



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 18 Haines Crescent
West End, Southampton, SO30 3LG

Contact: Tobias Whiting
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Report Issue Date: 16/05/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 79			Issued on Date	16/05/2022
Assessment Reference	As Built	Prop Type Ref	Nh		
Property	18 Haines Crescent, West End, Southampton, SO30 3LG				
SAP Rating	87 B	DER	15.22	TER	17.09
Environmental	87 B	% DER<TER	10.92		
CO ₂ Emissions (t/year)	1.40	DFEE	53.05	TFEE	59.11
General Requirements Compliance	Pass	% DFEE<TFEE	10.26		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.09	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.22	kgCO ₂ /m ²	Pass
	-1.87 (-10.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.11	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	53.05	kWh/m ² /yr	
	-6.1 (-10.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (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	4.42 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 18 S NG

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.33

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

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 (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

2.52 m², No overhang

Windows facing East

10.07 m², No overhang

Windows facing South West

1.44 m², No overhang

Windows facing West

8.57 m², No overhang

Windows facing North West

1.44 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.42 (measured in this dwelling) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Photovoltaic array	1.17	kW

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THERMAL BRIDGING

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SAP Rating	87 B	DER	15.22
Environmental	87 B	TER	17.09
CO ₂ Emissions (t/year)	1.40	% DER<TER	10.92
General Requirements Compliance	Pass	DFEE	53.05
		TFEE	59.11
		% DFEE<TFEE	10.26
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.91	0.06	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.02	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	3.02	0.21	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.640	3.54	2.27	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	3.70	1.11	
External wall	E3 Sill	Independently assessed	0.021	14.17	0.30	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	35.40	0.57	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Default	0.320	37.15	11.89	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	34.91	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	23.83	1.43	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	3.12	0.75	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	14.86	0.65	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	34.79	1.36	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	14.59	-1.33	Knauf P24

Total: **19.74** W/mK:
Y-Value: **0.064** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Detached House, total floor area 125 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:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.09 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.22 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)53.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (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: 4.42 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 18 S NG

Efficiency: 89.5% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.33 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes 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 (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 2.52 m², No overhang
Windows facing East: 10.07 m², No overhang
Windows facing South West: 1.44 m², No overhang
Windows facing West: 9.57 m², No overhang
Windows facing North West: 1.44 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 1.17 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1578 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3788 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3220 (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	0.4106	0.4025	0.3945	0.3542	0.3462	0.3059	0.3059	0.2979	0.3220	0.3462	0.3623	0.3784 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			18.0000	1112.0400 (32e)

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) =	20599.3368 (34)
	164.4001 (35)
	19.7393 (36)
(33) + (36) =	100.9740 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 61.0769 Feb 60.7347 Mar 60.3994 Apr 58.8243 May 58.5296 Jun 57.1577 Jul 57.1577 Aug 56.9036 Sep 57.6861 Oct 58.5296 Nov 59.1257 Dec 59.7490 (38)
Heat transfer coeff	162.0509 161.7087 161.3734 159.7983 159.5036 158.1317 158.1317 157.8776 158.6601 159.5036 160.0997 160.7230 (39)
Average = Sum(39)m / 12 =	159.7968 (39)

HLP	Jan 1.2933 Feb 1.2906 Mar 1.2879 Apr 1.2753 May 1.2730 Jun 1.2620 Jul 1.2620 Aug 1.2600 Sep 1.2662 Oct 1.2730 Nov 1.2777 Dec 1.2827 (40)
HLP (average)	1.2753 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
219.6554 193.6066 203.3333 182.2800 178.6322 159.6198 153.3030 168.2138 167.9145 189.0136 199.8561 214.3723 (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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723 (64)
Total per year (kWh/year) = Sum(64)m =												2229.8006 (64)
Heat gains from water heating, kWh/month	97.4495	86.4256	92.0224	84.2346	83.8093	76.7001	75.3873	80.3452	79.4581	87.2611	90.0787	95.6929 (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	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3397	23.3947	19.0258	14.4038	10.7670	9.0899	9.8220	12.7670	17.1358	21.7579	25.3947	27.0717 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9617	294.9914	287.3567	271.1035	250.5868	231.3040	218.4218	215.3922	223.0268	239.2800	259.7967	279.0796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084 (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)	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668 (71)
Water heating gains (Table 5)	130.9805	128.6095	123.6860	116.9925	112.6469	106.5279	101.3270	107.9908	110.3585	117.2864	125.1092	128.6195 (72)
Total internal gains	518.5069	516.2206	499.2936	471.7249	443.2257	416.1469	398.7959	405.3750	419.7462	447.5494	479.5257	503.9958 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North					2.5200	10.6334		0.6300	0.7000	0.7700	8.1893 (74)	
East					10.0700	19.6403		0.6300	0.7000	0.7700	60.4434 (76)	
Southwest					1.4400	36.7938		0.6300	0.7000	0.7700	16.1923 (79)	
West					8.5700	19.6403		0.6300	0.7000	0.7700	51.4399 (80)	
Northwest					1.4400	11.2829		0.6300	0.7000	0.7700	4.9654 (81)	
Solar gains	141.2303	272.2062	442.9850	645.0665	794.3632	815.9547	775.6055	662.8635	514.2361	321.1693	175.2502	116.7466 (83)
Total gains	659.7372	788.4268	942.2786	1116.7914	1237.5889	1232.1016	1174.4014	1068.2385	933.9823	768.7186	654.7759	620.7424 (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	35.3101	35.3848	35.4584	35.8079	35.8740	36.1853	36.1853	36.2435	36.0648	35.8740	35.7405	35.6019
alpha	3.3540	3.3590	3.3639	3.3872	3.3916	3.4124	3.4124	3.4162	3.4043	3.3916	3.3827	3.3735
util living area	0.9933	0.9873	0.9714	0.9277	0.8366	0.6922	0.5475	0.6087	0.8300	0.9591	0.9887	0.9946 (86)
MIT	18.9651	19.1880	19.5847	20.1056	20.5533	20.8409	20.9473	20.9239	20.6809	20.0811	19.4284	18.9282 (87)
Th 2	19.8461	19.8482	19.8503	19.8602	19.8621	19.8707	19.8707	19.8723	19.8674	19.8621	19.8583	19.8544 (88)
util rest of house	0.9917	0.9842	0.9642	0.9083	0.7914	0.6063	0.4250	0.4862	0.7650	0.9445	0.9854	0.9933 (89)
MIT 2	17.9957	18.2187	18.6126	19.1258	19.5406	19.7843	19.8526	19.8435	19.6670	19.1130	18.4666	17.9649 (90)
Living area fraction									fLA = Living area / (4) =			0.1414 (91)
MIT	18.1327	18.3558	18.7501	19.2644	19.6838	19.9337	20.0074	19.9963	19.8104	19.2499	18.6026	18.1012 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1327	18.3558	18.7501	19.2644	19.6838	19.9337	20.0074	19.9963	19.8104	19.2499	18.6026	18.1012 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9883	0.9787	0.9549	0.8958	0.832	0.6116	0.4408	0.5009	0.7611	0.9340	0.9803	0.9904 (94)
Useful gains	652.0017	771.6130	899.8205	1000.3933	969.2725	753.5463	517.7155	535.0627	710.8179	718.0054	641.8690	614.7613 (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	2241.6091	2175.9159	1976.8335	1656.2055	1273.4483	843.4258	538.8178	567.7688	906.0170	1379.6912	1841.5684	2234.2366 (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	1182.6679	943.6915	801.2977	472.1848	226.3067	0.0000	0.0000	0.0000	0.0000	492.2942	863.7836	1204.8896 (98)
Space heating												6187.1160 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 49.3784 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6836.5923 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1182.6679	943.6915	801.2977	472.1848	226.3067	0.0000	0.0000	0.0000	0.0000	492.2942	863.7836	1204.8896	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1306.8154	1042.7531	885.4118	521.7511	250.0627	0.0000	0.0000	0.0000	0.0000	543.9715	954.4570	1331.3697	(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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723	(64)
Efficiency of water heater (217)m	88.6384	88.4804	88.1089	87.2419	85.4459	79.8000	79.8000	79.8000	79.8000	87.2542	88.2759	79.8000	(216)
Fuel for water heating, kWh/month	247.8108	218.8131	230.7751	208.9362	209.0587	200.0249	192.1090	210.7942	210.4192	216.6240	226.3992	241.6729	(219)
Water heating fuel used												2613.4373	(219)
Annual totals kWh/year													
Space heating fuel - main system												6836.5923	(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)												465.1666	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.17 * 853 * 1.00) =											-798.4360	-798.4360	(233)
Total delivered energy for all uses												9191.7602	(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	6836.5923	0.2160	1476.7039	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2613.4373	0.2160	564.5024	(264)
Space and water heating			2041.2064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	465.1666	0.5190	241.4215	(268)
Energy saving/generation technologies				
PV Unit	-798.4360	0.5190	-414.3883	(269)
Total CO2, kg/year			1907.1646	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2200	(273)

