

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 19, Wesley Gate
1-2 Queens Road, READING, RG1 4FR

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 08/11/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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Property Reference	015386	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 19, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	80 C	DER	23.58
Environmental	87 B	TER	31.81
CO ₂ Emissions (t/year)	0.68	% DER<TER	25.88
General Requirements Compliance	Pass	DFEE	45.91
		TFEE	48.29
		% DFEE<TFEE	4.94
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	31.81	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.58	kgCO ₂ /m ²	Pass
	-8.23 (-25.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.29	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.91	kWh/m ² /yr	
	-2.4 (-5.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	7.87 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Room heaters - Electric Panel, convector or radiant heaters	
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This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.



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Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer and appliance thermostats

Pass

Hot water controls

No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power

0.52

Maximum

1.5

Pass

MVHR efficiency

90

%

Minimum

70

%

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Medium

Pass

Based on:

Overshading

Average

Windows facing North West

8.56 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

7.87 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K

Photovoltaic array

673.56

kWh/Year

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THERMAL BRIDGING

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		TFEE	48.29
		% DFEE<TFEE	4.94
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	4.08	1.22	
External wall	E3 Sill	Table K1 - Approved	0.040	4.08	0.16	
External wall	E4 Jamb	Table K1 - Approved	0.050	12.60	0.63	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	12.37	0.87	
External wall	E14 Flat roof	Table K1 - Default	0.080	12.37	0.99	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	2.37	0.21	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	7.08	0.42	
External roof	R1 Head of roof window	Table K1 - Default	0.080	0.70	0.06	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	0.70	0.04	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	1.00	0.08	

Total: **4.69** W/mK:
Y-Value: **0.071** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Top-floor flat, total floor area 37 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 31.81 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 23.58 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	7.87 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Room heaters - Electric

Panel, convector or radiant heaters

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer and appliance thermostats 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:	0.52
Maximum	1.5 OK
MVHR efficiency:	90%
Minimum:	70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:	Average
Windows facing North West:	8.56 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.08 W/m ² K
Photovoltaic array	673.56 kWh/Year

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (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								7.8700				
Infiltration rate								0.3935 (18)				
Number of sides sheltered								3 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3050 (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	0.3888	0.3812	0.3736	0.3355	0.3278	0.2897	0.2897	0.2821	0.3050	0.3278	0.3431	0.3583 (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) =												76.5000 (23c)
Effective ac	0.5063	0.4987	0.4911	0.4530	0.4453	0.4072	0.4072	0.3996	0.4225	0.4453	0.4606	0.4758 (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 to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	21.3700	8.5600	12.8100	0.1800	2.3058	0.0000	0.0000 (29a)
Wall to Hall	7.7000	1.8900	5.8100	0.2600	1.5106	18.0000	104.5800 (29a)
External Roof 1	37.4200	0.7200	36.7000	0.0800	2.9360	9.0000	330.3000 (30)
Total net area of external elements Aum(A, m ²)			66.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.7014		(33)
Party Wall 1			40.6600	0.0000	0.0000	20.0000	813.2000 (32)
Party Floor 1			37.4200			30.0000	1122.6000 (32d)
Internal Wall 1			37.4000			9.0000	336.6000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2707.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							72.3485 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6888 (36)
Total fabric heat loss						(33) + (36) =	26.3902 (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	14.6932	14.4720	14.2507	13.1445	12.9233	11.8170	11.8170	11.5958	12.2595	12.9233	13.3657	13.8082 (38)
Heat transfer coeff	41.0834	40.8622	40.6410	39.5347	39.3135	38.2073	38.2073	37.9860	38.6498	39.3135	39.7560	40.1985 (39)
Average = Sum(39)m / 12 =												39.4794 (39)
HLP	Jan 1.0979	Feb 1.0920	Mar 1.0861	Apr 1.0565	May 1.0506	Jun 1.0210	Jul 1.0210	Aug 1.0151	Sep 1.0329	Oct 1.0506	Nov 1.0624	Dec 1.0743 (40)
HLP (average)												1.0550 (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												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	Jan 72.6165	Feb 69.9759	Mar 67.3353	Apr 64.6947	May 62.0541	Jun 59.4135	Jul 59.4135	Aug 62.0541	Sep 64.6947	Oct 67.3353	Nov 69.9759	Dec 72.6165 (44)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (45)
Energy content (annual)										Total = Sum (45)m =		1038.6733 (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)
Total heat required for water heating calculated for each month												
Solar input	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (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	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (64)
								Total per year (kWh/year) = Sum (64)m =				882.8723 (64)
Heat gains from water heating, kWh/month	22.8837	20.0143	20.6529	18.0057	17.2769	14.9087	13.8151	15.8530	16.0423	18.6958	20.4079	22.1617 (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	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.2616	9.1142	7.4122	5.6115	4.1947	3.5413	3.8265	4.9739	6.6759	8.4766	9.8934	10.5468 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	115.1038	116.2982	113.2883	106.8806	98.7920	91.1899	86.1112	84.9168	87.9267	94.3344	102.4230	110.0251 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979 (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)	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832 (71)
Water heating gains (Table 5)	30.7577	29.7831	27.7593	25.0080	23.2217	20.7065	18.5686	21.3078	22.2810	25.1288	28.3443	29.7872 (72)
Total internal gains	199.2168	198.2893	191.5535	180.5938	169.3021	158.5314	151.6001	154.2922	159.9773	171.0334	183.7544	193.4528 (73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northwest		8.5600		11.2829		0.6300		0.7000		0.7700		29.5167 (81)
Horizontal		0.7200		26.0000		0.6300		0.7000		1.0000		7.4300 (82)
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060 (83)
Total gains	236.1635	273.8029	327.2361	401.2347	463.1350	470.4475	443.9353	389.1532	324.7436	263.3192	230.3244	223.5587 (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	18.3048	18.4039	18.5040	19.0218	19.1289	19.6827	19.6827	19.7973	19.4574	19.1289	18.9160	18.7077
alpha	2.2203	2.2269	2.2336	2.2681	2.2753	2.3122	2.3122	2.3198	2.2972	2.2753	2.2611	2.2472
util living area	0.9365	0.9119	0.8595	0.7524	0.6094	0.4577	0.3527	0.4075	0.6257	0.8286	0.9145	0.9426 (86)
MIT	18.2785	18.6045	19.1878	19.9485	20.5018	20.8233	20.9303	20.9020	20.6178	19.8610	18.9675	18.2528 (87)
Th 2	20.0025	20.0074	20.0122	20.0365	20.0414	20.0658	20.0658	20.0707	20.0560	20.0414	20.0316	20.0219 (88)
util rest of house	0.9291	0.9019	0.8435	0.7256	0.5689	0.4034	0.2853	0.3363	0.5709	0.8029	0.9031	0.9360 (89)
MIT 2	16.3574	16.8273	17.6610	18.7353	19.4776	19.8970	20.0147	19.9947	19.6609	18.6441	17.3684	16.3285 (90)
Living area fraction									fLA = Living area / (4) =			0.4735 (91)
MIT	17.2671	17.6689	18.3840	19.3098	19.9626	20.3356	20.4483	20.4243	20.1141	19.2204	18.1256	17.2397 (92)
Temperature adjustment												0.0000
adjusted MIT	17.2671	17.6689	18.3840	19.3098	19.9626	20.3356	20.4483	20.4243	20.1141	19.2204	18.1256	17.2397 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9014	0.8708	0.8112	0.7028	0.5654	0.4196	0.3135	0.3642	0.5745	0.7767	0.8738	0.9098 (94)
Useful gains	212.8699	238.4325	265.4634	281.9769	261.8405	197.3998	139.1898	141.7457	186.5628	204.5119	201.2472	203.3998 (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	532.7331	521.7643	482.9770	411.5489	324.8323	219.1422	147.0311	152.8687	232.4418	338.8973	438.3345	524.1759 (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	237.9782	190.3989	161.8301	93.2919	46.8659	0.0000	0.0000	0.0000	0.0000	99.9827	170.7028	238.6574 (98)
Space heating												1239.7079 (98)
Space heating per m2										(98) / (4) =		33.1296 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													100.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1239.7079	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	237.9782	190.3989	161.8301	93.2919	46.8659	0.0000	0.0000	0.0000	0.0000	99.9827	170.7028	238.6574	(98)	
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)	
Space heating fuel (main heating system)	237.9782	190.3989	161.8301	93.2919	46.8659	0.0000	0.0000	0.0000	0.0000	99.9827	170.7028	238.6574	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467	(64)	
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)	
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)	
Fuel for water heating, kWh/month	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467	(219)	
Water heating fuel used												882.8723	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1239.7079	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6500)														
mechanical ventilation fans (SFP = 0.6500)													69.7340	(230a)
Total electricity for the above, kWh/year													69.7340	(231)
Electricity for lighting (calculated in Appendix L)													181.2228	(232)
Energy saving/generation technologies (Appendices M,N and Q)														
Total delivered energy for all uses													2373.5371	(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	1239.7079	0.5190	643.4084	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	882.8723	0.5190	458.2107	(264)
Space and water heating			1101.6191	(265)
Pumps and fans	69.7340	0.5190	36.1920	(267)
Energy for lighting	181.2228	0.5190	94.0546	(268)
Energy saving/generation technologies				
PV Unit	-673.5600	0.5190	-349.5776	(269)
Total CO2, kg/year			882.2881	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			23.5800	(273)

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

DER			23.5800	ZC1
Total Floor Area		TFA	37.4200	
Assumed number of occupants		N	1.3396	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			18.2277	ZC2
CO2 emissions from cooking, equation (L16)			4.0393	ZC3
Total CO2 emissions			45.8470	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			45.8470	ZC8

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) = 0.2274 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4774 (18)
Number of sides sheltered					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3700 (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	0.4718	0.4625	0.4533	0.4070	0.3978	0.3515	0.3515	0.3423	0.3700	0.3978	0.4163	0.4348 (22b)
Effective ac	0.6113	0.6070	0.6027	0.5828	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5866	0.5945 (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			1.8900	1.0000	1.8900			(26)					
TER Opening Type (Uw = 1.40)			6.8900	1.3258	9.1345			(27)					
TER Room Window (Uw = 1.70)			0.5800	1.5918	0.9232			(27a)					
Main Walls	21.3700	6.8900	14.4800	0.1800	2.6064			(29a)					
Wall to Hall	7.7000	1.8900	5.8100	0.1800	1.0458			(29a)					
External Roof 1	37.4200	0.5800	36.8400	0.1300	4.7892			(30)					
Total net area of external elements Aum(A, m2)			66.4900					(31)					
Fabric heat loss, W/K = Sum (A x U)								(32)					
					(26) ... (30) + (32) =	20.3891		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								3.7096 (36)					
Total fabric heat loss						(33) + (36) =	24.0987	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 17.7389	Feb 17.6135	Mar 17.4906	Apr 16.9133	May 16.8053	Jun 16.3024	Jul 16.3024	Aug 16.2093	Sep 16.4961	Oct 16.8053	Nov 17.0238	Dec 17.2522	(38)
Heat transfer coeff	41.8376	41.7122	41.5893	41.0120	40.9039	40.4011	40.4011	40.3080	40.5948	40.9039	41.1225	41.3509	(39)
Average = Sum(39)m / 12 =												41.0114	(39)
HLP	Jan 1.1181	Feb 1.1147	Mar 1.1114	Apr 1.0960	May 1.0931	Jun 1.0797	Jul 1.0797	Aug 1.0772	Sep 1.0848	Oct 1.0931	Nov 1.0989	Dec 1.1050	(40)
HLP (average)												1.0960	(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												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	72.6165	69.9759	67.3353	64.6947	62.0541	59.4135	59.4135	62.0541	64.6947	67.3353	69.9759	72.6165 (44)
Energy conte	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (45)
Energy content (annual)										Total = Sum(45)m =		1038.6733 (45)
Distribution loss (46)m = 0.15 x (45)m												
16.1532	14.1277	14.5785	12.7099	12.1955	10.5238	9.7518	11.1904	11.3240	13.1970	14.4056	15.6435 (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)

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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	154.2831	136.2705	143.7852	129.8247	127.8981	115.2503	111.6070	121.1973	120.5852	134.5751	141.1291	150.8852 (59)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	154.2831	136.2705	143.7852	129.8247	127.8981	115.2503	111.6070	121.1973	120.5852	134.5751	141.1291	150.8852 (64)
								Total per year (kWh/year) =	Sum (64)m =			1587.2907 (64)
Heat gains from water heating, kWh/month	73.0823	64.9850	69.5917	64.2471	64.3092	59.4012	58.8925	62.0812	61.1750	66.5293	68.0059	71.9524 (65)

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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													1245.7509	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	246.2950	191.3246	148.1629	65.6345	17.9212	0.0000	0.0000	0.0000	0.0000	76.6776	167.2280	251.5331	(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)	263.4171	204.6252	158.4630	70.1974	19.1671	0.0000	0.0000	0.0000	0.0000	82.0081	178.8535	269.0194	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	154.2831	136.2705	143.7852	129.8247	127.8981	115.2503	111.6070	121.1973	120.5852	134.5751	141.1291	150.8852	(64)	
Efficiency of water heater (217)m	86.0558	85.7190	84.8938	83.0992	80.9766	79.8000	79.8000	79.8000	79.8000	83.3781	85.2673	86.1679	(216)	
Fuel for water heating, kWh/month	179.2826	158.9736	169.3706	156.2286	157.9444	144.4239	139.8584	151.8763	151.1093	161.4034	165.5138	175.1060	(219)	
Water heating fuel used												1911.0907	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1245.7509	(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)													182.2463	(232)
Total delivered energy for all uses													3414.0879	(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	1245.7509	0.2160	269.0822 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.0907	0.2160	412.7956 (264)
Space and water heating			681.8778 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	182.2463	0.5190	94.5858 (268)
Total CO2, kg/m2/year			815.3886 (272)
Emissions per m2 for space and water heating			18.2223 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5277 (272b)
Emissions per m2 for pumps and fans			1.0402 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.2223 * 1.55) + 2.5277 + 1.0402, rounded to 2 d.p.			31.8100 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (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) = 0.2274 (8)
Measured/design AP50					Yes
Infiltration rate					7.8700
Number of sides sheltered					0.6209 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4812 (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	0.6136	0.6015	0.5895	0.5293	0.5173	0.4572	0.4572	0.4451	0.4812	0.5173	0.5414	0.5654 (22b)
	0.6882	0.6809	0.6738	0.6401	0.6338	0.6045	0.6045	0.5991	0.6158	0.6338	0.6465	0.6599 (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 to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	21.3700	8.5600	12.8100	0.1800	2.3058	0.0000	0.0000 (29a)
Wall to Hall	7.7000	1.8900	5.8100	0.2600	1.5106	18.0000	104.5800 (29a)
External Roof 1	37.4200	0.7200	36.7000	0.0800	2.9360	9.0000	330.3000 (30)
Total net area of external elements Aum(A, m ²)			66.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.7014		(33)
Party Wall 1			40.6600	0.0000	0.0000	20.0000	813.2000 (32)
Party Floor 1			37.4200			30.0000	1122.6000 (32d)
Internal Wall 1			37.4000			9.0000	336.6000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	2707.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		72.3485 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.6888 (36)
Total fabric heat loss	(33) + (36) =	26.3902 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	19.9719	19.7598	19.5519	18.5753	18.3926	17.5421	17.5421	17.3846	17.8697	18.3926	18.7622	19.1486 (38)
Average = Sum(39)m / 12 =	46.3621	46.1500	45.9421	44.9656	44.7828	43.9323	43.9323	43.7748	44.2599	44.7828	45.1525	45.5389 (39)
												44.9647 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2390	1.2333	1.2277	1.2016	1.1968	1.1740	1.1740	1.1698	1.1828	1.1968	1.2066	1.2170 (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												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	72.6165	69.9759	67.3353	64.6947	62.0541	59.4135	59.4135	62.0541	64.6947	67.3353	69.9759	72.6165 (44)
Energy content (annual)	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (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)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	22.8837	20.0143	20.6529	18.0057	17.2769	14.9087	13.8151	15.8530	16.0423	18.6958	20.4079	22.1617	(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	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.2616	9.1142	7.4122	5.6115	4.1947	3.5413	3.8265	4.9739	6.6759	8.4766	9.8934	10.5468	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	115.1038	116.2982	113.2883	106.8806	98.7920	91.1899	86.1112	84.9168	87.9267	94.3344	102.4230	110.0251	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	(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)	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	(71)
Water heating gains (Table 5)	30.7577	29.7831	27.7593	25.0080	23.2217	20.7065	18.5686	21.3078	22.2810	25.1288	28.3443	29.7872	(72)
Total internal gains	199.2168	198.2893	191.5535	180.5938	169.3021	158.5314	151.6001	154.2922	159.9773	171.0334	183.7544	193.4528	(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				8.5600	11.2829	0.6300		0.7000		0.7700		29.5167
Horizontal				0.7200	26.0000	0.6300		0.7000		1.0000		7.4300 (81)
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060 (83)
Total gains	236.1635	273.8029	327.2361	401.2347	463.1350	470.4475	443.9353	389.1532	324.7436	263.3192	230.3244	223.5587 (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	16.2206	16.2952	16.3689	16.7244	16.7926	17.1177	17.1177	17.1793	16.9910	16.7926	16.6552	16.5139		
alpha	2.0814	2.0863	2.0913	2.1150	2.1195	2.1412	2.1412	2.1453	2.1327	2.1195	2.1103	2.1009		
util living area	0.9397	0.9175	0.8706	0.7750	0.6427	0.4980	0.3907	0.4479	0.6596	0.8439	0.9201	0.9454	(86)	
MIT	17.9497	18.2778	18.8848	19.6929	20.3325	20.7342	20.8874	20.8464	20.4849	19.6319	18.6741	17.9149	(87)	
Th 2	19.8890	19.8935	19.8979	19.9187	19.9226	19.9408	19.9408	19.9442	19.9338	19.9226	19.9147	19.9065	(88)	
util rest of house	0.9322	0.9074	0.8544	0.7473	0.5990	0.4352	0.3093	0.3634	0.6001	0.8177	0.9086	0.9386	(89)	
MIT 2	17.1133	17.4385	18.0342	18.8218	19.4123	19.7714	19.8871	19.8662	19.5761	18.7868	17.8482	17.0903	(90)	
Living area fraction														
MIT	17.5094	17.8359	18.4370	19.2343	19.8481	20.2273	20.3608	20.3304	20.0064	19.1870	18.2393	17.4808	(92)	
Temperature adjustment												0.0000		
adjusted MIT	17.5094	17.8359	18.4370	19.2343	19.8481	20.2273	20.3608	20.3304	20.0064	19.1870	18.2393	17.4808	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9107	0.8830	0.8282	0.7273	0.5957	0.4530	0.3427	0.3957	0.6046	0.7962	0.8856	0.9184	(94)
Useful gains	215.0779	241.7634	271.0145	291.8066	275.8887	213.1207	152.1368	154.0014	196.3328	209.6501	203.9842	205.3099	(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	612.4142	596.9927	548.4088	464.6888	364.8946	247.2209	165.2197	172.0504	261.4176	384.5487	502.9664	604.7912	(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	295.6182	238.7141	206.3813	124.4751	66.2204	0.0000	0.0000	0.0000	0.0000	130.1245	215.2672	297.2140	(98)
Space heating												1574.0149	(98)
Space heating per m2												(98) / (4) =	42.0635 (99)

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	412.9638	325.0992	332.6886	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7934	0.8403	0.8060	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	327.6481	273.1723	268.1309	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	591.7607	560.3997	498.5908	0.0000	0.0000	0.0000	0.0000	(103)
	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	190.1611	213.6972	171.4622	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												575.3205 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	47.5403	53.4243	42.8655	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.8301 (107)
Space cooling per m2												3.8437 (108)
Energy for space heating												42.0635 (99)
Energy for space cooling												3.8437 (108)
Total												45.9071 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.9 (109)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.2274 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4774 (18)
Number of sides sheltered					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3700 (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	0.4718	0.4625	0.4533	0.4070	0.3978	0.3515	0.3515	0.3423	0.3700	0.3978	0.4163	0.4348 (22b)
Effective ac	0.6113	0.6070	0.6027	0.5828	0.5791	0.5618	0.5618	0.5586	0.5685	0.5791	0.5866	0.5945 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			6.8900	1.3258	9.1345		(27)
TER Room Window (Uw = 1.70)			0.5800	1.5918	0.9232		(27a)
Main Walls	21.3700	6.8900	14.4800	0.1800	2.6064		(29a)
Wall to Hall	7.7000	1.8900	5.8100	0.1800	1.0458		(29a)
External Roof 1	37.4200	0.5800	36.8400	0.1300	4.7892		(30)
Total net area of external elements Aum(A, m ²)			66.4900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		20.3891		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							3.7096 (36)
Total fabric heat loss						(33) + (36) =	24.0987 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	17.7389	17.6135	17.4906	16.9133	16.8053	16.3024	16.3024	16.2093	16.4961	16.8053	17.0238	17.2522 (38)
Average = Sum(39)m / 12 =	41.8376	41.7122	41.5893	41.0120	40.9039	40.4011	40.4011	40.3080	40.5948	40.9039	41.1225	41.3509 (39)
												41.0114 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1181	1.1147	1.1114	1.0960	1.0931	1.0797	1.0797	1.0772	1.0848	1.0931	1.0989	1.1050 (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												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	72.6165	69.9759	67.3353	64.6947	62.0541	59.4135	59.4135	62.0541	64.6947	67.3353	69.9759	72.6165 (44)
Energy content (annual)	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (45)
Distribution loss (46)m = 0.15 x (45)m												1038.6733 (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												

