



Carbon Emissions Reduction Statement

Modulhaus™

For



Volumetric Modular Limited

August 2020

Contents

19% Carbon Emissions Reduction Statement	1
Contents	2
Summary	3
Local Planning Requirements.....	3
Recommendation.....	3
Method.....	4
Baseline Carbon Emission Calculations	4
Demand Reduction (Be Lean)	6
Passive Design Measures.....	6
Active Design Measures	7
Supply Energy Efficiently (Be Clean)	8
Low Carbon/Renewable Energy (Be Green)	8
Conclusion.....	8
Appendix 1 DER and TER Worksheets Clean, Green and Baseline	
Appendix 2 DFEE and TFEE Worksheets	

Summary

This report was commissioned by Volumetric Modular Limited in respect of the Modulhaus™ unit in order to demonstrate that Modulhaus™ will achieve reductions in CO₂ emissions of 19% below the Target Emission Rate of the 2013 edition of Part L of the Building Regulations.

The calculations have been carried out in accordance to SAP2012 methodology and Part L1A 2013 requirements.

Local Planning Requirements

The proposed planning permission condition 14 states :-

The development, hereby permitted, shall not be used or occupied until, carbon reduction measures have been implemented in accordance with a Carbon Reduction Statement which shall be submitted to and approved in writing by the local planning authority prior to implementation. This shall demonstrate that all new residential units shall achieve reductions in CO₂ emissions of 19% below the Target Emission Rate of the 2013 edition of Part L of the Building Regulations, and shall include the following details:

- a) Levels of carbon reduction achieved at each stage of the energy hierarchy;*
- b) A summary table showing the percentage improvement in Dwelling Emission Rate over the Target Emission Rate for each proposed unit*

Recommendation

Use a combination of fabric first approach coupled with community heating. The total regulated carbon dioxide emission savings contributed by these methods is 39.17% allowing Modulhaus™ to surpass the planning requirement.

Method

Modulhaus™ will be compared to Building Regulations Part L1A 2013 baselines. As the unit can be installed in any orientation with any number of sheltered sides the worst case giving the lowest reduction will be used.

The potential CO₂ savings for this development will be determined in accordance with the three step Energy Hierarchy:

- **Be Lean** - Improve the energy efficiency of the scheme
- **Be Clean** - Supply as much of the remaining energy requirement with low-carbon technologies such as combined heat and power (CHP)
- **Be Green** - Offset a proportion of the remaining carbon dioxide emissions by using renewable technologies.

Baseline Carbon Emission Calculations

The regulated CO₂ emissions assuming the development complied with Part L 2013 of the Building Regulations using Building Regulations approved compliance software for SAP2012 (Elmhurst DesignSAP) has been carried out.

The baseline emissions are derived by taking the Target Emission Rate (SAP ref 273) and multiplying by the total floor area (SAP ref 4). The TER worksheets can be found in appendix 2

Kg/CO ₂ /year	Item	Target Emission Rate	Total Floor Area	Totals
	SAP Ref	273	4	
	North	52.14	23.41	1220.60
	North East	52.17	23.41	1221.30
	East	52.03	23.41	1218.02
	South East	51.71	23.41	1210.53
	South	51.48	23.41	1205.15
	South West	51.71	23.41	1210.53
	West	52.03	23.41	1218.02
	North West	52.17	23.41	1221.3
				9725.45

Baseline Carbon Emissions = 9725.45 kg/CO₂/pa

Demand Reduction (Be Lean)

Passive Design Measures

Design features improving on Notional Dwelling values.

Item	Thermal Specification	U Value / Comment	Notional Dwelling	% Improvement
Floor	20mm Fermacel 2E11 Dry Screed Board; 70mm Celotex GA4000 insulation; 150mm Celotex XR4000 insulation; 15mm OSB; 0.5mm rolled steel skin; rectangular hollow section joist.	0.10W/m ² K	0.13 W/m ² K	23%
Wall	12.5mm Fermacel Board; 19mm; 12.5mm Standard Plasterboard; Visqueen Vapour Barrier; 150mm Celotex GA4000; 19mm low emissivity air space bridged with 46x19mm horizontal battens at 640mm centres; 0.9mm dimpled and castellated steel skin 50mm ventilated air gap; cladding. Helping hands fixed to welded brackets to prevent any encroachment into insulation.	0.14W/m ² K	0.18 W/m ² K	22%
Door	IG Solid door with manufacturer's declared U value.	1.00W/m ² K	1.2 W/m ² K	17%
Design Air Permeability Rate	3 m ³ /h.m ² @50Pa		5 m ³ /h.m ² @50Pa	40%
Non-Repeating Thermal Bridging Heat Loss	Y=3.37 (SAP Ref 36)	This is at junctions of elements (lintels, cills, jambs, ground floor perimeter, eaves, gables etc).	Y=9.32	64%

Active Design Measures

Community Heating and Hot water with high efficiency air source heat pump.

Low energy lighting will be used throughout the development.

Mechanical Ventilation with Heat Recovery with low specific fan power and efficient heat recovery.

The Lean emissions are derived by from boxes 261 to 268 of the Dwelling Emissions Worksheets. The DER worksheets can be found in appendix 2

Kg/CO ₂ /year	Item	Dwelling Emission Rate	Total Floor Area	Totals
	SAP Ref	273	4	
	North	31.73	23.41	742.8
	North East	31.75	23.41	743.27
	East	31.65	23.41	740.93
	South East	31.44	23.41	736.01
	South	31.3	23.41	732.73
	South West	31.44	23.41	736.01
	West	31.65	23.41	740.93
	North West	31.75	23.41	743.27
				5915.95

Savings from Energy Reduction 3809.5

Percentage Saving 39.17%

Lean Carbon Emissions = 5915.95kg/CO₂/pa

Supply Energy Efficiently (Be Clean)

The heating and cooling systems for Modulhaus™ have been considered.

It is understood that there are no existing or planned CCHP/CHP distribution networks local to the site. In this regard, connection to an adjacent or decentralised heat/cooling network is deemed unfeasible at this stage. However a high efficiency community heating system has been specified for Modulhaus™.

Clean Carbon Emissions = 5942.48kg/CO₂/pa

Low Carbon/Renewable Energy (Be Green)

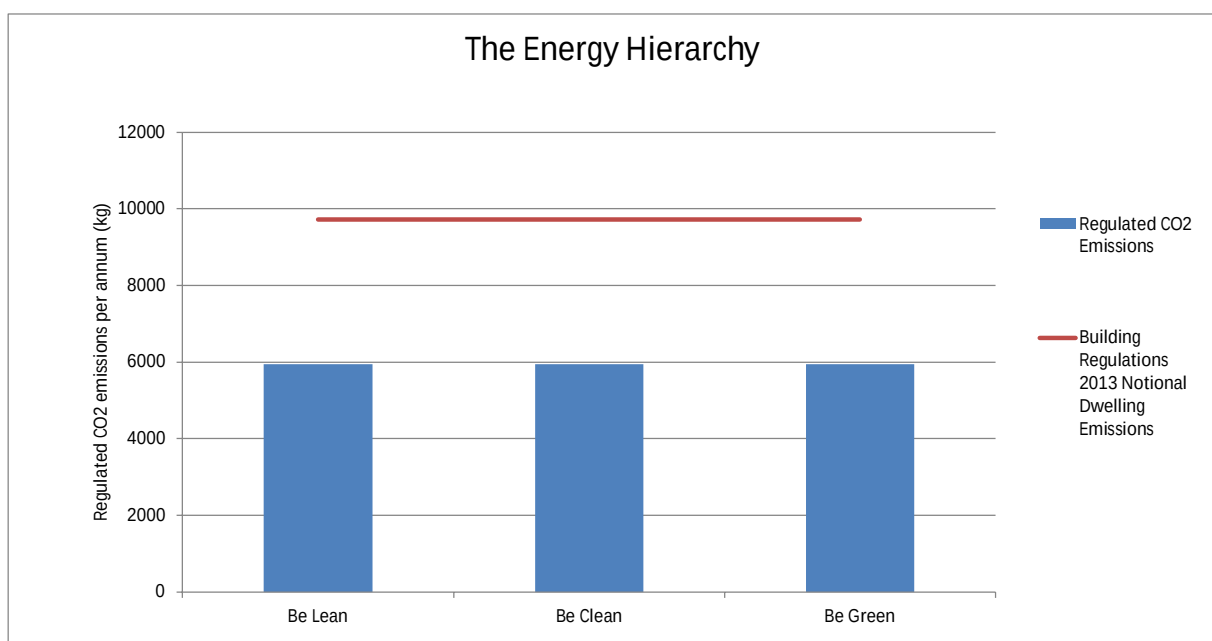
Modulhaus™ has been designed from the outset to use a low carbon heat source and already demonstrates a carbon emissions reduction of 39.17% over Part L1A..

Green Carbon Emissions = 5942.48kg/CO₂/pa

Conclusion

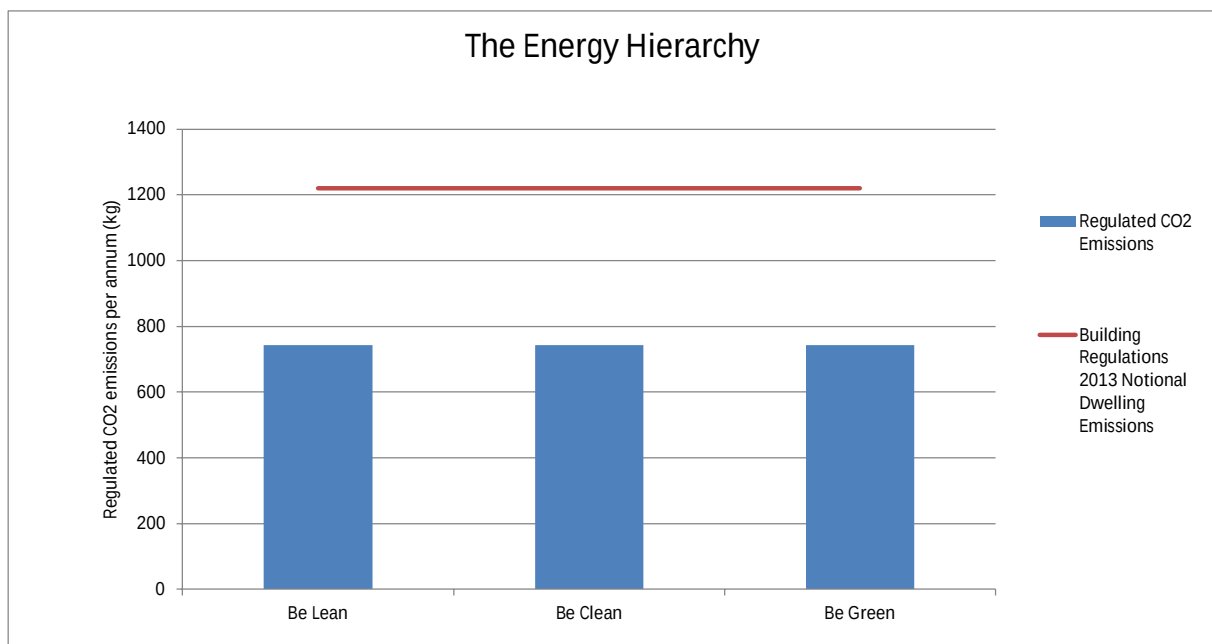
The graphs below provides a summary of the regulated CO₂ savings at each stage of the Energy Hierarchy. The solid blue line indicated the baseline condition which is equivalent to a notional building built to current L1A 2013 regulations.

Average of every Cardinal and Ordinal orientation



When taking into account every Cardinal and Ordinal orientation Modulhaus™ will reduce CO₂ emissions by 39.17% when compared with a notional building built in accordance with Building Regulations Part L1A 2013.

Worst Case Orientation (N, NE and NW)



The worst case orientation scheme will reduce CO₂ emissions by 39.14% when compared with a notional building built in accordance with Building Regulations Part L1A 2013.



Appendix 1 DER and TER Worksheets Clean, Green and Baseline

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction E	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.65	TER	52.03	
Environmental	86 B	% DER<TER	39.17			
CO ₂ Emissions (t/year)	0.66	DFEE	54.95	TFEE	87.54	
General Requirements Compliance	Pass	% DFEE<TFEE	37.23			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 52.03 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 31.65 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)87.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder
-------------------	-------------

6 Controls

Space heating controls:	Flat rate charging, programmer and TRVs	OK
-------------------------	---	----

Hot water controls:

No cylinder

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:	0.73
Maximum	1.5 OK
MVHR efficiency:	81%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading:

Average

Windows facing East: 2.10 m², No overhang

Windows facing West: 1.28 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour	
					heating		heating					
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												
Measured/design AP50												
Infiltration rate												
Number of sides sheltered												
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.7000 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
												0.5000 (23a)
												56.7000 (23c)
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(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)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	(64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	(65)
Total per year (kWh/year) = Sum (64)m =											1587.6732	(64)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	(72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	(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	
East					2.1000	19.6403	0.5800	0.7400	0.7700		12.2676	
West					1.2800	19.6403	0.5800	0.6400	0.7700		6.4669 (76)	
Solar gains	18.7345	36.6487	60.3552	88.0245	107.8773	110.4316	105.1354	90.3098	70.1956	43.4868	23.3598	15.4064 (83)
Total gains	251.3447	267.8637	285.2411	303.0321	313.4525	306.4816	294.7298	283.7896	268.5218	251.8273	243.1498	243.2083 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9355	0.9183	0.8817	0.8088	0.6939	0.5392	0.4049	0.4352	0.6305	0.8198	0.9077	0.9409 (86)
MIT	19.5619	19.7306	20.0362	20.4183	20.7269	20.9127	20.9739	20.9665	20.8497	20.4779	19.9700	19.5241 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9242	0.9041	0.8609	0.7751	0.6406	0.4625	0.3115	0.3409	0.5561	0.7812	0.8895	0.9305 (89)
MIT 2	18.6285	18.7927	19.0869	19.4495	19.7210	19.8723	19.9096	19.9079	19.8279	19.5131	19.0342	18.5971 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1803	19.3472	19.6481	20.0223	20.3157	20.4874	20.5388	20.5337	20.4320	20.0835	19.5874	19.1451 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1803	19.3472	19.6481	20.0223	20.3157	20.4874	20.5388	20.5337	20.4320	20.0835	19.5874	19.1451 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9155	0.8959	0.8555	0.7789	0.6614	0.5039	0.3659	0.3955	0.5930	0.7879	0.8833	0.9219	(94)
Useful gains	230.1126	239.9789	244.0230	236.0269	207.3130	154.4456	107.8522	112.2251	159.2383	198.4062	214.7837	224.2255	(95)
Ext temp.	4.3000	4.9000	6.5000	8.1000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	427.9799	414.8198	376.8793	316.1038	244.4453	165.6056	110.7944	116.0759	178.7287	269.0670	355.5102	426.9337	(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	147.2133	117.4931	98.8451	57.6554	27.6264	0.0000	0.0000	0.0000	0.0000	52.5716	101.3231	150.8149	(98)
Space heating												753.5428	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 32.1889 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	753.5428 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1186.8299 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	36.8742 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3896.4531 (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			312.0000 (367a)
Space heating from Heat pump	1181.8638	0.5190	613.3873 (367)
Electrical energy for heat distribution	36.8742	0.5190	19.1377 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			632.5250 (373)
Space and water heating			632.5250 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			741.0157 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.6500 (384)