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

DER		15.2200	ZC1
Total Floor Area	TFA	125.3000	
Assumed number of occupants	N	2.8817	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.8077	ZC2
CO2 emissions from cooking, equation (L16)		1.5017	ZC3
Total CO2 emissions		30.5294	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		30.5294	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1263 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3763 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3198 (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	0.4078	0.3998	0.3918	0.3518	0.3438	0.3038	0.3038	0.2958	0.3198	0.3438	0.3598	0.3758 (22b)
Effective ac	0.5831	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5511	0.5591	0.5647	0.5706 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			24.0400	1.3258	31.8712		(27)
Ground Floor			63.5200	0.1300	8.2576		(28a)
Brick and Block	182.0000	26.1600	155.8400	0.1800	28.0512		(29a)
Pitched Roof	63.5200		63.5200	0.1300	8.2576		(30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	78.5576	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2207 (36)
Total fabric heat loss						(33) + (36) =	92.7783 (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	60.9578	60.6203	60.2895	58.7356	58.4449	57.0916	57.0916	56.8409	57.6128	58.4449	59.0330	59.6479 (38)
Heat transfer coeff	153.7361	153.3986	153.0678	151.5139	151.2232	149.8699	149.8699	149.6192	150.3912	151.2232	151.8113	152.4262 (39)
Average = Sum(39)m / 12 =												151.5125 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2269	1.2243	1.2216	1.2092	1.2069	1.1961	1.1961	1.1941	1.2002	1.2069	1.2116	1.2165 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												215.0000 (47)
Store volume												1.7258 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

Enter (49) or (54) in (55)												0.9319 (55)
Total storage loss												
	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (56)
If cylinder contains dedicated solar storage	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (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												
	219.5848	193.5428	203.2627	182.2116	178.5615	159.5515	153.2323	168.1431	167.8461	188.9429	199.7877	214.3017 (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												
	219.5848	193.5428	203.2627	182.2116	178.5615	159.5515	153.2323	168.1431	167.8461	188.9429	199.7877	214.3017 (64)
Heat gains from water heating, kWh/month												
	97.3930	86.3746	91.9659	84.1799	83.7527	76.6454	75.3308	80.2886	79.4034	87.2046	90.0240	95.6364 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3397	23.3947	19.0258	14.4038	10.7670	9.0899	9.8220	12.7670	17.1358	21.7579	25.3947	27.0717 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9617	294.9914	287.3567	271.1035	250.5868	231.3040	218.4218	215.3922	223.0268	239.2800	259.7967	279.0796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084 (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)	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668 (71)
Water heating gains (Table 5)	130.9045	128.5336	123.6100	116.9165	112.5709	106.4520	101.2510	107.9148	110.2825	117.2104	125.0333	128.5435 (72)
Total internal gains	518.4310	516.1446	499.2176	471.6489	443.1497	416.0709	398.7199	405.2991	419.6702	447.4734	479.4498	503.9198 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains	
				m2	Table 6a	Specific data		Specific data	factor		W	
					W/m2	or Table 6b		or Table 6c	Table 6d			
North				2.5200	10.6334	0.6300		0.7000	0.7700	8.1893 (74)		
East				10.0700	19.6403	0.6300		0.7000	0.7700	60.4434 (76)		
Southwest				1.4400	36.7938	0.6300		0.7000	0.7700	16.1923 (79)		
West				8.5700	19.6403	0.6300		0.7000	0.7700	51.4399 (80)		
Northwest				1.4400	11.2829	0.6300		0.7000	0.7700	4.9654 (81)		

Solar gains	141.2303	272.2062	442.9850	645.0665	794.3632	815.9547	775.6055	662.8635	514.2361	321.1693	175.2502	116.7466 (83)
Total gains	659.6612	788.3509	942.2027	1116.7155	1237.5129	1232.0256	1174.3255	1068.1625	933.9063	768.6427	654.7000	620.6664 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, n _{l,m} , (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.5995	56.7240	56.8466	57.4296	57.5400	58.0596	58.0596	58.1569	57.8584	57.5400	57.3171	57.0859	
alpha	4.7733	4.7816	4.7898	4.8286	4.8360	4.8706	4.8706	4.8771	4.8572	4.8360	4.8211	4.8057	
util living area	0.9989	0.9971	0.9904	0.9622	0.8770	0.7124	0.5462	0.6153	0.8698	0.9837	0.9976	0.9992	(86)
MIT	19.5893	19.7549	20.0483	20.4373	20.7618	20.9394	20.9866	20.9769	20.8326	20.3942	19.9200	19.5629	(87)
Th 2	19.8985	19.9006	19.9028	19.9126	19.9145	19.9231	19.9231	19.9247	19.9198	19.9145	19.9107	19.9068	(88)
util rest of house	0.9985	0.9961	0.9868	0.9474	0.8302	0.6177	0.4203	0.4856	0.8013	0.9750	0.9965	0.9989	(89)
MIT 2	18.0154	18.2588	18.6872	19.2494	19.6811	19.8831	19.9183	19.9153	19.7817	19.1983	18.5077	17.9825	(90)
Living area fraction									fLA = Living area / (4) =			0.1414	(91)
MIT	18.2380	18.4704	18.8797	19.4174	19.8339	20.0325	20.0694	20.0654	19.9304	19.3674	18.7074	18.2060	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2380	18.4704	18.8797	19.4174	19.8339	20.0325	20.0694	20.0654	19.9304	19.3674	18.7074	18.2060	(93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9975	0.9940	0.9820	0.9385	0.8261	0.6282	0.4381	0.5036	0.8021	0.9686	0.9947	0.9981 (94)
Useful gains	658.0103	783.6169	925.2305	1048.0519	1022.3468	773.9171	514.4326	537.8750	749.0960	744.5072	651.2117	619.5032 (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	2142.7696	2081.6752	1894.9288	1593.5371	1230.0388	814.1720	519.9574	548.4171	876.8350	1325.8391	1762.1376	2134.8758 (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	1104.6609	872.2952	721.4555	392.7493	154.5228	0.0000	0.0000	0.0000	0.0000	432.5109	799.8667	1127.4372 (98)
Space heating												5605.4986 (98)
Space heating per m2											(98) / (4) =	44.7366 (99)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5995.1856 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1104.6609	872.2952	721.4555	392.7493	154.5228	0.0000	0.0000	0.0000	0.0000	432.5109	799.8667	1127.4372	(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)	1181.4555	932.9361	771.6102	420.0527	165.2651	0.0000	0.0000	0.0000	0.0000	462.5785	855.4724	1205.8152	(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	219.5848	193.5428	203.2627	182.2116	178.5615	159.5515	153.2323	168.1431	167.8461	188.9429	199.7877	214.3017	(64)
Efficiency of water heater (217)m	88.5316	88.3489	87.9090	86.8111	84.4310	79.8000	79.8000	79.8000	79.8000	86.9551	88.1381	79.8000	(216)
Fuel for water heating, kWh/month	248.0298	219.0665	231.2193	209.8943	211.4881	199.9392	192.0204	210.7057	210.3335	217.2878	226.6758	241.8687	(219)
Water heating fuel used												2618.5292	(219)
Annual totals kWh/year													
Space heating fuel - main system												5995.1856	(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)												465.1666	(232)
Total delivered energy for all uses												9153.8814	(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	5995.1856	0.2160	1294.9601	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2618.5292	0.2160	565.6023	(264)
Space and water heating			1860.5624	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	465.1666	0.5190	241.4215	(268)
Total CO2, kg/m2/year			2140.9089	(272)
Emissions per m2 for space and water heating			14.8489	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.9267	(272b)
Emissions per m2 for pumps and fans			0.3107	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8489 * 1.00) + 1.9267 + 0.3107, rounded to 2 d.p.			17.0900	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1263 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3473 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2952 (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	0.3764	0.3690	0.3616	0.3247	0.3173	0.2804	0.2804	0.2730	0.2952	0.3173	0.3321	0.3468 (22b)
Effective ac	0.5708	0.5681	0.5654	0.5527	0.5503	0.5393	0.5393	0.5373	0.5436	0.5503	0.5551	0.5601 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			9.0000	556.0200 (32e)

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) = 20043.3168 (34)
159.9626 (35)
19.7393 (36)
(33) + (36) = 100.9740 (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	59.6697	59.3822	59.1004	57.7768	57.5292	56.3764	56.3764	56.1630	56.8205	57.5292	58.0302	58.5539 (38)
Heat transfer coeff	160.6437	160.3562	160.0744	158.7508	158.5032	157.3504	157.3504	157.1370	157.7945	158.5032	159.0042	159.5279 (39)
Average = Sum(39)m / 12 =												158.7497 (39)
HLP	1.2821	1.2798	1.2775	1.2670	1.2650	1.2558	1.2558	1.2541	1.2593	1.2650	1.2690	1.2732 (40)
HLP (average)												1.2670 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5795	31.1180	32.1110	27.9952	26.8620	23.1799	21.4796	24.6481	24.9425	29.0681	31.7301	34.4568 (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	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3397	23.3947	19.0258	14.4038	10.7670	9.0899	9.8220	12.7670	17.1358	21.7579	25.3947	27.0717	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9617	294.9914	287.3567	271.1035	250.5868	231.3040	218.4218	215.3922	223.0268	239.2800	259.7967	279.0796	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	(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)	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	(71)
Water heating gains (Table 5)	47.8219	46.3066	43.1600	38.8822	36.1049	32.1943	28.8704	33.1292	34.6424	39.0700	44.0696	46.3129	(72)
Total internal gains	432.3483	430.9177	415.7676	390.6145	363.6837	338.8132	323.3393	327.5135	341.0301	366.3330	395.4860	418.6893	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					2.5200	10.6334	0.6300	0.7000	0.7700		8.1893 (74)	
East					10.0700	19.6403	0.6300	0.7000	0.7700		60.4434 (76)	
Southwest					1.4400	36.7938	0.6300	0.7000	0.7700		16.1923 (79)	
West					8.5700	19.6403	0.6300	0.7000	0.7700		51.4399 (80)	
Northwest					1.4400	11.2829	0.6300	0.7000	0.7700		4.9654 (81)	
Solar gains	141.2303	272.2062	442.9850	645.0665	794.3632	815.9547	775.6055	662.8635	514.2361	321.1693	175.2502	116.7466 (83)
Total gains	573.5786	703.1239	858.7526	1035.6811	1158.0469	1154.7680	1098.9448	990.3769	855.2662	687.5022	570.7363	535.4359 (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	34.6580	34.7201	34.7813	35.0712	35.1260	35.3834	35.3834	35.4314	35.2838	35.1260	35.0154	34.9004	
alpha	3.3105	3.3147	3.3188	3.3381	3.3417	3.3589	3.3589	3.3621	3.3523	3.3417	3.3344	3.3267	
util living area	0.9952	0.9902	0.9764	0.9371	0.8526	0.7153	0.5730	0.6383	0.8532	0.9679	0.9919	0.9962 (86)	
MIT	18.8590	19.0874	19.4953	20.0329	20.5044	20.8153	20.9361	20.9074	20.6339	19.9993	19.3279	18.8190 (87)	
Th 2	19.8549	19.8567	19.8585	19.8668	19.8684	19.8756	19.8756	19.8770	19.8728	19.8684	19.8652	19.8619 (88)	
util rest of house	0.9941	0.9878	0.9704	0.9200	0.8106	0.6314	0.4487	0.5155	0.7939	0.9563	0.9895	0.9953 (89)	
MIT 2	17.8997	18.1284	18.5340	19.0648	19.5059	19.7726	19.8528	19.8404	19.6364	19.0421	18.3752	17.8649 (90)	
Living area fraction	18.0354	18.2641	18.6700	19.2018	19.6471	19.9201	20.0060	19.9913	19.7774	19.1775	18.5100	17.9998 (92)	
Temperature adjustment	18.0354	18.2641	18.6700	19.2018	19.6471	19.9201	20.0060	19.9913	19.7774	19.1775	18.5100	17.9998 (93)	
adjusted MIT	18.0354	18.2641	18.6700	19.2018	19.6471	19.9201	20.0060	19.9913	19.7774	19.1775	18.5100	17.9998 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9914	0.9832	0.9620	0.9074	0.8009	0.6351	0.4643	0.5293	0.7878	0.9466	0.9854	0.9931	(94)
Useful gains	568.6567	691.2766	826.1227	939.8119	927.5017	733.4501	510.2026	524.2403	673.7454	650.7896	562.4075	531.7542	(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	2206.5030	2143.0084	1948.1034	1635.4122	1259.6476	837.1145	535.9398	564.3251	895.8691	1359.5563	1814.2324	2201.4534	(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	1218.5576	975.5638	834.7537	500.8322	247.1165	0.0000	0.0000	0.0000	0.0000	527.3224	901.3140	1242.2561	(98)
Space heating												6447.7163	(98)
Space heating per m2												(98) / (4) =	51.4582 (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													

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1479.0941	1164.3932	1194.2409	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7673	0.8356	0.7950	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1134.9420	972.9420	949.4648	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1466.6673	1398.7851	1274.1082	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	238.8422	316.8273	241.5347	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			797.2042 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	59.7106	79.2068	60.3837	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												199.3011 (107)
Energy for space heating												1.5906 (108)
Energy for space cooling												51.4582 (99)
Total												1.5906 (108)
Dwelling Fabric Energy Efficiency (DFEE)												53.0488 (109)
												53.0 (109)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (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) =					40.0000 / (5) =	0.1263 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3763 (18)		
Number of sides sheltered															2 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3198 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)					
Adj infilt rate	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)					
	0.4078	0.3998	0.3918	0.3518	0.3438	0.3038	0.3038	0.2958	0.3198	0.3438	0.3598	0.3758 (22b)					
Effective ac	0.5831	0.5799	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5511	0.5591	0.5647	0.5706 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			24.0400	1.3258	31.8712		(27)					
Ground Floor			63.5200	0.1300	8.2576		(28a)					
Brick and Block	182.0000	26.1600	155.8400	0.1800	28.0512		(29a)					
Pitched Roof	63.5200		63.5200	0.1300	8.2576		(30)					
Total net area of external elements Aum(A, m2)			309.0400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.5576		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2207 (36)					
Total fabric heat loss						(33) + (36) =	92.7783 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.9578	Feb 60.6203	Mar 60.2895	Apr 58.7356	May 58.4449	Jun 57.0916	Jul 57.0916	Aug 56.8409	Sep 57.6128	Oct 58.4449	Nov 59.0330	Dec 59.6479 (38)
Heat transfer coeff	153.7361	153.3986	153.0678	151.5139	151.2232	149.8699	149.8699	149.6192	150.3912	151.2232	151.8113	152.4262 (39)
Average = Sum(39)m / 12 =												151.5125 (39)
HLP	Jan 1.2269	Feb 1.2243	Mar 1.2216	Apr 1.2092	May 1.2069	Jun 1.1961	Jul 1.1961	Aug 1.1941	Sep 1.2002	Oct 1.2069	Nov 1.2116	Dec 1.2165 (40)
HLP (average)												1.2092 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
Daily hot water use	Jan 112.9036	Feb 108.7980	Mar 104.6925	Apr 100.5869	May 96.4813	Jun 92.3757	Jul 92.3757	Aug 96.4813	Sep 100.5869	Oct 104.6925	Nov 108.7980	Dec 112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (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	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)
	35.5795	31.1180	32.1110	27.9952	26.8620	23.1799	21.4796	24.6481	24.9425	29.0681	31.7301	34.4568 (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	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	144.0835	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3397	23.3947	19.0258	14.4038	10.7670	9.0899	9.8220	12.7670	17.1358	21.7579	25.3947	27.0717	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9617	294.9914	287.3567	271.1035	250.5868	231.3040	218.4218	215.3922	223.0268	239.2800	259.7967	279.0796	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	37.4084	(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)	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	(71)
Water heating gains (Table 5)	47.8219	46.3066	43.1600	38.8822	36.1049	32.1943	28.8704	33.1292	34.6424	39.0700	44.0696	46.3129	(72)
Total internal gains	432.3483	430.9177	415.7676	390.6145	363.6837	338.8132	323.3393	327.5135	341.0301	366.3330	395.4860	418.6893	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.5200	10.6334	0.6300		0.7000		0.7700		8.1893 (74)
East				10.0700	19.6403	0.6300		0.7000		0.7700		60.4434 (76)
Southwest				1.4400	36.7938	0.6300		0.7000		0.7700		16.1923 (79)
West				8.5700	19.6403	0.6300		0.7000		0.7700		51.4399 (80)
Northwest				1.4400	11.2829	0.6300		0.7000		0.7700		4.9654 (81)
Solar gains	141.2303	272.2062	442.9850	645.0665	794.3632	815.9547	775.6055	662.8635	514.2361	321.1693	175.2502	116.7466 (83)
Total gains	573.5786	703.1239	858.7526	1035.6811	1158.0469	1154.7680	1098.9448	990.3769	855.2662	687.5022	570.7363	535.4359 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	56.5995	56.7240	56.8466	57.4296	57.5400	58.0596	58.0596	58.1569	57.8584	57.5400	57.3171	57.0859	
alpha	4.7733	4.7816	4.7898	4.8286	4.8360	4.8706	4.8706	4.8771	4.8572	4.8360	4.8211	4.8057	
util living area	0.9994	0.9982	0.9935	0.9714	0.8983	0.7448	0.5791	0.6542	0.8986	0.9896	0.9987	0.9996	(86)
MIT	19.5260	19.6926	19.9891	20.3865	20.7284	20.9263	20.9829	20.9700	20.8001	20.3380	19.8584	19.5000	(87)
Th 2	19.8985	19.9006	19.9028	19.9126	19.9145	19.9231	19.9231	19.9247	19.9198	19.9145	19.9107	19.9068	(88)
util rest of house	0.9992	0.9976	0.9910	0.9596	0.8564	0.6511	0.4479	0.5207	0.8387	0.9838	0.9981	0.9994	(89)
MIT 2	18.5496	18.7177	19.0145	19.4123	19.7287	19.8890	19.9188	19.9160	19.8025	19.3713	18.8914	18.5301	(90)
Living area fraction									fLA = Living area / (4) =			0.1414	(91)
MIT	18.6876	18.8556	19.1523	19.5501	19.8700	20.0357	20.0693	20.0651	19.9436	19.5080	19.0282	18.6673	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6876	18.8556	19.1523	19.5501	19.8700	20.0357	20.0693	20.0651	19.9436	19.5080	19.0282	18.6673	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9988	0.9967	0.9886	0.9545	0.8543	0.6619	0.4665	0.5394	0.8403	0.9807	0.9974	0.9992	(94)
Ext temp.	572.9018	700.8186	848.9431	988.5315	989.3444	764.2893	512.6964	534.2337	718.7113	674.2256	569.2400	534.9853	(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	2211.9000	2140.7617	1936.6636	1613.6328	1235.4987	814.6435	519.9407	548.3681	878.8224	1347.1004	1810.8343	2205.1918	(97)
Space heating kWh	1.0000	1.0001	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1219.4147	967.6417	809.2641	450.0730	183.1388	0.0000	0.0000	0.0000	0.0000	500.6188	893.9479	1242.6336	(98)
Space heating per m2												6266.7327	(98)
												50.0138	(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	1408.7767	1109.0370	1137.1063	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8459	0.9101	0.8734	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1191.7154	1009.3479	993.1158	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1466.6673	1398.7851	1274.1082	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	197.9654	289.7413	209.0583	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												696.7650 (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	49.4914	72.4353	52.2646	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												174.1913 (107)
Space cooling per m2												1.3902 (108)
Energy for space heating												50.0138 (99)
Energy for space cooling												1.3902 (108)
Total												51.4040 (109)
Target Fabric Energy Efficiency (TFEE)												59.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (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) =					50.0000	/ (5) =	0.1578 (8)
Pressure test										Yes							
Measured/design AP50										4.4200							
Infiltration rate										0.3788 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3220 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000	(22)				
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250	(22a)				
Adj infilt rate	0.3784	0.3542	0.3542	0.3220	0.3301	0.3140	0.3140	0.3059	0.3059	0.3301	0.3220	0.3301	(22b)				
Effective ac	0.5716	0.5627	0.5627	0.5518	0.5545	0.5493	0.5493	0.5468	0.5468	0.5545	0.5518	0.5545	(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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			18.0000	1112.0400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20599.3368 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.4001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.7393 (36)
Total fabric heat loss (33) + (36) = 100.9740 (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	59.7490	58.8243	58.8243	57.6861	57.9605	57.4185	57.4185	57.1577	57.1577	57.9605	57.6861	57.9605 (38)
Heat transfer coeff	160.7230	159.7983	159.7983	158.6601	158.9345	158.3925	158.3925	158.1317	158.1317	158.9345	158.6601	158.9345 (39)
Average = Sum(39)m / 12 =												158.9576 (39)
HLP	1.2827	1.2753	1.2753	1.2662	1.2684	1.2641	1.2641	1.2620	1.2620	1.2684	1.2662	1.2684 (40)
HLP (average)												1.2686 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
Daily hot water use	Jan 112.9036	Feb 108.7980	Mar 104.6925	Apr 100.5869	May 96.4813	Jun 92.3757	Jul 92.3757	Aug 96.4813	Sep 100.5869	Oct 104.6925	Nov 108.7980	Dec 112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
219.6554 193.6066 203.3333 182.2800 178.6322 159.6198 153.3030 168.2138 167.9145 189.0136 199.8561 214.3723 (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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723 (64)
Total per year (kWh/year) = Sum(64)m =												2229.8006 (64)
												2230 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	97.4495	86.4256	92.0224	84.2346	83.8093	76.7001	75.3873	80.3452	79.4581	87.2611	90.0787	95.6929 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8492	58.4866	47.5645	36.0094	26.9175	22.7248	24.5550	31.9175	42.8396	54.3947	63.4867	67.6793 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	435.7638	440.2856	428.8907	404.6322	374.0102	345.2298	326.0027	321.4809	332.8758	357.1343	387.7563	416.5367 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717 (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)	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668 (71)
Water heating gains (Table 5)	130.9805	128.6095	123.6860	116.9925	112.6469	106.5279	101.3270	107.9908	110.3585	117.2864	125.1092	128.6195 (72)
Total internal gains	748.3985	743.1869	715.9463	673.4392	629.3796	590.2877	567.6898	577.1943	601.8790	644.6206	692.1574	728.6405 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.5200	13.4684	0.6300		0.7000		0.7700		10.3726 (74)
East				10.0700	25.1733	0.6300		0.7000		0.7700		77.4713 (76)
Southwest				1.4400	45.0642	0.6300		0.7000		0.7700		19.8320 (79)
West				8.5700	25.1733	0.6300		0.7000		0.7700		65.9314 (80)
Northwest				1.4400	14.6130	0.6300		0.7000		0.7700		6.4309 (81)

Solar gains	180.0382	295.6732	489.5284	713.4645	824.3220	935.6638	855.0155	764.2948	594.2657	376.4539	222.7767	140.8098 (83)
Total gains	928.4367	1038.8600	1205.4747	1386.9037	1453.7016	1525.9515	1422.7053	1341.4891	1196.1447	1021.0744	914.9341	869.4503 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	35.6019	35.8079	35.8079	36.0648	36.0025	36.1257	36.1257	36.1853	36.1853	36.0025	36.0648	36.0025
alpha	3.3735	3.3872	3.3872	3.4043	3.4002	3.4084	3.4084	3.4124	3.4124	3.4002	3.4043	3.4002
util living area	0.9768	0.9658	0.9321	0.8497	0.7132	0.4990	0.3596	0.3687	0.6465	0.8794	0.9591	0.9803 (86)
MIT	19.4400	19.6112	19.9859	20.4498	20.7816	20.9537	20.9890	20.9885	20.8878	20.4844	19.9115	19.4235 (87)
Th 2	19.8544	19.8602	19.8602	19.8674	19.8656	19.8691	19.8691	19.8707	19.8707	19.8656	19.8674	19.8656 (88)
util rest of house	0.9712	0.9576	0.9157	0.8138	0.6457	0.4000	0.2400	0.2426	0.5465	0.8398	0.9473	0.9755 (89)
MIT 2	18.4724	18.6444	19.0079	19.4469	19.7292	19.8507	19.8670	19.8687	19.8174	19.4896	18.9476	18.4649 (90)
Living area fraction	18.6092	18.7811	19.1462	19.5887	19.8780	20.0067	20.0257	20.0271	19.9688	19.6303	19.0839	18.6005 (92)
MIT	18.6092	18.7811	19.1462	19.5887	19.8780	20.0067	20.0257	20.0271	19.9688	19.6303	19.0839	18.6005 (93)
Temperature adjustment												0.0000
adjusted MIT	18.6092	18.7811	19.1462	19.5887	19.8780	20.0067	20.0257	20.0271	19.9688	19.6303	19.0839	18.6005 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	894.0776	984.3475	1088.5749	1114.4555	939.8025	629.5768	365.6329	349.4535	665.0571	847.2999	856.9660	841.7251 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	2090.8835	2042.4051	1845.0677	1505.4799	1077.2649	650.4701	368.3690	352.1679	722.4723	1196.8207	1663.3812	2050.3294 (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	890.4236	711.0147	562.8307	281.5376	102.2721	0.0000	0.0000	0.0000	0.0000	260.0435	580.6190	899.2016 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	4287.9427 (98)
RHI space heating demand	4288 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1578 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3788 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3220 (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	0.4106	0.4025	0.3945	0.3542	0.3462	0.3059	0.3059	0.2979	0.3220	0.3462	0.3623	0.3784 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			18.0000	1112.0400 (32e)

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) =	20599.3368 (34)
	164.4001 (35)
	19.7393 (36)
(33) + (36) =	100.9740 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 61.0769 Feb 60.7347 Mar 60.3994 Apr 58.8243 May 58.5296 Jun 57.1577 Jul 57.1577 Aug 56.9036 Sep 57.6861 Oct 58.5296 Nov 59.1257 Dec 59.7490 (38)
Heat transfer coeff	162.0509 161.7087 161.3734 159.7983 159.5036 158.1317 158.1317 157.8776 158.6601 159.5036 160.0997 160.7230 (39)
Average = Sum(39)m / 12 =	159.7968 (39)

HLP	Jan 1.2933 Feb 1.2906 Mar 1.2879 Apr 1.2753 May 1.2730 Jun 1.2620 Jul 1.2620 Aug 1.2600 Sep 1.2662 Oct 1.2730 Nov 1.2777 Dec 1.2827 (40)
HLP (average)	1.2753 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
219.6554 193.6066 203.3333 182.2800 178.6322 159.6198 153.3030 168.2138 167.9145 189.0136 199.8561 214.3723 (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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723 (64)
Total per year (kWh/year) = Sum(64)m =												2229.8006 (64)
Heat gains from water heating, kWh/month	97.4495	86.4256	92.0224	84.2346	83.8093	76.7001	75.3873	80.3452	79.4581	87.2611	90.0787	95.6929 (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	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8492	58.4866	47.5645	36.0094	26.9175	22.7248	24.5550	31.9175	42.8396	54.3947	63.4867	67.6793 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	435.7638	440.2856	428.8907	404.6322	374.0102	345.2298	326.0027	321.4809	332.8758	357.1343	387.7563	416.5367 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717	55.1717 (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)	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668	-115.2668 (71)
Water heating gains (Table 5)	130.9805	128.6095	123.6860	116.9925	112.6469	106.5279	101.3270	107.9908	110.3585	117.2864	125.1092	128.6195 (72)
Total internal gains	748.3985	743.1869	715.9463	673.4392	629.3796	590.2877	567.6898	577.1943	601.8790	644.6206	692.1574	728.6405 (73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.5200	10.6334	0.6300		0.7000		0.7700		8.1893 (74)
East				10.0700	19.6403	0.6300		0.7000		0.7700		60.4434 (76)
Southwest				1.4400	36.7938	0.6300		0.7000		0.7700		16.1923 (79)
West				8.5700	19.6403	0.6300		0.7000		0.7700		51.4399 (80)
Northwest				1.4400	11.2829	0.6300		0.7000		0.7700		4.9654 (81)

Solar gains	141.2303	272.2062	442.9850	645.0665	794.3632	815.9547	775.6055	662.8635	514.2361	321.1693	175.2502	116.7466 (83)
Total gains	889.6287	1015.3931	1158.9313	1318.5057	1423.7427	1406.2424	1343.2954	1240.0578	1116.1151	965.7899	867.4076	845.3871 (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	35.3101	35.3848	35.4584	35.8079	35.8740	36.1853	36.1853	36.2435	36.0648	35.8740	35.7405	35.6019
alpha	3.3540	3.3590	3.3639	3.3872	3.3916	3.4124	3.4124	3.4162	3.4043	3.3916	3.3827	3.3735
util living area	0.9838	0.9738	0.9502	0.8931	0.7879	0.6339	0.4900	0.5426	0.7654	0.9265	0.9744	0.9863 (86)
MIT	19.1832	19.3968	19.7693	20.2466	20.6394	20.8795	20.9624	20.9466	20.7599	20.2381	19.6254	19.1434 (87)
Th 2	19.8461	19.8482	19.8503	19.8602	19.8621	19.8707	19.8707	19.8723	19.8674	19.8621	19.8583	19.8544 (88)
util rest of house	0.9801	0.9678	0.9385	0.8673	0.7366	0.5477	0.3758	0.4265	0.6910	0.9031	0.9675	0.9831 (89)
MIT 2	18.2116	18.4239	18.7905	19.2545	19.6096	19.8075	19.8583	19.8530	19.7238	19.2587	18.6598	18.1783 (90)
Living area fraction									fLA = Living area / (4) =			0.1414 (91)
MIT	18.3490	18.5615	18.9289	19.3948	19.7553	19.9591	20.0144	20.0076	19.8703	19.3972	18.7964	18.3148 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3490	18.5615	18.9289	19.3948	19.7553	19.9591	20.0144	20.0076	19.8703	19.3972	18.7964	18.3148 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9735	0.9589	0.9266	0.8548	0.7312	0.5550	0.3910	0.4413	0.6913	0.8911	0.9588	0.9772 (94)
Useful gains	866.0464	973.6812	1073.8509	1127.0571	1040.9809	780.4622	525.2657	547.2597	771.5217	860.5902	831.7115	826.1472 (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	2276.6518	2209.1810	2005.7015	1677.0534	1284.8439	847.4374	539.9280	569.5625	915.5169	1403.1879	1872.5852	2268.5766 (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	1049.4904	830.2559	693.2969	395.9973	181.4340	0.0000	0.0000	0.0000	0.0000	403.6926	749.4290	1073.1675 (98)
Space heating												5376.7637 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Space heating per m2 (98) / (4) = 42.9111 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5941.1753 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1049.4904	830.2559	693.2969	395.9973	181.4340	0.0000	0.0000	0.0000	0.0000	403.6926	749.4290	1073.1675	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1159.6579	917.4098	766.0739	437.5661	200.4796	0.0000	0.0000	0.0000	0.0000	446.0692	828.0984	1185.8204	(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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723	(64)
Efficiency of water heater (217)m	88.4474	88.2621	87.8294	86.8301	84.8553	79.8000	79.8000	79.8000	79.8000	86.7889	88.0154	79.8000	(216)
Fuel for water heating, kWh/month	248.3457	219.3541	231.5095	209.9272	210.5137	200.0249	192.1090	210.7942	210.4192	217.7854	227.0695	242.1637	(219)
Water heating fuel used												2620.0160	(219)
Annual totals kWh/year													
Space heating fuel - main system												5941.1753	(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)												465.1666	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.17 * 853 * 1.00) =										-798.4360		-798.4360	(233)
Total delivered energy for all uses												8302.9220	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5941.1753	3.4800	206.7529 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2620.0160	3.4800	91.1766 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	465.1666	13.1900	61.3555 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-798.4360	13.1900	-105.3137 (252)
Total energy cost			383.8637 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9467 (257)
SAP value		86.7936
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5941.1753	0.2160	1283.2939 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2620.0160	0.2160	565.9235 (264)
Space and water heating			1849.2173 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.1666	0.5190	241.4215 (268)
Energy saving/generation technologies			
PV Unit	-798.4360	0.5190	-414.3883 (269)
Total kg/year			1715.1755 (272)
CO2 emissions per m2			13.6900 (273)
EI value			86.5042
EI rating			87 (274)
EI band			B

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Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8490 = 4.099$, stars = 4
Water heating environmental impact	$0.216 / 0.8490 = 0.2544$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1578 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3788 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3220 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.3784	0.3542	0.3542	0.3220	0.3301	0.3140	0.3140	0.3059	0.3059	0.3301	0.3220	0.3301 (22b)
Effective ac	0.5716	0.5627	0.5627	0.5518	0.5545	0.5493	0.5493	0.5468	0.5468	0.5545	0.5518	0.5545 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			18.0000	1112.0400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20599.3368 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.4001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7393 (36)
Total fabric heat loss						(33) + (36) =	100.9740 (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	59.7490	58.8243	58.8243	57.6861	57.9605	57.4185	57.4185	57.1577	57.1577	57.9605	57.6861	57.9605 (38)
Heat transfer coeff	160.7230	159.7983	159.7983	158.6601	158.9345	158.3925	158.3925	158.1317	158.1317	158.9345	158.6601	158.9345 (39)
Average = Sum(39)m / 12 =												158.9576 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2827	1.2753	1.2753	1.2662	1.2684	1.2641	1.2641	1.2620	1.2620	1.2684	1.2662	1.2684 (40)
HLP (average)												1.2686 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

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Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
219.6554 193.6066 203.3333 182.2800 178.6322 159.6198 153.3030 168.2138 167.9145 189.0136 199.8561 214.3723 (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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723 (64)
Total per year (kWh/year) = Sum(64)m =												2229.8006 (64)
Heat gains from water heating, kWh/month												
97.4495 86.4256 92.0224 84.2346 83.8093 76.7001 75.3873 80.3452 79.4581 87.2611 90.0787 95.6929 (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	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.8492 58.4866 47.5645 36.0094 26.9175 22.7248 24.5550 31.9175 42.8396 54.3947 63.4867 67.6793 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7638 440.2856 428.8907 404.6322 374.0102 345.2298 326.0027 321.4809 332.8758 357.1343 387.7563 416.5367 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 (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)												
-115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 (71)												
Water heating gains (Table 5)												
130.9805 128.6095 123.6860 116.9925 112.6469 106.5279 101.3270 107.9908 110.3585 117.2864 125.1092 128.6195 (72)												
Total internal gains	748.3985	743.1869	715.9463	673.4392	629.3796	590.2877	567.6898	577.1943	601.8790	644.6206	692.1574	728.6405 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				2.5200	13.4684	0.6300		0.7000		0.7700		10.3726 (74)
East				10.0700	25.1733	0.6300		0.7000		0.7700		77.4713 (76)
Southwest				1.4400	45.0642	0.6300		0.7000		0.7700		19.8320 (79)
West				8.5700	25.1733	0.6300		0.7000		0.7700		65.9314 (80)
Northwest				1.4400	14.6130	0.6300		0.7000		0.7700		6.4309 (81)