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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)
	22.8837	20.0143	20.6529	18.0057	17.2769	14.9087	13.8151	15.8530	16.0423	18.6958	20.4079	22.1617 (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	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790	66.9790 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.3195	9.1657	7.4541	5.6432	4.2184	3.5613	3.8481	5.0019	6.7136	8.5245	9.9493	10.6064 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	115.1038	116.2982	113.2883	106.8806	98.7920	91.1899	86.1112	84.9168	87.9267	94.3344	102.4230	110.0251 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979	29.6979 (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)	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832 (71)
Water heating gains (Table 5)	30.7577	29.7831	27.7593	25.0080	23.2217	20.7065	18.5686	21.3078	22.2810	25.1288	28.3443	29.7872 (72)
Total internal gains	199.2747	198.3408	191.5954	180.6255	169.3258	158.5514	151.6217	154.3202	160.0150	171.0813	183.8103	193.5124 (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				6.8900	11.2829	0.6300		0.7000		0.7700		23.7582
Horizontal				0.5800	26.0000	0.6300		0.7000		1.0000		5.9853 (81)

Solar gains	29.7434	60.7914	109.2296	177.6231	236.5436	251.1004	235.3376	189.0703	132.6428	74.2937	37.4906	24.2364 (83)
Total gains	229.0182	259.1321	300.8250	358.2486	405.8694	409.6518	386.9593	343.3906	292.6578	245.3750	221.3009	217.7487 (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	62.1119	62.2986	62.4827	63.3623	63.5296	64.3203	64.3203	64.4689	64.0134	63.5296	63.1920	62.8429
alpha	5.1408	5.1532	5.1655	5.2242	5.2353	5.2880	5.2880	5.2979	5.2676	5.2353	5.2128	5.1895
util living area	0.9978	0.9954	0.9860	0.9416	0.8112	0.6096	0.4553	0.5303	0.8215	0.9755	0.9956	0.9983 (86)
MIT	19.8131	19.9552	20.2255	20.5972	20.8703	20.9775	20.9960	20.9915	20.8992	20.5282	20.1101	19.7922 (87)
Th 2	19.9861	19.9888	19.9915	20.0041	20.0065	20.0175	20.0175	20.0195	20.0132	20.0065	20.0017	19.9967 (88)
util rest of house	0.9971	0.9939	0.9811	0.9215	0.7569	0.5251	0.3558	0.4222	0.7472	0.9634	0.9939	0.9978 (89)
MIT 2	18.9059	19.0496	19.3193	19.6865	19.9239	20.0079	20.0165	20.0172	19.9590	19.6302	19.2148	18.8936 (90)
Living area fraction	19.3355	19.4784	19.7484	20.1178	20.3720	20.4670	20.4803	20.4786	fLA = Living area / (4) =	20.0554	19.6388	0.4735 (91)
MIT	19.3355	19.4784	19.7484	20.1178	20.3720	20.4670	20.4803	20.4786	20.4042	20.0554	19.6388	19.3191 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3355	19.4784	19.7484	20.1178	20.3720	20.4670	20.4803	20.4786	20.4042	20.0554	19.6388	19.3191 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9965	0.9929	0.9796	0.9241	0.7782	0.5647	0.4031	0.4737	0.7792	0.9641	0.9930	0.9973 (94)
Ext temp.	228.2085	257.2889	294.6835	331.0548	315.8578	231.3170	155.9822	162.6526	228.0458	236.5759	219.7563	217.1523 (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	629.0476	608.0983	550.9914	460.0632	354.7205	237.0342	156.7694	164.4001	255.9177	386.7646	515.6257	625.1879 (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	298.2243	235.7440	190.6931	92.8860	28.9138	0.0000	0.0000	0.0000	0.0000	111.7404	213.0259	303.5785 (98)
Space heating per m2										(98) / (4) =		1474.8060 (98)
												39.4122 (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	379.7704	298.9682	306.3408	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9416	0.9714	0.9530	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	357.6072	290.4204	291.9439	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	522.6037	495.6062	446.6123	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	118.7974	152.6582	115.0733	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												386.5289 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)

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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	29.6994	38.1646	28.7683	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											96.6322 (107)
Space cooling per m2											2.5824 (108)
Energy for space heating											39.4122 (99)
Energy for space cooling											2.5824 (108)
Total											41.9946 (109)
Target Fabric Energy Efficiency (TFEE)											48.3 (109)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (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							7.8700					
Infiltration rate							0.3935		(18)			
Number of sides sheltered							3		(19)			
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750	(20)			
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3050	(21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3278	0.3126	0.3126	0.2897	0.2973	0.2592	0.2592	0.2516	0.2592	0.2897	0.2821	0.3050 (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) =												76.5000 (23c)
Effective ac	0.4453	0.4301	0.4301	0.4072	0.4148	0.3767	0.3767	0.3691	0.3767	0.4072	0.3996	0.4225 (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 to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	21.3700	8.5600	12.8100	0.1800	2.3058	0.0000	0.0000 (29a)
Wall to Hall	7.7000	1.8900	5.8100	0.2600	1.5106	18.0000	104.5800 (29a)
External Roof 1	37.4200	0.7200	36.7000	0.0800	2.9360	9.0000	330.3000 (30)
Total net area of external elements Aum(A, m ²)			66.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.7014		(33)
Party Wall 1			40.6600	0.0000	0.0000	20.0000	813.2000 (32)
Party Floor 1			37.4200			30.0000	1122.6000 (32d)
Internal Wall 1			37.4000			9.0000	336.6000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2707.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							72.3485 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6888 (36)
Total fabric heat loss						(33) + (36) =	26.3902 (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	12.9233	12.4808	12.4808	11.8170	12.0383	10.9321	10.9321	10.7108	10.9321	11.8170	11.5958	12.2595 (38)
Heat transfer coeff	39.3135	38.8710	38.8710	38.2073	38.4285	37.3223	37.3223	37.1010	37.3223	38.2073	37.9860	38.6498 (39)
Average = Sum(39)m / 12 =												38.1335 (39)
HLP	Jan 1.0506	Feb 1.0388	Mar 1.0388	Apr 1.0210	May 1.0270	Jun 0.9974	Jul 0.9974	Aug 0.9915	Sep 0.9974	Oct 1.0210	Nov 1.0151	Dec 1.0329 (40)
HLP (average)												1.0191 (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												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	Jan 72.6165	Feb 69.9759	Mar 67.3353	Apr 64.6947	May 62.0541	Jun 59.4135	Jul 59.4135	Aug 62.0541	Sep 64.6947	Oct 67.3353	Nov 69.9759	Dec 72.6165 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (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	1038.6733 (45)
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)
Total heat required for water heating calculated for each month	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (64)
RHI water heating demand	22.8837	20.0143	20.6529	18.0057	17.2769	14.9087	13.8151	15.8530	16.0423	18.6958	20.4079	882.8723 (64)
Heat gains from water heating, kWh/month												883 (64)
												22.1617 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6540	22.7856	18.5305	14.0288	10.4867	8.8533	9.5663	12.4346	16.6898	21.1915	24.7336	26.3670 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.7967	173.5794	169.0870	159.5233	147.4508	136.1043	128.5242	126.7415	131.2339	140.7976	152.8701	164.2166 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771 (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)	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832 (71)
Water heating gains (Table 5)	30.7577	29.7831	27.7593	25.0080	23.2217	20.7065	18.5686	21.3078	22.2810	25.1288	28.3443	29.7872 (72)
Total internal gains	299.3770	297.3168	286.5455	269.7287	252.3278	236.8328	227.8278	231.6526	241.3733	258.2865	277.1167	291.5394 (73)

