

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 1 , 18, Parkside Road
READING, RG30 2DB

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

Report Issue Date: 01/03/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
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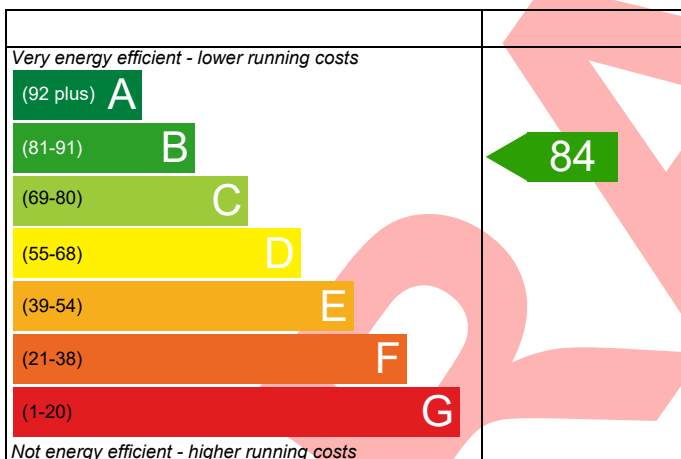
Flat 1 , 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, End-Terrace
Date of assessment: 01/03/2021
Produced by: Energy Calculations Limited
Total floor area: 73.4 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

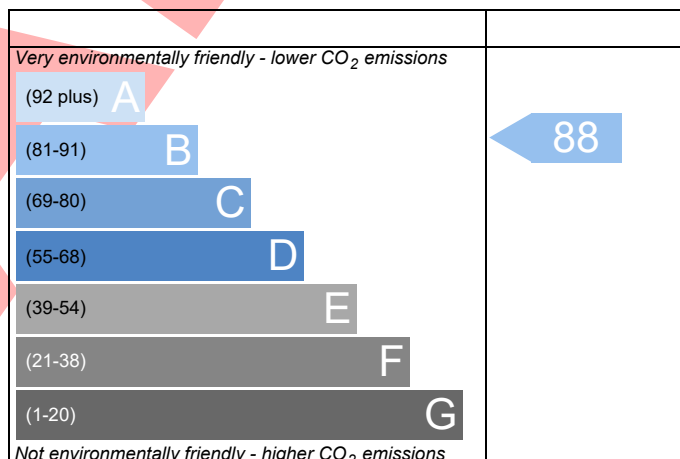


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

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

THERMAL BRIDGING

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Calculation Type: New Build (As Designed)

Property Reference	015722	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	16.43
Environmental	88 B	TER	27.83
CO ₂ Emissions (t/year)	1.01	% DER<TER	40.96
General Requirements Compliance	Pass	DFEE	51.81
		TFEE	54.01
		% DFEE<TFEE	4.08
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	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	7.83	2.35	
External wall	E3 Sill	Table K1 - Approved	0.040	3.82	0.15	
External wall	E4 Jamb	Table K1 - Approved	0.050	41.64	2.08	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	32.37	5.18	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	5.11	0.36	
External wall	E14 Flat roof	Table K1 - Default	0.080	8.50	0.68	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	9.48	0.85	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	4.74	-0.43	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	4.74	0.28	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	5.11	0.82	

Total: **12.33** W/mK:
Y-Value: **0.079** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Property Reference	015722			Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref			
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB				
SAP Rating	84 B	DER	16.43	TER	27.83
Environmental	88 B	% DER<TER	40.96		
CO ₂ Emissions (t/year)	1.01	DFEE	51.81	TFEE	54.01
General Requirements Compliance	Pass	% DFEE<TFEE	4.08		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 73 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) 27.83 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.43 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Panasonic WH-MDC05F3E5

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.86 kWh/day	
Permitted by DBSCG 2.30	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):	Not significant	OK
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Based on:

Overshading:	Average
Windows facing North:	4.83 m ² , No overhang
Windows facing South:	4.83 m ² , No overhang
Windows facing West:	4.83 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
Photovoltaic array	300.00 kWh/Year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3888 (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												
	0.4957	0.4860	0.4763	0.4277	0.4179	0.3693	0.3693	0.3596	0.3888	0.4179	0.4374	0.4568 (22b)
Effective ac	0.6229	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (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
External Door			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			14.4900	1.3258	19.2102		(27)
Main Floor			73.4000	0.1400	10.2760	110.0000	8074.0000 (28a)
Main Wall	60.4500	16.6100	43.8400	0.2200	9.6448	60.0000	2630.4000 (29a)
wall to Stairs	17.2400		17.2400	0.1864	3.2131	60.0000	1034.4000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			155.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.8960		(33)
Party Wall 1			12.1100	0.0000	0.0000	180.0000	2179.8000 (32)
Party Ceilings 1			69.2300			40.0000	2769.2000 (32b)
Internal Wall 1			94.4600			100.0000	9446.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 26171.3300 (34)
356.5576 (35)
12.3293 (36)
(33) + (36) = 58.2253 (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	36.2083	35.9310	35.6591	34.3823	34.1434	33.0314	33.0314	32.8254	33.4597	34.1434	34.6267	35.1319 (38)
Heat transfer coeff	94.4336	94.1562	93.8844	92.6076	92.3687	91.2566	91.2566	91.0507	91.6850	92.3687	92.8520	93.3572 (39)
Average = Sum(39)m / 12 =												92.6064 (39)
HLP	1.2866	1.2828	1.2791	1.2617	1.2584	1.2433	1.2433	1.2405	1.2491	1.2584	1.2650	1.2719 (40)
HLP (average)												1.2617 (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
Average daily hot water use (litres/day)
2.3258 (42)
89.4368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Energy conte	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
Energy content (annual)										Total = Sum(45)m =		1407.1894 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8843	19.1402	19.7509	17.2193	16.5224	14.2575	13.2117	15.1606	15.3417	17.8793	19.5166	21.1938 (46)