Solar gains	180.0382	295.6732	489.5284	713.4645	824.3220	935.6638	855.0155	764.2948	594.2657	376.4539	222.7767	140.8098 (83)
Total gains	928.4367	1038.8600	1205.4747	1386.9037	1453.7016	1525.9515	1422.7053	1341.4891	1196.1447	1021.0744	914.9341	869.4503 (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	35.6019	35.8079	35.8079	36.0648	36.0025	36.1257	36.1257	36.1853	36.1853	36.0025	36.0648	36.0025
alpha	3.3735	3.3872	3.3872	3.4043	3.4002	3.4084	3.4084	3.4124	3.4124	3.4002	3.4043	3.4002
util living area	0.9768	0.9658	0.9321	0.8497	0.7132	0.4990	0.3596	0.3687	0.6465	0.8794	0.9591	0.9803 (86)
MIT	19.4400	19.6112	19.9859	20.4498	20.7816	20.9537	20.9890	20.9885	20.8878	20.4844	19.9115	19.4235 (87)
Th 2	19.8544	19.8602	19.8602	19.8674	19.8656	19.8691	19.8691	19.8707	19.8707	19.8656	19.8674	19.8656 (88)
util rest of house	0.9712	0.9576	0.9157	0.8138	0.6457	0.4000	0.2400	0.2426	0.5465	0.8398	0.9473	0.9755 (89)
MIT 2	18.4724	18.6444	19.0079	19.4469	19.7292	19.8507	19.8670	19.8687	19.8174	19.4896	18.9476	18.4649 (90)
Living area fraction									fLA = Living area / (4) =			0.1414 (91)
MIT	18.6092	18.7811	19.1462	19.5887	19.8780	20.0067	20.0257	20.0271	19.9688	19.6303	19.0839	18.6005 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6092	18.7811	19.1462	19.5887	19.8780	20.0067	20.0257	20.0271	19.9688	19.6303	19.0839	18.6005 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9630 0.9475 0.9030 0.8036 0.6465 0.4126 0.2570 0.2605 0.5560 0.8298 0.9366 0.9681 (94)												
Useful gains	894.0776	984.3475	1088.5749	1114.4555	939.8025	629.5768	365.6329	349.4535	665.0571	847.2999	856.9660	841.7251 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	2090.8835	2042.4051	1845.0677	1505.4799	1077.2649	650.4701	368.3690	352.1679	722.4723	1196.8207	1663.3812	2050.3294 (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	890.4236	711.0147	562.8307	281.5376	102.2721	0.0000	0.0000	0.0000	0.0000	260.0435	580.6190	899.2016 (98)
Space heating												4287.9427 (98)

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Space heating per m2 (98) / (4) = 34.2214 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4738.0582 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	890.4236	711.0147	562.8307	281.5376	102.2721	0.0000	0.0000	0.0000	0.0000	260.0435	580.6190	899.2016	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	983.8935	785.6516	621.9123	311.0913	113.0078	0.0000	0.0000	0.0000	0.0000	287.3408	641.5679	993.5929	(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	219.6554	193.6066	203.3333	182.2800	178.6322	159.6198	153.3030	168.2138	167.9145	189.0136	199.8561	214.3723	(64)
Efficiency of water heater (217)m	88.1609	87.9754	87.3902	85.9698	83.3896	79.8000	79.8000	79.8000	79.8000	85.6652	87.4958	79.8000	(216)
Fuel for water heating, kWh/month	249.1528	220.0691	232.6729	212.0279	214.2140	200.0249	192.1090	210.7942	210.4192	220.6422	228.4178	242.9899	(219)
Water heating fuel used												2633.5338	(219)
Annual totals kWh/year													
Space heating fuel - main system												4738.0582	(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)												465.1666	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.17 * 966 * 1.00) =										-903.9774		-903.9774	(233)
Total delivered energy for all uses												7007.7812	(238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4738.0582	3.6300	171.9915	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2633.5338	3.6300	95.5973	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	465.1666	19.4400	90.4284	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-903.9774	19.4400	-175.7332	(252)
Total energy cost			291.8640	(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	4738.0582	0.2160	1023.4206	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2633.5338	0.2160	568.8433	(264)
Space and water heating			1592.2639	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	465.1666	0.5190	241.4215	(268)
Energy saving/generation technologies				
PV Unit	-903.9774	0.5190	-469.1642	(269)
Total kg/year			1403.4461	(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	4738.0582	1.2200	5780.4310	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2633.5338	1.2200	3212.9112	(264)
Space and water heating			8993.3422	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	465.1666	3.0700	1428.0616	(268)

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Energy saving/generation technologies			
PV Unit	-903.9774	3.0700	-2775.2105 (269)
Primary energy kWh/year			7876.4433 (272)
Primary energy kWh/m ² /year			62.8607 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
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
N Solar water heating	+ 1.3	-£ 40	-270 kg (19.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40 2.15 kg/m ²	B 88	B 89
Total Savings	£40 2.15 kg/m ²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	B 89

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£105	£115	-£10
Mains gas	£363	£313	£50
Space heating	£282	£283	-£2
Water heating	£96	£54	£42
Lighting	£90	£90	£0
Generated (PV)	-£176	-£176	£0
Total cost of fuels	£292	£252	£40
Total cost of uses	£292	£251	£40
Delivered energy	56 kWh/m ²	45 kWh/m ²	11 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	63 kWh/m ²	51 kWh/m ²	12 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1578 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3788 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3220 (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	0.4106	0.4025	0.3945	0.3542	0.3462	0.3059	0.3059	0.2979	0.3220	0.3462	0.3623	0.3784 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5627	0.5599	0.5468	0.5468	0.5444	0.5518	0.5599	0.5656	0.5716 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			18.0000	1112.0400 (32e)

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) =	20599.3368 (34)
	164.4001 (35)
	19.7393 (36)
(33) + (36) =	100.9740 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 61.0769 Feb 60.7347 Mar 60.3994 Apr 58.8243 May 58.5296 Jun 57.1577 Jul 57.1577 Aug 56.9036 Sep 57.6861 Oct 58.5296 Nov 59.1257 Dec 59.7490 (38)
Heat transfer coeff	162.0509 161.7087 161.3734 159.7983 159.5036 158.1317 158.1317 157.8776 158.6601 159.5036 160.0997 160.7230 (39)
Average = Sum(39)m / 12 =	159.7968 (39)

HLP	Jan 1.2933 Feb 1.2906 Mar 1.2879 Apr 1.2753 May 1.2730 Jun 1.2620 Jul 1.2620 Aug 1.2600 Sep 1.2662 Oct 1.2730 Nov 1.2777 Dec 1.2827 (40)
HLP (average)	1.2753 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy conte	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
209.5530 184.4819 191.8352 165.7499 155.7354 137.2366 130.1736 146.0149 152.7351 177.5155 190.0795 204.2700 (62)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1230 (H8)
Utilisation factor												0.5895 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												102.6397 (H14)
Volume ratio Veff/V												1.1399 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-940.1148 (H17)
Solar input	-27.2615	-45.4915	-77.4773	-103.8348	-128.2792	-126.1189	-124.4522	-108.7345	-85.1609	-58.1549	-32.3360	-22.8132 (63)
Solar input (sum of months) = Sum (63)m =												-940.1148 (63)
Output from w/h												
182.2916 138.9903 114.3579 61.9150 27.4563 11.1177 5.7215 37.2805 67.5742 119.3606 157.7435 181.4568 (64)												
Total per year (kWh/year) = Sum (64)m =												1105.2658 (64)
Heat gains from water heating, kWh/month												
89.3676 79.1258 82.8239 71.0105 65.4919 58.7935 56.8838 62.5861 67.3146 78.0626 82.2574 87.6110 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.8492 58.4866 47.5645 36.0094 26.9175 22.7248 24.5550 31.9175 42.8396 54.3947 63.4867 67.6793 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7638 440.2856 428.8907 404.6322 374.0102 345.2298 326.0027 321.4809 332.8758 357.1343 387.7563 416.5367 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 (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)												
-115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 (71)												
Water heating gains (Table 5)												
120.1177 117.7468 111.3224 98.6257 88.0267 81.6577 76.4568 84.1211 93.4925 104.9228 114.2465 117.7567 (72)												
Total internal gains	737.5357	732.3241	703.5827	655.0724	604.7594	565.4174	542.8196	553.3246	585.0130	632.2570	681.2946	717.7778 (73)