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

DER	31.6500 ZC1
Total Floor Area	23.4100
Assumed number of occupants	TFA
CO2 emission factor in Table 12 for electricity displaced from grid	N
CO2 emissions from appliances, equation (L14)	1.0670
CO2 emissions from cooking, equation (L16)	EF
Total CO2 emissions	0.5190
Residual CO2 emissions offset from biofuel CHP	20.9818 ZC2
Additional allowable electricity generation, kWh/m²/year	6.1772 ZC3
Resulting CO2 emissions offset from additional allowable electricity generation	58.8090 ZC4
Net CO2 emissions	0.0000 ZC5
	0.0000 ZC6
	0.0000 ZC7
	58.8090 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.3266 (36)			
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

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													1531.5040 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	267.0334	218.1211	191.8495	120.2791	63.1551	0.0000	0.0000	0.0000	0.0000	109.6885	191.1605	270.6691	(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)	285.5972	233.2846	205.1867	128.6407	67.5456	0.0000	0.0000	0.0000	0.0000	117.3139	204.4497	289.4856	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4443	86.2438	85.7656	84.7866	83.1930	79.8000	79.8000	79.8000	79.8000	84.4477	85.8065	86.5323	(216)
Fuel for water heating, kWh/month	166.2625	147.2985	156.5382	143.3208	144.1545	135.8038	131.8706	142.7101	141.8336	149.1441	153.4999	162.5517	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1531.5040 (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)													139.0760 (232)
Total delivered energy for all uses													3520.5681 (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	1531.5040	0.2160	330.8049 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.9881	0.2160	383.3974 (264)
Space and water heating			714.2023 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			825.3077 (272)
Emissions per m2 for space and water heating			30.5084 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.5084 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			52.0300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction N	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.73	TER	52.14
Environmental	86 B	% DER<TER	39.14		
CO ₂ Emissions (t/year)	0.67	DFEE	55.04	TFEE	87.68
General Requirements Compliance	Pass	% DFEE<TFEE	37.23		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 52.14 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 31.73 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)87.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Flat rate charging, programmer and TRVs OK

Hot water controls:

No cylinder

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:	0.73
Maximum	1.5 OK
MVHR efficiency:	81%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:

Average

Windows facing North: 2.10 m², No overhang

Windows facing South: 1.28 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
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													3.0000
Infiltration rate													0.1500 (18)
Number of sides sheltered													4 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)	
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(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)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	(64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	(65)
Total per year (kWh/year) = Sum (64)m =											1587.6732	(64)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	(72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	(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				2.1000	10.6334	0.5800	0.7400			0.7700	6.6418 (74)	
South				1.2800	46.7521	0.5800	0.6400			0.7700	15.3940 (78)	

Solar gains	22.0358	37.9042	53.6830	70.9407	84.4921	86.3600	82.2091	71.5447	59.4797	42.3020	26.4406	18.8388 (83)
Total gains	254.6459	269.1191	278.5689	285.9483	290.0673	282.4100	271.8034	265.0246	257.8059	250.6425	246.2307	246.6407 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9334	0.9174	0.8874	0.8281	0.7259	0.5745	0.4353	0.4620	0.6482	0.8214	0.9050	0.9389 (86)
MIT	19.5770	19.7360	20.0111	20.3693	20.6860	20.8949	20.9678	20.9602	20.8368	20.4745	19.9826	19.5401 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9219	0.9031	0.8674	0.7962	0.6740	0.4957	0.3363	0.3633	0.5737	0.7829	0.8864	0.9282 (89)
MIT 2	18.6429	18.7978	19.0638	19.4070	19.6898	19.8620	19.9073	19.9053	19.8196	19.5102	19.0459	18.6124 (90)
Living area fraction	fLA = Living area / (4) =											0.5912 (91)
MIT	19.1951	19.3525	19.6238	19.9759	20.2788	20.4726	20.5343	20.5289	20.4210	20.0803	19.5997	19.1609 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1951	19.3525	19.6238	19.9759	20.2788	20.4726	20.5343	20.5289	20.4210	20.0803	19.5997	19.1609 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9132	0.8949	0.8616	0.7983	0.6926	0.5374	0.3938	0.4202	0.6100	0.7894	0.8804	0.9196 (94)
Useful gains	232.5387	240.8404	240.0273	228.2728	200.8883	151.7654	107.0262	111.3515	157.2672	197.8687	216.7931	226.8042 (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	428.4056	414.9707	376.1834	314.7868	243.3980	165.1904	110.6662	115.9408	178.4161	268.9759	355.8596	427.3839 (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	145.7250	117.0156	101.3001	62.2901	31.6272	0.0000	0.0000	0.0000	0.0000	52.9037	100.1279	149.2313 (98)
Space heating												760.2209 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2

(98) / (4) = 32.4742 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	760.2209 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1197.3479 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	36.9793 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3906.9710 (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			312.0000 (367a)
Space heating from Heat pump	1185.2350	0.5190	615.1370 (367)
Electrical energy for heat distribution	36.9793	0.5190	19.1923 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			634.3292 (373)
Space and water heating			634.3292 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			742.8199 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.7300 (384)

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

DER	31.7300 ZC1
Total Floor Area	23.4100
Assumed number of occupants	N 1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	20.9818 ZC2
CO2 emissions from cooking, equation (L16)	6.1772 ZC3
Total CO2 emissions	58.8890 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	58.8890 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.3266 (36)			
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

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													1539.1305 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	264.3851	216.5343	194.3525	127.1289	70.5770	0.0000	0.0000	0.0000	0.0000	109.3712	188.7393	267.9986	(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)	282.7649	231.5875	207.8637	135.9667	75.4834	0.0000	0.0000	0.0000	0.0000	116.9746	201.8602	286.6295	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4192	86.2251	85.7997	84.9343	83.4555	79.8000	79.8000	79.8000	79.8000	84.4401	85.7729	86.5075	(216)
Fuel for water heating, kWh/month	166.3108	147.3305	156.4758	143.0715	143.7010	135.8038	131.8706	142.7101	141.8336	149.1576	153.5600	162.5983	(219)
Water heating fuel used												1774.4235	(219)
Annual totals kWh/year													
Space heating fuel - main system												1539.1305	(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)												139.0760	(232)
Total delivered energy for all uses												3527.6300	(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	1539.1305	0.2160	332.4522 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.4235	0.2160	383.2755 (264)
Space and water heating			715.7277 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			826.8331 (272)
Emissions per m2 for space and water heating			30.5736 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.5736 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			52.1400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction NE	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.75	TER	52.17
Environmental	86 B	% DER<TER	39.14		
CO ₂ Emissions (t/year)	0.67	DFEE	55.26	TFEE	87.94
General Requirements Compliance	Pass	% DFEE<TFEE	37.16		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 52.17 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 31.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)87.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder
-------------------	-------------

6 Controls

Space heating controls:	Flat rate charging, programmer and TRVs	OK
-------------------------	---	----

Hot water controls:

No cylinder

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:	0.73	
Maximum	1.5	OK
MVHR efficiency:	81%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading: Average

Windows facing North East: 2.10 m², No overhang

Windows facing South West: 1.28 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour	
					heating		heating					
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												3.0000
Infiltration rate												0.1500 (18)
Number of sides sheltered												4 (19)
Shelter factor										(20) = 1 -	[0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
Solar input	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416 (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)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416 (64)
Total per year (kWh/year) = Sum (64)m =												1587.6732 (64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	75.4980 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	101.4758 (72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	227.8019 (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				2.1000	11.2829	0.5800	0.7400			0.7700			7.0475 (75)
Southwest				1.2800	36.7938	0.5800	0.6400			0.7700			12.1151 (79)
Solar gains	19.1626	34.9818	54.0815	77.4316	96.2426	99.7310	94.4100	79.7364	62.0668	40.3389	23.3786	16.1233 (83)	
Total gains	251.7727	266.1968	278.9674	292.4392	301.8178	295.7810	284.0043	273.2163	260.3930	248.6794	243.1687	243.9252 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9352	0.9194	0.8871	0.8208	0.7097	0.5544	0.4187	0.4499	0.6438	0.8239	0.9076	0.9405 (86)
MIT	19.5639	19.7234	20.0126	20.3884	20.7074	20.9053	20.9712	20.9631	20.8400	20.4687	19.9701	19.5274 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9239	0.9054	0.8670	0.7881	0.6569	0.4768	0.3227	0.3532	0.5694	0.7857	0.8894	0.9300 (89)
MIT 2	18.6304	18.7860	19.0652	19.4236	19.7062	19.8680	19.9086	19.9065	19.8217	19.5054	19.0342	18.6003 (90)
Living area fraction	fLA = Living area / (4) =											0.5912 (91)
MIT	19.1822	19.3402	19.6253	19.9940	20.2981	20.4813	20.5368	20.5312	20.4237	20.0749	19.5875	19.1484 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1822	19.3402	19.6253	19.9940	20.2981	20.4813	20.5368	20.5312	20.4237	20.0749	19.5875	19.1484 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9152	0.8972	0.8613	0.7909	0.6767	0.5184	0.3785	0.4090	0.6059	0.7921	0.8833	0.9215	(94)
Useful gains	230.4284	238.8302	240.2685	231.2921	204.2396	153.3282	107.4933	111.7567	157.7607	196.9704	214.7961	224.7659	(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													
	428.0353	414.6185	376.2254	315.3006	243.9458	165.4329	110.7387	116.0035	178.4945	268.8235	355.5123	427.0281	(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													
	147.0196	118.1297	101.1519	60.4861	29.5414	0.0000	0.0000	0.0000	0.0000	53.4587	101.3157	150.4830	(98)
Space heating												761.5861	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 32.5325 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	761.5861 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1199.4982 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	37.0008 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3909.1213 (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			312.0000 (367a)
Space heating from Heat pump	1185.9242	0.5190	615.4946 (367)
Electrical energy for heat distribution	37.0008	0.5190	19.2034 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			634.6981 (373)
Space and water heating			634.6981 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			743.1887 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.7500 (384)

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

DER	31.7500 ZC1
Total Floor Area	23.4100
Assumed number of occupants	N 1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	20.9818 ZC2
CO2 emissions from cooking, equation (L16)	6.1772 ZC3
Total CO2 emissions	58.9090 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	58.9090 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.3266 (36)			
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

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													1541.3439 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	266.2929	218.3283	194.4589	124.4284	66.6687	0.0000	0.0000	0.0000	0.0000	110.5442	190.6270	269.8082	(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)	284.8052	233.5062	207.9774	133.0785	71.3035	0.0000	0.0000	0.0000	0.0000	118.2291	203.8791	288.5649	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4373	86.2463	85.8012	84.8770	83.3197	79.8000	79.8000	79.8000	79.8000	84.4682	85.7991	86.5243	(216)
Fuel for water heating, kWh/month	166.2759	147.2943	156.4732	143.1681	143.9353	135.8038	131.8706	142.7101	141.8336	149.1081	153.5130	162.5667	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1541.3439 (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)													139.0760 (232)
Total delivered energy for all uses													3529.9725 (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	1541.3439	0.2160	332.9303 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.5526	0.2160	383.3034 (264)
Space and water heating			716.2337 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			827.3391 (272)
Emissions per m2 for space and water heating			30.5952 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.5952 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			52.1700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction NW	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.75	TER	52.17
Environmental	86 B	% DER<TER	39.14		
CO ₂ Emissions (t/year)	0.67	DFEE	55.26	TFEE	87.94
General Requirements Compliance	Pass	% DFEE<TFEE	37.16		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 52.17 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 31.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)87.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Flat rate charging, programmer and TRVs OK

Hot water controls:

No cylinder

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:	0.73
Maximum	1.5 OK
MVHR efficiency:	81%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:

Average

Windows facing South East: 1.28 m², No overhang

Windows facing North West: 2.10 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour			
					heating		heating							
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													3.0000	
Infiltration rate													0.1500 (18)	
Number of sides sheltered													4 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.7000 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)		
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =												936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m													
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	14.1097	(46)
Water storage loss:													
Store volume													110.0000 (47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0152 (51)
Volume factor from Table 2a													1.0294 (52)
Temperature factor from Table 2b													0.6000 (53)
Enter (49) or (54) in (55)													1.0327 (55)
Total storage loss													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(56)
If cylinder contains dedicated solar storage													
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	(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													
Solar input	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(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	0.0000	(63)
Solar input (sum of months) = Sum (63)m =													0.0000 (63)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(64)
Total per year (kWh/year) = Sum (64)m =													1587.6732 (64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	75.4980	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	101.4758	(72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	227.8019	(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
Northwest				2.1000	11.2829	0.5800	0.7400			0.7700			7.0475 (81)
Southeast				1.2800	36.7938	0.5800	0.6400			0.7700			12.1151 (77)
Solar gains	19.1626	34.9818	54.0815	77.4316	96.2426	99.7310	94.4100	79.7364	62.0668	40.3389	23.3786	16.1233 (83)	
Total gains	251.7727	266.1968	278.9674	292.4392	301.8178	295.7810	284.0043	273.2163	260.3930	248.6794	243.1687	243.9252 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293	
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086	
util living area	0.9352	0.9194	0.8871	0.8208	0.7097	0.5544	0.4187	0.4499	0.6438	0.8239	0.9076	0.9405	(86)
MIT	19.5639	19.7234	20.0126	20.3884	20.7074	20.9053	20.9712	20.9631	20.8400	20.4687	19.9701	19.5274	(87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038	(88)
util rest of house	0.9239	0.9054	0.8670	0.7881	0.6569	0.4768	0.3227	0.3532	0.5694	0.7857	0.8894	0.9300	(89)
MIT 2	18.6304	18.7860	19.0652	19.4236	19.7062	19.8680	19.9086	19.9065	19.8217	19.5054	19.0342	18.6003	(90)
Living area fraction	fLA = Living area / (4) =												0.5912 (91)
MIT	19.1822	19.3402	19.6253	19.9940	20.2981	20.4813	20.5368	20.5312	20.4237	20.0749	19.5875	19.1484	(92)
Temperature adjustment													0.0000
adjusted MIT	19.1822	19.3402	19.6253	19.9940	20.2981	20.4813	20.5368	20.5312	20.4237	20.0749	19.5875	19.1484	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9152	0.8972	0.8613	0.7909	0.6767	0.5184	0.3785	0.4090	0.6059	0.7921	0.8833	0.9215	(94)
Useful gains	230.4284	238.8302	240.2685	231.2921	204.2396	153.3282	107.4933	111.7567	157.7607	196.9704	214.7961	224.7659	(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	428.0353	414.6185	376.2254	315.3006	243.9458	165.4329	110.7387	116.0035	178.4945	268.8235	355.5123	427.0281	(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	147.0196	118.1297	101.1519	60.4861	29.5414	0.0000	0.0000	0.0000	0.0000	53.4587	101.3157	150.4830	(98)
Space heating													761.5861 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 32.5325 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	761.5861 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1199.4982 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	37.0008 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3909.1213 (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			312.0000 (367a)
Space heating from Heat pump	1185.9242	0.5190	615.4946 (367)
Electrical energy for heat distribution	37.0008	0.5190	19.2034 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			634.6981 (373)
Space and water heating			634.6981 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			743.1887 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.7500 (384)

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

DER	31.7500 ZC1
Total Floor Area	23.4100
Assumed number of occupants	N 1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	20.9818 ZC2
CO2 emissions from cooking, equation (L16)	6.1772 ZC3
Total CO2 emissions	58.9090 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	58.9090 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.3266 (36)			
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

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													1541.3439 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	266.2929	218.3283	194.4589	124.4284	66.6687	0.0000	0.0000	0.0000	0.0000	110.5442	190.6270	269.8082	(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)	284.8052	233.5062	207.9774	133.0785	71.3035	0.0000	0.0000	0.0000	0.0000	118.2291	203.8791	288.5649	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4373	86.2463	85.8012	84.8770	83.3197	79.8000	79.8000	79.8000	79.8000	84.4682	85.7991	86.5243	(216)
Fuel for water heating, kWh/month	166.2759	147.2943	156.4732	143.1681	143.9353	135.8038	131.8706	142.7101	141.8336	149.1081	153.5130	162.5667	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1541.3439 (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)													139.0760 (232)
Total delivered energy for all uses													3529.9725 (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	1541.3439	0.2160	332.9303 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.5526	0.2160	383.3034 (264)
Space and water heating			716.2337 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			827.3391 (272)
Emissions per m2 for space and water heating			30.5952 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.5952 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			52.1700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction S	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.30	TER	51.48
Environmental	87 B	% DER<TER	39.20		
CO ₂ Emissions (t/year)	0.66	DFEE	53.12	TFEE	85.29
General Requirements Compliance	Pass	% DFEE<TFEE	37.71		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 51.48 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 31.30 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)85.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)53.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Flat rate charging, programmer and TRVs OK

Hot water controls:

No cylinder

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:	0.73
Maximum	1.5 OK
MVHR efficiency:	81%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:

Average

Windows facing North: 1.28 m², No overhang

Windows facing South: 2.10 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour		
					heating		heating						
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												3.0000	
Infiltration rate												0.1500 (18)	
Number of sides sheltered												4 (19)	
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.7000 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)	
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(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)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	(64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	(65)
Total per year (kWh/year) = Sum (64)m =												1587.6732 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	(72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	(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	
South				2.1000	46.7521	0.5800	0.7400			0.7700	29.2020 (78)	
North				1.2800	10.6334	0.5800	0.6400			0.7700	3.5012 (74)	
Solar gains	32.7033	54.5165	72.2908	87.1168	96.3518	95.3865	92.0545	85.0267	77.3094	59.5490	38.9336	28.1521 (83)
Total gains	265.3134	285.7314	297.1767	302.1244	301.9270	291.4365	281.6489	278.5065	275.6356	267.8896	258.7237	255.9540 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9267	0.9054	0.8711	0.8099	0.7095	0.5608	0.4218	0.4425	0.6191	0.7987	0.8941	0.9332 (86)
MIT	19.6248	19.8054	20.0796	20.4158	20.7076	20.9021	20.9706	20.9649	20.8577	20.5222	20.0325	19.5829 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9142	0.8896	0.8491	0.7762	0.6568	0.4828	0.3252	0.3469	0.5448	0.7579	0.8740	0.9217 (89)
MIT 2	18.6886	18.8633	19.1267	19.4473	19.7063	19.8662	19.9084	19.9072	19.8330	19.5503	19.0921	18.6535 (90)
Living area fraction	19.2421	19.4202	19.6901	20.0199	20.2982	20.4786	20.5364	20.5325	20.4388	20.1249	19.6481	19.2029 (92)
MIT	19.2421	19.4202	19.6901	20.0199	20.2982	20.4786	20.5364	20.5325	20.4388	20.1249	19.6481	19.2029 (92)
Temperature adjustment	19.2421	19.4202	19.6901	20.0199	20.2982	20.4786	20.5364	20.5325	20.4388	20.1249	19.6481	19.2029 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9055	0.8818	0.8444	0.7799	0.6766	0.5244	0.3814	0.4021	0.5821	0.7666	0.6866	0.9130	(94)
Useful gains	240.2391	251.9536	250.9425	235.6303	204.2695	152.8418	107.4083	111.9982	160.4461	205.3559	224.7227	233.6906	(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													
	429.7569	416.9171	378.0825	316.0367	243.9506	165.3576	110.7255	116.0408	178.9194	270.2411	357.2374	428.5863	(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													
	141.0012	110.8554	94.5922	57.8926	29.5228	0.0000	0.0000	0.0000	0.0000	48.2746	95.4105	145.0024	(98)
Space heating													
												722.5517	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 30.8651 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	722.5517 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1138.0189 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	36.3860 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3847.6420 (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			312.0000 (367a)
Space heating from Heat pump	1166.2193	0.5190	605.2678 (367)
Electrical energy for heat distribution	36.3860	0.5190	18.8844 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			624.1522 (373)
Space and water heating			624.1522 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			732.6428 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.3000 (384)

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

DER	31.3000 ZC1
Total Floor Area	23.4100
Assumed number of occupants	N 1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	20.9818 ZC2
CO2 emissions from cooking, equation (L16)	6.1772 ZC3
Total CO2 emissions	58.4590 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	58.4590 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		20.7569			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)				
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	93.5101	92.1347	89.2785	85.3955	82.8745	79.3249	76.3078	80.1735	81.5470	85.5660	90.1041	92.1404 (72)
Total internal gains	226.2799	224.8841	218.5542	208.6750	199.2419	189.7164	183.2609	187.1470	191.9942	202.0094	213.4596	221.4718 (73)

[Jan					Area	Solar flux	g		FF	Access		Gains
					m2	Table 6a	Table 6b		Table 6c	factor		W
						W/m2	or Table 6b		or Table 6c	Table 6d		
North					1.2800	10.6334	0.6300		0.7000	0.7700		4.1596
South					2.1000	46.7521	0.6300		0.7000	0.7700		30.0049 (78)

Solar gains	34.1645	57.0895	76.1037	92.4439	102.9504	102.2372	98.5330	90.4962	81.6295	62.4649	40.6974	29.3946 (83)
Total gains	260.4444	281.9736	294.6579	301.1189	302.1924	291.9536	281.7939	277.6432	273.6237	264.4743	254.1571	250.8665 (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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017
util living area	0.9817	0.9741	0.9601	0.9300	0.8665	0.7399	0.5869	0.6134	0.7977	0.9258	0.9703	0.9839 (86)
MIT	19.3964	19.5602	19.8354	20.2046	20.5595	20.8354	20.9479	20.9374	20.7658	20.3343	19.8116	19.3696 (87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844 (88)
util rest of house	0.9756	0.9654	0.9458	0.9023	0.8078	0.6209	0.4111	0.4424	0.6956	0.8910	0.9587	0.9785 (89)
MIT 2	17.4530	17.6901	18.0858	18.6133	19.0849	19.4062	19.4926	19.4895	19.3376	18.8003	18.0644	17.4221 (90)
Living area fraction									fLA = Living area / (4) =			0.5912 (91)
MIT	18.6019	18.7957	19.1202	19.5541	19.9567	20.2511	20.3530	20.3455	20.1819	19.7072	19.0974	18.5735 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6019	18.7957	19.1202	19.5541	19.9567	20.2511	20.3530	20.3455	20.1819	19.7072	19.0974	18.5735 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9710	0.9603	0.9416	0.9037	0.8283	0.6852	0.5156	0.5436	0.7470	0.8969	0.9548	0.9742 (94)
Useful gains	252.8853	270.7898	277.4443	272.1076	250.3077	200.0469	145.2983	150.9159	204.3928	237.2039	242.6612	244.3967 (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	601.6168	583.0640	528.2410	440.7811	340.8484	230.9008	153.3455	160.9010	249.4924	375.9576	497.4691	598.7513 (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	259.4562	209.8482	186.5927	121.4450	67.3623	0.0000	0.0000	0.0000	0.0000	103.2328	183.4617	263.6398 (98)
Space heating												1395.0388 (98)
Space heating per m2												59.5916 (99)
										(98) / (4) =		

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													1492.0201 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	259.4562	209.8482	186.5927	121.4450	67.3623	0.0000	0.0000	0.0000	0.0000	103.2328	183.4617	263.6398	(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)	277.4933	224.4366	199.5644	129.8877	72.0452	0.0000	0.0000	0.0000	0.0000	110.4094	196.2158	281.9677	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.3716	86.1443	85.6921	84.8123	83.3442	79.8000	79.8000	79.8000	79.8000	84.2889	85.6979	86.4664	(216)
Fuel for water heating, kWh/month	166.4025	147.4686	156.6724	143.2773	143.8930	135.8038	131.8706	142.7101	141.8336	149.4251	153.6943	162.6756	(219)
Water heating fuel used												1775.7269	(219)
Annual totals kWh/year													
Space heating fuel - main system												1492.0201	(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)												139.0760	(232)
Total delivered energy for all uses												3481.8230	(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	1492.0201	0.2160	322.2763 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1775.7269	0.2160	383.5570 (264)
Space and water heating			705.8333 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			816.9388 (272)
Emissions per m2 for space and water heating			30.1509 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.1509 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			51.4800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction SE	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.44	TER	51.71
Environmental	87 B	% DER<TER	39.20		
CO ₂ Emissions (t/year)	0.66	DFEE	53.91	TFEE	86.26
General Requirements Compliance	Pass	% DFEE<TFEE	37.51		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 51.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 31.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 86.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 53.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage	No cylinder
-------------------	-------------

6 Controls

Space heating controls:	Flat rate charging, programmer and TRVs	OK
-------------------------	---	----

Hot water controls:

No cylinder

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:	0.73
Maximum	1.5 OK
MVHR efficiency:	81%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading: Average

Windows facing South East: 2.10 m², No overhang

Windows facing North West: 1.28 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour			
					heating		heating							
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													3.0000	
Infiltration rate													0.1500 (18)	
Number of sides sheltered													4 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.7000 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)		
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(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)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	(64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	(65)
Total per year (kWh/year) = Sum (64)m =											1587.6732	(64)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	(72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Southeast				2.1000	36.7938	0.5800		0.7400		0.7700		22.9820 (77)	
Northwest				1.2800	11.2829	0.5800		0.6400		0.7700		3.7151 (81)	
Solar gains	26.6971	46.7090	67.1871	88.7421	104.4133	105.8640	101.1463	89.1176	74.5987	52.5072	32.2017	22.7017 (83)	
Total gains	259.3072	277.9240	292.0730	303.7497	309.9885	301.9140	290.7406	282.5975	272.9249	260.8478	251.9918	250.5037 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9305	0.9111	0.8757	0.8080	0.6986	0.5456	0.4099	0.4368	0.6234	0.8080	0.9000	0.9365 (86)
MIT	19.5980	19.7732	20.0613	20.4203	20.7212	20.9096	20.9730	20.9662	20.8547	20.5033	20.0059	19.5579 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9185	0.8960	0.8542	0.7742	0.6454	0.4685	0.3156	0.3422	0.5491	0.7680	0.8807	0.9255 (89)
MIT 2	18.6630	18.8329	19.1099	19.4512	19.7167	19.8705	19.9093	19.9077	19.8311	19.5345	19.0675	18.6296 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.2158	19.3888	19.6724	20.0241	20.3106	20.4849	20.5381	20.5335	20.4363	20.1072	19.6223	19.1784 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.2158	19.3888	19.6724	20.0241	20.3106	20.4849	20.5381	20.5335	20.4363	20.1072	19.6223	19.1784 (93)

8. Space heating requirement

Utilisation	0.9098	0.8880	0.8492	0.7781	0.6659	0.5100	0.3705	0.3969	0.5862	0.7759	0.8750	0.9169	(94)
Useful gains	235.9297	246.7970	248.0193	236.3392	206.4223	153.9822	107.7239	112.1751	159.9949	202.3853	220.4931	229.6802	(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	429.0007	416.0142	377.5745	316.1567	244.3008	165.5340	110.7745	116.0682	178.8482	269.7402	356.5028	427.8860	(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	143.6448	113.7140	96.3891	57.4686	28.1816	0.0000	0.0000	0.0000	0.0000	50.1121	97.9269	147.4651	(98)
Space heating												734.9022	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 31.3927 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	734.9022 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1157.4709 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	36.5806 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3867.0941 (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			312.0000 (367a)
Space heating from Heat pump	1172.4539	0.5190	608.5036 (367)
Electrical energy for heat distribution	36.5806	0.5190	18.9853 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			627.4889 (373)
Space and water heating			627.4889 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			735.9795 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.4400 (384)

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

DER		31.4400 ZC1
Total Floor Area	TFA	23.4100
Assumed number of occupants	N	1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		20.9818 ZC2
CO2 emissions from cooking, equation (L16)		6.1772 ZC3
Total CO2 emissions		58.5990 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		58.5990 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.3266 (36)			
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

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													1508.1439 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	262.7925	213.5713	188.9687	120.5005	64.5547	0.0000	0.0000	0.0000	0.0000	106.1460	186.8662	266.7147	(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)	281.0615	228.4185	202.1056	128.8775	69.0424	0.0000	0.0000	0.0000	0.0000	113.5252	199.8569	285.2563	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4039	86.1897	85.7256	84.7915	83.2440	79.8000	79.8000	79.8000	79.8000	84.3616	85.7466	86.4955	(216)
Fuel for water heating, kWh/month	166.3402	147.3910	156.6112	143.3125	144.0662	135.8038	131.8706	142.7101	141.8336	149.2964	153.6072	162.6209	(219)
Water heating fuel used												1775.4635	(219)
Annual totals kWh/year													
Space heating fuel - main system												1508.1439	(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)												139.0760	(232)
Total delivered energy for all uses												3497.6834	(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	1508.1439	0.2160	325.7591 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1775.4635	0.2160	383.5001 (264)
Space and water heating			709.2592 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			820.3646 (272)
Emissions per m2 for space and water heating			30.2973 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.2973 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			51.7100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction SW	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.44	TER	51.71
Environmental	87 B	% DER<TER	39.20		
CO ₂ Emissions (t/year)	0.66	DFEE	53.91	TFEE	86.26
General Requirements Compliance	Pass	% DFEE<TFEE	37.51		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 51.71 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 31.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 86.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 53.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Flat rate charging, programmer and TRVs OK

Hot water controls:

No cylinder

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: 0.73
Maximum 1.5 OK
MVHR efficiency: 81%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average

Windows facing North East: 1.28 m², No overhang

Windows facing South West: 2.10 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour			
					heating		heating							
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													3.0000	
Infiltration rate													0.1500 (18)	
Number of sides sheltered													4 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.7000 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)		
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
Solar input	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416 (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)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416 (64)
Total per year (kWh/year) = Sum (64)m =												1587.6732 (64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	75.4980 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	101.4758 (72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	227.8019 (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
Southwest				2.1000	36.7938	0.5800		0.7400		0.7700		22.9820 (79)
Northeast				1.2800	11.2829	0.5800		0.6400		0.7700		3.7151 (75)
Solar gains	26.6971	46.7090	67.1871	88.7421	104.4133	105.8640	101.1463	89.1176	74.5987	52.5072	32.2017	22.7017 (83)
Total gains	259.3072	277.9240	292.0730	303.7497	309.9885	301.9140	290.7406	282.5975	272.9249	260.8478	251.9918	250.5037 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9305	0.9111	0.8757	0.8080	0.6986	0.5456	0.4099	0.4368	0.6234	0.8080	0.9000	0.9365 (86)
MIT	19.5980	19.7732	20.0613	20.4203	20.7212	20.9096	20.9730	20.9662	20.8547	20.5033	20.0059	19.5579 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9185	0.8960	0.8542	0.7742	0.6454	0.4685	0.3156	0.3422	0.5491	0.7680	0.8807	0.9255 (89)
MIT 2	18.6630	18.8329	19.1099	19.4512	19.7167	19.8705	19.9093	19.9077	19.8311	19.5345	19.0675	18.6296 (90)
Living area fraction	fLA = Living area / (4) =											0.5912 (91)
MIT	19.2158	19.3888	19.6724	20.0241	20.3106	20.4849	20.5381	20.5335	20.4363	20.1072	19.6223	19.1784 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2158	19.3888	19.6724	20.0241	20.3106	20.4849	20.5381	20.5335	20.4363	20.1072	19.6223	19.1784 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9098	0.8880	0.8492	0.7781	0.6659	0.5100	0.3705	0.3969	0.5862	0.7759	0.8750	0.9169	(94)
Useful gains	235.9297	246.7970	248.0193	236.3392	206.4223	153.9822	107.7239	112.1751	159.9949	202.3853	220.4931	229.6802	(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	429.0007	416.0142	377.5745	316.1567	244.3008	165.5340	110.7745	116.0682	178.8482	269.7402	356.5028	427.8860	(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	143.6448	113.7140	96.3891	57.4686	28.1816	0.0000	0.0000	0.0000	0.0000	50.1121	97.9269	147.4651	(98)
Space heating												734.9022	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 31.3927 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	734.9022 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1157.4709 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	36.5806 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3867.0941 (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			312.0000 (367a)
Space heating from Heat pump	1172.4539	0.5190	608.5036 (367)
Electrical energy for heat distribution	36.5806	0.5190	18.9853 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			627.4889 (373)
Space and water heating			627.4889 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			735.9795 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.4400 (384)

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

DER	31.4400 ZC1
Total Floor Area	23.4100
Assumed number of occupants	N 1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	EF 0.5190
CO2 emissions from appliances, equation (L14)	20.9818 ZC2
CO2 emissions from cooking, equation (L16)	6.1772 ZC3
Total CO2 emissions	58.5990 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	58.5990 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									9.3266 (36)			
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	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)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum(64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

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													1508.1439 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	262.7925	213.5713	188.9687	120.5005	64.5547	0.0000	0.0000	0.0000	0.0000	106.1460	186.8662	266.7147	(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)	281.0615	228.4185	202.1056	128.8775	69.0424	0.0000	0.0000	0.0000	0.0000	113.5252	199.8569	285.2563	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4039	86.1897	85.7256	84.7915	83.2440	79.8000	79.8000	79.8000	79.8000	84.3616	85.7466	86.4955	(216)
Fuel for water heating, kWh/month	166.3402	147.3910	156.6112	143.3125	144.0662	135.8038	131.8706	142.7101	141.8336	149.2964	153.6072	162.6209	(219)
Water heating fuel used												1775.4635	(219)
Annual totals kWh/year													
Space heating fuel - main system												1508.1439	(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)												139.0760	(232)
Total delivered energy for all uses												3497.6834	(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	1508.1439	0.2160	325.7591 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1775.4635	0.2160	383.5001 (264)
Space and water heating			709.2592 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			820.3646 (272)
Emissions per m2 for space and water heating			30.2973 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.2973 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			51.7100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction W	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.65	TER	52.03
Environmental	86 B	% DER<TER	39.17		
CO ₂ Emissions (t/year)	0.66	DFEE	54.95	TFEE	87.54
General Requirements Compliance	Pass	% DFEE<TFEE	37.23		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 23 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) 52.03 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 31.65 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)87.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)55.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.23 (max. 2.00)	1.42 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Community heating scheme -

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Flat rate charging, programmer and TRVs OK

Hot water controls:

No cylinder

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:	0.73
Maximum	1.5 OK
MVHR efficiency:	81%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:

Average

Windows facing East: 1.28 m², No overhang

Windows facing West: 2.10 m², No overhang

Air change rate: 2.90 ach

Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

External wall U-value	0.14 W/m ² K
External wall U-value	0.14 W/m ² K
Exposed floor U-value	0.10 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K
Air permeability	3.0 m ³ /m ² h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

					main	secondary	other			total	m3 per hour	
					heating		heating					
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												3.0000
Infiltration rate												0.1500 (18)
Number of sides sheltered												4 (19)
Shelter factor										(20) = 1 -	[0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1050 (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	0.1339	0.1313	0.1286	0.1155	0.1129	0.0998	0.0998	0.0971	0.1050	0.1129	0.1181	0.1234 (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) =												56.7000 (23c)
Effective ac	0.3504	0.3478	0.3451	0.3320	0.3294	0.3163	0.3163	0.3136	0.3215	0.3294	0.3346	0.3399 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879	25.5500	(32)
Ptn Std Wall			46.6800				(32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss							(33) + (36) = 22.2653 (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	6.4962	6.4475	6.3989	6.1555	6.1068	5.8635	5.8635	5.8148	5.9608	6.1068	6.2042	6.3015 (38)
Heat transfer coeff	28.7615	28.7128	28.6641	28.4208	28.3721	28.1288	28.1288	28.0801	28.2261	28.3721	28.4695	28.5668 (39)
Average = Sum(39)m / 12 =												28.4086 (39)
HLP	1.2286	1.2265	1.2244	1.2140	1.2120	1.2016	1.2016	1.1995	1.2057	1.2120	1.2161	1.2203 (40)
HLP (average)												1.2135 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m =											936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097	(46)
Water storage loss:												
Store volume												110.0000 (47)
b) If manufacturer declared loss factor is not known :												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0152 (51)
Volume factor from Table 2a												1.0294 (52)
Temperature factor from Table 2b												0.6000 (53)
Enter (49) or (54) in (55)												1.0327 (55)
Total storage loss												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder contains dedicated solar storage												
32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(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												
152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	149.3416	(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)
Output from w/h	152.4064	134.8776	142.9378	129.9186	128.6084	116.7732	113.9146	122.5645	121.5851	134.6307	140.1147	(64)
Heat gains from water heating, kWh/month	76.5170	68.1879	73.3687	68.2062	68.6042	63.8354	63.7185	66.5946	65.4353	70.6066	71.5964	(65)
Total per year (kWh/year) = Sum (64)m =												1587.6732 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	102.8455	101.4701	98.6139	94.7309	92.2099	88.6603	85.6432	89.5089	90.8824	94.9014	99.4395	(72)
Total internal gains	232.6101	231.2149	224.8859	215.0076	205.5752	196.0500	189.5943	193.4799	198.3262	208.3405	219.7901	(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	
West					2.1000	19.6403	0.5800	0.7400	0.7700		12.2676 (80)	
East					1.2800	19.6403	0.5800	0.6400	0.7700		6.4669 (76)	
Solar gains	18.7345	36.6487	60.3552	88.0245	107.8773	110.4316	105.1354	90.3098	70.1956	43.4868	23.3598	15.4064 (83)
Total gains	251.3447	267.8637	285.2411	303.0321	313.4525	306.4816	294.7298	283.7896	268.5218	251.8273	243.1498	243.2083 (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	32.9051	32.9608	33.0168	33.2995	33.3566	33.6452	33.6452	33.7035	33.5292	33.3566	33.2426	33.1293
alpha	3.1937	3.1974	3.2011	3.2200	3.2238	3.2430	3.2430	3.2469	3.2353	3.2238	3.2162	3.2086
util living area	0.9355	0.9183	0.8817	0.8088	0.6939	0.5392	0.4049	0.4352	0.6305	0.8198	0.9077	0.9409 (86)
MIT	19.5619	19.7306	20.0362	20.4183	20.7269	20.9127	20.9739	20.9665	20.8497	20.4779	19.9700	19.5241 (87)
Th 2	19.8972	19.8988	19.9005	19.9088	19.9104	19.9187	19.9187	19.9204	19.9154	19.9104	19.9071	19.9038 (88)
util rest of house	0.9242	0.9041	0.8609	0.7751	0.6406	0.4625	0.3115	0.3409	0.5561	0.7812	0.8895	0.9305 (89)
MIT 2	18.6285	18.7927	19.0869	19.4495	19.7210	19.8723	19.9096	19.9079	19.8279	19.5131	19.0342	18.5971 (90)
Living area fraction										fLA = Living area / (4) =		0.5912 (91)
MIT	19.1803	19.3472	19.6481	20.0223	20.3157	20.4874	20.5388	20.5337	20.4320	20.0835	19.5874	19.1451 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1803	19.3472	19.6481	20.0223	20.3157	20.4874	20.5388	20.5337	20.4320	20.0835	19.5874	19.1451 (93)

8. Space heating requirement

Utilisation	0.9155	0.8959	0.8555	0.7789	0.6614	0.5039	0.3659	0.3955	0.5930	0.7879	0.8833	0.9219	(94)
Useful gains	230.1126	239.9789	244.0230	236.0269	207.3130	154.4456	107.8522	112.2251	159.2383	198.4062	214.7837	224.2255	(95)
Ext temp.	4.3000	4.9000	6.5000	8.1000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	427.9799	414.8198	376.8793	316.1038	244.4453	165.6056	110.7944	116.0759	178.7287	269.0670	355.5102	426.9337	(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	147.2133	117.4931	98.8451	57.6554	27.6264	0.0000	0.0000	0.0000	0.0000	52.5716	101.3231	150.8149	(98)
Space heating												753.5428	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2

(98) / (4) = 32.1889 (99)

8c. Space cooling requirement

Not applicable

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	1.0500 (305)
Factor for control and charging method (Table 4c(3)) for community water heating	1.0500 (305a)
Distribution loss factor (Table 12c) for community heating system	1.5000 (306)
Space heating:	
Annual space heating requirement	753.5428 (98)
Space heat from Heat pump = (98) x 1.00 x 1.05 x 1.50	1186.8299 (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	1587.6732 (64)
Water heat from Heat pump = (64) x 1.00 x 1.05 x 1.50	2500.5853 (310a)
Electricity used for heat distribution	36.8742 (313)
Annual totals kWh/year	
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.0220)	
mechanical ventilation fans (SFP = 1.0220)	70.0525 (330a)
Total electricity for the above, kWh/year	70.0525 (331)
Electricity for lighting (calculated in Appendix L)	138.9854 (332)
Total delivered energy for all uses	3896.4531 (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			312.0000 (367a)
Space heating from Heat pump	1181.8638	0.5190	613.3873 (367)
Electrical energy for heat distribution	36.8742	0.5190	19.1377 (372)
Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE)			632.5250 (373)
Space and water heating			632.5250 (376)
Pumps and fans	70.0525	0.5190	36.3572 (378)
Energy for lighting	138.9854	0.5190	72.1334 (379)
Total CO2, kg/year			741.0157 (383)
Dwelling Carbon Dioxide Emission Rate (DER)			31.6500 (384)

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

DER	31.6500 ZC1
Total Floor Area	23.4100
Assumed number of occupants	TFA 1.0670
CO2 emission factor in Table 12 for electricity displaced from grid	N 0.5190
CO2 emissions from appliances, equation (L14)	EF 20.9818 ZC2
CO2 emissions from cooking, equation (L16)	6.1772 ZC3
Total CO2 emissions	58.8090 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	58.8090 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)				
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (45)
Distribution loss (46)m = 0.15 x (45)m												
	14.5694	12.7425	13.1491	11.4637	10.9997	9.4919	8.7957	10.0932	10.2137	11.9031	12.9932	14.1097 (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)

 SapCode

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	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)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597 (64)
								Total per year (kWh/year) =	Sum (64)m =			1485.4508 (64)
Heat gains from water heating, kWh/month	69.5715	61.9145	66.4232	61.4848	61.6587	57.1139	56.7730	59.6491	58.7139	63.6611	64.8750	68.5525 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	93.5101	92.1347	89.2785	85.3955	82.8745	79.3249	76.3078	80.1735	81.5470	85.5660	90.1041	92.1404 (72)
Total internal gains	226.2799	224.8841	218.5542	208.6750	199.2419	189.7164	183.2609	187.1470	191.9942	202.0094	213.4596	221.4718 (73)

