167	38.0685	40.5825 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.9580	264.6763	257.8263	243.2434	224.8350	207.5338	195.9755	193.2572	200.1073	214.6902	233.0985	250.3997 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723	49.0723 (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)	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129	-80.4129 (71)
Water heating gains (Table 5)	82.3403	80.4474	76.5165	71.1726	67.7031	62.8179	58.6656	63.9858	65.8761	71.4072	77.6528	80.4553 (72)
Total internal gains	473.0621	469.4727	452.1426	425.2870	397.9574	373.2569	358.6438	365.6604	380.9500	407.9928	438.0985	460.7162 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.7400	9.9768	0.6700	0.7000	0.7700	15.3701 (75)			
Southwest				5.1900	32.4665	0.6700	0.7000	0.7700	54.7658 (79)			
Northwest				2.0200	9.9768	0.6700	0.7000	0.7700	6.5501 (81)			
Solar gains	76.6860	141.4778	223.0159	317.3617	378.3206	398.7170	369.3761	311.9754	260.1625	170.1311	95.7590	66.2428 (83)
Total gains	549.7480	610.9505	675.1585	742.6487	776.2779	771.9739	728.0198	677.6358	641.1125	578.1239	533.8575	526.9590 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356	58.3356
alpha	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890	4.8890
util living area	0.9546	0.9260	0.8619	0.7293	0.5464	0.3677	0.2732	0.3090	0.5175	0.7852	0.9226	0.9628 (86)
MIT	20.4186	20.5394	20.7081	20.8636	20.9362	20.9533	20.9552	20.9548	20.9436	20.8433	20.6051	20.3720 (87)
Th 2	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829	20.1829 (88)
util rest of house	0.9454	0.9119	0.8379	0.6904	0.4959	0.3118	0.2130	0.2446	0.4546	0.7430	0.9055	0.9550 (89)
MIT 2	19.4252	19.5936	19.8225	20.0196	20.1009	20.1165	20.1177	20.1175	20.1091	20.0006	19.6886	19.3595 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.4012 (91)
MIT	19.8237	19.9730	20.1778	20.3582	20.4360	20.4522	20.4537	20.4534	20.4439	20.3387	20.0563	19.7657 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8237	19.9730	20.1778	20.3582	20.4360	20.4522	20.4537	20.4534	20.4439	20.3387	20.0563	19.7657 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9407	0.9078	0.8377	0.6991	0.5118	0.3303	0.2330	0.2660	0.4750	0.7515	0.9025	0.9504 (94)
Useful gains	517.1222	554.6175	565.5963	519.1636	397.2884	254.9801	169.6182	180.2688	304.5372	434.4830	481.7816	500.8069 (95)
Ext temp.	5.2000	5.8000	7.4000	9.9000	12.9000	15.7000	17.3000	17.1000	14.7000	11.3000	7.9000	5.0000 (96)
Heat loss rate W	787.0176	762.7609	687.6711	562.8346	405.5719	255.7528	169.7235	180.4743	309.1231	486.4418	654.2229	794.6560 (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	200.8021	139.8724	90.8236	31.4431	6.1630	0.0000	0.0000	0.0000	0.0000	38.6573	124.1578	218.6237 (98)
Space heating												850.5431 (98)
Space heating per m2												13.9388 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 100.0000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 850.5431 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	200.8021	139.8724	90.8236	31.4431	6.1630	0.0000	0.0000	0.0000	0.0000	38.6573	124.1578	218.6237	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	200.8021	139.8724	90.8236	31.4431	6.1630	0.0000	0.0000	0.0000	0.0000	38.6573	124.1578	218.6237	(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	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	154.6925	135.8966	141.6613	125.5198	121.9405	107.4284	101.7182	113.6227	114.0507	130.2288	139.5521	150.4746	(219)
Water heating fuel used												1536.7864	(219)
Annual totals kWh/year													
Space heating fuel - main system												850.5431	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
 (MEVCentralised, Database: in-use factor = 1.4000, SFP = 0.4480)
 mechanical ventilation fans (SFP = 0.4480) 80.0426 (230a)
 Total electricity for the above, kWh/year 80.0426 (231)
 Electricity for lighting (calculated in Appendix L) 278.9274 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 Total delivered energy for all uses 2746.2995 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (0.00*43.39 + 1.00*12.14)	850.5431	12.1400	103.2559	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (electric off-peak tariff)				
High-rate fraction			0.0993	(243)
Low-rate fraction			0.9007	(244)
High-rate cost	152.6495	43.3900	66.2346	(245)
Low-rate cost	1384.1369	12.1400	168.0342	(246)
Mechanical ventilation fans (0.71*43.39 + 0.29*12.14)	80.0426	34.3275	27.4766	(249)
Pumps and fans for heating (0.90*43.39 + 0.10*12.14)	0.0000	0.0000	0.0000	(249)
Energy for lighting (0.90*43.39 + 0.10*12.14)	278.9274	40.2650	112.3101	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	0.0000	38.5575	0.0000	(252)
Total energy cost			477.3115	(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	850.5431	0.5190	441.4319	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	0.5190	797.5921	(264)
Space and water heating			1239.0240	(265)
Pumps and fans	80.0426	0.5190	41.5421	(267)
Energy for lighting	278.9274	0.5190	144.7633	(268)
Energy saving/generation technologies				
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	0.5190	-253.2720	(269)
Total kg/year			1172.0574	(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	850.5431	3.0700	2611.1673	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating	1536.7864	3.0700	4717.9341	(264)
Space and water heating			7329.1014	(265)
Pumps and fans	80.0426	3.0700	245.7308	(267)
Energy for lighting	278.9274	3.0700	856.3071	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit (0.90*43.39 + 0.10*12.14)	-488.0000	3.0700	-1498.1600 (269)
Primary energy kWh/year			6932.9793 (272)
Primary energy kWh/m ² /year			113.6181 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 84

(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/m ²

Potential energy efficiency rating:	B 87
Potential environmental impact rating:	B 84

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current £477	Potential £477	Saving £0
Electricity			
Space heating	£131	£131	£0
Water heating	£234	£234	£0
Lighting	£112	£112	£0
Total cost of fuels	£477	£477	£0
Total cost of uses	£477	£477	£0
Delivered energy	45 kWh/m ²	45 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m ²	19 kg/m ²	19 kg/m ²	0 kg/m ²
Primary energy	114 kWh/m ²	114 kWh/m ²	0 kWh/m ²

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	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	West Pennines
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	185.2 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	193.31 (P1)
Transmission heat loss coefficient	29.65 (37)
Summer heat loss coefficient	222.97 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.7400	89.6552	0.6700	0.7000	0.9000	161.4401
South West	5.1900	112.1012	0.6700	0.7000	0.9000	221.0220
North West	2.0200	89.6552	0.6700	0.7000	0.9000	68.7994
total:						451.2615

	Jun	Jul	Aug	
Solar gains	490	451	380	(P3)
Internal gains	373	359	366	
Total summer gains	864	810	745	(P5)

	3.87	3.63	3.34	
Summer gain/loss ratio				(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 185.2)	0.70	0.70	0.70	
Threshold temperature	19.28	20.74	20.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight