



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 2 Winifred Moody Road
West End, Southampton, SO30 3LB

Contact: Tobias Whiting
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Report Issue Date: 07/09/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 25	Issued on Date	07/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Property	2 Winifred Moody Road, West End, Southampton, SO30 3LB		
SAP Rating	89 B	DER	12.18
Environmental	89 B	TER	15.75
CO ₂ Emissions (t/year)	1.25	% DER<TER	22.65
General Requirements Compliance	Pass	DfEE	44.53
		TfEE	53.44
		% DfEE<TfEE	16.66
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)	15.75	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.18	kgCO ₂ /m ²	Pass
	-3.57 (-22.7%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	53.44	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	44.53	kWh/m ² /yr	
	-8.9 (-16.7%)	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	4.11 (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

4.11 (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	0.032	W/m ² K
Photovoltaic array	1.15	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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Assessment Reference	As Built	Prop Type Ref	M
Property	2 Winifred Moody Road, West End, Southampton, SO30 3LB		

SAP Rating	89 B	DER	12.18	TER	15.75
Environmental	89 B	% DER<TER	22.65		
CO ₂ Emissions (t/year)	1.25	DFEE	44.53	TFEE	53.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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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	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	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	3.20	0.77	
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: **10.71** W/mK:
Y-Value: **0.032** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	22.65		
CO ₂ Emissions (t/year)	1.25	DFEE	44.53	TFEE	53.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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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) 15.75 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.18 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.5 kWh/m²/yr OK

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: 4.11 (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 0.032 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					4.1100
Infiltration rate					0.3392 (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) =	0.2883 (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	0.3676	0.3604	0.3531	0.3171	0.3099	0.2739	0.2739	0.2667	0.2883	0.3099	0.3243	0.3387 (22b)
Effective ac	0.5675	0.5649	0.5624	0.5503	0.5480	0.5375	0.5375	0.5356	0.5416	0.5480	0.5526	0.5574 (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) 10.7070 (36)
Total fabric heat loss (33) + (36) = 91.9694 (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	70.0659	69.7420	69.4246	67.9338	67.6548	66.3563	66.3563	66.1159	66.8565	67.6548	68.2191	68.8091 (38)
Heat transfer coeff	162.0352	161.7114	161.3940	159.9031	159.6242	158.3257	158.3257	158.0852	158.8259	159.6242	160.1885	160.7784 (39)
Average = Sum(39)m / 12 =												159.9018 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0950	1.0928	1.0906	1.0806	1.0787	1.0699	1.0699	1.0683	1.0733	1.0787	1.0825	1.0865 (40)
HLP (average)												1.0806 (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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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	42.0874	42.1717	42.2546	42.6486	42.7231	43.0735	43.0735	43.1390	42.9378	42.7231	42.5726	42.4164
alpha	3.8058	3.8114	3.8170	3.8432	3.8482	3.8716	3.8716	3.8759	3.8625	3.8482	3.8382	3.8278
util living area	0.9956	0.9911	0.9818	0.9588	0.9046	0.7914	0.6436	0.6873	0.8698	0.9687	0.9920	0.9966 (86)
MIT	19.2403	19.4418	19.7510	20.1509	20.5310	20.8195	20.9414	20.9230	20.7121	20.2154	19.6506	19.2033 (87)
