



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 1, Winifred Moody Road
West End, Southampton, SO30 3LB

Contact: Tobias Whiting
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Report Issue Date: 08/09/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 24			Issued on Date	08/09/2022
Assessment Reference	As Built	Prop Type Ref	M		
Property	1, Winifred Moody Road, West End, Southampton, SO30 3LB				
SAP Rating	89 B	DER	12.12	TER	15.68
Environmental	89 B	% DER<TER	22.71		
CO ₂ Emissions (t/year)	1.24	DFEE	44.27	TFEE	53.09
General Requirements Compliance	Pass	% DFEE<TFEE	16.63		
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)	15.68	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.12	kgCO ₂ /m ²	Pass
	-3.56 (-22.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.09	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.27	kWh/m ² /yr	
	-8.8 (-16.6%)	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	4.13 (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 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

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)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

8.02 m², Overhang twice as wide as window, ratio 0.52

Windows facing East

1.32 m², No overhang

Windows facing South

11.41 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

4.13 (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
Thermal bridging ψ -value	0.030	W/m ² K
Photovoltaic array	1.15	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 24	Issued on Date	08/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Property	1, Winifred Moody Road, West End, Southampton, SO30 3LB		
SAP Rating	89 B	DER	12.12
Environmental	89 B	TER	15.68
CO ₂ Emissions (t/year)	1.24	% DER<TER	22.71
General Requirements Compliance	Pass	DFEE	44.27
		TFEE	53.09
		% DFEE<TFEE	16.63
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	0.077	1.90	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.00	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.51	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.88	0.25	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	2.77	0.16	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	10.93	0.23	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	33.60	0.54	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	37.60	6.02	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	35.26	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.04	1.08	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	22.43	0.99	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: **9.94** W/mK:
Y-Value: **0.030** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 148 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) 15.68 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.12 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 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: 4.13 (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 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

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): Not significant OK
Based on:
Overshading: Average
Windows facing North: 8.02 m², Overhang twice as wide as window, ratio 0.52
Windows facing East: 1.32 m², No overhang
Windows facing South: 11.41 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
Thermal bridging y-value 0.030 W/m²K
Photovoltaic array 1.15 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	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1300
Infiltration rate					0.3402 (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) =	0.2891 (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	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397 (22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (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)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.0200	0.1200	9.0024	84.0000	6301.6800 (28a)
Brick and Block	183.9800	22.8700	161.1100	0.2400	38.6664	42.2200	6802.0642 (29a)
Pitched Roof	75.0200		75.0200	0.1000	7.5020	9.1000	682.6820 (30)
Total net area of external elements Aum(A, m ²)			334.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2623		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			172.0000			9.0000	1548.0000 (32c)
Internal Floor 1			72.9600			18.0000	1313.2800 (32d)
Internal Ceiling 1			72.9600			18.0000	1313.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24550.6962 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.9055 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9390 (36)
Total fabric heat loss (33) + (36) = 91.2014 (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	70.1151	69.7894	69.4701	67.9704	67.6898	66.3837	66.3837	66.1418	66.8868	67.6898	68.2575	68.8509 (38)
Heat transfer coeff	161.3165	160.9907	160.6714	159.1718	158.8912	157.5850	157.5850	157.3432	158.0882	158.8912	159.4588	160.0522 (39)
Average = Sum(39)m / 12 =												159.1704 (39)
HLP	1.0901	1.0879	1.0858	1.0756	1.0737	1.0649	1.0649	1.0633	1.0683	1.0737	1.0776	1.0816 (40)
HLP (average)												1.0756 (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												2.9310 (42)
Average daily hot water use (litres/day)												103.8110 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1920	110.0396	105.8872	101.7347	97.5823	93.4299	93.4299	97.5823	101.7347	105.8872	110.0396	114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3505 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4015	22.2163	22.9253	19.9868	19.1778	16.5490	15.3351	17.5972	17.8074	20.7528	22.6533	24.6000 (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)
Combi loss	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (64)
Heat gains from water heating, kWh/month	63.7717	55.9865	58.2667	51.4917	49.9159	43.8167	41.3430	46.3930	46.6337	53.4247	57.4230	61.9858 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.8036 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4341	27.0313	21.9833	16.6428	12.4407	10.5029	11.3488	14.7516	19.7996	25.1401	29.3422	31.2799 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.3168	321.6199	313.2961	295.5758	273.2070	252.1835	238.1385	234.8354	243.1592	260.8796	283.2483	304.2718 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549 (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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395 (71)
Water heating gains (Table 5)	85.7146	83.3133	78.3155	71.5163	67.0913	60.8565	55.5686	62.3562	64.7690	71.8074	79.7541	83.3142 (72)
Total internal gains	504.4303	501.9293	483.5597	453.6996	422.7038	393.5078	375.0207	381.9080	397.6925	427.7919	462.3095	488.8308 (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			8.0200	10.6334		0.6300		0.7000		0.7700		26.0626 (74)
East			1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			11.4100	46.7521		0.6300		0.7000		0.7700		163.0265 (78)
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125 (83)
Total gains	701.4425	834.2309	933.8238	1011.2629	1052.0164	1021.7412	979.1596	931.0867	884.4166	793.4514	697.5822	657.9433 (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	42.2749	42.3604	42.4446	42.8445	42.9202	43.2759	43.2759	43.3424	43.1382	42.9202	42.7674	42.6088
alpha	3.8183	3.8240	3.8296	3.8563	3.8613	3.8851	3.8851	3.8895	3.8759	3.8613	3.8512	3.8406
util living area	0.9957	0.9911	0.9817	0.9586	0.9040	0.7901	0.6418	0.6856	0.8689	0.9685	0.9920	0.9966 (86)
MIT	19.2487	19.4500	19.7586	20.1574	20.5359	20.8222	20.9426	20.9245	20.7156	20.2210	19.6579	19.2119 (87)
Th 2	20.0089	20.0107	20.0125	20.0208	20.0223	20.0296	20.0296	20.0309	20.0268	20.0223	20.0192	20.0159 (88)
util rest of house	0.9946	0.9890	0.9771	0.9470	0.8740	0.7195	0.5260	0.5745	0.8172	0.9576	0.9897	0.9958 (89)
MIT 2	18.3973	18.5991	18.9067	19.3052	19.6673	19.9232	20.0071	19.9988	19.8378	19.3726	18.8134	18.3658 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.5195	18.7213	19.0290	19.4276	19.7921	20.0523	20.1414	20.1317	19.9638	19.4944	18.9346	18.4873 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5195	18.7213	19.0290	19.4276	19.7921	20.0523	20.1414	20.1317	19.9638	19.4944	18.9346	18.4873 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9924	0.9852	0.9710	0.9381	0.8655	0.7214	0.5405	0.5873	0.8132	0.9498	0.9862	0.9940 (94)
Ext temp.	696.1444	821.8775	906.7371	948.6873	910.5407	737.1032	529.2095	546.8378	719.1768	753.5860	687.9846	654.0166 (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	2293.8442	2225.0944	2013.0563	1675.6912	1285.7567	859.2037	558.0789	587.1637	927.0000	1413.2427	1887.1384	2286.7166 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1188.6886	942.9618	823.1015	523.4428	279.1607	0.0000	0.0000	0.0000	0.0000	490.7846	863.3908	1214.7288 (98)
Space heating per m2												6326.2597 (98)
										(98) / (4) =		42.7508 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6998.0749 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1188.6886	942.9618	823.1015	523.4428	279.1607	0.0000	0.0000	0.0000	0.0000	490.7846	863.3908	1214.7288	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1314.9211	1043.0994	910.5105	579.0297	308.8061	0.0000	0.0000	0.0000	0.0000	542.9033	955.0783	1343.7266	(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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230	(64)
Efficiency of water heater (217)m	90.0775	90.0483	89.9924	89.8702	89.5940	88.2000	88.2000	88.2000	88.2000	89.8285	90.0129	88.2000	(216)
Fuel for water heating, kWh/month	221.1467	194.4180	202.9408	180.2553	175.7622	157.4365	149.2459	166.5057	167.0729	187.0707	199.8097	215.1418	(219)
Water heating fuel used												2216.8062	(219)
Annual totals kWh/year													
Space heating fuel - main system												6998.0749	(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)												537.4755	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)
Total delivered energy for all uses												8834.1939	(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	6998.0749	0.2160	1511.5842 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2216.8062	0.2160	478.8301 (264)
Space and water heating			1990.4143 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	537.4755	0.5190	278.9498 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total CO2, kg/year			1792.8377 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1200 (273)