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Water storage loss:												210.0000 (47)
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
	Solar input (sum of months) = Sum (63)m =											0.0000 (63)
Output from w/h	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907 (64)
	Total per year (kWh/year) = Sum (64)m =											2047.6914 (64)
Heat gains from water heating, kWh/month	92.0293	81.7349	87.3003	80.2847	80.1436	73.7194	72.8050	77.1251	76.1226	83.1514	85.3771	90.4986 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9987	0.9965	0.9890	0.9578	0.8567	0.6482	0.4514	0.5031	0.7941	0.9725	0.9966	0.9991 (94)
Useful gains	518.1528	600.7507	671.2732	719.0500	681.8988	506.3798	337.8119	354.1253	518.2358	561.9755	512.3034	490.6343 (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	1427.6947	1379.0942	1243.9215	1029.0226	786.3077	520.4934	339.0695	356.5279	565.6329	869.7513	1167.2892	1419.5539 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	676.6991	523.0468	426.0503	223.1803	77.6802	0.0000	0.0000	0.0000	0.0000	228.9852	471.5898	691.1162 (98)
Space heating												3318.3480 (98)
Space heating per m2												(98) / (4) = 45.2091 (99)

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 %)												304.5762 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1089.4970 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	676.6991	523.0468	426.0503	223.1803	77.6802	0.0000	0.0000	0.0000	0.0000	228.9852	471.5898	691.1162 (98)
Space heating efficiency (main heating system 1)	304.5762	304.5762	304.5762	304.5762	304.5762	0.0000	0.0000	0.0000	0.0000	304.5762	304.5762	304.5762 (210)
Space heating fuel (main heating system)	222.1773	171.7294	139.8830	73.2757	25.5044	0.0000	0.0000	0.0000	0.0000	75.1816	154.8348	226.9108 (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	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (217)
Fuel for water heating, kWh/month	118.2095	104.3056	109.8157	98.8194	97.1128	87.1661	84.0869	91.7550	91.4318	102.4516	107.8581	115.4926 (219)
Water heating fuel used												1208.5053 (219)
Annual totals kWh/year												
Space heating fuel - main system												1089.4970 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												325.6481 (232)
Energy saving/generation technologies (Appendices M,N and Q)												
Total delivered energy for all uses												2623.6505 (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	1089.4970	0.5190	565.4489 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1208.5053	0.5190	627.2143 (264)
Space and water heating			1192.6632 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	325.6481	0.5190	169.0114 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1205.9746 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.4300 (273)