Th 2	20.0049	20.0067	20.0085	20.0167	20.0183	20.0255	20.0255	20.0268	20.0227	20.0183	20.0151	20.0119 (88)
util rest of house	0.9946	0.9990	0.9771	0.9472	0.8747	0.7208	0.5273	0.5759	0.8181	0.9577	0.9897	0.9958 (89)
MIT 2	18.3859	18.5878	18.8961	19.2956	19.6595	19.9174	20.0025	19.9941	19.8313	19.3639	18.8031	18.3543 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.5086	18.7104	19.0189	19.4184	19.7847	20.0470	20.1373	20.1275	19.9578	19.4862	18.9248	18.4762 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5086	18.7104	19.0189	19.4184	19.7847	20.0470	20.1373	20.1275	19.9578	19.4862	18.9248	18.4762 (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	0.9383	0.8661	0.7226	0.5418	0.5887	0.8140	0.9499	0.9862	0.9940 (94)
Ext temp.	696.1316	821.8718	906.7730	948.8827	911.1392	738.3027	530.5459	548.1024	719.8819	753.6869	687.9776	654.0042 (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	2302.2956	2233.3067	2020.4678	1681.9326	1290.5079	862.3930	560.0517	589.2550	930.3716	1418.4500	1894.1993	2295.3110 (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	1194.9860	948.4843	828.5889	527.7959	282.2503	0.0000	0.0000	0.0000	0.0000	494.5837	868.4797	1221.1322 (98)
Space heating per m2												6366.3010 (98)
										(98) / (4) =		43.0214 (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													7042.3684 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1194.9860	948.4843	828.5889	527.7959	282.2503	0.0000	0.0000	0.0000	0.0000	494.5837	868.4797	1221.1322	(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)	1321.8872	1049.2083	916.5807	583.8451	312.2238	0.0000	0.0000	0.0000	0.0000	547.1059	960.7076	1350.8100	(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	90.0790	90.0500	89.9946	89.8735	89.5996	88.2000	88.2000	88.2000	88.2000	89.8318	90.0148	88.2000	(216)
Fuel for water heating, kWh/month	221.1431	194.4143	202.9358	180.2487	175.7512	157.4365	149.2459	166.5057	167.0729	187.0639	199.8055	215.1385	(219)
Water heating fuel used												2216.7620	(219)
Annual totals kWh/year													
Space heating fuel - main system												7042.3684	(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												8878.4433	(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	7042.3684	0.2160	1521.1516 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2216.7620	0.2160	478.8206 (264)
Space and water heating			1999.9722 (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			1802.3955 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1800 (273)

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

DER		12.1800	ZC1
Total Floor Area		147.9800	
Assumed number of occupants	TFA	2.9310	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	12.7468	ZC2
CO2 emissions from cooking, equation (L16)		1.2795	ZC3
Total CO2 emissions		26.2064	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		26.2064	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	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					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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			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, m ²)			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/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0597 (36)
Total fabric heat loss						(33) + (36) =	92.1942 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	70.9626	70.6039	70.2524	68.6012	68.2923	66.8542	66.8542
Heat transfer coeff	163.1568	162.7981	162.4466	160.7954	160.4865	159.0483	159.0483
Average = Sum(39)m / 12 =							
HLP	1.1026	1.1001	1.0978	1.0866	1.0845	1.0748	1.0748
HLP (average)							
Days in month	31	28	31	30	31	30	31

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)
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	62.9848	63.1235	63.2601	63.9097	64.0327	64.6117	64.6117	64.7201	64.3875	64.0327	63.7844	63.5267	
alpha	5.1990	5.2082	5.2173	5.2606	5.2688	5.3074	5.3074	5.3147	5.2925	5.2688	5.2523	5.2351	