[Jan					Area	Solar flux		g		FF		Access		Gains	
					m2	Table 6a		Table 6b		Table 6c		factor		W	
						W/m2		or Table 6b		or Table 6c		Table 6d			
East					1.2800	19.6403		0.6300		0.7000		0.7700		7.6830 (76)	
West					2.1000	19.6403		0.6300		0.7000		0.7700		12.6049 (80)	
Solar gains	20.2878	39.6873	65.3594	95.3227	116.8216	119.5877	113.8524	97.7975	76.0156	47.0924	25.2966	16.6837	(83)		
Total gains	246.5677	264.5714	283.9136	303.9977	316.0635	309.3041	297.1132	284.9445	268.0098	249.1018	238.7562	238.1555	(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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260		
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017		
util living area	0.9845	0.9785	0.9641	0.9283	0.8528	0.7149	0.5629	0.6015	0.8055	0.9365	0.9753	0.9863	(86)	
MIT	19.3500	19.5035	19.8024	20.2123	20.5873	20.8539	20.9546	20.9413	20.7571	20.2926	19.7620	19.3266	(87)	
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)	
util rest of house	0.9793	0.9712	0.9510	0.9000	0.7908	0.5944	0.3914	0.4321	0.7048	0.9056	0.9654	0.9817	(89)	
MIT 2	17.3866	17.6098	18.0401	18.6233	19.1159	19.4199	19.4950	19.4910	19.3300	18.7470	17.9950	17.3605	(90)	
Living area fraction	18.5474	18.7294	19.0820	19.5628	19.9858	20.2676	20.3579	20.3484	20.1737	19.6608	19.0397	18.5229	(91)	
MIT	18.5474	18.7294	19.0820	19.5628	19.9858	20.2676	20.3579	20.3484	20.1737	19.6608	19.0397	18.5229	(92)	
Temperature adjustment	adjusted MIT	18.5474	18.7294	19.0820	19.5628	19.9858	20.2676	20.3579	20.3484	20.1737	19.6608	19.0397	18.5229	(93)
adjusted MIT	18.5474	18.7294	19.0820	19.5628	19.9858	20.2676	20.3579	20.3484	20.1737	19.6608	19.0397	18.5229	(93)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9750	0.9665	0.9467	0.9016	0.8136	0.6603	0.4933	0.5323	0.7551	0.9097	0.9616	0.9777 (94)
Useful gains	240.4054	255.6976	268.7798	274.0867	257.1618	204.2452	146.5651	151.6850	202.3714	226.6108	229.5771	232.8413 (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	599.3212	580.2826	526.6421	441.1410	342.0478	231.5755	153.5453	161.0217	249.1558	374.0416	495.0778	596.6438 (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	267.0334	218.1211	191.8495	120.2791	63.1551	0.0000	0.0000	0.0000	0.0000	109.6885	191.1605	270.6691 (98)
Space heating												1431.9563 (98)
Space heating per m2												61.1686 (99)
										(98) / (4) =		

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													1531.5040 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	267.0334	218.1211	191.8495	120.2791	63.1551	0.0000	0.0000	0.0000	0.0000	109.6885	191.1605	270.6691	(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)	285.5972	233.2846	205.1867	128.6407	67.5456	0.0000	0.0000	0.0000	0.0000	117.3139	204.4497	289.4856	(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	143.7245	127.0359	134.2559	121.5168	119.9265	108.3714	105.2327	113.8826	113.1832	125.9488	131.7129	140.6597	(64)
Efficiency of water heater (217)m	86.4443	86.2438	85.7656	84.7866	83.1930	79.8000	79.8000	79.8000	79.8000	84.4477	85.8065	86.5323	(216)
Fuel for water heating, kWh/month	166.2625	147.2985	156.5382	143.3208	144.1545	135.8038	131.8706	142.7101	141.8336	149.1441	153.4999	162.5517	(219)
Water heating fuel used													1774.9881 (219)
Annual totals kWh/year													
Space heating fuel - main system													1531.5040 (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)													139.0760 (232)
Total delivered energy for all uses													3520.5681 (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	1531.5040	0.2160	330.8049 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1774.9881	0.2160	383.3974 (264)
Space and water heating			714.2023 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	139.0760	0.5190	72.1804 (268)
Total CO2, kg/m2/year			825.3077 (272)
Emissions per m2 for space and water heating			30.5084 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			3.0833 (272b)
Emissions per m2 for pumps and fans			1.6628 (272c)
Target Carbon Dioxide Emission Rate (TER) = (30.5084 * 1.55) + 3.0833 + 1.6628, rounded to 2 d.p.			52.0300 (273)



Appendix 2 DFEE and TFEE Worksheets

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction E	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.65	TER	52.03	
Environmental	86 B	% DER<TER	39.17			
CO ₂ Emissions (t/year)	0.66	DFEE	54.95	TFEE	87.54	
General Requirements Compliance	Pass	% DFEE<TFEE	37.23			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											936.8334 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (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	
East					2.1000	19.6403	0.5800	0.7400	0.7700		12.2676 (76)	
West					1.2800	19.6403	0.5800	0.6400	0.7700		6.4669 (80)	

Solar gains	18.7345	36.6487	60.3552	88.0245	107.8773	110.4316	105.1354	90.3098	70.1956	43.4868	23.3598	15.4064 (83)
Total gains	176.2412	193.2566	211.6648	230.8572	242.1874	236.4976	225.8346	213.4994	197.7359	179.5909	169.2756	168.5991 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9752	0.9660	0.9462	0.9029	0.8242	0.6973	0.5615	0.6030	0.7924	0.9212	0.9647	0.9781 (86)
MIT	18.8482	19.0474	19.4252	19.9353	20.4051	20.7548	20.9069	20.8825	20.6130	20.0111	19.3466	18.8106 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9700	0.9588	0.9341	0.8793	0.7773	0.6096	0.4312	0.4757	0.7207	0.8972	0.9558	0.9734 (89)
MIT 2	17.8192	18.0175	18.3904	18.8917	19.3299	19.6330	19.7363	19.7257	19.5258	18.9752	18.3237	17.7888 (90)
Living area fraction	fLA = Living area / (4) = 0.5912 (91)											
MIT	18.4275	18.6264	19.0022	19.5087	19.9656	20.2962	20.4284	20.4096	20.1686	19.5876	18.9285	18.3929 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4275	18.6264	19.0022	19.5087	19.9656	20.2962	20.4284	20.4096	20.1686	19.5876	18.9285	18.3929 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9628	0.9506	0.9252	0.8738	0.7860	0.6500	0.5045	0.5457	0.7468	0.8931	0.9483	0.9668 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	169.6836	183.7005	195.8389	201.7151	190.3673	153.7132	113.9276	116.5142	147.6750	160.4010	160.5281	162.9989 (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												
Month fracti	472.2286	457.8127	416.0823	349.4796	271.7685	185.6117	124.7486	130.4338	198.4339	295.5086	390.4275	470.3702 (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	225.0935	184.2034	163.8611	106.3904	60.5625	0.0000	0.0000	0.0000	0.0000	100.5201	165.5275	228.6843 (98)
Space heating per m2												1234.8428 (98)
										(98) / (4) =		52.7485 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7579	0.8243	0.8016	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	232.1391	198.7537	198.1792	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	316.3644	303.3340	289.3919	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	60.6422	77.8077	67.8622	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												206.3122 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	15.1605	19.4519	16.9656	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												51.5780 (107)
Space cooling per m2												2.2032 (108)
Energy for space heating												52.7485 (99)
Energy for space cooling												2.2032 (108)
Total												54.9518 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.0 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)					
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)					
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)					
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)					
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)					
Total net area of external elements Aum(A, m2)			97.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)					
Total fabric heat loss						(33) + (36) =	30.0835	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733	(38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567	(39)
Average = Sum(39)m / 12 =												41.3717	(39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794	(40)
HLP (average)												1.7673	(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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(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
East					2.1000	19.6403	0.6300	0.7000			0.7700			12.6049 (76)
West					1.2800	19.6403	0.6300	0.7000			0.7700			7.6830 (80)

Solar gains	20.2878	39.6873	65.3594	95.3227	116.8216	119.5877	113.8524	97.7975	76.0156	47.0924	25.2966			16.6837 (83)
Total gains	177.7996	196.2997	216.6727	238.1582	251.1338	245.6554	234.5535	220.9896	203.5592	183.2007	171.2173			169.8818 (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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9945	0.9915	0.9839	0.9632	0.9136	0.8089	0.6710	0.7169	0.8921	0.9733	0.9912	0.9954	(86)
MIT	19.1134	19.2727	19.5849	20.0219	20.4426	20.7727	20.9190	20.8944	20.6332	20.0942	19.5344	19.0898	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9925	0.9884	0.9775	0.9466	0.8690	0.6994	0.4849	0.5393	0.8167	0.9580	0.9873	0.9937	(89)
MIT 2	17.8150	17.9756	18.2872	18.7255	19.1220	19.4045	19.4900	19.4831	19.3032	18.8039	18.2479	17.8004	(90)
Living area fraction									fLA = Living area / (4) =			0.5912	(91)
MIT	18.5826	18.7425	19.0544	19.4919	19.9027	20.2134	20.3348	20.3174	20.0895	19.5667	19.0085	18.5627	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5826	18.7425	19.0544	19.4919	19.9027	20.2134	20.3348	20.3174	20.0895	19.5667	19.0085	18.5627	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9909	0.9863	0.9751	0.9466	0.8833	0.7573	0.5959	0.6445	0.8516	0.9590	0.9857	0.9923	(94)
Ext temp.	176.1854	193.6156	211.2844	225.4361	221.8233	186.0451	139.7728	142.4214	173.3525	175.6847	168.7647	168.5723	(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	600.8035	580.8312	525.4863	438.2114	338.6193	229.3590	152.6011	159.7567	245.7010	370.1591	493.7846	598.3029	(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	315.9159	260.2089	233.7662	153.1982	86.8962	0.0000	0.0000	0.0000	0.0000	144.6889	234.0143	319.7196	(98)
Space heating per m2												1748.4081	(98)
										(98) / (4) =		74.6864	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7181	0.7991	0.7698	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	275.7931	241.6045	238.5949	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	327.0707	313.5274	298.1500	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	36.9199	53.5106	44.3090	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												134.7394	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	9.2300	13.3776	11.0772	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											33.6849 (107)
Space cooling per m2											1.4389 (108)
Energy for space heating											74.6864 (99)
Energy for space cooling											1.4389 (108)
Total											76.1253 (109)
Target Fabric Energy Efficiency (TFEE)											87.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction N	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.73	TER	52.14	
Environmental	86 B	% DER<TER	39.14			
CO ₂ Emissions (t/year)	0.67	DFEE	55.04	TFEE	87.68	
General Requirements Compliance	Pass	% DFEE<TFEE	37.23			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 56.1840 (5)
Dwelling volume			

