Energy Statement Template

Construction of a 3-bedroom house (Plot 72a)

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Location: 27 Steamer Point Road, Nocton, Lincoln.

1.0 Executive Summary

1.1 The purpose of this statement is to set out the design principles and energy performance calculations which have been adopted to ensure that the development proposed contributes to the transition to a zero-carbon future.

1.2 The application site consists of approximately 234 m^2 located at 27 Steamer Point Road, Nocton, Lincoln.

1.3 The site, is a disused piece of land bordered off with temporary site fencing. The site is relatively flat that is primarily made up of concrete and overgrown vegetation.

1.4 The site contains an existing established access which runs North-West along the eastern edge of the site. The access point lies at the north-east corner of the site.

1.5 The shape of the site allows a proposed dwelling to face south-west, which is an optimal position for energy efficiency.

1.6 Using SAP modelling, the proposed dwelling is calculated to have a space heating demand of 18.13 kwh/m2/yr and a total energy demand of 31.62 kwh/m2/yr. These figures meet the required policy standards of S7.2.

1.7 To meet the total energy demand of the dwelling, a total of 8no. solar PV panels are required. The inclusion of 8no. solar panels will ensure that the dwelling can generate at least the same amount of renewable electricity onsite as the electricity demand over the course of a year in accordance with policy S7.1.

2.0 Information Checklist

Item	Location and Additional Comments	Provided?
Completed Energy Efficiency Checklist	2709 - Energy Efficiency Checklist - Residential	✓
Table format setting out standards	Appendix A	✓
Detailed SAP/PHPP calculations	Appendix A	✓
Details of glazing proposed	Appendix E	✓
Details of insulation proposed	Appendix F	✓
Details of ventilation proposed	Appendix A: Page 3 of BREL Compliance Report	✓
Details of heat supply proposed	Appendix E	✓
Details of renewables proposed	Appendix D	✓
Location of heat pump and renewables	Drawing No. 2709-A3-03c	✓
Orientation plan	Drawing No. 2709-A3-03c	✓

3.0 Introduction and Context

3.1 This statement is intended to accompany a Planning Application for the development at 27 Steamer Point Road, Nocton, Lincoln. Steven Dunn Architects has produced this statement to highlight the rationale behind the design of the proposal.

3.2 The development proposed within this application involves the construction of a 3-bedroom house (Plot 72a). More information regarding the proposed development can be found in the Design and Access Statement submitted alongside the application.

3.3 Policy S6 (Design Principle for Efficient Buildings) of the adopted CLLP advises on the design principles expected for new development. In turn, policy S7 (Reducing Energy Consumption—Residential Development) states proposals should include an Energy Statement to include details for energy performance from renewable forms and overall energy reduction in energy.

4.0 Confirmation of Compliance Route

4.1 In addition to the design principles of policy S6, policies S7 requires, unless covered by an exceptional basis clause, that all development proposals:

1. Can generate at least the same amount of renewable electricity on- site (and preferably on-plot) as the electricity they demand over the course of a year, such demand including all energy use (regulated and unregulated), calculated using a methodology proven to accurately predict a building's actual energy performance; and

2. To help achieve point 1 above, target achieving a site average space heating demand of around 15-20kWh/m2/yr and a site average total energy demand of 35 kWh/m2/yr, achieved through a 'fabric first' approach to construction. No single dwelling unit to have a total energy demand in excess of 60 kWh/m2/yr, irrespective of amount of on-site renewable energy production. (For the avoidance of doubt, 'total energy demand' means the amount of energy used as measured by the metering of that home, with no deduction for renewable energy generated on site).

4.2 In order to demonstrate compliance with Policy S7.1. it is necessary first to calculate the total energy usage of the dwelling in accordance with requirements of Policy S7.2.

4.3 The methodology to calculate the regulated electricity usage of the dwelling has been done using SAP 10 design software (industry standard). The full SAP calculations are provided as part of Appendix A. There is no standard methodology to calculate the unregulated energy usage.