util living area	0.9993	0.9982	0.9950	0.9839	0.9461	0.8373	0.6724	0.7213	0.9153	0.9890	0.9984	0.9995	(86)
MIT	19.7090	19.8592	20.0906	20.3941	20.6848	20.8988	20.9760	20.9653	20.8166	20.4365	20.0143	19.6835	(87)
Th 2	19.9987	20.0007	20.0027	20.0118	20.0135	20.0215	20.0215	20.0229	20.0184	20.0135	20.0100	20.0064	(88)
util rest of house	0.9991	0.9975	0.9931	0.9770	0.9202	0.7595	0.5415	0.5949	0.8643	0.9831	0.9978	0.9994	(89)
MIT 2	18.2608	18.4819	18.8211	19.2672	19.6749	19.9445	20.0114	20.0066	19.8546	19.3327	18.7158	18.2290	(90)
Living area fraction	18.4688	18.6797	19.0034	19.4290	19.8199	20.0816	20.1499	20.1443	19.9927	19.4912	18.9022	18.4379	(91)
MIT	18.4688	18.6797	19.0034	19.4290	19.8199	20.0816	20.1499	20.1443	19.9927	19.4912	18.9022	18.4379	(92)
Temperature adjustment	18.4688	18.6797	19.0034	19.4290	19.8199	20.0816	20.1499	20.1443	19.9927	19.4912	18.9022	18.4379	(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	0.9713	0.9138	0.7650	0.5599	0.6121	0.8626	0.9785	0.9966	0.9989	(94)
Ext temp.	707.4812	838.1362	931.7421	989.1973	967.4551	786.3215	551.6698	574.0706	769.1340	783.4123	702.2754	664.3362	(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	2311.7353	2243.3023	2031.1314	1693.0202	1303.1403	871.8324	564.6083	594.5217	940.4909	1426.9209	1901.4736	2303.1916	(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	1193.5650	944.2716	817.9456	506.7525	249.7498	0.0000	0.0000	0.0000	0.0000	478.7704	863.4227	1219.3084	(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												6717.1158 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1193.5650	944.2716	817.9456	506.7525	249.7498	0.0000	0.0000	0.0000	0.0000	478.7704	863.4227	1219.3084 (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)	1277.9069	1010.9974	875.7448	542.5616	267.3981	0.0000	0.0000	0.0000	0.0000	512.6021	924.4354	1305.4694 (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	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	88.6624	88.5017	88.1876	87.4857	85.9097	80.3000	80.3000	80.3000	80.3000	87.2889	88.3082	80.3000 (216)
Fuel for water heating, kWh/month	248.4734	219.3589	231.0915	208.6746	206.7043	194.7717	186.6061	208.0221	209.2541	216.8785	226.8613	242.2690 (219)
Water heating fuel used												2598.9653 (219)
Annual totals kWh/year												
Space heating fuel - main system												6717.1158 (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												9928.5566 (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	6717.1158	0.2160	1450.8970 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2598.9653	0.2160	561.3765 (264)
Space and water heating			2012.2735 (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			2330.1483 (272)
Emissions per m2 for space and water heating			13.5983 (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) = (13.5983 * 1.00) + 1.8851 + 0.2630, rounded to 2 d.p.			15.7500 (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					4.1100
Infiltration rate					0.3124 (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) =	0.2656 (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	0.3386	0.3319	0.3253	0.2921	0.2855	0.2523	0.2523	0.2456	0.2656	0.2855	0.2988	0.3120 (22b)
Effective ac	0.5573	0.5551	0.5529	0.5427	0.5407	0.5318	0.5318	0.5302	0.5353	0.5407	0.5446	0.5487 (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) 10.7070 (36)
Total fabric heat loss (33) + (36) = 91.9694 (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	68.8031	68.5284	68.2590	66.9939	66.7572	65.6553	65.6553	65.4513	66.0797	66.7572	67.2360	67.7366 (38)
Heat transfer coeff	160.7725	160.4977	160.2284	158.9632	158.7265	157.6247	157.6247	157.4206	158.0491	158.7265	159.2054	159.7060 (39)
Average = Sum(39)m / 12 =												158.9621 (39)
HLP	1.0864	1.0846	1.0828	1.0742	1.0726	1.0652	1.0652	1.0638	1.0680	1.0726	1.0759	1.0792 (40)
HLP (average)												1.0742 (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	41.2834	41.3541	41.4236	41.7533	41.8156	42.1079	42.1079	42.1624	41.9948	41.8156	41.6898	41.5591	