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

DER		12.1200	ZC1
Total Floor Area	TFA	147.9800	
Assumed number of occupants	N	2.9310	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.7468	ZC2
CO2 emissions from cooking, equation (L16)		1.2795	ZC3
Total CO2 emissions		26.1464	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		26.1464	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	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) = 0.1069 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3569 (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) =				0.3034 (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	0.3868	0.3792	0.3716	0.3337	0.3261	0.2882	0.2882	0.2806	0.3034	0.3261	0.3413	0.3565 (22b)
Effective ac	0.5748	0.5719	0.5691	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5582	0.5635 (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)			20.7500	1.3258	27.5095		(27)					
Ground Floor			75.0200	0.1300	9.7526		(28a)					
Brick and Block	183.9800	22.8700	161.1100	0.1800	28.9998		(29a)					
Pitched Roof	75.0200		75.0200	0.1300	9.7526		(30)					
Total net area of external elements Aum(A, m2)			334.0200				(31)					
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				78.1345		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2917 (36)					
Total fabric heat loss	(33) + (36) =						91.4262 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.9626	Feb 70.6039	Mar 70.2524	Apr 68.6012	May 68.2923	Jun 66.8542	Jul 66.8542	Aug 66.5879	Sep 67.4081	Oct 68.2923	Nov 68.9173	Dec 69.5706 (38)
Heat transfer coeff	162.3888	162.0301	161.6786	160.0274	159.7185	158.2803	158.2803	158.0140	158.8343	159.7185	160.3434	160.9968 (39)
Average = Sum(39)m / 12 =	160.0259 (40)											
HLP	Jan 1.0974	Feb 1.0949	Mar 1.0926	Apr 1.0814	May 1.0793	Jun 1.0696	Jul 1.0696	Aug 1.0678	Sep 1.0733	Oct 1.0793	Nov 1.0835	Dec 1.0880 (40)
HLP (average)	1.0814 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1920	110.0396	105.8872	101.7347	97.5823	93.4299	93.4299	97.5823	101.7347	105.8872	110.0396	114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	25.4015	22.2163	22.9253	19.9868	19.1778	16.5490	15.3351	17.5972	17.8074	20.7528	22.6533	24.6000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.7269	46.0750	47.6108	49.7269	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	220.3024	194.1363	203.7940	182.5604	177.5790	156.4016	149.8447	167.0417	168.0310	189.3109	200.3371	214.9590 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	220.3024	194.1363	203.7940	182.5604	177.5790	156.4016	149.8447	167.0417	168.0310	189.3109	200.3371	214.9590 (64)
	69.0464	60.7531	63.5574	56.6329	54.9425	48.2024	45.8955	51.4389	51.8018	58.7418	62.5436	67.2698 (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	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4341	27.0313	21.9833	16.6428	12.4407	10.5029	11.3488	14.7516	19.7996	25.1401	29.3422	31.2799	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.3168	321.6199	313.2961	295.5758	273.2070	252.1835	238.1385	234.8354	243.1592	260.8796	283.2483	304.2718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	(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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	(71)
Water heating gains (Table 5)	92.8044	90.4063	85.4266	78.6567	73.8475	66.9477	61.6875	69.1383	71.9470	78.9540	86.8661	90.4164	(72)
Total internal gains	511.5200	509.0224	490.6709	460.8401	429.4600	399.5990	381.1396	388.6901	404.8706	434.9385	469.4214	495.9329	(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				8.0200	10.6334		0.6300	0.7000	0.7700	26.0626 (74)		
East				1.3200	19.6403		0.6300	0.7000	0.7700	7.9231 (76)		
South				11.4100	46.7521		0.6300	0.7000	0.7700	163.0265 (78)		

Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125 (83)
Total gains	708.5322	841.3240	940.9349	1018.4034	1058.7726	1027.8324	985.2785	937.8689	891.5946	800.5979	704.6942	665.0455 (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	63.2826	63.4227	63.5606	64.2164	64.3406	64.9252	64.9252	65.0347	64.6988	64.3406	64.0899	63.8298	
alpha	5.2188	5.2282	5.2374	5.2811	5.2894	5.3283	5.3283	5.3356	5.3133	5.2894	5.2727	5.2553	
util living area	0.9993	0.9982	0.9950	0.9838	0.9456	0.8358	0.6701	0.7191	0.9145	0.9890	0.9984	0.9995	(86)
MIT	19.7160	19.8660	20.0969	20.3995	20.6887	20.9009	20.9767	20.9662	20.8194	20.4411	20.0202	19.6905	(87)
Th 2	20.0030	20.0050	20.0069	20.0160	20.0178	20.0257	20.0257	20.0272	20.0227	20.0178	20.0143	20.0107	(88)
util rest of house	0.9991	0.9975	0.9930	0.9768	0.9196	0.7579	0.5398	0.5932	0.8633	0.9830	0.9978	0.9994	(89)
MIT 2	18.2741	18.4949	18.8333	19.2780	19.6836	19.9504	20.0160	20.0113	19.8614	19.3424	18.7275	18.2424	(90)
Living area fraction	18.4812	18.6918	19.0147	19.4390	19.8279	20.0869	20.1539	20.1484	19.9990	19.5002	18.9131	18.4503	(91)
MIT	18.4812	18.6918	19.0147	19.4390	19.8279	20.0869	20.1539	20.1484	19.9990	19.5002	18.9131	18.4503	(92)
Temperature adjustment	18.4812	18.6918	19.0147	19.4390	19.8279	20.0869	20.1539	20.1484	19.9990	19.5002	18.9131	18.4503	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9962	0.9902	0.9712	0.9132	0.7635	0.5582	0.6104	0.8617	0.9785	0.9966	0.9989	(94)
Ext temp.	707.4866	838.1418	931.7291	989.0611	966.8418	784.7811	549.9762	572.4341	768.3064	783.3495	702.2806	664.3406	(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	2302.8596	2234.6874	2023.3624	1686.5349	1298.1775	868.4703	562.5170	592.3061	936.9619	1421.5242	1894.1525	2294.2557	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1186.9575	938.4787	812.1752	502.1812	246.5138	0.0000	0.0000	0.0000	0.0000	474.8020	858.1477	1212.6569	(98)
Space heating per m2													(98) / (4) =