6. Solar gains

[Jan]												Gains
	Area				Solar flux	g		FF		Access		W
	m2				Table 6a	or Table 6b		or Table 6c		factor		
					W/m2					Table 6d		
Northwest	8.5600				13.7804	0.6300		0.7000		0.7700		36.0502
Horizontal	0.7200				32.0000	0.6300		0.7000		1.0000		9.1446 (81)
Solar gains	45.1948	81.0500	144.9239	238.8497	308.8054	346.0270	321.4116	265.6364	187.5638	106.4601	56.1950	36.9852 (83)
Total gains	344.5718	378.3668	431.4695	508.5783	561.1332	582.8598	549.2394	497.2890	428.9371	364.7466	333.3116	328.5246 (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	19.1289	19.3466	19.3466	19.6827	19.5694	20.1494	20.1494	20.2696	20.1494	19.6827	19.7973	19.4574
alpha	2.2753	2.2898	2.2898	2.3122	2.3046	2.3433	2.3433	2.3513	2.3433	2.3122	2.3198	2.2972
util living area	0.8651	0.8331	0.7631	0.6326	0.4806	0.3157	0.2190	0.2461	0.4607	0.6964	0.8208	0.8735 (86)
MIT	19.0465	19.3218	19.8028	20.3805	20.7491	20.9383	20.9823	20.9768	20.8390	20.3406	19.6639	19.0281 (87)
Th 2	20.0414	20.0511	20.0511	20.0658	20.0609	20.0855	20.0855	20.0904	20.0855	20.0658	20.0707	20.0560 (88)
util rest of house	0.8512	0.8166	0.7401	0.5999	0.4370	0.2647	0.1602	0.1829	0.4034	0.6594	0.8005	0.8605 (89)
MIT 2	17.4692	17.8628	18.5351	19.3273	19.7958	20.0346	20.0761	20.0775	19.9354	19.2970	18.3672	17.4521 (90)
Living area fraction									fLA = Living area / (4) =			0.4735 (91)
MIT	18.2161	18.5537	19.1354	19.8260	20.2472	20.4625	20.5052	20.5034	20.3633	19.7912	18.9812	18.1984 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2161	18.5537	19.1354	19.8260	20.2472	20.4625	20.5052	20.5034	20.3633	19.7912	18.9812	18.1984 (93)