4.4 A compliance summary with the requirements of policy S7 is provided at Appendix C.

4.5 In summary, the proposed dwelling complies with the space heating demand requirements and the total energy demand requirements set out within policy S7.2.

5.0 Design Principles

5.1 Policy S6 of the CLLP sets out a series of design principles to be considered.

5.2 The design principles include:

1. Orientation of buildings – such as positioning buildings to maximise

opportunities for solar gain, and minimise winter cold wind heat loss;

2. Form of buildings – creating buildings that are more efficient to heat

and stay warm in colder conditions and stay cool in warmer

conditions because of their shape and design;

3. Fabric of buildings – using materials and building techniques that

reduce heat and energy needs. Ideally, this could also consider

using materials with a lower embodied carbon content and/or high

practical recyclable content;

4. Heat supply – net zero carbon content of heat supply (for example,

this means no connection to the gas network or use of oil or bottled

gas);

5. Renewable energy generated – generating enough energy from

renewable sources onsite (and preferably on plot) to meet

reasonable estimates of all regulated and unregulated total annual

energy demand across the year.

5.3 The policy guidance is clear that the more benefits that can be achieved through steps 1-3, the more reward can be achieved, and the least amount needs to be achieved by steps 4 and 5. Steps 1-3 focus on making sure development will have a much-reduced energy demand, and, in doing so, stand the test of time and be fit for a net-zero carbon future.

5.4 Development now must therefore be of the highest possible thermal efficiency. The expected energy use of such buildings must be as low as possible, and new development must, as the final step, take all practical and reasonable steps to generate low or zero carbon energy itself.

5.5 Overall, developers should follow the design principles for efficient buildings as part of all design proposals, as set out in Policy S6.

5.6 This section of the report identifies how these design principles have informed the design of the proposed dwelling.

Orientation and Form of Buildings

5.7 Appropriate siting and orientation can significantly reduce the energy requirement of a typical building. The aim is to maximise natural daylight and sunlight into a building through passive design measures. This will take advantage of the natural characteristics in building materials and air to help reduce the additional energy needed for heating and cooling.

5.8 Where possible and where it would not impact on the efficient use of available land, it would be advantageous for the main orientation of a building should be within 30° of south. Buildings oriented south-east will benefit from the morning sun and those south-west will benefit from the late afternoon sun. Optimising the orientation and pitch of a roof to maximise sun and daylight exposure will also benefit the energy that can be gained from solar panels located on the roof.

5.9 The proposed dwelling has been orientated so that its front elevation principally face south-east, c22° of south.

5.10 In adopting this approach, the dwelling's front elevation will benefit from solar gain throughout the majority of daylight hours. The ground-floor internal primary living spaces are located to the front of the dwelling which maximises the heat transfer through the building whilst minimising the need for energy consuming heating systems.

5.11 The dwelling's window ratio to the North-West elevation is 26.8% based on 28.4m2 of external surface area of which 7.6m2 is glazed. The North-East window ratio is 0.9% based on 46.8m2 of external surface area of which 0.8m2 is glazed. The South-East window ratio is 27.8%, based on 28.4m2 of external surface area of which 7.9m2 is glazed. The South-West window ratio is 0%, based on 46.8m2 of external surface area of which 0m2 is glazed. These ratios fall below the residential targets for elevations set out on page 13 of the Energy Efficiency Design Guide 2023.

5.12 The site is provided with a large rear garden which provides space to allow washing to dry naturally outdoors, reducing the need to use energy intensive tumble driers.

5.13 The proposed dwelling is detached which typically results in a higher form factor. However, the proposed design contains a simple plan form to minimise the exposed surface area of the dwelling thereby promoting a higher thermally efficient form factor.

5.14 The form factor is calculated using the following formula:

$$\text{Form factor} = \frac{\text{Exposed external surface area}}{\text{Gross internal floor area}}$$

Source: Energy Efficiency Design Guide 2023

Form Factor Calculation:

$$\frac{221m^2}{77m^2} = 2.87$$

5.15 The lower the form factor the more efficient the design. The form factor of 2.87 for the proposed dwelling falls below the example used on page 24 in the CLLP: Climate Change Evidence Base for predicted form factor of 2.95 for detached house. As such falling below the target suggests the form of the dwelling is acceptable.