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6672.2835 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1186.9575	938.4787	812.1752	502.1812	246.5138	0.0000	0.0000	0.0000	0.0000	474.8020	858.1477	1212.6569 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	1270.8324	1004.7952	869.5666	537.6672	263.9334	0.0000	0.0000	0.0000	0.0000	508.3533	918.7877	1298.3478 (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	220.3024	194.1363	203.7940	182.5604	177.5790	156.4016	149.8447	167.0417	168.0310	189.3109	200.3371	214.9590 (64)
Efficiency of water heater (217)m	88.6544	88.4922	88.1753	87.4669	85.8771	80.3000	80.3000	80.3000	80.3000	87.2710	88.2980	80.3000 (216)
Fuel for water heating, kWh/month	248.4958	219.3824	231.1236	208.7195	206.7826	194.7717	186.6061	208.0221	209.2541	216.9231	226.8875	242.2899 (219)
Water heating fuel used												2599.2583 (219)
Annual totals kWh/year												
Space heating fuel - main system												6672.2835 (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)												537.4755 (232)
Total delivered energy for all uses												9884.0173 (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	6672.2835	0.2160	1441.2132 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2599.2583	0.2160	561.4398 (264)
Space and water heating			2002.6530 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	537.4755	0.5190	278.9498 (268)
Total CO2, kg/m2/year			2320.5278 (272)
Emissions per m2 for space and water heating			13.5333 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8851 (272b)
Emissions per m2 for pumps and fans			0.2630 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5333 * 1.00) + 1.8851 + 0.2630, rounded to 2 d.p.			15.6800 (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	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) = 0.1069 (8)
Pressure test					Yes
Measured/design AP50					4.1300
Infiltration rate					0.3134 (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) =	0.2664 (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	0.3397	0.3330	0.3264	0.2931	0.2864	0.2531	0.2531	0.2464	0.2664	0.2864	0.2997	0.3130 (22b)
Effective ac	0.5577	0.5554	0.5533	0.5429	0.5410	0.5320	0.5320	0.5304	0.5355	0.5410	0.5449	0.5490 (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)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.0200	0.1200	9.0024	84.0000	6301.6800 (28a)
Brick and Block	183.9800	22.8700	161.1100	0.2400	38.6664	42.2200	6802.0642 (29a)
Pitched Roof	75.0200		75.0200	0.1000	7.5020	9.1000	682.6820 (30)
Total net area of external elements Aum(A, m ²)			334.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2623		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			172.0000			9.0000	1548.0000 (32c)
Internal Floor 1			72.9600			18.0000	1313.2800 (32d)
Internal Ceiling 1			72.9600			9.0000	656.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 23894.0562 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 161.4681 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9390 (36)
Total fabric heat loss (33) + (36) = 91.2014 (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	68.8485	68.5720	68.3009	67.0277	66.7894	65.6805	65.6805	65.4752	66.1077	66.7894	67.2714	67.7752 (38)
Heat transfer coeff	160.0499	159.7733	159.5022	158.2290	157.9908	156.8819	156.8819	156.6765	157.3090	157.9908	158.4727	158.9765 (39)
Average = Sum(39)m / 12 =												158.2279 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0816	1.0797	1.0779	1.0693	1.0676	1.0602	1.0602	1.0588	1.0630	1.0676	1.0709	1.0743 (40)
HLP (average)												1.0693 (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												2.9310 (42)
Average daily hot water use (litres/day)												103.8110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1920	110.0396	105.8872	101.7347	97.5823	93.4299	93.4299	97.5823	101.7347	105.8872	110.0396	114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3505 (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	35.9855	31.4731	32.4775	28.3146	27.1686	23.4444	21.7247	24.9294	25.2271	29.3998	32.0922	34.8500 (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	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4341	27.0313	21.9833	16.6428	12.4407	10.5029	11.3488	14.7516	19.7996	25.1401	29.3422	31.2799	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.3168	321.6199	313.2961	295.5758	273.2070	252.1835	238.1385	234.8354	243.1592	260.8796	283.2483	304.2718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	(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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	(71)
Water heating gains (Table 5)	48.3676	46.8350	43.6525	39.3259	36.5169	32.5617	29.1999	33.5073	35.0377	39.5159	44.5725	46.8414	(72)
Total internal gains	464.0833	462.4511	445.8968	418.5093	389.1294	362.2130	345.6520	350.0591	364.9613	392.5003	424.1278	449.3580	(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				8.0200	10.6334		0.6300		0.7000		0.7700		26.0626 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South				11.4100	46.7521		0.6300		0.7000		0.7700		163.0265 (78)
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125	(83)
Total gains	661.0955	794.7527	896.1608	976.0725	1018.4420	990.4464	949.7909	899.2378	851.6853	758.1598	659.4006	618.4706	(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	41.4698	41.5416	41.6122	41.9470	42.0103	42.3072	42.3072	42.3627	42.1924	42.0103	41.8825	41.7498	
alpha	3.7647	3.7694	3.7741	3.7965	3.8007	3.8205	3.8205	3.8242	3.8128	3.8007	3.7922	3.7833	
util living area	0.9961	0.9917	0.9827	0.9605	0.9080	0.7979	0.6521	0.6974	0.8760	0.9708	0.9927	0.9970	(86)
MIT	19.1933	19.3989	19.7143	20.1208	20.5098	20.8072	20.9360	20.9156	20.6941	20.1835	19.6076	19.1541	(87)
Th 2	20.0159	20.0174	20.0190	20.0260	20.0273	20.0335	20.0335	20.0346	20.0311	20.0273	20.0247	20.0219	(88)
util rest of house	0.9952	0.9898	0.9784	0.9495	0.8793	0.7294	0.5371	0.5878	0.8267	0.9608	0.9907	0.9963	(89)
MIT 2	18.3499	18.5559	18.8702	19.2759	19.6492	19.9162	20.0077	19.9977	19.8248	19.3423	18.7701	18.3153	(90)
Living area fraction									fLA = Living area / (4) =			0.1436	(91)
MIT	18.4710	18.6770	18.9914	19.3973	19.7728	20.0442	20.1410	20.1295	19.9497	19.4631	18.8904	18.4357	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4710	18.6770	18.9914	19.3973	19.7728	20.0442	20.1410	20.1295	19.9497	19.4631	18.8904	18.4357	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9931	0.9862	0.9724	0.9406	0.8703	0.7302	0.5511	0.5998	0.8217	0.9530	0.9875	0.9946	(94)
Ext temp.	656.5637	783.7529	871.4438	918.0590	886.3313	723.2508	523.3878	539.3533	699.8349	722.5224	651.1258	615.1435	(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	2268.0733	2201.1893	1992.4141	1660.9706	1275.4245	854.0931	555.5255	584.3316	920.2040	1400.2871	1868.4487	2263.1465	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1198.9632	952.5172	834.0019	534.8964	289.4854	0.0000	0.0000	0.0000	0.0000	504.2570	876.4725	1226.1143	(98)
												6416.7078	(98)
												43.3620	(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	1474.6895	1160.9258	1190.7414	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7344	0.8158	0.7881	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1082.9519	947.0854	938.3737	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1283.6478	1233.2756	1176.9208	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	144.5011	212.9255	177.4790	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												534.9056 (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	36.1253	53.2314	44.3698	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.7264 (107)