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

DER		16.4300 ZC1
Total Floor Area	TFA	73.4000
Assumed number of occupants	N	2.3258
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.5582 ZC2
CO2 emissions from cooking, equation (L16)		2.3817 ZC3
Total CO2 emissions		35.3699 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.3699 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3888 (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												
	0.4957	0.4860	0.4763	0.4277	0.4179	0.3693	0.3693	0.3596	0.3888	0.4179	0.4374	0.4568 (22b)
Effective ac	0.6229	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			14.4900	1.3258	19.2102			(27)					
Main Floor			73.4000	0.1300	9.5420			(28a)					
Main Wall	60.4500	16.6100	43.8400	0.1800	7.8912			(29a)					
wall to Stairs	17.2400		17.2400	0.1800	3.1032			(29a)					
Flat roof	4.1700		4.1700	0.1300	0.5421			(30)					
Total net area of external elements Aum(A, m2)			155.2600					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		42.8327			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.0012 (36)					
Total fabric heat loss						(33) + (36) =	52.8339	(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	36.2083	35.9310	35.6591	34.3823	34.1434	33.0314	33.0314	32.8254	33.4597	34.1434	34.6267	35.1319	(38)
Average = Sum(39)m / 12 =	89.0422	88.7649	88.4931	87.2162	86.9774	85.8653	85.8653	85.6594	86.2936	86.9774	87.4606	87.9659	(39)
												87.2151	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2131	1.2093	1.2056	1.1882	1.1850	1.1698	1.1698	1.1670	1.1757	1.1850	1.1916	1.1984	(40)
Days in month												1.1882	(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3258 (42)
Average daily hot water use (litres/day)												89.4368 (43)
Daily hot water use												
Energy conte	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Distribution loss (46)m = 0.15 x (45)m	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
										Total = Sum(45)m =		1407.1894 (45)
Water storage loss:	21.8843	19.1402	19.7509	17.2193	16.5224	14.2575	13.2117	15.1606	15.3417	17.8793	19.5166	21.1938 (46)
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	197.6420	174.3399	183.4195	164.8730	161.8957	145.1277	139.8247	152.8175	152.3554	170.9418	180.1882	193.0385 (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	197.6420	174.3399	183.4195	164.8730	161.8957	145.1277	139.8247	152.8175	152.3554	170.9418	180.1882	193.0385 (64)
Heat gains from water heating, kWh/month	89.9075	79.8184	85.1785	78.2314	78.0219	71.6661	70.6832	75.0033	74.0693	81.0297	83.3237	88.3768 (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	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4395	16.3778	13.3194	10.0836	7.5376	6.3636	6.8761	8.9378	11.9963	15.2320	17.7780	18.9520	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.0989	207.2272	201.8640	190.4464	176.0336	162.4877	153.4382	151.3099	156.6731	168.0908	182.5035	196.0494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	(71)
Water heating gains (Table 5)	120.8434	118.7774	114.4872	108.6547	104.8681	99.5363	95.0044	100.8110	102.8740	108.9108	115.7274	118.7861	(72)
Total internal gains	405.2683	403.2689	390.5570	370.0711	349.3258	329.2740	316.2050	321.9451	332.4298	353.1200	376.8953	394.6739	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				4.8300	10.6334	0.6300	0.7000		0.7700		15.6961 (74)	
South				4.8300	46.7521	0.6300	0.7000		0.7700		69.0112 (78)	
West				4.8300	19.6403	0.6300	0.7000		0.7700		28.9912 (80)	
Solar gains	113.6985	199.7315	288.3394	380.8055	446.7885	452.1382	432.3628	382.0421	320.3034	224.9065	137.3136	96.5580 (83)
Total gains	518.9668	603.0004	678.8964	750.8767	796.1142	781.4121	748.5678	703.9872	652.7333	578.0265	514.2089	491.2320 (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	57.2450	57.4239	57.6003	58.4435	58.6040	59.3630	59.3630	59.5057	59.0683	58.6040	58.2802	57.9455
alpha	4.8163	4.8283	4.8400	4.8962	4.9069	4.9575	4.9575	4.9670	4.9379	4.9069	4.8853	4.8630
util living area	0.9959	0.9910	0.9778	0.9370	0.8373	0.6617	0.4961	0.5455	0.7912	0.9568	0.9913	0.9968 (86)
MIT	19.7728	19.9474	20.2156	20.5531	20.8190	20.9586	20.9918	20.9872	20.8994	20.5531	20.1035	19.7467 (87)
Th 2	19.9095	19.9125	19.9155	19.9294	19.9320	19.9442	19.9442	19.9465	19.9395	19.9320	19.9268	19.9212 (88)
util rest of house	0.9945	0.9880	0.9702	0.9150	0.7838	0.5692	0.3815	0.4277	0.7095	0.9371	0.9879	0.9958 (89)
MIT 2	18.2907	18.5465	18.9350	19.4179	19.7608	19.9178	19.9413	19.9415	19.8634	19.4293	18.7850	18.2609 (90)
Living area fraction									fLA = Living area / (4) =			0.4360 (91)
MIT	18.9368	19.1572	19.4933	19.9128	20.2221	20.3716	20.3993	20.3974	20.3151	19.9192	19.3598	18.9087 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9368	19.1572	19.4933	19.9128	20.2221	20.3716	20.3993	20.3974	20.3151	19.9192	19.3598	18.9087 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9928	0.9852	0.9665	0.9146	0.7997	0.6082	0.4318	0.4793	0.7410	0.9368	0.9854	0.9944	(94)
Useful gains	515.2464	594.0763	656.1402	686.7800	636.6741	475.2685	323.2108	337.4432	483.6579	541.5117	506.7255	488.4777	(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	1303.2938	1265.5403	1149.8162	960.4947	741.2325	495.5790	326.2295	342.4132	536.3231	810.5614	1072.2532	1293.8628	(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	586.3072	451.2238	367.2950	197.0746	77.7915	0.0000	0.0000	0.0000	0.0000	200.1730	407.1800	599.2065	(98)
Space heating												2886.2516	(98)
Space heating per m2												(98) / (4) =	39.3222 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3086.9001 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	586.3072	451.2238	367.2950	197.0746	77.7915	0.0000	0.0000	0.0000	0.0000	200.1730	407.1800	599.2065	(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)	627.0665	482.5923	392.8288	210.7750	83.1995	0.0000	0.0000	0.0000	0.0000	214.0888	435.4866	640.8626	(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	197.6420	174.3399	183.4195	164.8730	161.8957	145.1277	139.8247	152.8175	152.3554	170.9418	180.1882	193.0385	(64)
Efficiency of water heater (217)m	87.5407	87.2400	86.6312	85.2906	82.9843	79.8000	79.8000	79.8000	79.8000	85.2357	86.9245	79.8000	(216)
Fuel for water heating, kWh/month	225.7715	199.8395	211.7245	193.3073	195.0919	181.8642	175.2189	191.5006	190.9215	200.5519	207.2928	220.2711	(219)
Water heating fuel used												2393.3557	(219)
Annual totals kWh/year													
Space heating fuel - main system												3086.9001	(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)												325.6481	(232)
Total delivered energy for all uses												5880.9039	(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	3086.9001	0.2160	666.7704	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2393.3557	0.2160	516.9648	(264)
Space and water heating			1183.7352	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	325.6481	0.5190	169.0114	(268)
Total CO2, kg/m2/year			1391.6716	(272)
Emissions per m2 for space and water heating			16.1272	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.3026	(272b)
Emissions per m2 for pumps and fans			0.5303	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1272 * 1.55) + 2.3026 + 0.5303, rounded to 2 d.p.			27.8300	(273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (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					3 * 10 = 30.0000 (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					30.0000 / (5) = 0.1703 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4203 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3888 (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												
	0.4957	0.4860	0.4763	0.4277	0.4179	0.3693	0.3693	0.3596	0.3888	0.4179	0.4374	0.4568 (22b)
Effective ac	0.6229	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (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
External Door			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			14.4900	1.3258	19.2102		(27)
Main Floor			73.4000	0.1400	10.2760	110.0000	8074.0000 (28a)
Main Wall	60.4500	16.6100	43.8400	0.2200	9.6448	60.0000	2630.4000 (29a)
wall to Stairs	17.2400		17.2400	0.1864	3.2131	60.0000	1034.4000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			155.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.8960		(33)
Party Wall 1			12.1100	0.0000	0.0000	180.0000	2179.8000 (32)
Party Ceilings 1			69.2300			30.0000	2076.9000 (32b)
Internal Wall 1			94.4600			100.0000	9446.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 25479.0300 (34)
347.1257 (35)
12.3293 (36)
(33) + (36) = 58.2253 (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	36.2083	35.9310	35.6591	34.3823	34.1434	33.0314	33.0314	32.8254	33.4597	34.1434	34.6267	35.1319 (38)
Heat transfer coeff	94.4336	94.1562	93.8844	92.6076	92.3687	91.2566	91.2566	91.0507	91.6850	92.3687	92.8520	93.3572 (39)
Average = Sum(39)m / 12 =												92.6064 (39)
HLP	1.2866	1.2828	1.2791	1.2617	1.2584	1.2433	1.2433	1.2405	1.2491	1.2584	1.2650	1.2719 (40)
HLP (average)												1.2617 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3258 (42)
Average daily hot water use (litres/day)												89.4368 (43)
Daily hot water use	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Energy conte	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
Energy content (annual)										Total = Sum(45)m =		1407.1894 (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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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	(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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.0028	27.1152	27.9805	24.3941	23.4067	20.1982	18.7166	21.4776	21.7341	25.3290	27.6486	(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	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4395	16.3778	13.3194	10.0836	7.5376	6.3636	6.8761	8.9378	11.9963	15.2320	17.7780	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.0989	207.2272	201.8640	190.4464	176.0336	162.4877	153.4382	151.3099	156.6731	168.0908	182.5035	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	(71)
Water heating gains (Table 5)	41.6704	40.3500	37.6082	33.8807	31.4606	28.0530	25.1567	28.8677	30.1862	34.0443	38.4008	(72)
Total internal gains	323.0953	321.8415	310.6779	292.2970	272.9183	254.7907	243.3574	247.0018	256.7420	275.2535	296.5687	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					4.8300	10.6334	0.6300	0.7000			0.7700			15.6961 (74)
South					4.8300	46.7521	0.6300	0.7000			0.7700			69.0112 (78)
West					4.8300	19.6403	0.6300	0.7000			0.7700			28.9912 (80)
Solar gains	113.6985	199.7315	288.3394	380.8055	446.7885	452.1382	432.3628	382.0421	320.3034	224.9065	137.3136			96.5580 (83)
Total gains	436.7938	521.5730	599.0173	673.1026	719.7068	706.9289	675.7202	629.0439	577.0454	500.1600	433.8822			409.8014 (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	74.9470	75.1677	75.3853	76.4247	76.6224	77.5561	77.5561	77.7315	77.1937	76.6224	76.2236	75.8111
alpha	5.9965	6.0112	6.0257	6.0950	6.1082	6.1704	6.1704	6.1821	6.1462	6.1082	6.0816	6.0541
util living area	0.9997	0.9989	0.9960	0.9816	0.9231	0.7669	0.5843	0.6468	0.8964	0.9910	0.9991	0.9998 (86)
MIT	19.9045	20.0438	20.2647	20.5568	20.8123	20.9595	20.9935	20.9884	20.8886	20.5516	20.1742	19.8847 (87)
Th 2	19.8514	19.8543	19.8573	19.8710	19.8735	19.8855	19.8855	19.8878	19.8809	19.8735	19.8683	19.8629 (88)
util rest of house	0.9995	0.9984	0.9939	0.9710	0.8790	0.6604	0.4421	0.5012	0.8210	0.9841	0.9986	0.9997 (89)
MIT 2	18.8601	19.0016	19.2239	19.5216	19.7556	19.8706	19.8845	19.8855	19.8266	19.5222	19.1436	18.8498 (90)
Living area fraction									fLA = Living area / (4) =			0.4360 (91)
MIT	19.3154	19.4559	19.6776	19.9729	20.2163	20.3453	20.3680	20.3664	20.2896	19.9710	19.5929	19.3010 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3154	19.4559	19.6776	19.9729	20.2163	20.3453	20.3680	20.3664	20.2896	19.9710	19.5929	19.3010 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9994	0.9981	0.9934	0.9722	0.8945	0.7073	0.5050	0.5660	0.8528	0.9849	0.9984	0.9996 (94)
Ext temp.	436.5344	520.6010	595.0858	654.3839	643.7804	500.0283	341.2178	356.0670	492.0959	492.6000	433.1952	409.6374 (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	1417.9596	1370.5331	1237.1745	1025.4384	786.6361	524.2977	343.8519	361.1392	567.4918	865.5853	1159.9891	1409.7860 (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	730.1803	571.1544	477.7140	267.1592	106.2847	0.0000	0.0000	0.0000	0.0000	277.5011	523.2916	744.1106 (98)
Space heating per m2												3697.3959 (98)
										(98) / (4) =		50.3732 (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	857.8125	675.2992	691.9854	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8858	0.9452	0.9229	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.8265	638.2911	638.6329	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	912.7497	874.5138	821.3861	0.0000	0.0000	0.0000	0.0000 (103)