5.16 The building principally aligns with the south-westerly prevailing wind which allows a simple purge ventilation to limit the risk of summer overheating. Mechanical Ventilation with heat recovery shall be utilised for the proposed dwelling, minimising heat loses whilst meeting the requirements of Part F of Building Regulations.

Fabric of Buildings

5.17 Optimising thermal mass can help retain heat by absorbing the sun's energy, or if exposed, lose heat to the cooler external environment. Building materials that are heavyweight (e.g. brick, concrete) absorb and release heat in buildings to help moderate the temperature. Designing out thermal bridges (gaps) will prevent heat loss through the building envelope.

5.18 The final external facing materials consist of limestone and clay pantiles which will assist with thermal efficiency. Where possible locally sourced materials will be selected. The use of plastics and other synthetic materials will be minimised.

5.19 The development is to include efficient building fabrics to minimise Energy Loss as follows:

<u>General Construction/Insulation</u>

- Ground Floor U-Value – 0.1 w/m2-k – Slab on ground, screed over insulation,
- Cavity Wall U – Value – 0.13 w/m2-k – Cavity wall : dense plaster, AAC block, filled cavity,
- Roof U-Value – 0.1 w/m2k – Plasterboard, insulated at ceiling level,
- Window U-Value – 0.8 w/m2-k – Triple Low-E Hard 0.2.

<u>Thermal bridging</u>

- Enhanced thermal bridging / airtightness details with robust on-site monitoring and the use of hi-therm cavity lintels to reduce the typical weakest points of thermal bridging.

<u>Airtightness</u>

- Proposed air tightness of 1.0 m3/hm2 in conjunction with thermal bridging above

Heat Supply

5.20 Net zero carbon content of heat supply (for example, this means no connection to the gas network or use of oil or bottled gas)

5.21 Supplying fossil fuel free energy is key to minimizing carbon emissions. For new builds, heat pumps are the most efficient means of heating a building without reliance on fossil fuels.

5.22 The proposed development will utilise an Air Source Heat Pump heating system and hot water system. There are no connections proposed to the gas network or use of oil or bottled gas.

Renewable Energy Generated

5.23 As stated within the following section, policy S7 specifically requires proposals to generate at least the same amount of renewable electricity on-site as the electricity they demand over the course of a year. In order to demonstrate compliance with Policy S7.1. it is necessary first to calculate the total energy usage of the dwelling in accordance with requirements of Policy S7.2. The results of this are shown in Appendix C – detailing the requirement to install 7 No 450W solar panels (data sheets included in Appendix D).

5.24 The total energy demand for the dwelling is 31.62 kwh/m2/yr and as such 6.34 Solar PV panels are required to meet this demand. 7 no. Solar PV panels are proposed (full assessment provided at Appendix C).

5.25 As such, the proposed development includes Solar PV on the dwelling's SE roof slope. No additional renewable energy generation is proposed (wind turbine etc.).

5.26 Overall, the on-plot energy generation meets the predicted estimates of the total energy demand of the dwelling across the year. See Appendix C for compliance summary.

5.27 In adopting these design principles as a whole, it is considered that the scheme delivers a highly sustainable and energy efficient dwelling, in accordance with the design principles of policy S6.

6.0 Water Efficiency and Sustainable Water Management

6.1 The supply and disposal of water has a significant carbon impact. Reducing water use (supply and disposal) therefore can have a significant carbon impact, even more so if that water is heated.

6.2 Through the Building Regulations all developments are required to achieve a mandatory standard of 125 litres per person per day. The optional technical standards for housing allows local authorities to apply a more stringent standard of 110 litres per person per day where there is a clear local need. Central Lincolnshire is identified as being within an area of serious water stress1 and so this optional standard is required in the CLLP.

6.3 Policy S12 states to minimise impact on the water environment all new dwellings should achieve the Optional Technical Housing Standard of 110 litres per day per person for water efficiency as described by Building Regulation G2.