alpha	3.7522	3.7569	3.7616	3.7836	3.7877	3.8072	3.8072	3.8108	3.7997	3.7877	3.7793	3.7706	
util living area	0.9961	0.9917	0.9827	0.9606	0.9085	0.7992	0.6539	0.6991	0.8768	0.9709	0.9927	0.9970	(86)
MIT	19.1847	19.3905	19.7065	20.1141	20.5047	20.8043	20.9347	20.9140	20.6905	20.1777	19.6002	19.1454	(87)
Th 2	20.0119	20.0134	20.0149	20.0219	20.0233	20.0294	20.0294	20.0305	20.0270	20.0233	20.0206	20.0178	(88)
util rest of house	0.9952	0.9898	0.9785	0.9497	0.8800	0.7306	0.5384	0.5891	0.8276	0.9609	0.9907	0.9962	(89)
MIT 2	18.3384	18.5445	18.8595	19.2662	19.6412	19.9103	20.0031	19.9929	19.8183	19.3335	18.7597	18.3036	(90)
Living area fraction									fLA = Living area / (4) =			0.1436	(91)
MIT	18.4600	18.6660	18.9811	19.3880	19.7652	20.0387	20.1369	20.1252	19.9435	19.4548	18.8804	18.4245	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4600	18.6660	18.9811	19.3880	19.7652	20.0387	20.1369	20.1252	19.9435	19.4548	18.8804	18.4245	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9931	0.9861	0.9724	0.9407	0.8708	0.7314	0.5524	0.6011	0.8224	0.9531	0.9874	0.9946	(94)
Ext temp.	656.5507	783.7442	871.4703	918.2284	886.8732	724.3671	524.6728	540.5509	700.4668	722.6025	651.1162	615.1314	(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	2276.5312	2209.4066	1999.8286	1667.2050	1280.1669	857.2719	557.4971	586.4181	923.5632	1405.4847	1875.5020	2271.7373	(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	1205.2655	958.0451	839.4986	539.2632	292.6105	0.0000	0.0000	0.0000	0.0000	508.0643	881.5578	1232.5148	(98)
												6456.8199	(98)
												43.6331	(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	1481.6719	1166.4226	1196.3967	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7318	0.8135	0.7856	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	1084.2373	948.8282	939.8721	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	143.5756	211.6288	176.3642	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												531.5686 (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	35.8939	52.9072	44.0911	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.8922 (107)
Space cooling per m2												0.8980 (108)
Energy for space heating												43.6331 (99)
Energy for space cooling												0.8980 (108)
Total												44.5311 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.5 (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)							14.0597 (36)					
Total fabric heat loss						(33) + (36) =	92.1942 (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	163.1568	162.7981	162.4466	160.7954	160.4865	159.0483	159.0483	158.7820	159.6023	160.4865	161.1114	161.7648 (39)
Average = Sum(39)m / 12 =												160.7939 (39)
HLP	Jan 1.1026	Feb 1.1001	Mar 1.0978	Apr 1.0866	May 1.0845	Jun 1.0748	Jul 1.0748	Aug 1.0730	Sep 1.0785	Oct 1.0845	Nov 1.0887	Dec 1.0932 (40)
HLP (average)												1.0866 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	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)													
tau	62.9848	63.1235	63.2601	63.9097	64.0327	64.6117	64.6117	64.7201	64.3875	64.0327	63.7844	63.5267	
alpha	5.1990	5.2082	5.2173	5.2606	5.2688	5.3074	5.3074	5.3147	5.2925	5.2688	5.2523	5.2351	
util living area	0.9995	0.9986	0.9960	0.9866	0.9533	0.8527	0.6919	0.7432	0.9274	0.9914	0.9989	0.9997	(86)
MIT	19.6787	19.8296	20.0626	20.3691	20.6650	20.8885	20.9726	20.9600	20.7998	20.4107	19.9854	19.6537	(87)
Th 2	19.9987	20.0007	20.0027	20.0118	20.0135	20.0215	20.0215	20.0229	20.0184	20.0135	20.0100	20.0064	(88)
util rest of house	0.9994	0.9981	0.9944	0.9807	0.9301	0.7779	0.5598	0.6169	0.8812	0.9866	0.9984	0.9996	(89)
MIT 2	18.7820	18.9343	19.1682	19.4792	19.7650	19.9624	20.0135	20.0097	19.8936	19.5236	19.0976	18.7631	(90)
Living area fraction									fLA = Living area / (4) =			0.1436	(91)