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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)				(28)...(30) + (32) + (32a)...(32e) =			3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											936.8334 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (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				2.1000	10.6334	0.5800		0.7400		0.7700		6.6418
South				1.2800	46.7521	0.5800		0.6400		0.7700		15.3940 (74)
Solar gains	22.0358	37.9042	53.6830	70.9407	84.4921	86.3600	82.2091	71.5447	59.4797	42.3020	26.4406	18.8388 (83)
Total gains	179.5425	194.5120	204.9926	213.7734	218.8022	212.4260	202.9083	194.7343	187.0199	178.4061	172.3564	172.0315 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9740	0.9655	0.9500	0.9174	0.8534	0.7390	0.6062	0.6414	0.8107	0.9223	0.9631	0.9769 (86)
MIT	18.8649	19.0536	19.3944	19.8662	20.3330	20.7102	20.8855	20.8609	20.5846	20.0061	19.3617	18.8283 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9686	0.9582	0.9386	0.8965	0.8112	0.6542	0.4720	0.5124	0.7420	0.8986	0.9539	0.9721 (89)
MIT 2	17.8357	18.0235	18.3608	18.8281	19.2696	19.6038	19.7273	19.7157	19.5048	18.9706	18.3384	17.8062 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4442	18.6325	18.9718	19.4419	19.8983	20.2579	20.4121	20.3927	20.1431	19.5828	18.9434	18.4105 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4442	18.6325	18.9718	19.4419	19.8983	20.2579	20.4121	20.3927	20.1431	19.5828	18.9434	18.4105 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9612	0.9499	0.9299	0.8901	0.8166	0.6910	0.5465	0.5823	0.7657	0.8945	0.9463	0.9652 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	172.5807	184.7596	190.6209	190.2854	178.6765	146.7800	110.8808	113.3864	143.1930	159.5757	163.1003	166.0505 (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												
Month fracti	472.7848	458.0167	415.0723	347.2783	269.5560	184.3647	124.2168	129.8855	197.6022	295.3499	390.9201	470.9517 (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	223.3519	183.6288	166.9919	113.0349	67.6143	0.0000	0.0000	0.0000	0.0000	101.0160	164.0303	226.8465 (98)
Space heating per m2												1246.5144 (98)
										(98) / (4) =		53.2471 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7228	0.7946	0.7747	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	221.4081	191.5964	191.5337	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	288.2288	276.5370	267.4587	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	48.1108	63.1958	56.4882	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												167.7948 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	12.0277	15.7989	14.1220	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												41.9487 (107)
Space cooling per m2												1.7919 (108)
Energy for space heating												53.2471 (99)
Energy for space cooling												1.7919 (108)
Total												55.0390 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.0 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)					
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)					
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)					
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)					
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)					
Total net area of external elements Aum(A, m2)			97.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)					
Total fabric heat loss						(33) + (36) =	30.0835	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733	(38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567	(39)
Average = Sum(39)m / 12 =												41.3717	(39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794	(40)
HLP (average)												1.7673	(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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(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				2.1000	10.6334	0.6300		0.7000	0.7700		6.8244 (74)	
South				1.2800	46.7521	0.6300		0.7000	0.7700		18.2887 (78)	
Solar gains	25.1131	42.9939	60.3148	78.7184	92.8874	94.5782	90.1791	79.0567	66.5009	47.8307	30.0971	21.4922 (83)
Total gains	182.6249	199.6063	211.6281	221.5539	227.1996	220.6460	210.8802	202.2487	194.0445	183.9390	176.0178	174.6903 (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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9940	0.9910	0.9850	0.9701	0.9332	0.8462	0.7186	0.7548	0.9038	0.9730	0.9904	0.9949	(86)
MIT	19.1303	19.2842	19.5679	19.9698	20.3797	20.7293	20.8977	20.8735	20.6108	20.0966	19.5511	19.1067	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9918	0.9877	0.9790	0.9563	0.8960	0.7461	0.5310	0.5793	0.8335	0.9576	0.9862	0.9931	(89)
MIT 2	17.8317	17.9869	18.2706	18.6766	19.0690	19.3785	19.4837	19.4758	19.2869	18.8061	18.2642	17.8172	(90)
Living area fraction									fLA = Living area / (4) =			0.5912	(91)
MIT	18.5994	18.7538	19.0376	19.4411	19.8439	20.1771	20.3197	20.3021	20.0696	19.5690	19.0250	18.5796	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5994	18.7538	19.0376	19.4411	19.8439	20.1771	20.3197	20.3021	20.0696	19.5690	19.0250	18.5796	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9902	0.9856	0.9767	0.9557	0.9064	0.7975	0.6429	0.6831	0.8653	0.9585	0.9845	0.9916	(94)
Ext temp.	180.8268	196.7392	206.7022	211.7301	205.9350	175.9727	135.5752	138.1489	167.9083	176.3120	173.2819	173.2230	(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	601.5117	581.3087	524.7828	436.1087	336.1906	227.8759	151.9827	159.1320	244.8824	370.2549	494.4696	599.0068	(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	312.9896	258.4306	236.6520	161.5526	96.9102	0.0000	0.0000	0.0000	0.0000	144.2935	231.2551	316.7831	(98)
Space heating per m2												175.8668	(98)
												75.1331	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6763	0.7625	0.7380	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	259.7552	230.5509	228.7348	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	297.8388	285.8573	276.2452	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	27.4202	41.1480	35.3477	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												103.9159	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	6.8551	10.2870	8.8369	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											25.9790 (107)
Space cooling per m2											1.1097 (108)
Energy for space heating											75.1331 (99)
Energy for space cooling											1.1097 (108)
Total											76.2429 (109)
Target Fabric Energy Efficiency (TFEE)											87.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction NE	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.75	TER	52.17	
Environmental	86 B	% DER<TER	39.14			
CO ₂ Emissions (t/year)	0.67	DFEE	55.26	TFEE	87.94	
General Requirements Compliance	Pass	% DFEE<TFEE	37.16			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (40)
Days in month												1.4072 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy content (annual)	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Distribution loss (46)m = 0.15 x (45)m												936.8334 (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)
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (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					2.1000	11.2829	0.5800	0.7400	0.7700		7.0475 (75)	
Southwest					1.2800	36.7938	0.5800	0.6400	0.7700		12.1151 (79)	
Solar gains	19.1626	34.9818	54.0815	77.4316	96.2426	99.7310	94.4100	79.7364	62.0668	40.3389	23.3786	16.1233 (83)
Total gains	176.6692	191.5897	205.3911	220.2643	230.5527	225.7970	215.1092	202.9260	189.6070	176.4430	169.2944	169.3161 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9751	0.9667	0.9498	0.9120	0.8388	0.7156	0.5818	0.6242	0.8063	0.9242	0.9647	0.9778 (86)
MIT	18.8503	19.0392	19.3962	19.8929	20.3703	20.7360	20.8976	20.8708	20.5916	19.9977	19.3467	18.8143 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9698	0.9596	0.9384	0.8900	0.7942	0.6289	0.4495	0.4958	0.7368	0.9008	0.9558	0.9732 (89)
MIT 2	17.8214	18.0095	18.3626	18.8528	19.3010	19.6209	19.7325	19.7204	19.5100	18.9630	18.3238	17.7924 (90)
Living area fraction												0.5912 (91)
MIT	18.4297	18.6183	18.9737	19.4677	19.9331	20.2802	20.4213	20.4005	20.1495	19.5747	18.9286	18.3966 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4297	18.6183	18.9737	19.4677	19.9331	20.2802	20.4213	20.4005	20.1495	19.5747	18.9286	18.3966 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9626	0.9515	0.9296	0.8840	0.8012	0.6678	0.5235	0.5659	0.7611	0.8966	0.9483	0.9665 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	170.0601	182.2906	190.9348	194.7043	184.7200	150.7937	112.6000	114.8320	144.3065	158.2002	160.5440	163.6376 (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												
Month fracti	472.3009	457.5411	415.1330	348.1296	270.7021	185.0887	124.5174	130.1395	197.8093	295.0854	390.4305	470.4919 (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	224.8672	184.9683	166.8035	110.4662	63.9706	0.0000	0.0000	0.0000	0.0000	101.8426	165.5183	228.2996 (98)
Space heating per m2												1246.7363 (98)
										(98) / (4) =		53.2566 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7430	0.8111	0.7869	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	227.5680	195.5690	194.5556	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	303.8571	290.7978	277.0335	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	54.9282	70.8502	61.3636	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												187.1419 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	13.7320	17.7125	15.3409	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												46.7855 (107)
Space cooling per m2												1.9985 (108)
Energy for space heating												53.2566 (99)
Energy for space cooling												1.9985 (108)
Total												55.2551 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.3 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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) = 0.3560 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.6060 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.7569			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)				
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(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				2.1000	11.2829	0.6300	0.7000				0.7700			7.2412 (75)
Southwest				1.2800	36.7938	0.6300	0.7000				0.7700			14.3932 (79)
Solar gains	21.6344	39.2567	60.1015	85.1772	105.1799	108.7186	103.0272	87.4470	68.6816	45.1096	26.3511			18.2311 (83)
Total gains	179.1462	195.8691	211.4148	228.0127	239.4921	234.7864	223.7283	210.6391	196.2252	181.2179	172.2718			171.4292 (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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9944	0.9916	0.9851	0.9675	0.9234	0.8252	0.6923	0.7377	0.9012	0.9742	0.9910	0.9952	(86)
MIT	19.1181	19.2712	19.5672	19.9903	20.4126	20.7548	20.9099	20.8834	20.6160	20.0878	19.5381	19.0952	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9923	0.9884	0.9791	0.9526	0.8824	0.7194	0.5051	0.5609	0.8296	0.9593	0.9871	0.9935	(89)
MIT 2	17.8196	17.9741	18.2699	18.6958	19.0970	19.3939	19.4874	19.4793	19.2907	18.7979	18.2515	17.8058	(90)
Living area fraction									fLA = Living area / (4) =			0.5912	(91)
MIT	18.5873	18.7410	19.0368	19.4611	19.8748	20.1985	20.3284	20.3094	20.0742	19.5605	19.0121	18.5681	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5873	18.7410	19.0368	19.4611	19.8748	20.1985	20.3284	20.3094	20.0742	19.5605	19.0121	18.5681	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	177.4821	193.2082	206.5077	217.1181	214.2762	181.8941	137.9981	140.1738	169.1832	173.9950	169.7589	170.0703	(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	601.0013	580.7689	524.7530	436.9348	337.4664	228.7493	152.3394	159.4280	245.0743	369.9010	493.9353	598.5296	(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	315.0983	260.4408	236.7745	158.2681	91.6535	0.0000	0.0000	0.0000	0.0000	145.7541	233.4071	318.7737	(98)
Space heating												1760.1700	(98)
Space heating per m2												75.1888	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7006	0.7831	0.7528	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	269.0743	236.7850	233.3064	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	314.3666	300.8746	286.0520	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	32.6104	47.6827	39.2428	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												119.5359	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	8.1526	11.9207	9.8107	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											29.8840 (107)
Space cooling per m2											1.2765 (108)
Energy for space heating											75.1888 (99)
Energy for space cooling											1.2765 (108)
Total											76.4654 (109)
Target Fabric Energy Efficiency (TFEE)											87.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction NW	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.75	TER	52.17	
Environmental	86 B	% DER<TER	39.14			
CO ₂ Emissions (t/year)	0.67	DFEE	55.26	TFEE	87.94	
General Requirements Compliance	Pass	% DFEE<TFEE	37.16			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 56.1840 (5)
Dwelling volume			

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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)				(28)...(30) + (32) + (32a)...(32e) =			3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 = 32.9425 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (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 1.0670 (42)
Average daily hot water use (litres/day) 59.5424 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy content (annual)	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (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
Northwest					2.1000	11.2829	0.5800	0.7400	0.7700			7.0475 (81)
Southeast					1.2800	36.7938	0.5800	0.6400	0.7700			12.1151 (77)
Solar gains	19.1626	34.9818	54.0815	77.4316	96.2426	99.7310	94.4100	79.7364	62.0668	40.3389	23.3786	16.1233 (83)
Total gains	176.6692	191.5897	205.3911	220.2643	230.5527	225.7970	215.1092	202.9260	189.6070	176.4430	169.2944	169.3161 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9751	0.9667	0.9498	0.9120	0.8388	0.7156	0.5818	0.6242	0.8063	0.9242	0.9647	0.9778 (86)
MIT	18.8503	19.0392	19.3962	19.8929	20.3703	20.7360	20.8976	20.8708	20.5916	19.9977	19.3467	18.8143 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9698	0.9596	0.9384	0.8900	0.7942	0.6289	0.4495	0.4958	0.7368	0.9008	0.9558	0.9732 (89)
MIT 2	17.8214	18.0095	18.3626	18.8528	19.3010	19.6209	19.7325	19.7204	19.5100	18.9630	18.3238	17.7924 (90)
Living area fraction									fLA = Living area / (4) =			0.5912 (91)
MIT	18.4297	18.6183	18.9737	19.4677	19.9331	20.2802	20.4213	20.4005	20.1495	19.5747	18.9286	18.3966 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4297	18.6183	18.9737	19.4677	19.9331	20.2802	20.4213	20.4005	20.1495	19.5747	18.9286	18.3966 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9626	0.9515	0.9296	0.8840	0.8012	0.6678	0.5235	0.5659	0.7611	0.8966	0.9483	0.9665 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	170.0601	182.2906	190.9348	194.7043	184.7200	150.7937	112.6000	114.8320	144.3065	158.2002	160.5440	163.6376 (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												
Month fracti	472.3009	457.5411	415.1330	348.1296	270.7021	185.0887	124.5174	130.1395	197.8093	295.0854	390.4305	470.4919 (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	224.8672	184.9683	166.8035	110.4662	63.9706	0.0000	0.0000	0.0000	0.0000	101.8426	165.5183	228.2996 (98)
Space heating per m2												1246.7363 (98)
										(98) / (4) =		53.2566 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7430	0.8111	0.7869	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	227.5680	195.5690	194.5556	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	303.8571	290.7978	277.0335	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	54.9282	70.8502	61.3636	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												187.1419 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	13.7320	17.7125	15.3409	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												46.7855 (107)
Space cooling per m2												1.9985 (108)
Energy for space heating												53.2566 (99)
Energy for space cooling												1.9985 (108)
Total												55.2551 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.3 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)					
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)					
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)					
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)					
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)					
Total net area of external elements Aum(A, m2)			97.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			20.7569		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)					
Total fabric heat loss						(33) + (36) =	30.0835	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733	(38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567	(39)
Average = Sum(39)m / 12 =												41.3717	(39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794	(40)
HLP (average)												1.7673	(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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(73)

6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains					
			m2	Table 6a	Specific data	Specific data	factor	W					
				W/m2	or Table 6b	or Table 6c	Table 6d						
Southeast			1.2800	36.7938	0.6300	0.7000	0.7700	14.3932					
Northwest			2.1000	11.2829	0.6300	0.7000	0.7700	7.2412					
Solar gains	21.6344	39.2567	60.1015	85.1772	105.1799	108.7186	103.0272	87.4470	68.6816	45.1096	26.3511	18.2311	(83)
Total gains	179.1462	195.8691	211.4148	228.0127	239.4921	234.7864	223.7283	210.6391	196.2252	181.2179	172.2718	171.4292	(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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9944	0.9916	0.9851	0.9675	0.9234	0.8252	0.6923	0.7377	0.9012	0.9742	0.9910	0.9952	(86)
MIT	19.1181	19.2712	19.5672	19.9903	20.4126	20.7548	20.9099	20.8834	20.6160	20.0878	19.5381	19.0952	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9923	0.9884	0.9791	0.9526	0.8824	0.7194	0.5051	0.5609	0.8296	0.9593	0.9871	0.9935	(89)
MIT 2	17.8196	17.9741	18.2699	18.6958	19.0970	19.3939	19.4874	19.4793	19.2907	18.7979	18.2515	17.8058	(90)
Living area fraction									fLA = Living area / (4) =			0.5912	(91)
MIT	18.5873	18.7410	19.0368	19.4611	19.8748	20.1985	20.3284	20.3094	20.0742	19.5605	19.0121	18.5681	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5873	18.7410	19.0368	19.4611	19.8748	20.1985	20.3284	20.3094	20.0742	19.5605	19.0121	18.5681	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9907	0.9864	0.9768	0.9522	0.8947	0.7747	0.6168	0.6655	0.8622	0.9601	0.9854	0.9921	(94)
Ext temp.	177.4821	193.2082	206.5077	217.1181	214.2762	181.8941	137.9981	140.1738	169.1832	173.9950	169.7589	170.0703	(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	601.0013	580.7689	524.7530	436.9348	337.4664	228.7493	152.3394	159.4280	245.0743	369.9010	493.9353	598.5296	(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	315.0983	260.4408	236.7745	158.2681	91.6535	0.0000	0.0000	0.0000	0.0000	145.7541	233.4071	318.7737	(98)
Space heating per m2												1760.1700	(98)
												75.1888	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7006	0.7831	0.7528	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	269.0743	236.7850	233.3064	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	314.3666	300.8746	286.0520	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	32.6104	47.6827	39.2428	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												119.5359	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	8.1526	11.9207	9.8107	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											29.8840 (107)
Space cooling per m2											1.2765 (108)
Energy for space heating											75.1888 (99)
Energy for space cooling											1.2765 (108)
Total											76.4654 (109)
Target Fabric Energy Efficiency (TFEE)											87.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction S	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.30	TER	51.48	
Environmental	87 B	% DER<TER	39.20			
CO ₂ Emissions (t/year)	0.66	DFEE	53.12	TFEE	85.29	
General Requirements Compliance	Pass	% DFEE<TFEE	37.71			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 56.1840 (5)
Dwelling volume			