6. Solar gains

[Jan]												
Area												
m2												
Solar flux												
Table 6a												
W/m2												
Specific data												
g												
or Table 6b												
Specific data												
FF												
or Table 6c												
Access												
factor												
Table 6d												
Gains												
W												
North												8.1893 (74)
East												60.4434 (76)
Southwest												16.1923 (79)
West												51.4399 (80)
Northwest												4.9654 (81)
Solar gains	141.2303	272.2062	442.9850	645.0665	794.3632	815.9547	775.6055	662.8635	514.2361	321.1693	175.2502	116.7466 (83)
Total gains	878.7660	1004.5303	1146.5677	1300.1389	1399.1226	1381.3721	1318.4251	1216.1880	1099.2491	953.4263	856.5448	834.5243 (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	35.3101	35.3848	35.4584	35.8079	35.8740	36.1853	36.1853	36.2435	36.0648	35.8740	35.7405	35.6019
alpha	3.3540	3.3590	3.3639	3.3872	3.3916	3.4124	3.4124	3.4162	3.4043	3.3916	3.3827	3.3735
util living area	0.9844	0.9745	0.9516	0.8964	0.7943	0.6419	0.4978	0.5511	0.7714	0.9287	0.9753	0.9868 (86)
MIT	19.1731	19.3871	19.7592	20.2346	20.6291	20.8747	20.9606	20.9440	20.7535	20.2289	19.6156	19.1332 (87)
Th 2	19.8461	19.8482	19.8503	19.8602	19.8621	19.8707	19.8707	19.8723	19.8674	19.8621	19.8583	19.8544 (88)
util rest of house												
0.9808 0.9687 0.9401 0.8712 0.7437 0.5555 0.3823 0.4340 0.6976 0.9060 0.9686 0.9837 (89)												
MIT 2	18.2016	18.4144	18.7809	19.2437	19.6015	19.8047	19.8576	19.8519	19.7194	19.2503	18.6503	18.1682 (90)
Living area fraction												
MIT	18.3390	18.5519	18.9192	19.3838	19.7468	19.9560	20.0136	20.0063	19.8656	19.3887	18.7868	18.3047 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment
adjusted MIT 18.3390 18.5519 18.9192 19.3838 19.7468 19.9560 20.0136 20.0063 19.8656 19.3887 18.7868 0.0000
18.3047 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9743	0.9600	0.9283	0.8586	0.7379	0.5626	0.3977	0.4488	0.6975	0.8940	0.9601	0.9780	(94)
Useful gains	856.2120	964.3560	1064.4119	1116.3419	1032.4315	777.1632	524.3549	545.8850	766.7047	852.3173	822.3920	816.1799	(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	2275.0338	2207.6390	2004.1322	1675.2956	1283.4965	846.9492	539.7942	569.3610	914.7717	1401.8254	1871.0551	2266.9497	(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	1055.6034	835.4861	699.1520	402.4467	186.7924	0.0000	0.0000	0.0000	0.0000	408.8341	755.0374	1079.3728	(98)
Space heating												5422.7249	(98)
Space heating per m2												43.2779	(99)

(98) / (4) =

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 %) 90.5000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 5991.9612 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1055.6034	835.4861	699.1520	402.4467	186.7924	0.0000	0.0000	0.0000	0.0000	408.8341	755.0374	1079.3728	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1166.4126	923.1891	772.5436	444.6925	206.4004	0.0000	0.0000	0.0000	0.0000	451.7504	834.2955	1192.6771	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	182.2916	138.9903	114.3579	61.9150	27.4563	11.1177	5.7215	37.2805	67.5742	119.3606	157.7435	181.4568	(64)
Efficiency of water heater (217)m	88.7477	88.8017	88.8257	88.9105	88.9712	79.8000	79.8000	79.8000	79.8000	87.8385	88.4504	79.8000	(216)
Fuel for water heating, kWh/month	205.4044	156.5177	128.7441	69.6375	30.8597	13.9320	7.1697	46.7174	84.6794	135.8865	178.3412	204.3739	(219)
Water heating fuel used												1262.2635	(219)
Annual totals kWh/year													
Space heating fuel - main system												5991.9612	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												465.1666	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.17 * 853 * 1.00) =										-798.4360		-798.4360	(233)
Total delivered energy for all uses												7045.9554	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5991.9612	3.4800	208.5203	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1262.2635	3.4800	43.9268	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	465.1666	13.1900	61.3555	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-798.4360	13.1900	-105.3137	(252)
Total energy cost			344.9763	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
 Energy cost factor (ECF) 0.8508 (257)
 SAP value [(255) x (256)] / [(4) + 45.0] = 88.1314
 SAP rating (Section 12) 88 (258)
 SAP band B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	5991.9612	0.2160	1294.2636 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1262.2635	0.2160	272.6489 (264)
Space and water heating			1566.9125 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	465.1666	0.5190	241.4215 (268)
Energy saving/generation technologies			
PV Unit	-798.4360	0.5190	-414.3883 (269)
Total kg/year			1458.8207 (272)
CO2 emissions per m2			11.6400 (273)
EI value			88.5213
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3900 (2b)	= 151.8128 (1b) - (3b)
First floor	61.7800 (1c)	x 2.6700 (2c)	= 164.9526 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.7654 (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					5 * 10 = 50.0000 (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) =				50.0000 / (5) = 0.1578 (8)
Pressure test					Yes
Measured/design AP50					4.4200
Infiltration rate					0.3788 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3220 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.3784	0.3542	0.3542	0.3220	0.3301	0.3140	0.3140	0.3059	0.3059	0.3301	0.3220	0.3301 (22b)
Effective ac	0.5716	0.5627	0.5627	0.5518	0.5545	0.5493	0.5493	0.5468	0.5468	0.5545	0.5518	0.5545 (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
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			24.0400	1.1450	27.5267		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	182.0000	26.1600	155.8400	0.2400	37.4016	42.2200	6579.5648 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			309.0400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2347		(33)
GF Block			56.7100			75.0000	4253.2500 (32c)
GF Stud			33.0600			9.0000	297.5400 (32c)
FF Stud			147.9100			9.0000	1331.1900 (32c)
Internal Floor 1			61.7800			18.0000	1112.0400 (32d)
Internal Ceiling 1			61.7800			18.0000	1112.0400 (32e)

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) =	20599.3368 (34)
	164.4001 (35)
	19.7393 (36)
(33) + (36) =	100.9740 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 59.7490 Feb 58.8243 Mar 58.8243 Apr 57.6861 May 57.9605 Jun 57.4185 Jul 57.4185 Aug 57.1577 Sep 57.1577 Oct 57.9605 Nov 57.6861 Dec 57.9605 (38)
Heat transfer coeff	160.7230 159.7983 159.7983 158.6601 158.9345 158.3925 158.3925 158.1317 158.1317 158.9345 158.6601 158.9345 (39)
Average = Sum(39)m / 12 =	158.9576 (39)

HLP	Jan 1.2827 Feb 1.2753 Mar 1.2753 Apr 1.2662 May 1.2684 Jun 1.2641 Jul 1.2641 Aug 1.2620 Sep 1.2620 Oct 1.2684 Nov 1.2662 Dec 1.2684 (40)
HLP (average)	1.2686 (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												2.8817 (42)
Average daily hot water use (litres/day)												102.6397 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9036	108.7980	104.6925	100.5869	96.4813	92.3757	92.3757	96.4813	100.5869	104.6925	108.7980	112.9036 (44)
Energy content	167.4328	146.4378	151.1107	131.7420	126.4096	109.0818	101.0804	115.9912	117.3765	136.7910	149.3181	162.1497 (45)
Energy content (annual)										Total = Sum(45)m =		1614.9216 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.1149	21.9657	22.6666	19.7613	18.9614	16.3623	15.1621	17.3987	17.6065	20.5186	22.3977	24.3225 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
209.5530 184.4819 191.8352 165.7499 155.7354 137.2366 130.1736 146.0149 152.7351 177.5155 190.0795 204.2700 (62)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2546 (H8)
Utilisation factor												0.5493 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												102.6397 (H14)
Volume ratio Veff/V												1.1399 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-978.6825 (H17)
Solar input	-31.9357	-45.4161	-78.8086	-106.0109	-123.1918	-133.9969	-127.0495	-115.8569	-90.6809	-62.6754	-37.7726	-25.2871 (63)
Solar input (sum of months) = Sum (63)m =												-978.6825 (63)
Output from w/h												
177.6174 139.0658 113.0266 59.7390 32.5436 3.2397 3.1241 30.1581 62.0542 114.8401 152.3069 178.9828 (64)												
Total per year (kWh/year) = Sum (64)m =												1066.6982 (64)
Heat gains from water heating, kWh/month												
89.3676 79.1258 82.8239 71.0105 65.4919 58.7935 56.8838 62.5861 67.3146 78.0626 82.2574 87.6110 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002	172.9002 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.8492 58.4866 47.5645 36.0094 26.9175 22.7248 24.5550 31.9175 42.8396 54.3947 63.4867 67.6793 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7638 440.2856 428.8907 404.6322 374.0102 345.2298 326.0027 321.4809 332.8758 357.1343 387.7563 416.5367 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 55.1717 (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)												
-115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 -115.2668 (71)												
Water heating gains (Table 5)												
120.1177 117.7468 111.3224 98.6257 88.0267 81.6577 76.4568 84.1211 93.4925 104.9228 114.2465 117.7567 (72)												
Total internal gains	737.5357	732.3241	703.5827	655.0724	604.7594	565.4174	542.8196	553.3246	585.0130	632.2570	681.2946	717.7778 (73)