6.4 The proposed development includes low usage appliances and flow restrictors shall be fitted as appropriate throughout to limit water waste.

6.5 Policy S12 also includes a series of water management measures to be included with all residential development or other development comprising new buildings.

6.6 In accordance with these requirements, all new external surfacing will comprise of permeable construction.

6.7 The proposal includes 1no. 100l water butt located to the rear of the dwelling that will connect to a downpipe to collect surface water from the roof.

6.8 With the inclusion of these measures, the carbon impact of the development proposed will be further reduced and overall, the proposed development will provide a highly efficient and well managed dwelling.

7.0 Conclusion

7.1 The purpose of this statement is to set out the design principles and energy performance calculations which have been adopted to ensure that the development proposed contributes to the transition to a zero-carbon future.

7.2 The proposed design of the dwelling has been informed by a series of design principles in accordance with the CLLP Energy Efficiency Design Guide 2023. In adopting these design principles as a whole, it is considered that the scheme delivers a highly sustainable and energy efficient dwelling, designed with a 'fabric first' approach, in accordance with the design principles of policy S6.

7.3 The report also sets out the energy performance calculations of the proposed dwelling using an industry standard methodology. The proposed dwelling complies with the space heating demand requirements and the total energy demand requirements set out within policy S7.2. Furthermore, the proposed dwelling will generate at least the same amount of renewable electricity on-site as the electricity it demands over the course of a year.

7.4 The development proposal also incudes a series of water efficiency and management measures that will be employed on site in order to further reduce the carbon impact of the dwelling.

7.5 Overall, the proposed development will support the transition to a low carbon future in accordance with policy S6 and S7 of the CLLP and the high design aspirations of the NPPF.

Appendices

Appendix A – Design Stage SAP Calculations

Appendix B – Design Stage EPC

Appendix C – Policy S7 Compliance Summary

Appendix D – Solar PV Datasheet

Appendix E – Air Source Heat Pump Technical Specification

Appendix F – Glazing, Wall & Roof Specification

Appendix A – Design Stage SAP Calculations

Full SAP Calculation Printout

elmhurst energy

Property Reference	23-224	**Issued on Date**	27/11/2023
Assessment Reference	23-224 Plot 72A	**Prop Type Ref**	23-224 Plot 72A
Property	Plot 72A, Steamer Point Road, Nocton, Lincs		

SAP Rating	94 A	**DER**	0.22	**TER**	12.60
Environmental	100 A	**% DER < TER**			98.25
CO_2 Emissions (t/year)	0.01	**DFEE**	27.54	**TFEE**	40.91
Compliance Check	See BREL	**% DFEE < TFEE**			32.68
% DPER < TPER	73.20	**DPER**	17.68	**TPER**	65.96

Assessor Details	Mrs. Kerry Simpson	**Assessor ID**	Y750-0001
Client	, Steve Dunn		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5300 (1b)	x	2.4000 (2b)	=	92.4720 (1b) - (3b)	
First floor	38.5300 (1c)	x	2.6000 (2c)	=	100.1780 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.6500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	1 * 20 =	20.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1038	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		1.0000	(17)
Infiltration rate		0.1538	(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) =	0.1307	(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	0.1667	0.1634	0.1602	0.1438	0.1405	0.1242	0.1242	0.1209	0.1307	0.1405	0.1471	0.1536	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	42.0000 (23c)