Space cooling per m2												0.9037 (108)
Energy for space heating												43.3620 (99)
Energy for space cooling												0.9037 (108)
Total												44.2657 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) =							0.1069 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3569 (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) =							0.3034 (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	0.3868	0.3792	0.3716	0.3337	0.3261	0.2882	0.2882	0.2806	0.3034	0.3261	0.3413	0.3565	(22b)				
Effective ac	0.5748	0.5719	0.5691	0.5557	0.5532	0.5415	0.5415	0.5394	0.5460	0.5532	0.5582	0.5635	(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)			20.7500	1.3258	27.5095		(27)					
Ground Floor			75.0200	0.1300	9.7526		(28a)					
Brick and Block	183.9800	22.8700	161.1100	0.1800	28.9998		(29a)					
Pitched Roof	75.0200		75.0200	0.1300	9.7526		(30)					
Total net area of external elements Aum(A, m2)			334.0200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.1345		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2917 (36)					
Total fabric heat loss						(33) + (36) =	91.4262 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.9626	Feb 70.6039	Mar 70.2524	Apr 68.6012	May 68.2923	Jun 66.8542	Jul 66.8542	Aug 66.5879	Sep 67.4081	Oct 68.2923	Nov 68.9173	Dec 69.5706 (38)
Heat transfer coeff	162.3888	162.0301	161.6786	160.0274	159.7185	158.2803	158.2803	158.0140	158.8343	159.7185	160.3434	160.9968 (39)
Average = Sum(39)m / 12 =												160.0259 (39)
HLP	Jan 1.0974	Feb 1.0949	Mar 1.0926	Apr 1.0814	May 1.0793	Jun 1.0696	Jul 1.0696	Aug 1.0678	Sep 1.0733	Oct 1.0793	Nov 1.0835	Dec 1.0880 (40)
HLP (average)												1.0814 (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												2.9310 (42)
Average daily hot water use (litres/day)												103.8110 (43)
Daily hot water use	Jan 114.1920	Feb 110.0396	Mar 105.8872	Apr 101.7347	May 97.5823	Jun 93.4299	Jul 93.4299	Aug 97.5823	Sep 101.7347	Oct 105.8872	Nov 110.0396	Dec 114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)												Total = Sum(45)m = 1633.3505 (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)
	35.9855	31.4731	32.4775	28.3146	27.1686	23.4444	21.7247	24.9294	25.2271	29.3998	32.0922	34.8500 (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	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494	146.5494 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.4341	27.0313	21.9833	16.6428	12.4407	10.5029	11.3488	14.7516	19.7996	25.1401	29.3422	31.2799 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.3168	321.6199	313.2961	295.5758	273.2070	252.1835	238.1385	234.8354	243.1592	260.8796	283.2483	304.2718 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549	37.6549 (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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395 (71)
Water heating gains (Table 5)	48.3676	46.8350	43.6525	39.3259	36.5169	32.5617	29.1999	33.5073	35.0377	39.5159	44.5725	46.8414 (72)
Total internal gains	464.0833	462.4511	445.8968	418.5093	389.1294	362.2130	345.6520	350.0591	364.9613	392.5003	424.1278	449.3580 (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				8.0200	10.6334	0.6300	0.7000	0.7700	26.0626 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				11.4100	46.7521	0.6300	0.7000	0.7700	163.0265 (78)			
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125 (83)
Total gains	661.0955	794.7527	896.1608	976.0725	1018.4420	990.4464	949.7909	899.2378	851.6853	758.1598	659.4006	618.4706 (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	63.2826	63.4227	63.5606	64.2164	64.3406	64.9252	64.9252	65.0347	64.6988	64.3406	64.0899	63.8298
alpha	5.2188	5.2282	5.2374	5.2811	5.2894	5.3283	5.3283	5.3356	5.3133	5.2894	5.2727	5.2553
util living area	0.9995	0.9986	0.9960	0.9865	0.9529	0.8513	0.6897	0.7411	0.9267	0.9914	0.9989	0.9997 (86)
MIT	19.6857	19.8364	20.0689	20.3744	20.6690	20.8906	20.9734	20.9610	20.8026	20.4153	19.9913	19.6607 (87)
Th 2	20.0030	20.0050	20.0069	20.0160	20.0178	20.0257	20.0257	20.0272	20.0227	20.0178	20.0143	20.0107 (88)
util rest of house	0.9994	0.9981	0.9944	0.9806	0.9295	0.7764	0.5582	0.6152	0.8803	0.9866	0.9984	0.9996 (89)
MIT 2	18.7923	18.9445	19.1779	19.4879	19.7723	19.9679	20.0179	20.0144	19.8997	19.5316	19.1069	18.7735 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.9206	19.0726	19.3058	19.6152	19.9010	20.1004	20.1551	20.1503	20.0294	19.6585	19.2339	18.9009 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9206	19.0726	19.3058	19.6152	19.9010	20.1004	20.1551	20.1503	20.0294	19.6585	19.2339	18.9009 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9991	0.9974	0.9929	0.9774	0.9260	0.7831	0.5771	0.6329	0.8807	0.9841	0.9978	0.9994 (94)
Useful gains	660.4917	792.7244	889.7966	953.9838	943.1020	775.6264	548.0809	569.0912	750.0811	746.1258	657.9476	618.0753 (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	2374.2207	2296.3819	2070.4269	1714.7287	1309.8566	870.6046	562.7095	592.6007	941.7896	1446.8053	1945.5947	2366.8039 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1275.0143	1010.4578	878.3889	547.7364	272.8654	0.0000	0.0000	0.0000	0.0000	521.3055	927.1059	1301.0541 (98)
Space heating												6733.9284 (98)
Space heating per m2										(98) / (4) =		45.5057 (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	1487.8353	1171.2746	1200.9066	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7739	0.8629	0.8335	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1151.4957	1010.6512	1001.0099	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1283.6478	1233.2756	1176.9208	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	95.1495	165.6325	130.8777	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												391.6597 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	23.7874	41.4081	32.7194	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												97.9149 (107)
Space cooling per m2												0.6617 (108)
Energy for space heating												45.5057 (99)
Energy for space cooling												0.6617 (108)
Total												46.1673 (109)
Target Fabric Energy Efficiency (TFEE)												53.1 (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	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1300
Infiltration rate					0.3402 (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) =		0.2891 (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	0.3397	0.3180	0.3180	0.2891	0.2964	0.2819	0.2819	0.2747	0.2747	0.2964	0.2891	0.2964 (22b)
Effective ac	0.5577	0.5506	0.5506	0.5418	0.5439	0.5397	0.5397	0.5377	0.5377	0.5439	0.5418	0.5439 (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)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.0200	0.1200	9.0024	84.0000	6301.6800 (28a)
Brick and Block	183.9800	22.8700	161.1100	0.2400	38.6664	42.2200	6802.0642 (29a)
Pitched Roof	75.0200		75.0200	0.1000	7.5020	9.1000	682.6820 (30)
Total net area of external elements Aum(A, m ²)			334.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2623		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			172.0000			9.0000	1548.0000 (32c)