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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	110.1047	175.7497	135.9684	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												421.8228 (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	27.5262	43.9374	33.9921	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												105.4557 (107)
Space cooling per m2												1.4367 (108)
Energy for space heating												50.3732 (99)
Energy for space cooling												1.4367 (108)
Total												51.8100 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.8 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3888 (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												
	0.4957	0.4860	0.4763	0.4277	0.4179	0.3693	0.3693	0.3596	0.3888	0.4179	0.4374	0.4568 (22b)
Effective ac	0.6229	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			14.4900	1.3258	19.2102			(27)					
Main Floor			73.4000	0.1300	9.5420			(28a)					
Main Wall	60.4500	16.6100	43.8400	0.1800	7.8912			(29a)					
wall to Stairs	17.2400		17.2400	0.1800	3.1032			(29a)					
Flat roof	4.1700		4.1700	0.1300	0.5421			(30)					
Total net area of external elements Aum(A, m2)			155.2600					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			42.8327		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K									250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)									10.0012 (36)				
Total fabric heat loss						(33) + (36) =		52.8339 (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	36.2083	35.9310	35.6591	34.3823	34.1434	33.0314	33.0314	32.8254	33.4597	34.1434	34.6267	35.1319	(38)
Heat transfer coeff	89.0422	88.7649	88.4931	87.2162	86.9774	85.8653	85.8653	85.6594	86.2936	86.9774	87.4606	87.9659	(39)
Average = Sum(39)m / 12 =												87.2151	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2131	1.2093	1.2056	1.1882	1.1850	1.1698	1.1698	1.1670	1.1757	1.1850	1.1916	1.1984	(40)
HLP (average)												1.1882	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3258 (42)
Average daily hot water use (litres/day)												89.4368 (43)
Daily hot water use	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Energy conte	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
Energy content (annual)										Total = Sum(45)m =		1407.1894 (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												

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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)
	31.0028	27.1152	27.9805	24.3941	23.4067	20.1982	18.7166	21.4776	21.7341	25.3290	27.6486	30.0245 (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	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	116.2880	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4395	16.3778	13.3194	10.0836	7.5376	6.3636	6.8761	8.9378	11.9963	15.2320	17.7780	18.9520	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	205.0989	207.2272	201.8640	190.4464	176.0336	162.4877	153.4382	151.3099	156.6731	168.0908	182.5035	196.0494	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	34.6288	(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)	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	(71)
Water heating gains (Table 5)	41.6704	40.3500	37.6082	33.8807	31.4606	28.0530	25.1567	28.8677	30.1862	34.0443	38.4008	40.3556	(72)
Total internal gains	323.0953	321.8415	310.6779	292.2970	272.9183	254.7907	243.3574	247.0018	256.7420	275.2535	296.5687	313.2434	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					4.8300	10.6334	0.6300	0.7000			0.7700			15.6961 (74)
South					4.8300	46.7521	0.6300	0.7000			0.7700			69.0112 (78)
West					4.8300	19.6403	0.6300	0.7000			0.7700			28.9912 (80)