Effective ac	0.4567	0.4534	0.4502	0.4338	0.4305	0.4142	0.4142	0.4109	0.4207	0.4305	0.4371	0.4436	(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	
Glazing (Uw = 0.80)			14.1100	0.7752	10.9380			(27)
Front Door			2.3100	1.0000	2.3100			(26)
Heatloss Floor			38.5300	0.1000	3.8530	110.0000	4238.3000	(28a)
External Wall	124.9000	16.4200	108.4800	0.1300	14.1024	70.0000	7593.6000	(29a)
Plane Roof	38.5300		38.5300	0.1000	3.8530	9.0000	346.7700	(30)
Total net area of external elements Aum(A, m2)			201.9600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.0564			(33)
Internal Wall 1			50.4000			100.0000	5040.0000	(32c)
Internal Wall 2			81.6000			9.0000	734.4000	(32c)
Internal Floor 1			38.5300			18.0000	693.5400	(32d)
Internal Ceiling 1			38.5300			9.0000	346.7700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18993.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		246.4752 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	11.9200	0.0560	0.6675	
E3 Sill	9.5700	0.0150	0.1436	
E4 Jamb	25.2000	0.0100	0.2520	
E5 Ground floor (normal)	24.9800	0.0970	2.4231	
E6 Intermediate floor within a dwelling	24.9800	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0620	0.6200	
E10 Eaves (insulation at ceiling level)	11.1200	0.0600	0.6672	
E12 Gable (insulation at ceiling level)	13.8600	0.0840	1.1642	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.9376	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	40.9940	(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	29.0343	28.8265	28.6187	27.5797	27.3719	26.3329	26.3329	26.1251	26.7485	27.3719	27.7875	28.2031	(38)
Heat transfer coeff	70.0283	69.8205	69.6127	68.5737	68.3659	67.3269	67.3269	67.1191	67.7425	68.3659	68.7815	69.1971	(39)
Average = Sum(39)m / 12 =												68.5217	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9087	0.9061	0.9034	0.8899	0.8872	0.8737	0.8737	0.8710	0.8791	0.8872	0.8926	0.8980	(40)
HLP (average)												0.8892	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4047	(42)
Hot water usage for mixer showers	64.5388	63.5689	62.1556	59.4514	57.4558	55.2304	53.9654	55.3680	56.9056	59.2951	62.0573	64.2915	(42a)
Hot water usage for baths	27.8770	27.4630	26.8800	25.8050	25.0001	24.1075	23.6254	24.2044	24.8347	25.7898	26.8869	27.7828	(42b)
Hot water usage for other uses	39.2566	37.8291	36.4016	34.9741	33.5466	32.1191	32.1191	33.5466	34.9741	36.4016	37.8291	39.2566	(42c)
Average daily hot water use (litres/day)												121.0368	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.6724	128.8610	125.4371	120.2305	116.0025	111.4570	109.7099	113.1190	116.7144	121.4864	126.7733	131.3309	(44)
Energy conte	208.5369	183.4963	192.7922	164.5896	156.1616	137.0493	132.6846	140.0649	143.9205	164.8559	180.6118	205.6325	(45)
Energy content (annual)										Total = Sum(45)m =		2010.3963	
Distribution loss (46)m = 0.15 x (45)m	31.2805	27.5245	28.9188	24.6884	23.4242	20.5574	19.9027	21.0097	21.5881	24.7284	27.0918	30.8449	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8802	(55)
Total storage loss	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)
If cylinder contains dedicated solar storage	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	(61)
Total heat required for water heating calculated for each month	259.0855	229.1531	243.3408	213.5076	206.7102	185.9673	183.2332	190.6135	192.8385	215.4045	229.5298	256.1811	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
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	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.0855	229.1531	243.3408	213.5076	206.7102	185.9673	183.2332	190.6135	192.8385	215.4045	229.5298	256.1811	(64)
								Total per year (kWh/year) = Sum(64)m =				2605.5653	(64)
12Total per year (kWh/year)												2606	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	109.7774	97.5380	104.5423	93.8604	92.3626	84.7033	84.5565	87.0105	86.9880	95.2535	99.1878	108.8117	(65)

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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	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.1521	124.1683	112.1521	115.8905	112.1521	115.8905	112.1521	112.1521	115.8905	112.1521	115.8905	112.1521	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.1865	215.3987	209.8240	197.9561	182.9751	168.8950	159.4887	157.2764	162.8511	174.7190	189.7000	203.7801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	(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)	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	(71)
Water heating gains (Table 5)	147.5503	145.1458	140.5138	130.3617	124.1433	117.6435	113.6512	116.9496	120.8166	128.0289	137.7609	146.2522	(72)
Total internal gains	531.9594	543.7835	521.5605	503.2789	478.3411	461.4996	444.3626	445.4487	458.6289	473.9706	502.4220	521.2551	(73)