Internal Floor 1			72.9600			18.0000	1313.2800 (32d)
Internal Ceiling 1			72.9600			18.0000	1313.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24550.6962 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.9055 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9390 (36)
Total fabric heat loss (33) + (36) = 91.2014 (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	68.8509	67.9704	67.9704	66.8868	67.1480	66.6320	66.6320	66.3837	66.3837	67.1480	66.8868	67.1480 (38)
Heat transfer coeff	160.0522	159.1718	159.1718	158.0882	158.3494	157.8334	157.8334	157.5850	157.5850	158.3494	158.0882	158.3494 (39)
Average = Sum(39)m / 12 =												158.3714 (39)
HLP	1.0816	1.0756	1.0756	1.0683	1.0701	1.0666	1.0666	1.0649	1.0649	1.0701	1.0683	1.0701 (40)
HLP (average)												1.0702 (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												2.9310 (42)
Average daily hot water use (litres/day)												103.8110 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1920	110.0396	105.8872	101.7347	97.5823	93.4299	93.4299	97.5823	101.7347	105.8872	110.0396	114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3505 (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	25.4015	22.2163	22.9253	19.9868	19.1778	16.5490	15.3351	17.5972	17.8074	20.7528	22.6533	24.6000 (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)
Combi loss	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (64)
RHI water heating demand												1982.8036 (64)
Heat gains from water heating, kWh/month	63.7717	55.9865	58.2667	51.4917	49.9159	43.8167	41.3430	46.3930	46.6337	53.4247	57.4230	61.9858 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.8036 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.0852	67.5782	54.9583	41.6070	31.1017	26.2574	28.3720	36.8790	49.4989	62.8503	73.3555	78.1999 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	475.0997	480.0297	467.6062	441.1579	407.7717	376.3933	355.4307	350.5006	362.9242	389.3725	422.7587	454.1370 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169 (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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395 (71)
Water heating gains (Table 5)	85.7146	83.3133	78.3155	71.5163	67.0913	60.8565	55.5686	62.3562	64.7690	71.8074	79.7541	83.3142 (72)
Total internal gains	754.0362	748.0579	718.0166	671.4178	623.1013	580.6439	556.5079	566.8724	594.3287	641.1668	693.0050	732.7877 (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					8.0200	13.4684	0.6300	0.7000	0.7700		33.0113 (74)	
East					1.3200	25.1733	0.6300	0.7000	0.7700		10.1551 (76)	
South					11.4100	56.5862	0.6300	0.7000	0.7700		197.3186 (78)	
Solar gains	240.4851	345.3025	477.9558	599.0458	641.2544	710.7664	655.7500	617.9889	542.3710	410.3178	286.2225	195.4524 (83)
Total gains	994.5213	1093.3603	1195.9724	1270.4635	1264.3557	1291.4103	1212.2579	1184.8613	1136.6997	1051.4847	979.2275	928.2401 (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	42.6088	42.8445	42.8445	43.1382	43.0670	43.2078	43.2078	43.2759	43.2759	43.0670	43.1382	43.0670
alpha	3.8406	3.8563	3.8563	3.8759	3.8711	3.8805	3.8805	3.8851	3.8851	3.8711	3.8759	3.8711
util living area	0.9815	0.9727	0.9498	0.8958	0.7905	0.5817	0.4203	0.4166	0.6848	0.8925	0.9648	0.9848 (86)
MIT	19.6907	19.8338	20.1218	20.4837	20.7781	20.9525	20.9900	20.9906	20.9081	20.5847	20.1039	19.6693 (87)
Th 2	20.0159	20.0208	20.0208	20.0268	20.0253	20.0282	20.0282	20.0296	20.0296	20.0253	20.0268	20.0253 (88)
util rest of house	0.9772	0.9664	0.9377	0.8694	0.7347	0.4863	0.3011	0.2947	0.5955	0.8585	0.9551	0.9812 (89)
MIT 2	18.8414	18.9857	19.2672	19.6167	19.8774	20.0074	20.0260	20.0276	19.9831	19.7146	19.2580	18.8278 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.9633	19.1075	19.3899	19.7412	20.0068	20.1432	20.1644	20.1659	20.1159	19.8395	19.3795	18.9487 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9633	19.1075	19.3899	19.7412	20.0068	20.1432	20.1644	20.1659	20.1159	19.8395	19.3795	18.9487 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9710	0.9588	0.9281	0.8603	0.7335	0.4982	0.3182	0.3122	0.6041	0.8507	0.9467	0.9758 (94)
Ext temp.	965.7111	1048.3400	1109.9869	1092.9980	927.4375	643.4229	385.7494	369.9637	686.7154	894.5214	927.0798	905.7849 (95)
Heat loss rate W	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)
Month fracti	2138.8294	2086.3476	1876.6231	1524.1564	1093.6846	669.7107	388.9692	372.8349	743.1541	1225.5505	1704.1071	2097.9200 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
RHI space heating demand	872.8000	697.5411	570.3774	310.4341	123.6879	0.0000	0.0000	0.0000	0.0000	246.2856	559.4596	886.9485 (98)
												4267.5341 (98)
												4268 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1300
Infiltration rate					0.3402 (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) =	0.2891 (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	0.3686	0.3614	0.3542	0.3180	0.3108	0.2747	0.2747	0.2674	0.2891	0.3108	0.3253	0.3397 (22b)
Effective ac	0.5679	0.5653	0.5627	0.5506	0.5483	0.5377	0.5377	0.5358	0.5418	0.5483	0.5529	0.5577 (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)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.0200	0.1200	9.0024	84.0000	6301.6800 (28a)
Brick and Block	183.9800	22.8700	161.1100	0.2400	38.6664	42.2200	6802.0642 (29a)
Pitched Roof	75.0200		75.0200	0.1000	7.5020	9.1000	682.6820 (30)
Total net area of external elements Aum(A, m ²)			334.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2623		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			172.0000			9.0000	1548.0000 (32c)
Internal Floor 1			72.9600			18.0000	1313.2800 (32d)
Internal Ceiling 1			72.9600			18.0000	1313.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24550.6962 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.9055 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9390 (36)
Total fabric heat loss (33) + (36) = 91.2014 (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	70.1151	69.7894	69.4701	67.9704	67.6898	66.3837	66.3837	66.1418	66.8868	67.6898	68.2575	68.8509 (38)
Heat transfer coeff	161.3165	160.9907	160.6714	159.1718	158.8912	157.5850	157.5850	157.3432	158.0882	158.8912	159.4588	160.0522 (39)
Average = Sum(39)m / 12 =												159.1704 (39)
HLP	1.0901	1.0879	1.0858	1.0756	1.0737	1.0649	1.0649	1.0633	1.0683	1.0737	1.0776	1.0816 (40)
HLP (average)												1.0756 (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												2.9310 (42)
Average daily hot water use (litres/day)												103.8110 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1920	110.0396	105.8872	101.7347	97.5823	93.4299	93.4299	97.5823	101.7347	105.8872	110.0396	114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3505 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4015	22.2163	22.9253	19.9868	19.1778	16.5490	15.3351	17.5972	17.8074	20.7528	22.6533	24.6000 (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)
Combi loss	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (64)
Heat gains from water heating, kWh/month	63.7717	55.9865	58.2667	51.4917	49.9159	43.8167	41.3430	46.3930	46.6337	53.4247	57.4230	61.9858 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.8036 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.0852	67.5782	54.9583	41.6070	31.1017	26.2574	28.3720	36.8790	49.4989	62.8503	73.3555	78.1999 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	475.0997	480.0297	467.6062	441.1579	407.7717	376.3933	355.4307	350.5006	362.9242	389.3725	422.7587	454.1370 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169 (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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395 (71)