8. Space heating requirement

Utilisation	0.8191	0.7857	0.7152	0.5909	0.4459	0.2860	0.1874	0.2119	0.4214	0.6476	0.7726	0.8289 (94)
Useful gains	282.2397	297.2938	308.5677	300.5277	250.2128	166.7033	102.9472	105.3906	180.7542	236.1933	257.5148	272.3000 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	515.6406	499.6370	456.1662	379.2457	282.3433	174.0167	104.6971	107.7178	200.1703	316.7841	417.1340	506.2499 (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	173.6503	135.9746	109.8133	56.6770	23.9051	0.0000	0.0000	0.0000	0.0000	59.9596	114.9258	174.0587 (98)
Space heating												848.9643 (98)
RHI space heating demand												849 (98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (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								7.8700				
Infiltration rate								0.3935 (18)				
Number of sides sheltered								3 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3050 (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	0.3888	0.3812	0.3736	0.3355	0.3278	0.2897	0.2897	0.2821	0.3050	0.3278	0.3431	0.3583 (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) =												76.5000 (23c)
Effective ac	0.5063	0.4987	0.4911	0.4530	0.4453	0.4072	0.4072	0.3996	0.4225	0.4453	0.4606	0.4758 (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 to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	21.3700	8.5600	12.8100	0.1800	2.3058	0.0000	0.0000 (29a)
Wall to Hall	7.7000	1.8900	5.8100	0.2600	1.5106	18.0000	104.5800 (29a)
External Roof 1	37.4200	0.7200	36.7000	0.0800	2.9360	9.0000	330.3000 (30)
Total net area of external elements Aum(A, m ²)			66.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.7014		(33)
Party Wall 1			40.6600	0.0000	0.0000	20.0000	813.2000 (32)
Party Floor 1			37.4200			30.0000	1122.6000 (32d)
Internal Wall 1			37.4000			9.0000	336.6000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2707.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							72.3485 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6888 (36)
Total fabric heat loss						(33) + (36) =	26.3902 (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	14.6932	14.4720	14.2507	13.1445	12.9233	11.8170	11.8170	11.5958	12.2595	12.9233	13.3657	13.8082 (38)
Heat transfer coeff	41.0834	40.8622	40.6410	39.5347	39.3135	38.2073	38.2073	37.9860	38.6498	39.3135	39.7560	40.1985 (39)
Average = Sum(39)m / 12 =												39.4794 (39)
HLP	Jan 1.0979	Feb 1.0920	Mar 1.0861	Apr 1.0565	May 1.0506	Jun 1.0210	Jul 1.0210	Aug 1.0151	Sep 1.0329	Oct 1.0506	Nov 1.0624	Dec 1.0743 (40)
HLP (average)												1.0550 (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												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	Jan 72.6165	Feb 69.9759	Mar 67.3353	Apr 64.6947	May 62.0541	Jun 59.4135	Jul 59.4135	Aug 62.0541	Sep 64.6947	Oct 67.3353	Nov 69.9759	Dec 72.6165 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (45)
Energy content (annual)										Total =	Sum (45)m =	1038.6733 (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)
Total heat required for water heating calculated for each month	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (64)
Heat gains from water heating, kWh/month	22.8837	20.0143	20.6529	18.0057	17.2769	14.9087	13.8151	15.8530	16.0423	18.6958	20.4079	22.1617 (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	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6540	22.7856	18.5305	14.0288	10.4867	8.8533	9.5663	12.4346	16.6898	21.1915	24.7336	26.3670 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.7967	173.5794	169.0870	159.5233	147.4508	136.1043	128.5242	126.7415	131.2339	140.7976	152.8701	164.2166 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771 (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)	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832 (71)
Water heating gains (Table 5)	30.7577	29.7831	27.7593	25.0080	23.2217	20.7065	18.5686	21.3078	22.2810	25.1288	28.3443	29.7872 (72)
Total internal gains	299.3770	297.3168	286.5455	269.7287	252.3278	236.8328	227.8278	231.6526	241.3733	258.2865	277.1167	291.5394 (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					8.5600	11.2829	0.6300		0.7000		0.7700		29.5167
Horizontal					0.7200	26.0000	0.6300		0.7000		1.0000		7.4300 (81)
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060	(83)
Total gains	336.3237	372.8304	422.2281	490.3696	546.1607	548.7488	520.1630	466.5137	406.1396	350.5723	323.6867	321.6453	(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	18.3048	18.4039	18.5040	19.0218	19.1289	19.6827	19.6827	19.7973	19.4574	19.1289	18.9160	18.7077
alpha	2.2203	2.2269	2.2336	2.2681	2.2753	2.3122	2.3122	2.3198	2.2972	2.2753	2.2611	2.2472
util living area	0.8836	0.8544	0.7959	0.6854	0.5480	0.4047	0.3067	0.3496	0.5423	0.7461	0.8502	0.8913 (86)
MIT	18.7233	19.0086	19.5102	20.1522	20.6039	20.8641	20.9482	20.9293	20.7204	20.1201	19.3513	18.7019 (87)
Th 2	20.0025	20.0074	20.0122	20.0365	20.0414	20.0658	20.0658	20.0707	20.0560	20.0414	20.0316	20.0219 (88)
util rest of house	0.8715	0.8397	0.7756	0.6559	0.5079	0.3542	0.2465	0.2859	0.4880	0.7143	0.8329	0.8801 (89)
MIT 2	16.9884	17.3950	18.1038	19.0013	19.5991	19.9378	20.0284	20.0170	19.7741	18.9850	17.9044	16.9674 (90)
Living area fraction	17.8099	18.1591	18.7698	19.5463	20.0749	20.3764	20.4640	20.4490	20.2222	19.5226	18.5895	17.7888 (92)
MIT	17.8099	18.1591	18.7698	19.5463	20.0749	20.3764	20.4640	20.4490	20.2222	19.5226	18.5895	17.7888 (93)
Temperature adjustment												0.0000
adjusted MIT	17.8099	18.1591	18.7698	19.5463	20.0749	20.3764	20.4640	20.4490	20.2222	19.5226	18.5895	17.7888 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8382	0.8064	0.7460	0.6395	0.5093	0.3714	0.2726	0.3124	0.4981	0.6949	0.8018	0.8476 (94)
Ext temp.	281.9051	300.6374	314.9666	313.6086	278.1709	203.8154	141.7945	145.7459	202.2865	243.6067	259.5345	272.6410 (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	555.0353	541.7947	498.6556	420.8991	329.2478	220.7021	147.6330	153.8072	236.6211	350.7766	456.7782	546.2478 (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	203.2089	162.0577	136.6646	77.2491	38.0012	0.0000	0.0000	0.0000	0.0000	79.7345	142.0155	203.5634 (98)
Space heating per m2												1042.4949 (98)
										(98) / (4) =		27.8593 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1042.4949 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	203.2089	162.0577	136.6646	77.2491	38.0012	0.0000	0.0000	0.0000	0.0000	79.7345	142.0155	203.5634	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	203.2089	162.0577	136.6646	77.2491	38.0012	0.0000	0.0000	0.0000	0.0000	79.7345	142.0155	203.5634	(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	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1042.4949 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6500)													69.7340 (230a)
mechanical ventilation fans (SFP = 0.6500)													69.7340 (231)
Total electricity for the above, kWh/year													181.2228 (232)
Electricity for lighting (calculated in Appendix L)													
Energy saving/generation technologies (Appendices M ,N and Q)													2176.3240 (238)
Total delivered energy for all uses													

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1042.4949	13.1900	137.5051 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	882.8723	13.1900	116.4509 (247)
Mechanical ventilation fans	69.7340	13.1900	9.1979 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	181.2228	13.1900	23.9033 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			287.0571 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4628 (257)
SAP value		79.5939
SAP rating (Section 12)		80 (258)
SAP band		C

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	1042.4949	0.5190	541.0548 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	882.8723	0.5190	458.2107 (264)
Space and water heating			999.2656 (265)
Pumps and fans	69.7340	0.5190	36.1920 (267)
Energy for lighting	181.2228	0.5190	94.0546 (268)
Energy saving/generation technologies			
PV Unit	-673.5600	0.5190	-349.5776 (269)
Total kg/year			779.9345 (272)
CO2 emissions per m2			20.8400 (273)
EI value			87.3197
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

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Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 1.0000 = 13.190$, stars = 1
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 1.0000 = 0.5190$, stars = 2
Water heating energy efficiency	$13.19 / 1.0000 = 13.190$, stars = 1
Water heating environmental impact	$0.519 / 1.0000 = 0.5190$, stars = 2

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	37.4200 (1b)	x 2.3500 (2b)	= 87.9370 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	37.4200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 87.9370 (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							7.8700					
Infiltration rate							0.3935	(18)				
Number of sides sheltered							3	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750	(20)			
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3050	(21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Adj infilt rate	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
	0.3278	0.3126	0.3126	0.2897	0.2973	0.2592	0.2592	0.2516	0.2592	0.2897	0.2821	0.3050 (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) =												76.5000 (23c)
Effective ac	0.4453	0.4301	0.4301	0.4072	0.4148	0.3767	0.3767	0.3691	0.3767	0.4072	0.3996	0.4225 (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	
Door to Hall			1.8900	1.4000	2.6460			(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485			(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545			(27a)
Main Walls	21.3700	8.5600	12.8100	0.1800	2.3058	0.0000	0.0000	(29a)
Wall to Hall	7.7000	1.8900	5.8100	0.2600	1.5106	18.0000	104.5800	(29a)
External Roof 1	37.4200	0.7200	36.7000	0.0800	2.9360	9.0000	330.3000	(30)
Total net area of external elements Aum(A, m2)			66.4900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	21.7014			(33)
Party Wall 1			40.6600	0.0000	0.0000	20.0000	813.2000	(32)
Party Floor 1			37.4200			30.0000	1122.6000	(32d)
Internal Wall 1			37.4000			9.0000	336.6000	(32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2707.2800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							72.3485	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6888	(36)
Total fabric heat loss						(33) + (36) =	26.3902	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3396 (42)
Average daily hot water use (litres/day)												66.0150 (43)
Daily hot water use	Jan 72.6165	Feb 69.9759	Mar 67.3353	Apr 64.6947	May 62.0541	Jun 59.4135	Jul 59.4135	Aug 62.0541	Sep 64.6947	Oct 67.3353	Nov 69.9759	Dec 72.6165 (44)