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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	7.6900	10.6334	0.6400	0.7000	0.7700	25.3869	(74)
East	0.8400	19.6403	0.6400	0.7000	0.7700	5.1220	(76)
South	5.5800	46.7521	0.6400	0.7000	0.7700	80.9928	(78)

Solar gains	111.5016	191.1806	267.9075	347.4543	406.8762	412.6661	394.1504	347.8574	294.8164	212.7111	133.7085	95.3610 (83)
Total gains	643.4611	734.9641	789.4680	850.7332	885.2173	874.1657	838.5130	793.3061	753.4452	686.6817	636.1306	616.6161 (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	75.3401	75.5644	75.7899	76.9383	77.1721	78.3630	78.3630	78.6056	77.8823	77.1721	76.7058	76.2451	
alpha	6.0227	6.0376	6.0527	6.1292	6.1448	6.2242	6.2242	6.2404	6.1922	6.1448	6.1137	6.0830	
util living area	0.9875	0.9720	0.9402	0.8488	0.6890	0.4898	0.3529	0.3885	0.6077	0.8746	0.9707	0.9900	(86)
Living	20.3588	20.4959	20.6535	20.8300	20.9208	20.9471	20.9498	20.9497	20.9393	20.8270	20.5742	20.3381	
Non living	19.4174	19.5906	19.7852	19.9982	20.0914	20.1243	20.1258	20.1282	20.1145	20.0014	19.6999	19.3990	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.6720	20.4959	20.6535	20.8300	20.9208	20.9471	20.9498	20.9497	20.9393	20.8270	20.5742	20.4307	(87)
Th 2	20.1601	20.1624	20.1646	20.1761	20.1784	20.1899	20.1899	20.1922	20.1853	20.1784	20.1738	20.1692	(88)
util rest of house	0.9839	0.9645	0.9248	0.8156	0.6372	0.4292	0.2882	0.3207	0.5411	0.8388	0.9615	0.9871	(89)
MIT 2	19.8640	19.5906	19.7852	19.9982	20.0914	20.1243	20.1258	20.1282	20.1145	20.0014	19.6999	19.5378	(90)
Living area fraction										fLA = Living area / (4) =		0.2000	(91)
MIT	20.0256	19.7717	19.9588	20.1645	20.2572	20.2888	20.2906	20.2924	20.2794	20.1665	19.8747	19.7164	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0256	19.7717	19.9588	20.1645	20.2572	20.2888	20.2906	20.2924	20.2794	20.1665	19.8747	19.7164	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9833	0.9602	0.9204	0.8150	0.6423	0.4367	0.2962	0.3291	0.5490	0.8382	0.9574	0.9851	(94)
Useful gains	632.6976	705.7392	726.6041	693.3847	568.6046	381.7421	248.3839	261.0853	413.6509	575.6011	609.0363	607.4416	(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	1101.2332	1038.3461	936.9021	772.4490	585.0235	383.0107	248.4740	261.2565	418.6109	654.0219	878.6633	1073.6860	(97)
Space heating kWh	348.5905	223.5118	156.4617	56.9263	12.2157	0.0000	0.0000	0.0000	0.0000	58.3451	194.1314	346.8859	(98a)
Space heating requirement - total per year (kWh/year)												1397.0684	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	348.5905	223.5118	156.4617	56.9263	12.2157	0.0000	0.0000	0.0000	0.0000	58.3451	194.1314	346.8859	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1397.0684	
Space heating per m2											(98c) / (4) =	18.1296	(99)