Solar gains	113.6985	199.7315	288.3394	380.8055	446.7885	452.1382	432.3628	382.0421	320.3034	224.9065	137.3136	96.5580	(83)	
Total gains	436.7938	521.5730	599.0173	673.1026	719.7068	706.9289	675.7202	629.0439	577.0454	500.1600	433.8822	409.8014	(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, (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.2450	57.4239	57.6003	58.4435	58.6040	59.3630	59.3630	59.5057	59.0683	58.6040	58.2802	57.9455	
alpha	4.8163	4.8283	4.8400	4.8962	4.9069	4.9575	4.9575	4.9670	4.9379	4.9069	4.8853	4.8630	
util living area	0.9981	0.9951	0.9865	0.9569	0.8753	0.7134	0.5449	0.6020	0.8444	0.9748	0.9958	0.9986	(86)
MIT	19.6704	19.8480	20.1232	20.4775	20.7725	20.9424	20.9877	20.9804	20.8622	20.4698	20.0049	19.6447	(87)
Th 2	19.9095	19.9125	19.9155	19.9294	19.9320	19.9442	19.9442	19.9465	19.9395	19.9320	19.9268	19.9212	(88)
util rest of house	0.9974	0.9934	0.9816	0.9405	0.8286	0.6202	0.4214	0.4761	0.7707	0.9622	0.9941	0.9981	(89)
MIT 2	18.7024	18.8816	19.1565	19.5115	19.7799	19.9181	19.9412	19.9410	19.8642	19.5119	19.0499	18.6860	(90)
Living area fraction									fLA = Living area / (4) =			0.4360	(91)
MIT	19.1245	19.3029	19.5779	19.9326	20.2126	20.3647	20.3974	20.3942	20.2993	19.9295	19.4662	19.1040	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1245	19.3029	19.5779	19.9326	20.2126	20.3647	20.3974	20.3942	20.2993	19.9295	19.4662	19.1040	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9922	0.9797	0.9405	0.8423	0.6594	0.4757	0.5315	0.7986	0.9621	0.9931	0.9976	(94)
Ext temp.	435.3708	517.4805	586.8292	633.0785	606.1828	466.1831	321.4544	334.3529	460.8384	481.2171	430.8707	408.8146	(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	1320.0022	1278.4714	1157.3076	962.2247	740.4062	494.9858	326.0677	342.1367	534.9583	811.4580	1081.5558	1311.0394	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	658.1657	511.3859	424.4360	236.9853	99.8622	0.0000	0.0000	0.0000	0.0000	245.6992	468.4933	671.2552	(98)
Space heating per m2												3316.2829	(98)
										(98) / (4) =		45.1810	(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	807.1338	635.4032	651.0112	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8789	0.9340	0.9129	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	709.3871	593.4923	594.2834	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	912.7497	874.5138	821.3861	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	146.4210	209.0800	168.9644	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												524.4654	(104)

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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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	36.6053	52.2700	42.2411	0.0000	0.0000	0.0000 (107)
Space cooling											131.1164 (107)
Space cooling per m2											1.7863 (108)
Energy for space heating											45.1810 (99)
Energy for space cooling											1.7863 (108)
Total											46.9673 (109)
Target Fabric Energy Efficiency (TFEE)											54.0 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =				30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3888 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.4277	0.3985	0.3985	0.3791	0.3791	0.3305	0.3305	0.3207	0.3305	0.3693	0.3596	0.3888 (22b)
Effective ac	0.5914	0.5794	0.5794	0.5718	0.5718	0.5546	0.5546	0.5514	0.5546	0.5682	0.5647	0.5756 (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
External Door			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			14.4900	1.3258	19.2102		(27)
Main Floor			73.4000	0.1400	10.2760	110.0000	8074.0000 (28a)
Main Wall	60.4500	16.6100	43.8400	0.2200	9.6448	60.0000	2630.4000 (29a)
wall to Stairs	17.2400		17.2400	0.1864	3.2131	60.0000	1034.4000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			155.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.8960		(33)
Party Wall 1			12.1100	0.0000	0.0000	180.0000	2179.8000 (32)
Party Ceilings 1			69.2300			40.0000	2769.2000 (32b)
Internal Wall 1			94.4600			100.0000	9446.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 26171.3300 (34)
356.5576 (35)
12.3293 (36)
(33) + (36) = 58.2253 (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	34.3823	33.6821	33.6821	33.2428	33.2428	32.2406	32.2406	32.0566	32.2406	33.0314	32.8254	33.4597 (38)
Heat transfer coeff	92.6076	91.9074	91.9074	91.4681	91.4681	90.4658	90.4658	90.2819	90.4658	91.2566	91.0507	91.6850 (39)
Average = Sum(39)m / 12 =												91.2525 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2617	1.2521	1.2521	1.2462	1.2462	1.2325	1.2325	1.2300	1.2325	1.2433	1.2405	1.2491 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3258 (42)
Average daily hot water use (litres/day)												89.4368 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Energy content (annual)	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1407.1894 (45)
	21.8843	19.1402	19.7509	17.2193	16.5224	14.2575	13.2117	15.1606	15.3417	17.8793	19.5166	21.1938 (46)