MIT	18.9107	19.0628	19.2967	19.6070	19.8942	20.0954	20.1512	20.1462	20.0237	19.6510	19.2251	18.8910	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9107	19.0628	19.2967	19.6070	19.8942	20.0954	20.1512	20.1462	20.0237	19.6510	19.2251	18.8910	(93)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9991	0.9974	0.9929	0.9775	0.9265	0.7846	0.5788	0.6346	0.8815	0.9842	0.9978	0.9994	(94)
Ext temp.	660.4881	792.7199	889.8043	954.0882	943.6285	777.0602	549.7306	570.6600	750.7962	746.1679	657.9435	618.0725	(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	2383.8382	2305.6826	2078.7738	1721.6349	1315.0580	874.0346	564.8096	594.8295	945.4419	1452.5625	1953.4927	2376.4892	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1282.1725	1016.7110	884.5933	552.6336	276.3436	0.0000	0.0000	0.0000	0.0000	525.5576	932.7955	1308.2621	(98)
Space heating per m2												6779.0690	(98)
										(98) / (4) =		45.8107	(99)

8c. Space cooling requirement													

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1495.0545	1176.9578	1206.7434	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7711	0.8604	0.8309	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1152.8198	1012.7074	1002.7093	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	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)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	94.1961	164.1027	129.6133	0.0000	0.0000	0.0000	0.0000	(104)
												387.9122	(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	23.5490	41.0257	32.4033	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												96.9781 (107)
Space cooling per m2												0.6553 (108)
Energy for space heating												45.8107 (99)
Energy for space cooling												0.6553 (108)
Total												46.4661 (109)
Target Fabric Energy Efficiency (TFEE)												53.4 (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					4.1100
Infiltration rate					0.3392 (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) =		0.2883 (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	0.3387	0.3171	0.3171	0.2883	0.2955	0.2811	0.2811	0.2739	0.2739	0.2955	0.2883	0.2955 (22b)
Effective ac	0.5574	0.5503	0.5503	0.5416	0.5437	0.5395	0.5395	0.5375	0.5375	0.5437	0.5416	0.5437 (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) 10.7070 (36)
Total fabric heat loss (33) + (36) = 91.9694 (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	68.8091	67.9338	67.9338	66.8565	67.1162	66.6032	66.6032	66.3563	66.3563	67.1162	66.8565	67.1162 (38)
Heat transfer coeff	160.7784	159.9031	159.9031	158.8259	159.0856	158.5726	158.5726	158.3257	158.3257	159.0856	158.8259	159.0856 (39)
Average = Sum(39)m / 12 =												159.1075 (39)
HLP	1.0865	1.0806	1.0806	1.0733	1.0750	1.0716	1.0716	1.0699	1.0699	1.0750	1.0733	1.0750 (40)
HLP (average)												1.0752 (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												
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)
												1983 (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	42.4164	42.6486	42.6486	42.9378	42.8677	43.0064	43.0064	43.0735	43.0735	42.8677	42.9378	42.8677	
alpha	3.8278	3.8432	3.8432	3.8625	3.8578	3.8671	3.8671	3.8716	3.8716	3.8578	3.8625	3.8578	
util living area	0.9816	0.9728	0.9500	0.8965	0.7918	0.5835	0.4220	0.4183	0.6866	0.8932	0.9650	0.9849	(86)
MIT	19.6826	19.8257	20.1146	20.4780	20.7747	20.9514	20.9896	20.9903	20.9063	20.5800	20.0971	19.6611	(87)
Th 2	20.0119	20.0167	20.0167	20.0227	20.0213	20.0241	20.0241	20.0255	20.0255	20.0213	20.0227	20.0213	(88)
util rest of house	0.9772	0.9665	0.9380	0.8701	0.7360	0.4877	0.3019	0.2955	0.5969	0.8592	0.9552	0.9812	(89)
MIT 2	18.8302	18.9746	19.2570	19.6080	19.8711	20.0028	20.0218	20.0235	19.9780	19.7070	19.2482	18.8166	(90)
Living area fraction									fLA = Living area / (4) =			0.1436	(91)
MIT	18.9526	19.0969	19.3801	19.7329	20.0008	20.1391	20.1608	20.1623	20.1113	19.8324	19.3701	18.9378	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9526	19.0969	19.3801	19.7329	20.0008	20.1391	20.1608	20.1623	20.1113	19.8324	19.3701	18.9378	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	965.7517	1048.4459	1110.2888	1093.7958	928.9142	645.2719	386.9020	371.0577	688.3293	895.2048	927.2315	905.8081	(94)