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 %)												312.1687 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	348.5905	223.5118	156.4617	56.9263	12.2157	0.0000	0.0000	0.0000	0.0000	58.3451	194.1314	346.8859	(98)
Space heating efficiency (main heating system 1)	312.1687	312.1687	312.1687	312.1687	312.1687	0.0000	0.0000	0.0000	0.0000	312.1687	312.1687	312.1687	(210)
Space heating fuel (main heating system)	111.6673	71.5997	50.1209	18.2357	3.9132	0.0000	0.0000	0.0000	0.0000	18.6903	62.1880	111.1213	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	259.0855	229.1531	243.3408	213.5076	206.7102	185.9673	183.2332	190.6135	192.8385	215.4045	229.5298	256.1811	(64)
Efficiency of water heater												170.4420	(216)
(217)m	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	170.4420	(217)
Fuel for water heating, kWh/month	152.0080	134.4464	142.7705	125.2670	121.2789	109.1089	107.5048	111.8349	113.1403	126.3800	134.6674	150.3040	(219)
Space cooling fuel requirement													
(221)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	(221)
Pumps and Fa	23.7544	21.4556	23.7544	22.9882	23.7544	22.9882	23.7544	23.7544	22.9882	23.7544	22.9882	23.7544	(231)
Lighting	22.4033	17.9728	16.1825	11.8560	9.1579	7.4821	8.3541	10.8590	14.1048	18.5063	20.9028	23.0260	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-56.9457	-78.8998	-110.3876	-119.8546	-127.5790	-118.7362	-117.5807	-111.9456	-100.8748	-87.4013	-61.8214	-49.4810	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)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	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)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	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-26.9994	-56.4120	-108.7501	-159.6326	-207.0049	-206.2306	-204.7448	-176.4954	-135.0037	-82.3702	-36.7767	-21.4411	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)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	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)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	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)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	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												447.5364	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.4420	
Water heating fuel used												1528.7110	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.7000, SFP = 1.1900)		
mechanical ventilation fans (SFP = 1.1900)	279.6893	(230a)
Total electricity for the above, kWh/year	279.6893	(231)
Electricity for lighting (calculated in Appendix L)	180.8075	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2563.3692	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-126.6250	(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	447.5364	0.1575	70.4955	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1528.7110	0.1409	215.4313	(264)
Space and water heating			285.9268	(265)
Pumps, fans and electric keep-hot	279.6893	0.1387	38.7963	(267)
Energy for lighting	180.8075	0.1443	26.0961	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1141.5077	0.1351	-154.2065	
PV Unit electricity exported	-1421.8615	0.1265	-179.9365	
Total			-334.1430	(269)
Total CO2, kg/year			16.6763	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.2200	(273)

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	447.5364	1.5831	708.4961	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1528.7110	1.5211	2325.2999	(278)
Space and water heating			3033.7960	(279)
Pumps, fans and electric keep-hot	279.6893	1.5128	423.1139	(281)
Energy for lighting	180.8075	1.5338	277.3285	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1141.5077	1.4993	-1711.4608	
PV Unit electricity exported	-1421.8615	0.4646	-660.5585	
Total			-2372.0194	(283)
Total Primary energy kWh/year			1362.2191	(286)
Dwelling Primary energy Rate (DPER)			17.6800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.5300 (1b)	x	2.4000 (2b)	=	92.4720 (1b) - (3b)	
First floor	38.5300 (1c)	x	2.6000 (2c)	=	100.1780 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	192.6500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1557	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4057	(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) =	0.3449	(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	0.4397	0.4311	0.4225	0.3794	0.3707	0.3276	0.3276	0.3190	0.3449	0.3707	0.3880	0.4052	(22b)
Effective ac	0.5967	0.5929	0.5892	0.5720	0.5687	0.5537	0.5537	0.5509	0.5595	0.5687	0.5753	0.5821	(25)