6. Solar gains

[Jan]												
Area												
m2												
Solar flux												
Table 6a												
W/m2												
Specific data												
g												
or Table 6b												
Specific data												
or Table 6c												
Access												
factor												
Table 6d												
Gains												
W												
North												10.3726 (74)
East												77.4713 (76)
Southwest												19.8320 (79)
West												65.9314 (80)
Northwest												6.4309 (81)
Solar gains	180.0382	295.6732	489.5284	713.4645	824.3220	935.6638	855.0155	764.2948	594.2657	376.4539	222.7767	140.8098 (83)
Total gains	917.5739	1027.9972	1193.1111	1368.5369	1429.0815	1501.0812	1397.8351	1317.6193	1179.2787	1008.7109	904.0713	858.5875 (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	35.6019	35.8079	35.8079	36.0648	36.0025	36.1257	36.1257	36.1853	36.1853	36.0025	36.0648	36.0025 (86)
alpha	3.3735	3.3872	3.3872	3.4043	3.4002	3.4084	3.4084	3.4124	3.4124	3.4002	3.4043	3.4002 (87)
util living area	0.9776	0.9667	0.9338	0.8538	0.7204	0.5060	0.3656	0.3749	0.6528	0.8826	0.9604	0.9810 (88)
MIT	19.4302	19.6017	19.9764	20.4397	20.7743	20.9517	20.9884	20.9879	20.8844	20.4767	19.9023	19.4135 (89)
Th 2	19.8544	19.8602	19.8602	19.8674	19.8656	19.8691	19.8691	19.8707	19.8707	19.8656	19.8674	19.8656 (90)
util rest of house	0.9721	0.9588	0.9178	0.8184	0.6532	0.4060	0.2442	0.2469	0.5527	0.8436	0.9489	0.9763 (91)
MIT 2	18.4627	18.6353	18.9991	19.4383	19.7242	19.8498	19.8669	19.8686	19.8155	19.4831	18.9388	18.4551 (92)
Living area fraction									fLA = Living area / (4) =			0.1414 (93)
MIT	18.5996	18.7719	19.1373	19.5799	19.8727	20.0057	20.0255	20.0269	19.9667	19.6236	19.0751	18.5906 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													0.0000
adjusted MIT	18.5996	18.7719	19.1373	19.5799	19.8727	20.0057	20.0255	20.0269	19.9667	19.6236	19.0751	18.5906	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9641	0.9488	0.9051	0.8080	0.6537	0.4187	0.2614	0.2651	0.5621	0.8335	0.9384	0.9691	(94)
Useful gains	884.6159	975.4082	1079.9312	1105.7520	934.1994	628.4648	365.4533	349.2718	662.8159	840.7802	848.3766	832.0903	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	2089.3281	2040.9343	1843.6403	1504.0795	1076.4104	650.3085	368.3405	352.1387	722.1397	1195.7630	1661.9725	2048.7615	(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	896.3059	716.0335	568.1995	286.7958	105.8050	0.0000	0.0000	0.0000	0.0000	264.1072	585.7891	905.2033	(98)
Space heating												4328.2393	(98)
Space heating per m2											(98) / (4) =	34.5430	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4782.5849	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	896.3059	716.0335	568.1995	286.7958	105.8050	0.0000	0.0000	0.0000	0.0000	264.1072	585.7891	905.2033	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	990.3932	791.1973	627.8448	316.9014	116.9116	0.0000	0.0000	0.0000	0.0000	291.8312	647.2807	1000.2247	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	177.6174	139.0658	113.0266	59.7390	32.5436	3.2397	3.1241	30.1581	62.0542	114.8401	152.3069	178.9828	(64)	
Efficiency of water heater (217)m	88.5366	88.5366	88.5305	88.4554	87.7328	79.8000	79.8000	79.8000	79.8000	86.9662	88.0634	79.8000	(216)	
Fuel for water heating, kWh/month	200.6147	157.0147	127.6697	67.5357	37.0940	4.0597	3.9149	37.7921	77.7621	132.0514	172.9514	202.1488	(219)	
Water heating fuel used												1220.6094	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4782.5849	(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)	
pump for solar water heating												50.0000	(230g)	
Total electricity for the above, kWh/year												125.0000	(231)	
Electricity for lighting (calculated in Appendix L)												465.1666	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.17 * 966 * 1.00) =										-903.9774		-903.9774	(233)	
Total delivered energy for all uses												5689.3836	(238)	

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4782.5849	3.6300	173.6078	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1220.6094	3.6300	44.3081	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	465.1666	19.4400	90.4284	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-903.9774	19.4400	-175.7332	(252)
Total energy cost			251.9111	(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	4782.5849	0.2160	1033.0383	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1220.6094	0.2160	263.6516	(264)
Space and water heating			1296.6900	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	465.1666	0.5190	241.4215 (268)
Energy saving/generation technologies			
PV Unit	-903.9774	0.5190	-469.1642 (269)
Total kg/year			1133.8222 (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	4782.5849	1.2200	5834.7536 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1220.6094	1.2200	1489.1434 (264)
Space and water heating			7323.8970 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	465.1666	3.0700	1428.0616 (268)
Energy saving/generation technologies			
PV Unit	-903.9774	3.0700	-2775.2105 (269)
Primary energy kWh/year			6360.4981 (272)
Primary energy kWh/m2/year			50.7622 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 79	Issued on Date	16/05/2022
Assessment Reference	As Built	Prop Type Ref	Nh
Project	18 Haines Crescent, West End, Southampton, SO30 3LG		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	15.22	TER	17.09
Environmental	87 B	% DER<TER	10.92		
CO ₂ Emissions (t/year)	1.40	DFEE	53.05	TREE	59.11
General Requirements Compliance	Pass	% DFEE<TFEE	10.26		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 79	Issued on Date	16/05/2022
Assessment Reference	As Built	Prop Type Ref	Nh
Project	18 Haines Crescent, West End, Southampton, SO30 3LG		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	15.22	TER	17.09
Environmental	87 B	% DER<TER	10.92		
CO ₂ Emissions (t/year)	1.40	DFEE	53.05	TFEE	59.11
General Requirements Compliance	Pass	% DFEE<TFEE	10.26		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 79	Issued on Date	16/05/2022
Assessment Reference	As Built	Prop Type Ref	Nh
Project	18 Haines Crescent, West End, Southampton, SO30 3LG		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	15.22	TER	17.09
Environmental	87 B	% DER<TER	10.92		
CO ₂ Emissions (t/year)	1.40	DFEE	53.05	TFEE	59.11
General Requirements Compliance	Pass	% DFEE<TFEE	10.26		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 79	Issued on Date	16/05/2022
Assessment Reference	As Built	Prop Type Ref	Nh
Property	18 Haines Crescent, West End, Southampton, SO30 3LG		
SAP Rating	87 B	DER	15.22
Environmental	87 B	TER	17.09
CO ₂ Emissions (t/year)	1.40	% DER<TER	10.92
General Requirements Compliance	Pass	DfEE	53.05
		TFEE	59.11
		% DfEE<TFEE	10.26
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	37.15 m	63.52 m ²
	1st Storey:	34.91 m	61.78 m ²
			2.39 m
			2.67 m

7.0 Living Area	17.72	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	164.4	kJ/m²K

9.0 External Walls			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	182.00	155.84

9.1 Party Walls			U-Value	Kappa	Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00	

9.2 Internal Walls			Kappa	Area
Description	Construction		(kJ/m ² K)	(m ²)
GF Block	Dense block, plasterboard on dabs		75.00	56.71
GF Stud	Plasterboard on timber frame		9.00	33.06
FF Stud	Plasterboard on timber frame		9.00	147.91

10.0 External Roofs			U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction	(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	63.52	63.52

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	61.78

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	63.52

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	61.78

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacture	Solid Door							1.10
Windows	Manufacture	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	West							2.12	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					8.57	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					2.52	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					10.07	
Bay	Window	[1] Brick and Block	South West	None	0.00					1.44	
Bay	Window	[1] Brick and Block	North West	None	0.00					1.44	

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	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	0.91	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.02	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.02	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.54	0.640	No	Birtley Supatherm
Table K1 - Approved	E2 Other lintels (including other steel lintels)	3.70	0.300	No	
Independently assessed	E3 Sill	14.17	0.021	No	Knauf P5
Independently assessed	E4 Jamb	35.40	0.016	No	Knauf P6
Table K1 - Default	E5 Ground floor (normal)	37.15	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	34.91	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	23.83	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	3.12	0.240	No	
Independently assessed	E12 Gable (insulation at ceiling level)	14.86	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	34.79	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	14.59	-0.091	No	Knauf P24

Y-value	0.064	W/m²K
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18.0 Pressure Testing

Yes

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
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SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Tested ? Yes
As Built AP₅₀ 4.42 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open
Cross ventilation possible Yes
Night Ventilation Yes
Air change rate 4.00

Mechanical Ventilation

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				5
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 26
Total number of L.E.L. fittings 26
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

Database
Description Gas System
Percentage of Heat 100 %
Database Ref. No. 18911
Fuel Type Mains gas
Main Heating BGB
SAP Code 102
In Winter 90.5
In Summer 79.8
Controls CBE Programmer, room thermostat and TRVs
PCDF Controls 0
Delayed Start Stat No
Sap Code 2106
Flue Type Balanced
Fan Assisted Flue Yes
Is MHS Pumped Pump in heated space
Heat Emitter Radiators
Flow Temperature Normal (> 45°C)

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
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	215.00	L		
Loss	1.73	kWh/day		
Pipes insulation	Fully insulated primary pipework			
31.0 Thermal Store	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.17	East	45°	None Or Little	Yes
Recommendations				
Lower cost measures				
None				
Further measures to achieve even higher standards				
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£40	B 88	