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Water storage loss:											210.0000	(47)	
Store volume											1.8600	(48)	
a) If manufacturer declared loss factor is known (kWh/day):											0.5400	(49)	
Temperature factor from Table 2b											1.0044	(55)	
Enter (49) or (54) in (55)													
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	(56)	
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month													
	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =											0.0000	(63)	
Output from w/h													
	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907	(64)
Total per year (kWh/year) = Sum(64)m =											2047.6914	(64)	
RHI water heating demand											2048	(64)	
Heat gains from water heating, kWh/month													
	92.0293	81.7349	87.3003	80.2847	80.1436	73.7194	72.8050	77.1251	76.1226	83.1514	85.3771	90.4986	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457	139.5457 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.0989	40.9446	33.2984	25.2090	18.8440	15.9089	17.1902	22.3444	29.9906	38.0800	44.4450	47.3801 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.1178	309.2943	301.2895	284.2483	262.7368	242.5190	229.0122	225.8357	233.8405	250.8817	272.3933	292.6111 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803	51.2803 (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)	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304	-93.0304 (71)
Water heating gains (Table 5)	123.6953	121.6293	117.3391	111.5066	107.7199	102.3881	97.8562	103.6628	105.7259	111.7627	118.5792	121.6379 (72)
Total internal gains	573.7075	569.6638	549.7226	518.7594	487.0963	458.6116	441.8541	449.6385	467.3526	498.5200	533.2130	559.4246 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				4.8300	12.7500	0.6300	0.7000	0.7700	18.8204 (74)			
South				4.8300	54.0600	0.6300	0.7000	0.7700	79.7986 (78)			
West				4.8300	23.7835	0.6300	0.7000	0.7700	35.1071 (80)			
Solar gains	133.7260	205.5953	295.8608	399.1522	458.4440	491.6699	465.1600	417.4782	351.1814	248.7927	159.1502	114.1938 (83)
Total gains	707.4335	775.2591	845.5833	917.9117	945.5403	950.2814	907.0142	867.1166	818.5340	747.3127	692.3633	673.6184 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil/m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	78.5013	79.0993	79.0993	79.4792	79.4792	80.3598	80.3598	80.5235	80.3598	79.6634	79.8436	79.2912
alpha	6.2334	6.2733	6.2733	6.2986	6.2986	6.3573	6.3573	6.3682	6.3573	6.3109	6.3229	6.2861
util living area	0.9949	0.9899	0.9714	0.9086	0.7532	0.5104	0.3389	0.3744	0.6644	0.9216	0.9868	0.9961 (86)
Tweekday	19.0985	19.2367	19.4562	19.6814	19.7974	19.8306	19.8314	19.8335	19.8259	19.6997	19.3860	19.0874
Tweekend	20.6120	20.6712	20.7716	20.8806	20.9505	20.9707	20.9722	20.9722	20.9645	20.8863	20.7344	20.6034
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.4012	20.4914	20.6475	20.8136	20.9237	20.9550	20.9571	20.9571	20.9446	20.8245	20.5854	20.3879 (87)
Th 2	19.8710	19.8785	19.8785	19.8833	19.8833	19.8941	19.8941	19.8961	19.8941	19.8855	19.8878	19.8809 (88)
util rest of house	0.9926	0.9851	0.9579	0.8692	0.6719	0.4080	0.2288	0.2598	0.5565	0.8781	0.9795	0.9942 (89)
Tweekday	19.0985	19.2367	19.4562	19.6814	19.7974	19.8306	19.8314	19.8335	19.8259	19.6997	19.3860	19.0874
Tweekend	19.0985	19.2367	19.4562	19.6814	19.7974	19.8306	19.8314	19.8335	19.8259	19.6997	19.3860	19.0874
MIT 2	19.0985	19.2367	19.4562	19.6814	19.7974	19.8306	19.8314	19.8335	19.8259	19.6997	19.3860	19.0874 (90)
Living area fraction									fLA = Living area / (4) =			0.4360 (91)
MIT	19.6664	19.7837	19.9756	20.1750	20.2884	20.3208	20.3222	20.3233	20.3136	20.1901	19.9089	19.6544 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6664	19.7837	19.9756	20.1750	20.2884	20.3208	20.3222	20.3233	20.3136	20.1901	19.9089	19.6544 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9920	0.9846	0.9593	0.8808	0.7030	0.4479	0.2715	0.3043	0.5989	0.8918	0.9797	0.9937 (94)
Useful gains	701.7734	763.3413	811.1806	808.4719	664.6810	425.6118	246.2183	263.8284	490.2098	666.4518	678.3038	669.3682 (95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)
Heat loss rate W												
	1367.4823	1312.7763	1164.9787	958.1274	694.0964	427.0717	246.2634	263.9226	498.7924	802.1527	1102.5244	1352.7565 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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												
	495.2874	369.2203	263.2258	107.7520	21.8851	0.0000	0.0000	0.0000	0.0000	100.9614	305.4388	508.4409 (98)
Space heating												2172.2116 (98)
RHI space heating demand												2172 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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					30.0000 / (5) = 0.1703 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4203 (18)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3888 (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	0.4957	0.4860	0.4763	0.4277	0.4179	0.3693	0.3693	0.3596	0.3888	0.4179	0.4374	0.4568 (22b)
Effective ac	0.6229	0.6181	0.6134	0.5914	0.5873	0.5682	0.5682	0.5647	0.5756	0.5873	0.5956	0.6043 (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
External Door			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			14.4900	1.3258	19.2102		(27)
Main Floor			73.4000	0.1400	10.2760	110.0000	8074.0000 (28a)
Main Wall	60.4500	16.6100	43.8400	0.2200	9.6448	60.0000	2630.4000 (29a)
wall to Stairs	17.2400		17.2400	0.1864	3.2131	60.0000	1034.4000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			155.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.8960		(33)
Party Wall 1			12.1100	0.0000	0.0000	180.0000	2179.8000 (32)
Party Ceilings 1			69.2300			40.0000	2769.2000 (32b)
Internal Wall 1			94.4600			100.0000	9446.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 26171.3300 (34)
356.5576 (35)
12.3293 (36)
(33) + (36) = 58.2253 (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	36.2083	35.9310	35.6591	34.3823	34.1434	33.0314	33.0314	32.8254	33.4597	34.1434	34.6267	35.1319 (38)
Heat transfer coeff	94.4336	94.1562	93.8844	92.6076	92.3687	91.2566	91.2566	91.0507	91.6850	92.3687	92.8520	93.3572 (39)
Average = Sum(39)m / 12 =												92.6064 (39)
HLP	1.2866	1.2828	1.2791	1.2617	1.2584	1.2433	1.2433	1.2405	1.2491	1.2584	1.2650	1.2719 (40)
HLP (average)												1.2617 (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
Average daily hot water use (litres/day)
2.3258 (42)
89.4368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Energy conte	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
Energy content (annual)										Total = Sum(45)m =		1407.1894 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8843	19.1402	19.7509	17.2193	16.5224	14.2575	13.2117	15.1606	15.3417	17.8793	19.5166	21.1938 (46)

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8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9944	0.9882	0.9709	0.9152	0.7808	0.5649	0.3873	0.4277	0.6925	0.9307	0.9869	0.9957 (94)
Useful gains	683.5537	760.2896	813.6638	823.2611	729.1361	514.4423	338.6182	355.7049	545.4826	673.2742	661.7617	653.1550 (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	1441.6232	1392.5432	1255.9285	1037.7010	790.0804	521.1335	339.1459	356.6710	567.7879	878.9632	1179.7825	1433.1012 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	564.0037	424.8744	329.0449	154.3967	45.3425	0.0000	0.0000	0.0000	0.0000	153.0326	372.9750	580.2799 (98)
Space heating												2623.9497 (98)
Space heating per m2												(98) / (4) = 35.7486 (99)

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 %)												304.5762 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												861.5086 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	564.0037	424.8744	329.0449	154.3967	45.3425	0.0000	0.0000	0.0000	0.0000	153.0326	372.9750	580.2799 (98)
Space heating efficiency (main heating system 1)	304.5762	304.5762	304.5762	304.5762	304.5762	0.0000	0.0000	0.0000	0.0000	304.5762	304.5762	304.5762 (210)
Space heating fuel (main heating system)	185.1766	139.4969	108.0337	50.6923	14.8871	0.0000	0.0000	0.0000	0.0000	50.2445	122.4571	190.5205 (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	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907 (64)
Efficiency of water heater (217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	118.2095	104.3056	109.8157	98.8194	97.1128	87.1661	84.0869	91.7550	91.4318	102.4516	107.8581	115.4926 (219)
Water heating fuel used												1208.5053 (219)
Annual totals kWh/year												
Space heating fuel - main system												861.5086 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												325.6481 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2395.6621 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	861.5086	13.1900	113.6330 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1208.5053	13.1900	159.4019 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	325.6481	13.1900	42.9530 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			315.9878 (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] =	1.1209 (257)
SAP value		84.3634
SAP rating (Section 12)		84 (258)
SAP band		B