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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (40)
Days in month												1.4072 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											936.8334 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (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		
South						2.1000	46.7521	0.5800	0.7400	0.7700	29.2020 (78)		
North						1.2800	10.6334	0.5800	0.6400	0.7700	3.5012 (74)		
Solar gains	32.7033	54.5165	72.2908	87.1168		96.3518	95.3865	92.0545	85.0267	77.3094	59.5490	38.9336	28.1521 (83)
Total gains	190.2099	211.1243	223.6004	229.9494		230.6619	221.4525	212.7537	208.2163	204.8496	195.6531	184.8494	181.3448 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9701	0.9581	0.9391	0.9037	0.8387	0.7231	0.5864	0.6135	0.7803	0.9056	0.9564	0.9737 (86)
MIT	18.9186	19.1343	19.4794	19.9317	20.3706	20.7279	20.8954	20.8768	20.6308	20.0768	19.4222	18.8759 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9639	0.9494	0.9257	0.8803	0.7940	0.6370	0.4537	0.4856	0.7069	0.8780	0.9458	0.9682 (89)
MIT 2	17.8883	18.1019	18.4421	18.8885	19.3012	19.6156	19.7315	19.7231	19.5387	19.0350	18.3967	17.8529 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4974	18.7123	19.0554	19.5052	19.9335	20.2732	20.4196	20.4052	20.1843	19.6509	19.0029	18.4577 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4974	18.7123	19.0554	19.5052	19.9335	20.2732	20.4196	20.4052	20.1843	19.6509	19.0029	18.4577 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9560	0.9404	0.9167	0.8746	0.8011	0.6753	0.5278	0.5557	0.7345	0.8752	0.9378	0.9609 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	181.8372	198.5410	204.9692	201.1240	184.7745	149.5359	112.2864	115.6981	150.4668	171.2265	173.3494	174.2493 (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												
Month fracti	474.5648	460.6766	417.8515	349.3658	270.7124	184.8624	124.4627	130.2912	198.9494	297.5895	392.8860	472.5162 (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	217.7893	176.1551	158.3844	106.7341	63.9378	0.0000	0.0000	0.0000	0.0000	94.0141	158.0664	221.9106 (98)
Space heating per m2												1196.9916 (98)
										(98) / (4) =		51.1316 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7366	0.8080	0.7944	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	225.6227	194.8321	196.4062	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	298.7792	288.0446	283.2169	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	52.6727	69.3501	64.5871	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												186.6099 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	13.1682	17.3375	16.1468	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												46.6525 (107)
Space cooling per m2												1.9928 (108)
Energy for space heating												51.1316 (99)
Energy for space cooling												1.9928 (108)
Total												53.1245 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.1 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)					
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)					
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)					
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)					
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)					
Total net area of external elements Aum(A, m2)			97.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)					
Total fabric heat loss						(33) + (36) =	30.0835	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733	(38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567	(39)
Average = Sum(39)m / 12 =												41.3717	(39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794	(40)
HLP (average)												1.7673	(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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(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				1.2800	10.6334	0.6300		0.7000		0.7700		4.1596 (74)	
South				2.1000	46.7521	0.6300		0.7000		0.7700		30.0049 (78)	
Solar gains	34.1645	57.0895	76.1037	92.4439	102.9504	102.2372	98.5330	90.4962	81.6295	62.4649	40.6974	29.3946 (83)	
Total gains	191.6763	213.7019	227.4170	235.2794	237.2626	228.3050	219.2341	213.6883	209.1731	198.5733	186.6182	182.5927 (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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9930	0.9889	0.9813	0.9644	0.9252	0.8349	0.7014	0.7315	0.8850	0.9662	0.9884	0.9941	(86)
MIT	19.1619	19.3327	19.6208	20.0130	20.4067	20.7434	20.9059	20.8867	20.6460	20.1431	19.5876	19.1345	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9905	0.9848	0.9740	0.9483	0.8849	0.7316	0.5139	0.5544	0.8067	0.9475	0.9835	0.9920	(89)
MIT 2	17.8630	18.0347	18.3221	18.7172	19.0920	19.3871	19.4862	19.4805	19.3123	18.8495	18.3001	17.8448	(90)
Living area fraction									fLA = Living area / (4) =			0.5912	(91)
MIT	18.6309	18.8021	19.0898	19.4833	19.8693	20.1890	20.3255	20.3118	20.1007	19.6143	19.0613	18.6073	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6309	18.8021	19.0898	19.4833	19.8693	20.1890	20.3255	20.3118	20.1007	19.6143	19.0613	18.6073	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	189.4939	209.9565	220.9481	223.0941	212.7918	179.2555	137.1921	140.8635	176.4224	188.5217	183.1771	180.8370	(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	602.8355	583.3318	526.9717	437.8518	337.2395	228.3606	152.2207	159.5288	246.1616	372.1219	495.9722	600.1600	(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	307.5261	250.9082	227.6815	154.6255	92.5891	0.0000	0.0000	0.0000	0.0000	136.5985	225.2125	311.9764	(98)
Space heating												1707.1178	(98)
Space heating per m2												72.9226	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6897	0.7761	0.7579	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	264.8850	234.6696	234.9039	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	306.7909	295.6216	289.6161	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	30.1722	45.3483	40.7059	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												116.2264	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	7.5431	11.3371	10.1765	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											29.0566 (107)
Space cooling per m2											1.2412 (108)
Energy for space heating											72.9226 (99)
Energy for space cooling											1.2412 (108)
Total											74.1638 (109)
Target Fabric Energy Efficiency (TFEE)											85.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction SE		Prop Type Ref			
Property						
SAP Rating	75 C	DER	31.44	TER	51.71	
Environmental	87 B	% DER<TER	39.20			
CO ₂ Emissions (t/year)	0.66	DFEE	53.91	TFEE	86.26	
General Requirements Compliance	Pass	% DFEE<TFEE	37.51			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (40)
Days in month												1.4072 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											936.8334 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				2.1000	36.7938	0.5800		0.7400		0.7700		22.9820
Northwest				1.2800	11.2829	0.5800		0.6400		0.7700		3.7151 (77)

Solar gains	26.6971	46.7090	67.1871	88.7421	104.4133	105.8640	101.1463	89.1176	74.5987	52.5072	32.2017	22.7017 (83)
Total gains	184.2038	203.3169	218.4967	231.5748	238.7234	231.9300	221.8455	212.3072	202.1389	188.6113	178.1175	175.8945 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9724	0.9617	0.9422	0.9023	0.8286	0.7051	0.5690	0.6054	0.7849	0.9125	0.9601	0.9756 (86)
MIT	18.8885	19.0967	19.4564	19.9381	20.3950	20.7470	20.9036	20.8812	20.6241	20.0485	19.3898	18.8481 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9666	0.9536	0.9294	0.8786	0.7823	0.6177	0.4378	0.4779	0.7122	0.8865	0.9503	0.9705 (89)
MIT 2	17.8588	18.0654	18.4202	18.8943	19.3215	19.6280	19.7349	19.7251	19.5339	19.0093	18.3655	17.8256 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4675	18.6751	19.0328	19.5114	19.9561	20.2895	20.4258	20.4086	20.1784	19.6236	18.9710	18.4301 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4675	18.6751	19.0328	19.5114	19.9561	20.2895	20.4258	20.4086	20.1784	19.6236	18.9710	18.4301 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9590	0.9449	0.9204	0.8731	0.7905	0.6575	0.5114	0.5480	0.7392	0.8831	0.9424	0.9635 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	176.6454	192.1182	201.0971	202.1811	188.7201	152.4972	113.4523	116.3342	149.4197	166.5633	167.8629	169.4658 (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												
Month fracti	473.5659	459.4359	417.1009	349.5693	271.4579	185.3943	124.6659	130.4024	198.7563	296.6934	391.8330	471.6030 (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	220.9089	179.6375	160.7068	106.1195	61.5570	0.0000	0.0000	0.0000	0.0000	96.8167	161.2585	224.7901 (98)
Space heating per m2												1211.7950 (98)
										(98) / (4) =		51.7640 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7516	0.8195	0.8000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	230.2255	197.6011	197.7856	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	311.0256	298.6713	287.9985	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	58.1761	75.1963	67.1184	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												200.4908 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	14.5440	18.7991	16.7796	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												50.1227 (107)
Space cooling per m2												2.1411 (108)
Energy for space heating												51.7640 (99)
Energy for space cooling												2.1411 (108)
Total												53.9051 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.9 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)					
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)					
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)					
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)					
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)					
Total net area of external elements Aum(A, m2)			97.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)					
Total fabric heat loss						(33) + (36) =	30.0835	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733	(38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567	(39)
Average = Sum(39)m / 12 =												41.3717	(39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794	(40)
HLP (average)												1.7673	(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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Southeast				2.1000	36.7938	0.6300	0.7000		23.6138 (77)			
Northwest				1.2800	11.2829	0.6300	0.7000	0.7700	4.4137 (81)			
Solar gains	28.0275	49.2073	71.2217	94.7743	112.1127	113.9226	108.7429	95.4070	79.3150	55.4345	33.8375	23.8130 (83)
Total gains	185.5393	205.8197	222.5350	237.6097	246.4249	239.9903	229.4441	218.5991	206.8586	191.5428	179.7582	177.0110 (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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017
util living area	0.9937	0.9901	0.9825	0.9634	0.9176	0.8174	0.6810	0.7216	0.8880	0.9696	0.9897	0.9947 (86)
MIT	19.1405	19.3056	19.6045	20.0202	20.4306	20.7636	20.9148	20.8919	20.6408	20.1209	19.5640	19.1149 (87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844 (88)
util rest of house	0.9914	0.9865	0.9756	0.9469	0.8745	0.7098	0.4942	0.5442	0.8108	0.9525	0.9853	0.9928 (89)
MIT 2	17.8418	18.0080	18.3063	18.7239	19.1120	19.3991	19.4888	19.4822	19.3086	18.8289	18.2769	17.8253 (90)
Living area fraction									fLA = Living area / (4) =			0.5912 (91)
MIT	18.6096	18.7752	19.0738	19.4903	19.8916	20.2058	20.3319	20.3156	20.0962	19.5927	19.0378	18.5877 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6096	18.7752	19.0738	19.4903	19.8916	20.2058	20.3319	20.3156	20.0962	19.5927	19.0378	18.5877 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9897	0.9843	0.9732	0.9469	0.8879	0.7664	0.6057	0.6492	0.8468	0.9539	0.9835	0.9913 (94)
Ext temp.	183.6233	202.5856	216.5737	224.9910	218.8118	183.9233	138.9633	141.9254	175.1694	182.7096	176.7863	175.4628 (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	601.9386	582.2030	526.2990	438.1430	338.1595	229.0476	152.4817	159.6841	245.9737	371.2327	495.0014	599.3459 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	311.2266	255.1029	230.4356	153.4695	88.7946	0.0000	0.0000	0.0000	0.0000	140.2612	229.1149	315.3690 (98)
												1723.7743 (98)
												73.6341 (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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7091	0.7917	0.7660	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	272.3386	239.3773	237.4070	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	320.4491	307.5553	295.3560	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	34.6396	50.7244	43.1140	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												128.4780 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	8.6599	12.6811	10.7785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											32.1195 (107)
Space cooling per m2											1.3720 (108)
Energy for space heating											73.6341 (99)
Energy for space cooling											1.3720 (108)
Total											75.0061 (109)
Target Fabric Energy Efficiency (TFEE)											86.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement			Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction SW	Prop Type Ref			
Property					
SAP Rating	75 C	DER	31.44	TER	51.71
Environmental	87 B	% DER<TER	39.20		
CO ₂ Emissions (t/year)	0.66	DFEE	53.91	TFEE	86.26
General Requirements Compliance	Pass	% DFEE<TFEE	37.51		
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk			Assessor ID	L855-0001
Client					

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)				(28)...(30) + (32) + (32a)...(32e) =			3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											936.8334 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (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
Southwest				2.1000	36.7938	0.5800		0.7400		0.7700		22.9820
Northeast				1.2800	11.2829	0.5800		0.6400		0.7700		3.7151 (75)

Solar gains	26.6971	46.7090	67.1871	88.7421	104.4133	105.8640	101.1463	89.1176	74.5987	52.5072	32.2017	22.7017 (83)
Total gains	184.2038	203.3169	218.4967	231.5748	238.7234	231.9300	221.8455	212.3072	202.1389	188.6113	178.1175	175.8945 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9724	0.9617	0.9422	0.9023	0.8286	0.7051	0.5690	0.6054	0.7849	0.9125	0.9601	0.9756 (86)
MIT	18.8885	19.0967	19.4564	19.9381	20.3950	20.7470	20.9036	20.8812	20.6241	20.0485	19.3898	18.8481 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9666	0.9536	0.9294	0.8786	0.7823	0.6177	0.4378	0.4779	0.7122	0.8865	0.9503	0.9705 (89)
MIT 2	17.8588	18.0654	18.4202	18.8943	19.3215	19.6280	19.7349	19.7251	19.5339	19.0093	18.3655	17.8256 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4675	18.6751	19.0328	19.5114	19.9561	20.2895	20.4258	20.4086	20.1784	19.6236	18.9710	18.4301 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4675	18.6751	19.0328	19.5114	19.9561	20.2895	20.4258	20.4086	20.1784	19.6236	18.9710	18.4301 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9590	0.9449	0.9204	0.8731	0.7905	0.6575	0.5114	0.5480	0.7392	0.8831	0.9424	0.9635 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	176.6454	192.1182	201.0971	202.1811	188.7201	152.4972	113.4523	116.3342	149.4197	166.5633	167.8629	169.4658 (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												
Month fracti	473.5659	459.4359	417.1009	349.5693	271.4579	185.3943	124.6659	130.4024	198.7563	296.6934	391.8330	471.6030 (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	220.9089	179.6375	160.7068	106.1195	61.5570	0.0000	0.0000	0.0000	0.0000	96.8167	161.2585	224.7901 (98)
Space heating per m2												1211.7950 (98)
										(98) / (4) =		51.7640 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7516	0.8195	0.8000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	230.2255	197.6011	197.7856	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	311.0256	298.6713	287.9985	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	58.1761	75.1963	67.1184	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												200.4908 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	14.5440	18.7991	16.7796	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												50.1227 (107)
Space cooling per m2												2.1411 (108)
Energy for space heating												51.7640 (99)
Energy for space cooling												2.1411 (108)
Total												53.9051 (109)
Dwelling Fabric Energy Efficiency (DFEE)												53.9 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.3560 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.6060 (18)
					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1000	1.0000	2.1000			(26)				
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)				
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)				
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)				
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)				
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)				
Total net area of external elements Aum(A, m2)			97.2400					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.7569			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)				
Total fabric heat loss						(33) + (36) =		30.0835 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733 (38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567 (39)
Average = Sum(39)m / 12 =												41.3717 (39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794 (40)
HLP (average)												1.7673 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(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				1.2800	11.2829	0.6300	0.7000			0.7700			4.4137 (75)
Southwest				2.1000	36.7938	0.6300	0.7000			0.7700			23.6138 (79)