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	2146.8103	2094.2275	1883.6780	1529.9608	1097.8213	672.1984	390.2181	374.0153	745.9231	1230.1105	1710.5676	2105.9507	(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	878.7076	702.7652	575.4015	314.0388	125.6669	0.0000	0.0000	0.0000	0.0000	249.1698	564.0020	892.9061	(98)
Space heating												4302.6579	(98)
RHI space heating demand												4303	(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					4.1100
Infiltration rate					0.3392 (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) =	0.2883 (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	0.3676	0.3604	0.3531	0.3171	0.3099	0.2739	0.2739	0.2667	0.2883	0.3099	0.3243	0.3387 (22b)
Effective ac	0.5675	0.5649	0.5624	0.5503	0.5480	0.5375	0.5375	0.5356	0.5416	0.5480	0.5526	0.5574 (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) 10.7070 (36)
Total fabric heat loss (33) + (36) = 91.9694 (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	70.0659	69.7420	69.4246	67.9338	67.6548	66.3563	66.3563	66.1159	66.8565	67.6548	68.2191	68.8091 (38)
Heat transfer coeff	162.0352	161.7114	161.3940	159.9031	159.6242	158.3257	158.3257	158.0852	158.8259	159.6242	160.1885	160.7784 (39)
Average = Sum(39)m / 12 =												159.9018 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0950	1.0928	1.0906	1.0806	1.0787	1.0699	1.0699	1.0683	1.0733	1.0787	1.0825	1.0865 (40)
HLP (average)												1.0806 (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	42.0874	42.1717	42.2546	42.6486	42.7231	43.0735	43.0735	43.1390	42.9378	42.7231	42.5726	42.4164
alpha	3.8058	3.8114	3.8170	3.8432	3.8482	3.8716	3.8716	3.8759	3.8625	3.8482	3.8382	3.8278
util living area	0.9878	0.9792	0.9634	0.9283	0.8552	0.7195	0.5639	0.6023	0.7997	0.9370	0.9794	0.9899 (86)
MIT	19.4516	19.6445	19.9341	20.3015	20.6362	20.8734	20.9629	20.9515	20.7961	20.3692	19.8416	19.4116 (87)
Th 2	20.0049	20.0067	20.0085	20.0167	20.0183	20.0255	20.0255	20.0268	20.0227	20.0183	20.0151	20.0119 (88)
util rest of house	0.9851	0.9746	0.9549	0.9103	0.8163	0.6430	0.4539	0.4941	0.7358	0.9176	0.9740	0.9877 (89)
MIT 2	18.5956	18.7877	19.0743	19.4371	19.7494	19.9534	20.0117	20.0075	19.8947	19.5082	18.9911	18.5613 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.7185	18.9107	19.1978	19.5612	19.8767	20.0855	20.1483	20.1430	20.0242	19.6319	19.1132	18.6834 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7185	18.9107	19.1978	19.5612	19.8767	20.0855	20.1483	20.1430	20.0242	19.6319	19.1132	18.6834 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	932.3628	1045.7807	1105.2815	1106.3195	1014.1975	783.5646	543.8016	566.8219	795.5761	914.3156	898.1175	887.1067 (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	2336.3050	2265.6942	2049.3415	1704.7625	1305.2057	868.5010	561.7914	591.7154	940.9093	1441.7022	1924.3747	2328.6185 (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	1044.5330	819.7819	702.3807	430.8789	216.5101	0.0000	0.0000	0.0000	0.0000	392.3757	738.9052	1072.4848 (98)
Space heating												5417.8501 (98)
Space heating per m2												(98) / (4) = 36.6120 (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													5993.1970 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1044.5330	819.7819	702.3807	430.8789	216.5101	0.0000	0.0000	0.0000	0.0000	392.3757	738.9052	1072.4848	(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)	1155.4568	906.8383	776.9698	476.6360	239.5023	0.0000	0.0000	0.0000	0.0000	434.0439	817.3730	1186.3770	(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	90.0403	90.0049	89.9371	89.7881	89.4604	88.2000	88.2000	88.2000	88.2000	89.7289	89.9607	88.2000	(216)
Fuel for water heating, kWh/month	221.2381	194.5117	203.0656	180.4202	176.0247	157.4365	149.2459	166.5057	167.0729	187.2783	199.9256	215.2245	(219)