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	861.5086	0.5190	447.1230 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1208.5053	0.5190	627.2143 (264)
Space and water heating			1074.3372 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	325.6481	0.5190	169.0114 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1087.6486 (272)
CO2 emissions per m2			14.8200 (273)
EI value			87.6905
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.0458 = 4.645$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.0458 = 0.1828$, stars = 5
Water heating energy efficiency	$13.19 / 1.6944 = 7.784$, stars = 2
Water heating environmental impact	$0.519 / 1.6944 = 0.3063$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	73.4000 (1b)	x 2.4000 (2b)	= 176.1600 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.1600 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1703 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4203 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3888 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.4277	0.3985	0.3985	0.3791	0.3791	0.3305	0.3305	0.3207	0.3305	0.3693	0.3596	0.3888 (22b)
Effective ac	0.5914	0.5794	0.5794	0.5718	0.5718	0.5546	0.5546	0.5514	0.5546	0.5682	0.5647	0.5756 (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
External Door			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			14.4900	1.3258	19.2102		(27)
Main Floor			73.4000	0.1400	10.2760	110.0000	8074.0000 (28a)
Main Wall	60.4500	16.6100	43.8400	0.2200	9.6448	60.0000	2630.4000 (29a)
wall to Stairs	17.2400		17.2400	0.1864	3.2131	60.0000	1034.4000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			155.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.8960		(33)
Party Wall 1			12.1100	0.0000	0.0000	180.0000	2179.8000 (32)
Party Ceilings 1			69.2300			40.0000	2769.2000 (32b)
Internal Wall 1			94.4600			100.0000	9446.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 26171.3300 (34)
356.5576 (35)
12.3293 (36)
(33) + (36) = 58.2253 (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	34.3823	33.6821	33.6821	33.2428	33.2428	32.2406	32.2406	32.0566	32.2406	33.0314	32.8254	33.4597 (38)
Heat transfer coeff	92.6076	91.9074	91.9074	91.4681	91.4681	90.4658	90.4658	90.2819	90.4658	91.2566	91.0507	91.6850 (39)
Average = Sum(39)m / 12 =												91.2525 (39)
HLP	1.2617	1.2521	1.2521	1.2462	1.2462	1.2325	1.2325	1.2300	1.2325	1.2433	1.2405	1.2491 (40)
HLP (average)												1.2432 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3258 (42)
Average daily hot water use (litres/day)												89.4368 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	98.3805	94.8030	91.2256	87.6481	84.0706	80.4931	80.4931	84.0706	87.6481	91.2256	94.8030	98.3805 (44)
Energy content (annual)	145.8954	127.6011	131.6729	114.7956	110.1491	95.0503	88.0781	101.0709	102.2780	119.1952	130.1108	141.2919 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1407.1894 (45)
	21.8843	19.1402	19.7509	17.2193	16.5224	14.2575	13.2117	15.1606	15.3417	17.8793	19.5166	21.1938 (46)

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Water storage loss:											210.0000	(47)	
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):											1.8600	(48)	
Temperature factor from Table 2b											0.5400	(49)	
Enter (49) or (54) in (55)											1.0044	(55)	
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
											Solar input (sum of months) = Sum(63)m =	0.0000	(63)
Output from w/h													
	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907	(64)
											Total per year (kWh/year) = Sum(64)m =	2047.6914	(64)
Heat gains from water heating, kWh/month													
	92.0293	81.7349	87.3003	80.2847	80.1436	73.7194	72.8050	77.1251	76.1226	83.1514	85.3771	90.4986	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9920	0.9846	0.9593	0.8808	0.7030	0.4479	0.2715	0.3043	0.5989	0.8918	0.9797	0.9937 (94)
Useful gains	701.7734	763.3413	811.1806	808.4719	664.6810	425.6118	246.2183	263.8284	490.2098	666.4518	678.3038	669.3682 (95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)
Heat loss rate W	1367.4823	1312.7763	1164.9787	958.1274	694.0964	427.0717	246.2634	263.9226	498.7924	802.1527	1102.5244	1352.7565 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	495.2874	369.2203	263.2258	107.7520	21.8851	0.0000	0.0000	0.0000	0.0000	100.9614	305.4388	508.4409 (98)
Space heating												2172.2116 (98)
Space heating per m2												(98) / (4) = 29.5942 (99)

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 %)												301.9801 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												719.3228 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	495.2874	369.2203	263.2258	107.7520	21.8851	0.0000	0.0000	0.0000	0.0000	100.9614	305.4388	508.4409 (98)
Space heating efficiency (main heating system 1)	301.9801	301.9801	301.9801	301.9801	301.9801	0.0000	0.0000	0.0000	0.0000	301.9801	301.9801	301.9801 (210)
Space heating fuel (main heating system)	164.0133	122.2664	87.1666	35.6818	7.2472	0.0000	0.0000	0.0000	0.0000	33.4331	101.1453	168.3690 (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	200.2942	176.7355	186.0717	167.4396	164.5479	147.6943	142.4769	155.4697	154.9220	173.5940	182.7548	195.6907 (64)
Efficiency of water heater (217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	118.2095	104.3056	109.8157	98.8194	97.1128	87.1661	84.0869	91.7550	91.4318	102.4516	107.8581	115.4926 (219)
Water heating fuel used												1208.5053 (219)
Annual totals kWh/year												
Space heating fuel - main system												719.3228 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												325.6481 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2253.4762 (238)

10a. Fuel costs - using BEDF prices (472)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	719.3228	18.9000	135.9520 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1208.5053	18.9000	228.4075 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	325.6481	18.9000	61.5475 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.9000	0.0000 (252)
Total energy cost			425.9070 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	719.3228	0.5190	373.3285 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1208.5053	0.5190	627.2143 (264)
Space and water heating			1000.5428 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	325.6481	0.5190	169.0114 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1013.8542 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	719.3228	3.0700	2208.3209 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1208.5053	3.0700	3710.1114 (264)
Space and water heating			5918.4323 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	325.6481	3.0700	999.7398 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5997.1721 (272)
Primary energy kWh/m2/year			81.7053 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 88