Water heating gains (Table 5)	85.7146	83.3133	78.3155	71.5163	67.0913	60.8565	55.5686	62.3562	64.7690	71.8074	79.7541	83.3142 (72)
Total internal gains	754.0362	748.0579	718.0166	671.4178	623.1013	580.6439	556.5079	566.8724	594.3287	641.1668	693.0050	732.7877 (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			8.0200		10.6334		0.6300		0.7000		0.7700		26.0626 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			11.4100		46.7521		0.6300		0.7000		0.7700		163.0265 (78)
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125	(83)
Total gains	951.0484	1080.3595	1168.2806	1228.9810	1252.4139	1208.8773	1160.6468	1116.0512	1081.0528	1006.8263	928.2777	901.9003	(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	42.2749	42.3604	42.4446	42.8445	42.9202	43.2759	43.2759	43.3424	43.1382	42.9202	42.7674	42.6088
alpha	3.8183	3.8240	3.8296	3.8563	3.8613	3.8851	3.8851	3.8895	3.8759	3.8613	3.8512	3.8406
util living area	0.9878	0.9792	0.9632	0.9279	0.8543	0.7178	0.5620	0.6004	0.7985	0.9366	0.9793	0.9899 (86)
MIT	19.4602	19.6529	19.9419	20.3080	20.6407	20.8757	20.9638	20.9526	20.7991	20.3748	19.8490	19.4204 (87)
Th 2	20.0089	20.0107	20.0125	20.0208	20.0223	20.0296	20.0296	20.0309	20.0268	20.0223	20.0192	20.0159 (88)
util rest of house	0.9851	0.9745	0.9547	0.9098	0.8153	0.6415	0.4526	0.4927	0.7346	0.9172	0.9740	0.9877 (89)
MIT 2	18.6072	18.7991	19.0850	19.4465	19.7569	19.9589	20.0162	20.0120	19.9007	19.5168	19.0015	18.5730 (90)
Living area fraction	18.7297	18.9217	19.2080	19.5702	19.8838	20.0905	20.1523	20.1471	20.0298	19.6400	19.1232	18.6947 (92)
MIT	18.7297	18.9217	19.2080	19.5702	19.8838	20.0905	20.1523	20.1471	20.0298	19.6400	19.1232	18.6947 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7297	18.9217	19.2080	19.5702	19.8838	20.0905	20.1523	20.1471	20.0298	19.6400	19.1232	18.6947 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	932.3564	1045.7240	1105.1024	1105.8237	1013.1194	781.8845	542.2322	565.2604	794.3490	913.9638	898.0669	887.1082 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2327.7408	2257.3675	2041.8141	1698.3981	1300.3308	865.2228	559.7820	589.5763	937.4239	1436.3781	1917.2049	2319.9126 (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	1038.1660	814.2244	696.9135	426.6536	213.6853	0.0000	0.0000	0.0000	0.0000	388.6763	733.7794	1066.0065 (98)
Space heating												5378.1050 (98)
Space heating per m2												(98) / (4) = 36.3435 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5949.2312 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1038.1660	814.2244	696.9135	426.6536	213.6853	0.0000	0.0000	0.0000	0.0000	388.6763	733.7794	1066.0065	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1148.4137	900.6908	770.9221	471.9619	236.3776	0.0000	0.0000	0.0000	0.0000	429.9516	811.7029	1179.2107	(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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230	(64)
Efficiency of water heater (217)m	90.0384	90.0027	89.9342	89.7837	89.4533	88.2000	88.2000	88.2000	88.2000	89.7245	89.9583	88.2000	(216)
Fuel for water heating, kWh/month	221.2426	194.5165	203.0721	180.4290	176.0386	157.4365	149.2459	166.5057	167.0729	187.2876	199.9311	215.2287	(219)
Water heating fuel used												2218.0072	(219)
Annual totals kWh/year													
Space heating fuel - main system												5949.2312	(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)												537.4755	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)
Total delivered energy for all uses												7786.5512	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5949.2312	3.4800	207.0332 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2218.0072	3.4800	77.1867 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	537.4755	13.1900	70.8930 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-993.1627	13.1900	-130.9982 (252)
Total energy cost			354.0073 (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] =	0.7705 (257)
SAP value		89.2521
SAP rating (Section 12)		89 (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	5949.2312	0.2160	1285.0339 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2218.0072	0.2160	479.0896 (264)
Space and water heating			1764.1235 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	537.4755	0.5190	278.9498 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total kg/year			1566.5468 (272)
CO2 emissions per m2			10.5900 (273)
EI value			89.1223
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8931 = 3.896$, stars = 4
Water heating environmental impact	$0.216 / 0.8931 = 0.2418$, 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	75.0200 (1b)	x 2.3900 (2b)	= 179.2978 (1b) - (3b)
First floor	72.9600 (1c)	x 2.6700 (2c)	= 194.8032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 374.1010 (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) = 0.1337 (8)
Pressure test					Yes
Measured/design AP50					4.1300
Infiltration rate					0.3402 (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) =	0.2891 (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	0.3397	0.3180	0.3180	0.2891	0.2964	0.2819	0.2819	0.2747	0.2747	0.2964	0.2891	0.2964 (22b)
Effective ac	0.5577	0.5506	0.5506	0.5418	0.5439	0.5397	0.5397	0.5377	0.5377	0.5439	0.5418	0.5439 (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)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.0200	0.1200	9.0024	84.0000	6301.6800 (28a)
Brick and Block	183.9800	22.8700	161.1100	0.2400	38.6664	42.2200	6802.0642 (29a)
Pitched Roof	75.0200		75.0200	0.1000	7.5020	9.1000	682.6820 (30)
Total net area of external elements Aum(A, m ²)			334.0200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2623		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			172.0000			9.0000	1548.0000 (32c)
Internal Floor 1			72.9600			18.0000	1313.2800 (32d)
Internal Ceiling 1			72.9600			18.0000	1313.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24550.6962 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.9055 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.9390 (36)
Total fabric heat loss (33) + (36) = 91.2014 (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	68.8509	67.9704	67.9704	66.8868	67.1480	66.6320	66.6320	66.3837	66.3837	67.1480	66.8868	67.1480 (38)
Heat transfer coeff	160.0522	159.1718	159.1718	158.0882	158.3494	157.8334	157.8334	157.5850	157.5850	158.3494	158.0882	158.3494 (39)
Average = Sum(39)m / 12 =												158.3714 (39)
HLP	1.0816	1.0756	1.0756	1.0683	1.0701	1.0666	1.0666	1.0649	1.0649	1.0701	1.0683	1.0701 (40)
HLP (average)												1.0702 (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												2.9310 (42)
Average daily hot water use (litres/day)												103.8110 (43)
Daily hot water use	114.1920	110.0396	105.8872	101.7347	97.5823	93.4299	93.4299	97.5823	101.7347	105.8872	110.0396	114.1920 (44)
Energy conte	169.3435	148.1089	152.8351	133.2454	127.8521	110.3266	102.2339	117.3148	118.7160	138.3520	151.0220	164.0001 (45)
Energy content (annual)										Total = Sum(45)m =		1633.3505 (45)