Water heating fuel used												2217.9499	(219)
Annual totals kWh/year													
Space heating fuel - main system												5993.1970	(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												7830.4596	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5993.1970	3.4800	208.5633 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2217.9499	3.4800	77.1847 (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			355.5353 (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] =	0.7738 (257)
SAP value		89.2057
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	5993.1970	0.2160	1294.5305 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.9499	0.2160	479.0772 (264)
Space and water heating			1773.6077 (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			1576.0311 (272)
CO2 emissions per m2			10.6500 (273)
EI value			89.0565
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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					4.1100
Infiltration rate					0.3392 (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) =	0.2883 (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	0.3387	0.3171	0.3171	0.2883	0.2955	0.2811	0.2811	0.2739	0.2739	0.2955	0.2883	0.2955 (22b)
Effective ac	0.5574	0.5503	0.5503	0.5416	0.5437	0.5395	0.5395	0.5375	0.5375	0.5437	0.5416	0.5437 (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) 10.7070 (36)
Total fabric heat loss (33) + (36) = 91.9694 (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	68.8091	67.9338	67.9338	66.8565	67.1162	66.6032	66.6032	66.3563	66.3563	67.1162	66.8565	67.1162 (38)
Heat transfer coeff	160.7784	159.9031	159.9031	158.8259	159.0856	158.5726	158.5726	158.3257	158.3257	159.0856	158.8259	159.0856 (39)
Average = Sum(39)m / 12 =												159.1075 (39)
HLP	1.0865	1.0806	1.0806	1.0733	1.0750	1.0716	1.0716	1.0699	1.0699	1.0750	1.0733	1.0750 (40)
HLP (average)												1.0752 (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 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	42.4164	42.6486	42.6486	42.9378	42.8677	43.0064	43.0064	43.0735	43.0735	42.8677	42.9378	42.8677
alpha	3.8278	3.8432	3.8432	3.8625	3.8578	3.8671	3.8671	3.8716	3.8716	3.8578	3.8625	3.8578
util living area	0.9816	0.9728	0.9500	0.8965	0.7918	0.5835	0.4220	0.4183	0.6866	0.8932	0.9650	0.9849 (86)
MIT	19.6826	19.8257	20.1146	20.4780	20.7747	20.9514	20.9896	20.9903	20.9063	20.5800	20.0971	19.6611 (87)
Th 2	20.0119	20.0167	20.0167	20.0227	20.0213	20.0241	20.0241	20.0255	20.0255	20.0213	20.0227	20.0213 (88)
util rest of house	0.9772	0.9665	0.9380	0.8701	0.7360	0.4877	0.3019	0.2955	0.5969	0.8592	0.9552	0.9812 (89)
MIT 2	18.8302	18.9746	19.2570	19.6080	19.8711	20.0028	20.0218	20.0235	19.9780	19.7070	19.2482	18.8166 (90)
Living area fraction									fLA = Living area / (4) =			0.1436 (91)
MIT	18.9526	19.0969	19.3801	19.7329	20.0008	20.1391	20.1608	20.1623	20.1113	19.8324	19.3701	18.9378 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9526	19.0969	19.3801	19.7329	20.0008	20.1391	20.1608	20.1623	20.1113	19.8324	19.3701	18.9378 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	965.7517	1048.4459	1110.2888	1093.7958	928.9142	645.2719	386.9020	371.0577	688.3293	895.2048	927.2315	905.8081 (94)
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	2146.8103	2094.2275	1883.6780	1529.9608	1097.8213	672.1984	390.2181	374.0153	745.9231	1230.1105	1710.5676	2105.9507 (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	878.7076	702.7652	575.4015	314.0388	125.6669	0.0000	0.0000	0.0000	0.0000	249.1698	564.0020	892.9061 (98)
Space heating												4302.6579 (98)
Space heating per m2												(98) / (4) = 29.0759 (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													4759.5773 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	878.7076	702.7652	575.4015	314.0388	125.6669	0.0000	0.0000	0.0000	0.0000	249.1698	564.0020	892.9061	(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)	972.0216	777.3952	636.5061	347.3881	139.0120	0.0000	0.0000	0.0000	0.0000	275.6303	623.8960	987.7280	(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	89.9852	89.9525	89.8600	89.6391	89.1631	88.2000	88.2000	88.2000	88.2000	89.5008	89.8581	88.2000	(216)