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Energy conte	107.6882	94.1848	97.1903	84.7328	81.3032	70.1585	65.0121	74.6024	75.4933	87.9802	96.0373	104.2903 (45)
Energy content (annual)										Total = Sum (45)m =		1038.6733 (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)
Total heat required for water heating calculated for each month												
Solar input	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (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	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467 (64)
								Total per year (kWh/year) = Sum (64)m =				882.8723 (64)
Heat gains from water heating, kWh/month	22.8837	20.0143	20.6529	18.0057	17.2769	14.9087	13.8151	15.8530	16.0423	18.6958	20.4079	22.1617 (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	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748	80.3748 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6540	22.7856	18.5305	14.0288	10.4867	8.8533	9.5663	12.4346	16.6898	21.1915	24.7336	26.3670 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	171.7967	173.5794	169.0870	159.5233	147.4508	136.1043	128.5242	126.7415	131.2339	140.7976	152.8701	164.2166 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771	44.3771 (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)	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832	-53.5832 (71)
Water heating gains (Table 5)	30.7577	29.7831	27.7593	25.0080	23.2217	20.7065	18.5686	21.3078	22.2810	25.1288	28.3443	29.7872 (72)
Total internal gains	299.3770	297.3168	286.5455	269.7287	252.3278	236.8328	227.8278	231.6526	241.3733	258.2865	277.1167	291.5394 (73)

6. Solar gains

[Jan]		Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northwest		8.5600		13.7804		0.6300		0.7000		0.7700		36.0502 (81)
Horizontal		0.7200		32.0000		0.6300		0.7000		1.0000		9.1446 (82)
Solar gains	45.1948	81.0500	144.9239	238.8497	308.8054	346.0270	321.4116	265.6364	187.5638	106.4601	56.1950	36.9852 (83)
Total gains	344.5718	378.3668	431.4695	508.5783	561.1332	582.8598	549.2394	497.2890	428.9371	364.7466	333.3116	328.5246 (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	19.1289	19.3466	19.3466	19.6827	19.5694	20.1494	20.1494	20.2696	20.1494	19.6827	19.7973	19.4574
alpha	2.2753	2.2898	2.2898	2.3122	2.3046	2.3433	2.3433	2.3513	2.3433	2.3122	2.3198	2.2972
util living area	0.8651	0.8331	0.7631	0.6326	0.4806	0.3157	0.2190	0.2461	0.4607	0.6964	0.8208	0.8735 (86)
MIT	19.0465	19.3218	19.8028	20.3805	20.7491	20.9383	20.9823	20.9768	20.8390	20.3406	19.6639	19.0281 (87)
Th 2	20.0414	20.0511	20.0511	20.0658	20.0609	20.0855	20.0855	20.0904	20.0855	20.0658	20.0707	20.0560 (88)
util rest of house	0.8512	0.8166	0.7401	0.5999	0.4370	0.2647	0.1602	0.1829	0.4034	0.6594	0.8005	0.8605 (89)
MIT 2	17.4692	17.8628	18.5351	19.3273	19.7958	20.0346	20.0761	20.0775	19.9354	19.2970	18.3672	17.4521 (90)
Living area fraction									fLA = Living area / (4) =			0.4735 (91)
MIT	18.2161	18.5537	19.1354	19.8260	20.2472	20.4625	20.5052	20.5034	20.3633	19.7912	18.9812	18.1984 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2161	18.5537	19.1354	19.8260	20.2472	20.4625	20.5052	20.5034	20.3633	19.7912	18.9812	18.1984 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8191	0.7857	0.7152	0.5909	0.4459	0.2860	0.1874	0.2119	0.4214	0.6476	0.7726	0.8289 (94)
Useful gains	282.2397	297.2938	308.5677	300.5277	250.2128	166.7033	102.9472	105.3906	180.7542	236.1933	257.5148	272.3000 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W	515.6406	499.6370	456.1662	379.2457	282.3433	174.0167	104.6971	107.7178	200.1703	316.7841	417.1340	506.2499 (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	173.6503	135.9746	109.8133	56.6770	23.9051	0.0000	0.0000	0.0000	0.0000	59.9596	114.9258	174.0587 (98)
Space heating												848.9643 (98)
Space heating per m ²										(98) / (4) =		22.6874 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													848.9643 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	173.6503	135.9746	109.8133	56.6770	23.9051	0.0000	0.0000	0.0000	0.0000	59.9596	114.9258	174.0587	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	173.6503	135.9746	109.8133	56.6770	23.9051	0.0000	0.0000	0.0000	0.0000	59.9596	114.9258	174.0587	(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	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	91.5350	80.0571	82.6117	72.0229	69.1077	59.6347	55.2603	63.4120	64.1693	74.7832	81.6317	88.6467	(219)
Water heating fuel used												882.8723	(219)
Annual totals kWh/year													
Space heating fuel - main system												848.9643	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6500)													
mechanical ventilation fans (SFP = 0.6500)													69.7340 (230a)
Total electricity for the above, kWh/year													69.7340 (231)
Electricity for lighting (calculated in Appendix L)													181.2228 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													1982.7935 (238)

10a. Fuel costs - using BEDF prices (485)

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	848.9643	19.1200	162.3220	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	882.8723	19.1200	168.8052	(247)
Mechanical ventilation fans	69.7340	19.1200	13.3331	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	181.2228	19.1200	34.6498	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	19.1200	0.0000	(252)
Total energy cost			379.1101	(255)

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

	Energy	Emission factor	Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	848.9643	0.5190	440.6125	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	882.8723	0.5190	458.2107	(264)
Space and water heating			898.8232	(265)
Pumps and fans	69.7340	0.5190	36.1920	(267)
Energy for lighting	181.2228	0.5190	94.0546	(268)
Energy saving/generation technologies				
PV Unit	-673.5600	0.5190	-349.5776	(269)
Total kg/year			679.4922	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy	
	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	848.9643	3.0700	2606.3204	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	882.8723	3.0700	2710.4180	(264)
Space and water heating			5316.7384	(265)
Pumps and fans	69.7340	3.0700	214.0835	(267)
Energy for lighting	181.2228	3.0700	556.3540	(268)
Energy saving/generation technologies				
PV Unit	-673.5600	3.0700	-2067.8292	(269)
Primary energy kWh/year			4019.3468	(272)
Primary energy kWh/m2/year			107.4117	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 80
Current environmental impact rating: B 87

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

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

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			

Total Savings	£0	0.00 kg/m²
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Potential energy efficiency rating: C 80
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 485 TEST (29 Oct 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£379	£379	£0
Space heating	£176	£176	£0
Water heating	£169	£169	£0
Lighting	£35	£35	£0
Total cost of fuels	£379	£379	£0
Total cost of uses	£380	£380	£0
Delivered energy	53 kWh/m²	53 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	18 kg/m²	18 kg/m²	0 kg/m²
Primary energy	107 kWh/m²	107 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	72.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	174.12 (P1)
Transmission heat loss coefficient	26.39 (37)
Summer heat loss coefficient	200.51 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North West	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
North West	1.000	0.90	1.000 0.900 (P8)
Horizontal	1.000	1.00	1.000 1.000 (P8)
[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b
			FF Specific data or Table 6c
North West	8.5600	98.8453	0.6300 0.7000
Horizontal	0.7200	203.0000	0.6300 0.7000
total:			360.2518