FULL SAP CALCULATION PRINTOUT

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	25.4015	22.2163	22.9253	19.9868	19.1778	16.5490	15.3351	17.5972	17.8074	20.7528	22.6533	24.6000 (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)
Combi loss	29.8599	26.9612	29.7961	28.7505	29.6203	28.5324	29.4010	29.5432	28.6424	29.6908	28.8325	29.8228 (61)
Total heat required for water heating calculated for each month	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230 (64)
Heat gains from water heating, kWh/month	63.7717	55.9865	58.2667	51.4917	49.9159	43.8167	41.3430	46.3930	46.6337	53.4247	57.4230	61.9858 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.8036 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592	175.8592 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.0852	67.5782	54.9583	41.6070	31.1017	26.2574	28.3720	36.8790	49.4989	62.8503	73.3555	78.1999 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	475.0997	480.0297	467.6062	441.1579	407.7717	376.3933	355.4307	350.5006	362.9242	389.3725	422.7587	454.1370 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169	55.5169 (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)	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395	-117.2395 (71)
Water heating gains (Table 5)	85.7146	83.3133	78.3155	71.5163	67.0913	60.8565	55.5686	62.3562	64.7690	71.8074	79.7541	83.3142 (72)
Total internal gains	754.0362	748.0579	718.0166	671.4178	623.1013	580.6439	556.5079	566.8724	594.3287	641.1668	693.0050	732.7877 (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				8.0200	13.4684	0.6300	0.7000	0.7700	33.0113 (74)			
East				1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)			
South				11.4100	56.5862	0.6300	0.7000	0.7700	197.3186 (78)			
Solar gains	240.4851	345.3025	477.9558	599.0458	641.2544	710.7664	655.7500	617.9889	542.3710	410.3178	286.2225	195.4524 (83)
Total gains	994.5213	1093.3603	1195.9724	1270.4635	1264.3557	1291.4103	1212.2579	1184.8613	1136.6997	1051.4847	979.2275	928.2401 (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	42.6088	42.8445	42.8445	43.1382	43.0670	43.2078	43.2078	43.2759	43.2759	43.0670	43.1382	43.0670
alpha	3.8406	3.8563	3.8563	3.8759	3.8711	3.8805	3.8805	3.8851	3.8851	3.8711	3.8759	3.8711
util living area	0.9815	0.9727	0.9498	0.8958	0.7905	0.5817	0.4203	0.4166	0.6848	0.8925	0.9648	0.9848 (86)
MIT	19.6907	19.8338	20.1218	20.4837	20.7781	20.9525	20.9900	20.9906	20.9081	20.5847	20.1039	19.6693 (87)
Th 2	20.0159	20.0208	20.0208	20.0268	20.0253	20.0282	20.0282	20.0296	20.0296	20.0253	20.0268	20.0253 (88)
util rest of house	0.9772	0.9664	0.9377	0.8694	0.7347	0.4863	0.3011	0.2947	0.5955	0.8585	0.9551	0.9812 (89)
MIT 2	18.8414	18.9857	19.2672	19.6167	19.8774	20.0074	20.0260	20.0276	19.9831	19.7146	19.2580	18.8278 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.9633	19.1075	19.3899	19.7412	20.0068	20.1432	20.1644	20.1659	20.1159	19.8395	19.3795	18.9487 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9633	19.1075	19.3899	19.7412	20.0068	20.1432	20.1644	20.1659	20.1159	19.8395	19.3795	18.9487 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	965.7111	1048.3400	1109.9869	1092.9980	927.4375	643.4229	385.7494	369.9637	686.7154	894.5214	927.0798	905.7849 (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	2138.8294	2086.3476	1876.6231	1524.1564	1093.6846	669.7107	388.9692	372.8349	743.1541	1225.5505	1704.1071	2097.9200 (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	872.8000	697.5411	570.3774	310.4341	123.6879	0.0000	0.0000	0.0000	0.0000	246.2856	559.4596	886.9485 (98)
Space heating												4267.5341 (98)
Space heating per m2												(98) / (4) = 28.8386 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4720.7236 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	872.8000	697.5411	570.3774	310.4341	123.6879	0.0000	0.0000	0.0000	0.0000	246.2856	559.4596	886.9485	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	965.4867	771.6163	630.9484	343.4005	136.8229	0.0000	0.0000	0.0000	0.0000	272.4399	618.8712	981.1377	(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	199.2034	175.0701	182.6312	161.9958	157.4724	138.8590	131.6348	146.8580	147.3583	168.0428	179.8546	193.8230	(64)
Efficiency of water heater (217)m	89.9829	89.9499	89.8564	89.6334	89.1545	88.2000	88.2000	88.2000	88.2000	89.4946	89.8548	88.2000	(216)
Fuel for water heating, kWh/month	221.3791	194.6308	203.2479	180.7316	176.6287	157.4365	149.2459	166.5057	167.0729	187.7686	200.1614	215.3650	(219)
Water heating fuel used												2220.1742	(219)
Annual totals kWh/year													
Space heating fuel - main system												4720.7236	(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)												537.4755	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1206 * 1.00) =										-1109.5294		-1109.5294	(233)
Total delivered energy for all uses												6443.8438	(238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4720.7236	3.7400	176.5551 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2220.1742	3.7400	83.0345 (247)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	537.4755	20.4300	109.8062 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1109.5294	20.4300	-226.6769 (252)
Total energy cost			253.0415 (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	4720.7236	0.2160	1019.6763 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.1742	0.2160	479.5576 (264)
Space and water heating			1499.2339 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	537.4755	0.5190	278.9498 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	0.5190	-575.8458 (269)
Total kg/year			1241.2629 (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	4720.7236	1.2200	5759.2828 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.1742	1.2200	2708.6125 (264)
Space and water heating			8467.8953 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	537.4755	3.0700	1650.0496 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	3.0700	-3406.2553 (269)
Primary energy kWh/year			6941.9396 (272)
Primary energy kWh/m2/year			46.9113 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 89

(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	SAP increase too small
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
(none)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 29 -198 kg (16.0%)

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

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

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 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	£125	£125	£0
Mains gas	£355	£355	£0
Space heating	£287	£287	£0
Water heating	£83	£83	£0
Lighting	£110	£110	£0
Generated (PV)	-£227	-£227	£0
Total cost of fuels	£253	£253	£0
Total cost of uses	£253	£253	£0
Delivered energy	44 kWh/m²	44 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	47 kWh/m²	47 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 24	Issued on Date	08/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	1, Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.12	TER	15.68
Environmental	89 B	% DER<TER	22.71		
CO ₂ Emissions (t/year)	1.24	DFEE	44.27	TFEE	53.09
General Requirements Compliance	Pass	% DFEE<TFEE	16.63		

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 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² 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 24	Issued on Date	08/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	1, Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.12	TER	15.68
Environmental	89 B	% DER<TER	22.71		
CO ₂ Emissions (t/year)	1.24	DFEE	44.27	TFEE	53.09
General Requirements Compliance	Pass	% DFEE<TFEE	16.63		

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 24	Issued on Date	08/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	1, Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.12	TER	15.68
Environmental	89 B	% DER<TER	22.71		
CO ₂ Emissions (t/year)	1.24	DFEE	44.27	TFEE	53.09
General Requirements Compliance	Pass	% DFEE<TFEE	16.63		

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 24	Issued on Date	08/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Property	1, Winifred Moody Road, West End, Southampton, SO30 3LB		

SAP Rating	89 B	DER	12.12	TER	15.68
Environmental	89 B	% DER<TER	22.71		
CO ₂ Emissions (t/year)	1.24	DFEE	44.27	TFEE	53.09
General Requirements Compliance	Pass	% DFEE<TFEE	16.63		

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

Orientation	North
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:	37.60 m	75.02 m ²	2.39 m
	1st Storey:	35.25 m	72.96 m ²	2.67 m

7.0 Living Area	21.25	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	165.91	kJ/m ² K

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	183.98	161.11

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	84.24
GF Stud	Plasterboard on timber frame		9.00	30.19
FF Stud	Plasterboard on timber frame		9.00	172.00

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	75.02	75.02

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	72.96

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	75.02

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	72.96

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	Manufacturer	Solid Door							1.10
Windows	Manufacturer	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	North							2.12	
Front Shaded	Window	[1] Brick and Block	North	None	0.52	Yes				1.68	
Front Elevation	Window	[1] Brick and Block	North	None	0.00					6.34	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	South	None	0.00					11.41	

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)	1.90	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.00	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.88	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.77	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	10.93	0.021	No	Knauf P5
Independently assessed	E4 Jamb	33.60	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	37.60	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	35.26	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.04	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	22.43	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 0.030 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.13	m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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
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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	28	
Total number of L.E.L. fittings	28	
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

0 Main Heating 1	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	18445	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.4	
In Summer	88.2	
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)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

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	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.15	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None