(For testing purposes):

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

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

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

Potential energy efficiency rating:	B 84
Potential environmental impact rating:	B 88

Fuel prices for cost data on this page from database revision number 472 TEST (30 Jan 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current £426	Potential £426	Saving £0
Electricity			
Space heating	£136	£136	£0
Water heating	£228	£228	£0
Lighting	£62	£62	£0
Total cost of fuels	£426	£426	£0
Total cost of uses	£426	£426	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	82 kWh/m²	82 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	356.6 (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	348.80 (P1)
Transmission heat loss coefficient	58.23 (37)
Summer heat loss coefficient	407.02 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.8300	81.1852	0.6300	0.7000	0.9000	140.0708
South	4.8300	112.2060	0.6300	0.7000	0.9000	193.5917
West	4.8300	117.5071	0.6300	0.7000	0.9000	202.7378
total:						536.4003

	Jun	Jul	Aug	
Solar gains	567	536	483	(P3)
Internal gains	459	442	450	
Total summer gains	1026	978	933	(P5)

	2.52	2.40	2.29	
Summer gain/loss ratio	2.52	2.40	2.29	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 356.6)	0.00	0.00	0.00	
Threshold temperature	18.52	20.30	20.09	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015722	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	16.43
Environmental	88 B	TER	27.83
CO ₂ Emissions (t/year)	1.01	% DER<TER	40.96
General Requirements Compliance	Pass	DFEE	51.81
		TFEE	54.01
		% DFEE<TFEE	4.08
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 Designed)

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)	27.83	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.43	kgCO ₂ /m ²	Pass
	-11.40 (-41.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.01	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.81	kWh/m ² /yr	
	-2.2 (-4.1%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (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	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Panasonic WH-MDC05F3E5	
Secondary heating system	None	

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
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Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.86 kWh/day
Permitted by DBSCG 2.30

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

4.83 m², No overhang

Windows facing South

4.83 m², No overhang

Windows facing West

4.83 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

Solid Wall

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00 W/m²K

Photovoltaic array

300.00 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

Energy Calculations Ltd
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Calculation Type: New Build (As Designed)

Property Reference	015722	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	16.43
Environmental	88 B	TER	27.83
CO ₂ Emissions (t/year)	1.01	% DER<TER	40.96
General Requirements Compliance	Pass	DFEE	51.81
		TFEE	54.01
		% DFEE<TFEE	4.08
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 Designed)

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, End-Terrace					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	1					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
Ground Floor:		Heat Loss Perimeter		Internal Floor Area		Average Storey Height
		32.37 m		73.40 m²		2.40 m
7.0 Living Area	32.00			m²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	356.56			kJ/m²K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	60.45
wall to Stairs	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	17.24
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill		0.00	180.00	12.11
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, dense plaster				100.00	94.46
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Flat roof	External Flat Roof	Plasterboard, insulated flat roof		0.14	9.00	4.17
10.1 Party Ceilings						

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete planks floor, screed, carpeted	30.00	69.23

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Main Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.14	110.00	73.40

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Door to Stairs	SAP table	Door to Corridor							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	Half Glazed Door	[1] Main Wall	West							2.12	
Windows	Window	[1] Main Wall	South	None	0.00					4.83	
Windows	Window	[1] Main Wall	West	None	0.00					4.83	
Windows	Window	[1] Main Wall	North	None	0.00					4.83	

14.0 Conservatory

None

15.0 Draught Proofing

100

 %

16.0 Draught Lobby

No

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)	7.83	0.300	No
Table K1 - Approved	E3 Sill	3.82	0.040	No
Table K1 - Approved	E4 Jamb	41.64	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	32.37	0.160	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	5.11	0.070	No
Table K1 - Default	E14 Flat roof	8.50	0.080	No
Table K1 - Approved	E16 Corner (normal)	9.48	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	4.74	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	4.74	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	5.11	0.160	No

Y-value

0.079

 W/m²K

18.0 Pressure Testing

Yes

5.00

 m³/(h.m²) @ 50 Pa

Property Tested ?

 m³/(h.m²) @ 50 Pa

As Built AP₅₀

 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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Mechanical Ventilation System Present

No

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				3
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	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Percentage of Heat	100	%
Database Ref. No.	102968	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Immersion Only Heating Hot Water	Yes	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	300.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000516	Issued on Date	01/03/2021
Block Name	Parkside Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
015722-003	1	73.4	16.43	27.83	40.96 %
015723-003	1	53	21.18	34.27	38.19 %
015724-003	1	50	19.12	28.78	33.57 %
015725-003	1	62.62	17.20	27.70	37.90 %
015726-003	1	45.84	19.12	29.28	34.69 %
015727-003	1	50.5	18.06	27.97	35.44 %
015728-003	1	44.2	21.03	31.09	32.37 %
015729-003	1	78.1	14.72	23.84	38.25 %
015730-003	1	63.8	17.28	28.45	39.26 %
015731-003	1	60.7	17.13	27.10	36.79 %
015732-003	1	43.25	21.26	29.47	27.86 %
015733-003	1	78.25	15.78	27.04	41.63 %
Totals:	12	703.66	218.31	342.81	
Average DER = 17.80 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 28.24 kgCO ₂ /m ²		36.97 %			

Block Compliance Report - DFEE

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
015722-003	1	73.4	51.81	54.01	4.08 %
015723-003	1	53	67.01	66.99	-0.03 %
015724-003	1	50	45.25	46.33	2.34 %
015725-003	1	62.62	49.26	49.72	0.92 %
015726-003	1	45.84	46.34	45.82	-1.15 %
015727-003	1	50.5	45.03	44.75	-0.61 %
015728-003	1	44.2	47.58	50.81	6.35 %
015729-003	1	78.1	41.12	42.82	3.99 %
015730-003	1	63.8	50.50	52.76	4.28 %
015731-003	1	60.7	45.65	47.49	3.89 %
015732-003	1	43.25	42.47	43.04	1.31 %
015733-003	1	78.25	50.76	53.42	4.97 %
Totals:	12	703.66	582.78	597.97	
Average DFEE = 48.63 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 50.00 kWh/m ² /yr		2.74 %			