Solar gains	28.0275	49.2073	71.2217	94.7743	112.1127	113.9226	108.7429	95.4070	79.3150	55.4345	33.8375	23.8130	(83)
Total gains	185.5393	205.8197	222.5350	237.6097	246.4249	239.9903	229.4441	218.5991	206.8586	191.5428	179.7582	177.0110	(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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9937	0.9901	0.9825	0.9634	0.9176	0.8174	0.6810	0.7216	0.8880	0.9696	0.9897	0.9947	(86)
MIT	19.1405	19.3056	19.6045	20.0202	20.4306	20.7636	20.9148	20.8919	20.6408	20.1209	19.5640	19.1149	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9914	0.9865	0.9756	0.9469	0.8745	0.7098	0.4942	0.5442	0.8108	0.9525	0.9853	0.9928	(89)
MIT 2	17.8418	18.0080	18.3063	18.7239	19.1120	19.3991	19.4888	19.4822	19.3086	18.8289	18.2769	17.8253	(90)
Living area fraction													(91)
MIT	18.6096	18.7752	19.0738	19.4903	19.8916	20.2058	20.3319	20.3156	20.0962	19.5927	19.0378	18.5877	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6096	18.7752	19.0738	19.4903	19.8916	20.2058	20.3319	20.3156	20.0962	19.5927	19.0378	18.5877	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9997	0.9943	0.9732	0.9469	0.8879	0.7664	0.6057	0.6492	0.8468	0.9539	0.9835	0.9913	(94)
Ext temp.	183.6233	202.5856	216.5737	224.9910	218.8118	183.9233	138.9633	141.9254	175.1694	182.7096	176.7863	175.4628	(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	601.9386	582.2030	526.2990	438.1430	338.1595	229.0476	152.4817	159.6841	245.9737	371.2327	495.0014	599.3459	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	311.2266	255.1029	230.4356	153.4695	88.7946	0.0000	0.0000	0.0000	0.0000	140.2612	229.1149	315.3690	(98)
												1723.7743	(98)
												73.6341	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7091	0.7917	0.7660	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	272.3386	239.3773	237.4070	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	320.4491	307.5553	295.3560	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	34.6396	50.7244	43.1140	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												128.4780	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	8.6599	12.6811	10.7785	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											32.1195 (107)
Space cooling per m2											1.3720 (108)
Energy for space heating											73.6341 (99)
Energy for space cooling											1.3720 (108)
Total											75.0061 (109)
Target Fabric Energy Efficiency (TFEE)											86.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Volumetric Carbon Statement				Issued on Date	25/08/2020
Assessment Reference	Carbon Reduction W	Prop Type Ref				
Property						
SAP Rating	75 C	DER	31.65	TER	52.03	
Environmental	86 B	% DER<TER	39.17			
CO ₂ Emissions (t/year)	0.66	DFEE	54.95	TFEE	87.54	
General Requirements Compliance	Pass	% DFEE<TFEE	37.23			
Assessor Details	Mr. Colin Padwick, SapCode, Tel: 01604 875005, colin@sapcode.co.uk				Assessor ID	L855-0001
Client						

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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 56.1840 (5)
Dwelling volume			

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				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) =	0.3560 (8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.5060	(18)
Number of sides sheltered				4	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3985	0.4162 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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
Door			2.1000	1.0000	2.1000		(26)
Nordan Front (Uw = 1.35)			2.1000	1.2808	2.6898		(27)
Nordan Back (Uw = 1.42)			1.2800	1.3437	1.7199		(27)
Heat Loss Floor 1			23.4100	0.1000	2.3410	25.3000	592.2730 (28b)
Ext Wall 1 Sides	35.0300		35.0300	0.1400	4.9042	25.5600	895.3668 (29a)
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1400	1.3874	25.2600	250.3266 (29a)
External Roof 1	23.4100		23.4100	0.1600	3.7456	20.3500	476.3935 (30)
Total net area of external elements Aum(A, m ²)			97.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.8879		(33)
Ptn Std Wall			46.6800			25.5500	1192.6740 (32c)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		3407.0339 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.5375 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.3774 (36)
Total fabric heat loss						(33) + (36) =	22.2653 (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	11.1608	11.0874	11.0155	10.6775	10.6143	10.3199	10.3199	10.2654	10.4333	10.6143	10.7422	10.8759 (38)
Heat transfer coeff	33.4261	33.3527	33.2807	32.9428	32.8795	32.5852	32.5852	32.5307	32.6986	32.8795	33.0075	33.1412 (39)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average = Sum(39)m / 12 =												32.9425 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4279	1.4247	1.4216	1.4072	1.4045	1.3919	1.3919	1.3896	1.3968	1.4045	1.4100	1.4157 (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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	65.4966	63.1149	60.7332	58.3515	55.9698	53.5881	53.5881	55.9698	58.3515	60.7332	63.1149	65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											936.8334 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
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	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8699	6.9900	5.6847	4.3036	3.2170	2.7159	2.9347	3.8146	5.1200	6.5010	7.5876	8.0887 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352 (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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819 (71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666 (72)
Total internal gains	157.5067	156.6078	151.3096	142.8327	134.3101	126.0660	120.6992	123.1896	127.5402	136.1041	145.9158	153.1928 (73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
West	2.1000				19.6403		0.5800		0.7400		0.7700		12.2676 (80)
East	1.2800				19.6403		0.5800		0.6400		0.7700		6.4669 (76)
Solar gains	18.7345	36.6487	60.3552	88.0245	107.8773	110.4316	105.1354	90.3098	70.1956	43.4868	23.3598	15.4064 (83)	
Total gains	176.2412	193.2566	211.6648	230.8572	242.1874	236.4976	225.8346	213.4994	197.7359	179.5909	169.2756	168.5991 (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	28.3131	28.3755	28.4368	28.7286	28.7838	29.0438	29.0438	29.0925	28.9431	28.7838	28.6723	28.5566
alpha	2.8875	2.8917	2.8958	2.9152	2.9189	2.9363	2.9363	2.9395	2.9295	2.9189	2.9115	2.9038
util living area	0.9752	0.9660	0.9462	0.9029	0.8242	0.6973	0.5615	0.6030	0.7924	0.9212	0.9647	0.9781 (86)
MIT	18.8482	19.0474	19.4252	19.9353	20.4051	20.7548	20.9069	20.8825	20.6130	20.0111	19.3466	18.8106 (87)
Th 2	19.7420	19.7444	19.7468	19.7578	19.7599	19.7695	19.7695	19.7713	19.7658	19.7599	19.7557	19.7513 (88)
util rest of house	0.9700	0.9588	0.9341	0.8793	0.7773	0.6096	0.4312	0.4757	0.7207	0.8972	0.9558	0.9734 (89)
MIT 2	17.8192	18.0175	18.3904	18.8917	19.3299	19.6330	19.7363	19.7257	19.5258	18.9752	18.3237	17.7888 (90)
Living area fraction	fLA = Living area / (4) = 0.5912 (91)											
MIT	18.4275	18.6264	19.0022	19.5087	19.9656	20.2962	20.4284	20.4096	20.1686	19.5876	18.9285	18.3929 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4275	18.6264	19.0022	19.5087	19.9656	20.2962	20.4284	20.4096	20.1686	19.5876	18.9285	18.3929 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9628	0.9506	0.9252	0.8738	0.7860	0.6500	0.5045	0.5457	0.7468	0.8931	0.9483	0.9668 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful gains	169.6836	183.7005	195.8389	201.7151	190.3673	153.7132	113.9276	116.5142	147.6750	160.4010	160.5281	162.9989 (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												
Month fracti	472.2286	457.8127	416.0823	349.4796	271.7685	185.6117	124.7486	130.4338	198.4339	295.5086	390.4275	470.3702 (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	225.0935	184.2034	163.8611	106.3904	60.5625	0.0000	0.0000	0.0000	0.0000	100.5201	165.5275	228.6843 (98)
Space heating per m2												1234.8428 (98)
										(98) / (4) =		52.7485 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	306.3006	241.1303	247.2330	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7579	0.8243	0.8016	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	232.1391	198.7537	198.1792	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	316.3644	303.3340	289.3919	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	60.6422	77.8077	67.8622	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												206.3122 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	15.1605	19.4519	16.9656	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												51.5780 (107)
Space cooling per m2												2.2032 (108)
Energy for space heating												52.7485 (99)
Energy for space cooling												2.2032 (108)
Total												54.9518 (109)
Dwelling Fabric Energy Efficiency (DFEE)												55.0 (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	23.4100 (1b)	x 2.4000 (2b)	= 56.1840 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	23.4100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 56.1840 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.3560 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.6060 (18)
Number of sides sheltered					4 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.7000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4242 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.5408	0.5302	0.5196	0.4666	0.4560	0.4030	0.4030	0.3924	0.4242	0.4560	0.4772	0.4984 (22b)
	0.6462	0.6406	0.6350	0.6089	0.6040	0.5812	0.5812	0.5770	0.5900	0.6040	0.6139	0.6242 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			3.3800	1.3258	4.4811			(27)					
Heat Loss Floor 1			23.4100	0.1300	3.0433			(28b)					
Ext Wall 1 Sides	35.0300		35.0300	0.1800	6.3054			(29a)					
Ext Wall 2 Thin Ends	15.3900	5.4800	9.9100	0.1800	1.7838			(29a)					
External Roof 1	23.4100		23.4100	0.1300	3.0433			(30)					
Total net area of external elements Aum(A, m2)			97.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			20.7569		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.3266 (36)					
Total fabric heat loss						(33) + (36) =	30.0835	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 11.9819	Feb 11.8766	Mar 11.7734	Apr 11.2887	May 11.1980	Jun 10.7757	Jul 10.7757	Aug 10.6976	Sep 10.9384	Oct 11.1980	Nov 11.3814	Dec 11.5733	(38)
Heat transfer coeff	42.0654	41.9601	41.8569	41.3721	41.2814	40.8592	40.8592	40.7810	41.0218	41.2814	41.4649	41.6567	(39)
Average = Sum(39)m / 12 =												41.3717	(39)
HLP	Jan 1.7969	Feb 1.7924	Mar 1.7880	Apr 1.7673	May 1.7634	Jun 1.7454	Jul 1.7454	Aug 1.7420	Sep 1.7523	Oct 1.7634	Nov 1.7712	Dec 1.7794	(40)
HLP (average)												1.7673	(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												1.0670 (42)
Average daily hot water use (litres/day)												59.5424 (43)
Daily hot water use	Jan 65.4966	Feb 63.1149	Mar 60.7332	Apr 58.3515	May 55.9698	Jun 53.5881	Jul 53.5881	Aug 55.9698	Sep 58.3515	Oct 60.7332	Nov 63.1149	Dec 65.4966 (44)
Energy conte	97.1296	84.9502	87.6610	76.4249	73.3316	63.2796	58.6378	67.2877	68.0914	79.3539	86.6210	94.0648 (45)
Energy content (annual)										Total = Sum(45)m =		936.8334 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	20.6400	18.0519	18.6280	16.2403	15.5830	13.4469	12.4605	14.2986	14.4694	16.8627	18.4070	19.9888 (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	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	53.3524	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	7.8751	6.9946	5.6884	4.3065	3.2191	2.7177	2.9366	3.8171	5.1233	6.5052	7.5925	8.0939	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	82.8890	83.7492	81.5817	76.9673	71.1425	65.6681	62.0108	61.1507	63.3182	67.9325	73.7573	79.2318	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	28.3352	(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)	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	-42.6819	(71)
Water heating gains (Table 5)	27.7420	26.8630	25.0376	22.5560	20.9448	18.6763	16.7480	19.2186	20.0964	22.6649	25.5652	26.8666	(72)
Total internal gains	157.5118	156.6124	151.3133	142.8355	134.3122	126.0678	120.7011	123.1921	127.5436	136.1083	145.9207	153.1980	(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	
East				1.2800	19.6403	0.6300			0.7000		0.7700	7.6830 (76)	
West				2.1000	19.6403	0.6300			0.7000		0.7700	12.6049 (80)	
Solar gains	20.2878	39.6873	65.3594	95.3227	116.8216	119.5877	113.8524	97.7975	76.0156	47.0924	25.2966	16.6837	(83)
Total gains	177.7996	196.2997	216.6727	238.1582	251.1338	245.6554	234.5535	220.9896	203.5592	183.2007	171.2173	169.8818	(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	38.6468	38.7438	38.8394	39.2944	39.3808	39.7877	39.7877	39.8640	39.6300	39.3808	39.2065	39.0260	
alpha	3.5765	3.5829	3.5893	3.6196	3.6254	3.6525	3.6525	3.6576	3.6420	3.6254	3.6138	3.6017	
util living area	0.9945	0.9915	0.9839	0.9632	0.9136	0.8089	0.6710	0.7169	0.8921	0.9733	0.9912	0.9954	(86)
MIT	19.1134	19.2727	19.5849	20.0219	20.4426	20.7727	20.9190	20.8944	20.6332	20.0942	19.5344	19.0898	(87)
Th 2	19.4722	19.4753	19.4784	19.4930	19.4957	19.5085	19.5085	19.5109	19.5036	19.4957	19.4902	19.4844	(88)
util rest of house	0.9925	0.9884	0.9775	0.9466	0.8690	0.6994	0.4849	0.5393	0.8167	0.9580	0.9873	0.9937	(89)
MIT 2	17.8150	17.9756	18.2872	18.7255	19.1220	19.4045	19.4900	19.4831	19.3032	18.8039	18.2479	17.8004	(90)
Living area fraction									fLA = Living area / (4) =			0.5912	(91)
MIT	18.5826	18.7425	19.0544	19.4919	19.9027	20.2134	20.3348	20.3174	20.0895	19.5667	19.0085	18.5627	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5826	18.7425	19.0544	19.4919	19.9027	20.2134	20.3348	20.3174	20.0895	19.5667	19.0085	18.5627	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9909	0.9863	0.9751	0.9466	0.8833	0.7573	0.5959	0.6445	0.8516	0.9590	0.9857	0.9923	(94)
Ext temp.	176.1854	193.6156	211.2844	225.4361	221.8233	186.0451	139.7728	142.4214	173.3525	175.6847	168.7647	168.5723	(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	600.8035	580.8312	525.4863	438.2114	338.6193	229.3590	152.6011	159.7567	245.7010	370.1591	493.7846	598.3029	(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	315.9159	260.2089	233.7662	153.1982	86.8962	0.0000	0.0000	0.0000	0.0000	144.6889	234.0143	319.7196	(98)
Space heating per m2												1748.4081	(98)
										(98) / (4) =		74.6864	(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	384.0765	302.3581	309.9357	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7181	0.7991	0.7698	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	275.7931	241.6045	238.5949	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	327.0707	313.5274	298.1500	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	36.9199	53.5106	44.3090	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												134.7394	(104)
Cooled fraction												1.0000	(105)
												fC = cooled area / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	9.2300	13.3776	11.0772	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											33.6849 (107)
Space cooling per m2											1.4389 (108)
Energy for space heating											74.6864 (99)
Energy for space cooling											1.4389 (108)
Total											76.1253 (109)
Target Fabric Energy Efficiency (TFEE)											87.5 (109)