Fuel for water heating, kWh/month	221.3735	194.6250	203.2398	180.7200	176.6117	157.4365	149.2459	166.5057	167.0729	187.7556	200.1540	215.3598	(219)
Water heating fuel used												2220.1005	(219)
Annual totals kWh/year													
Space heating fuel - main system												4759.5773	(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												6482.6238	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4759.5773	3.6300	172.7727 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2220.1005	3.6300	80.5896 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	537.4755	19.4400	104.4852 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1109.5294	19.4400	-215.6925 (252)
Total energy cost			251.7350 (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	4759.5773	0.2160	1028.0687 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.1005	0.2160	479.5417 (264)
Space and water heating			1507.6104 (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			1249.6394 (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	4759.5773	1.2200	5806.6843 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.1005	1.2200	2708.5226 (264)
Space and water heating			8515.2069 (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			6989.2513 (272)
Primary energy kWh/m2/year			47.2311 (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 -£ 28 -198 kg (15.9%)

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 500 TEST (30 Jun 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	£119	£119	£0
Mains gas	£348	£348	£0
Space heating	£282	£282	£0
Water heating	£81	£81	£0
Lighting	£104	£104	£0
Generated (PV)	-£216	-£216	£0
Total cost of fuels	£251	£251	£0
Total cost of uses	£251	£251	£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 25	Issued on Date	07/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	2 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.18	TER	15.75
Environmental	89 B	% DER<TER	22.65		
CO ₂ Emissions (t/year)	1.25	DFEE	44.53	TFEE	53.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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 25	Issued on Date	07/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	2 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.18	TER	15.75
Environmental	89 B	% DER<TER	22.65		
CO ₂ Emissions (t/year)	1.25	DFEE	44.53	TFEE	53.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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 25	Issued on Date	07/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	2 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.18	TER	15.75
Environmental	89 B	% DER<TER	22.65		
CO ₂ Emissions (t/year)	1.25	DFEE	44.53	TFEE	53.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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 = 75.02 m², Perimeter = 37.60 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 25	Issued on Date	07/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Property	2 Winifred Moody Road, West End, Southampton, SO30 3LB		
SAP Rating	89 B	DER	12.18
Environmental	89 B	TER	15.75
CO ₂ Emissions (t/year)	1.25	% DER<TER	22.65
General Requirements Compliance	Pass	DfEE	44.53
		TFEE	53.44
		% DfEE<TFEE	16.66
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	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	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	3.20	0.240	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 0.032 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.11	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
---------------------------------------	----

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
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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