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	388	360	297	
Total summer gains	237	228	232	
	625	588	528	(P5)
Summer gain/loss ratio	3.12	2.93	2.64	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 72.3)	1.49	1.49	1.49	
Threshold temperature	20.61	22.33	21.93	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015386	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 19, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	80 C	DER	23.58	TER	31.81
Environmental	87 B	% DER<TER	25.88		
CO ₂ Emissions (t/year)	0.68	DFEE	45.91	TFEE	48.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.94		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
Client			

Building Elements

Roof 000003 - Flat roof inverted

Roof Type: Flat Roof inverted (with corrections)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Membrane				
	Main construction	1	1.0000	0.0010	100.00
Layer 2	TR27				
	Main construction	25	0.0250	1.0000	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	OPTIR				
	Main construction	40	0.0070	5.7143	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	OPTIR				
	Main construction	40	0.0070	5.7143	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Plywood				
	Main construction	15	0.1300	0.1154	100.00
Layer 6	Standard cavity				
	Main construction	150	0.9375	0.1600	91.67
	Main construction	150	0.1300	1.1538	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 8	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance: Upper limit = 13.041 m² K/W Lower limit = 12.976 m² K/W Average = 13.009 m² K/W
Total correction = 0.0039 m² K/W U-value (unrounded) = 0.08 W/m² K

Unheated space: None

Total thickness: 296 mm

U-value: 0.08 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015386	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 19, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	80 C	DER	23.58	TER	31.81
Environmental	87 B	% DER<TER	25.88		
CO ₂ Emissions (t/year)	0.68	DFEE	45.91	TFEE	48.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.94		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
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Client	
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Building Elements

Wall 000001 - Timber Frame

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Softwood, dry						
	Main construction	12	0.1300	0.0923	100.00		
Layer 2	airspace/timber battens						
	Main construction	22	0.1222	0.1800	89.63		
	Main construction	22	0.1243	0.1770	10.37		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Plywood						
	Main construction	12	0.1300	0.0923	100.00		
Layer 4	Isover Earthwool						
	Main construction	75	0.0380	1.9737	91.67		
	Main construction	75	0.1300	0.5769	8.33		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Standard cavity						
	Main construction	25	0.1389	0.1800	91.67		
	Main construction	25	0.1300	0.1923	8.33		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 6	K118						
	Main construction	62.5	0.0202	3.1000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Int surface				0.1300			

Total resistance: Upper limit = 5.640 m² K/W Lower limit = 5.458 m² K/W Average = 5.549 m² K/W
Total correction = 0.0040 m² K/W U-value (unrounded) = 0.18 W/m² K

Unheated space: None

Total thickness: 209 mm

U-value: 0.18 W/m² K

Kappa: 0.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015386	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 19, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	80 C	DER	23.58	TER	31.81
Environmental	87 B	% DER<TER	25.88		
CO ₂ Emissions (t/year)	0.68	DFEE	45.91	TFEE	48.29
General Requirements Compliance	Pass	% DFEE<TFEE	4.94		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
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Client	
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Building Elements

Wall 000002 - Timber framed insulation between studs

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Layer 2	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Layer 3	Standard cavity				
	Main construction	20	0.1111	0.1800	91.67
	Main construction	20	0.1300	0.1538	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Mineral wool batt				
	Main construction	100	0.0380	2.6316	91.67
	Main construction	100	0.1300	0.7692	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Standard cavity				
	Main construction	20	0.1143	0.1750	91.67
	Main construction	20	0.1300	0.1538	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Layer 7	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 3.130 m ² K/W	Lower limit = 2.996 m ² K/W	Average = 3.063 m ² K/W
	Total correction = 0.0051 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: StairwellStairwell1		
Total thickness: 200 mm	U-value: 0.26 W/m² K	Kappa: n/a

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015386	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 19, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	80 C	DER	23.58
Environmental	87 B	TER	31.81
CO ₂ Emissions (t/year)	0.68	% DER<TER	25.88
General Requirements Compliance	Pass	DFEE	45.91
		TFEE	48.29
		% DFEE<TFEE	4.94
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	31.81	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	23.58	kgCO ₂ /m ²	Pass
	-8.23 (-25.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.29	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.91	kWh/m ² /yr	
	-2.4 (-5.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	7.87 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Room heaters - Electric Panel, convector or radiant heaters	
Secondary heating system	None	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer and appliance thermostats

Pass

Hot water controls

No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power

0.52

Maximum

1.5

Pass

MVHR efficiency

90

%

Minimum

70

%

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Medium

Pass

Based on:

Overshading

Average

Windows facing North West

8.56 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

7.87 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K

Photovoltaic array

673.56

kWh/Year

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015386	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 19, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	80 C	DER	23.58
Environmental	87 B	TER	31.81
CO ₂ Emissions (t/year)	0.68	% DER<TER	25.88
General Requirements Compliance	Pass	DFEE	45.91
		TFEE	48.29
		% DFEE<TFEE	4.94
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South East
Property Tenure	Owner-occupied
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Mid-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements			
	Ground Floor:	Heat Loss Perimeter 12.37 m	Internal Floor Area 37.42 m ²
			Average Storey Height 2.35 m

7.0 Living Area	17.72	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	72.35	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Main Walls	Timber Frame	Other	0.18	0.00	21.37	12.81
Wall to Hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.26	18.00	7.70	5.81

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board	0.00	20.00	40.66

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Plasterboard on timber frame		9.00	37.40	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.08	9.00	37.42	36.70

11.1 Party Floors

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	37.42

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Door to Hall	SAP table	Door to Corridor							1.40
Windows	Manufacture	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Roof lights	Manufacture	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door to Hall	Door to Corridor	[2] Wall to Hall	South East							1.89	
Windows	Window	[1] Main Walls	North West	None	0.00					8.56	
Roof lights	Roof Window	[1] External Roof 1	Horizontal	None						0.72	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

Yes

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	4.08	0.300	No
Table K1 - Approved	E3 Sill	4.08	0.040	No
Table K1 - Approved	E4 Jamb	12.60	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	12.37	0.070	No
Table K1 - Default	E14 Flat roof	12.37	0.080	No
Table K1 - Approved	E16 Corner (normal)	2.37	0.090	No
Table K1 - Approved	E18 Party wall between dwellings	7.08	0.060	No
Table K1 - Default	R1 Head of roof window	0.70	0.080	No
Table K1 - Default	R2 Sill of roof window	0.70	0.060	No
Table K1 - Default	R3 Jamb of roof window	1.00	0.080	No

Y-value	0.071	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	7.97	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	7.87	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	6.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Built)

MV Reference Number	500500
Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	90.00
Wet Rooms	1

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	8	
Total number of L.E.L. fittings	8	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
------------------------	----

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	SAP table	
Percentage of Heat	100	%
Main Heating	REA	
SAP Code	691	
Efficiency (SAP Table)	100.0	%
Controls	CRC Programmer and appliance thermostats	
Sap Code	2603	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

	HES Instantaneous at point of use
Water Heating	Independent
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	909

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	673.56	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None