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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			2.3100	1.0000	2.3100			(26)
TER Opening Type (Uw = 1.20)			14.1100	1.1450	16.1565			(27)
Heatloss Floor			38.5300	0.1300	5.0089			(28a)
External Wall	124.9000	16.4200	108.4800	0.1800	19.5264			(29a)
Plane Roof	38.5300		38.5300	0.1100	4.2383			(30)
Total net area of external elements Aum(A, m2)			201.9600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.2401			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 246.4752 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	11.9200	0.0500	0.5960
E3	Sill	9.5700	0.0500	0.4785
E4	Jamb	25.2000	0.0500	1.2600
E5	Ground floor (normal)	24.9800	0.1600	3.9968
E6	Intermediate floor within a dwelling	24.9800	0.0000	0.0000
E16	Corner (normal)	10.0000	0.0900	0.9000
E10	Eaves (insulation at ceiling level)	11.1200	0.0600	0.6672
E12	Gable (insulation at ceiling level)	13.8600	0.0600	0.8316

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7301 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 55.9702 (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	37.9329	37.6943	37.4604	36.3617	36.1561	35.1992	35.1992	35.0219	35.5678	36.1561	36.5719	37.0067	(38)
Heat transfer coeff	93.9031	93.6645	93.4306	92.3318	92.1263	91.1693	91.1693	90.9921	91.5379	92.1263	92.5421	92.9769	(39)
Average = Sum(39)m / 12 =												92.3309	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2186	1.2155	1.2124	1.1982	1.1955	1.1831	1.1831	1.1808	1.1879	1.1955	1.2009	1.2066	(40)
HLP (average)												1.1982	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4047 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
64.5388	63.5689	62.1556	59.4514	57.4558	55.2304	53.9654	55.3680	56.9056	59.2951	62.0573	64.2915	(42a)

Hot water usage for baths

27.8770	27.4630	26.8800	25.8050	25.0001	24.1075	23.6254	24.2044	24.8347	25.7898	26.8869	27.7828	(42b)

Hot water usage for other uses

39.2566	37.8291	36.4016	34.9741	33.5466	32.1191	32.1191	33.5466	34.9741	36.4016	37.8291	39.2566	(42c)

Average daily hot water use (litres/day) 121.0368 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.6724	128.8610	125.4371	120.2305	116.0025	111.4570	109.7099	113.1190	116.7144	121.4864	126.7733	131.3309	(44)
Energy conte	208.5369	183.4963	192.7922	164.5896	156.1616	137.0493	132.6846	140.0649	143.9205	164.8559	180.6118	205.6325	(45)
Energy content (annual)										Total = Sum(45)m =		2010.3963	
Distribution loss (46)m = 0.15 x (45)m	31.2805	27.5245	28.9188	24.6884	23.4242	20.5574	19.9027	21.0097	21.5881	24.7284	27.0918	30.8449	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)

If cylinder contains dedicated solar storage

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
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	(61)

Total heat required for water heating calculated for each month

260.2835	230.2352	244.5388	214.6669	207.9082	187.1267	184.4312	191.8115	193.9979	216.6025	230.6891	257.3790	(62)
WWHRS -29.5044	-26.0940	-27.3241	-22.6254	-21.0861	-18.0435	-16.9129	-17.9852	-18.6685	-22.0081	-24.9325	-28.9581	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
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	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

230.7791	204.1412	217.2147	192.0415	186.8221	169.0832	167.5183	173.8263	175.3294	194.5944	205.7566	228.4210	(64)
								Total per year (kWh/year) = Sum(64)m =			2345.5279	(64)
12Total per year (kWh/year)											2346	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)

Heat gains from water heating, kWh/month

110.7358	98.4036	105.5007	94.7879	93.3210	85.6308	85.5149	87.9689	87.9155	96.2119	100.1153	109.7701	(65)

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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	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	120.2355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.5319	121.2675	109.5319	113.1830	109.5319	113.1830	109.5319	109.5319	113.1830	109.5319	113.1830	109.5319	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													

	213.1865	215.3987	209.8240	197.9561	182.9751	168.8950	159.4887	157.2764	162.8511	174.7190	189.7000	203.7801 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236	35.0236 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884	-96.1884 (71)
Water heating gains (Table 5)												
	148.8384	146.4340	141.8020	131.6499	125.4315	118.9316	114.9394	118.2377	122.1048	129.3170	139.0490	147.5404 (72)
Total internal gains												
	533.6275	545.1708	523.2286	504.8597	480.0091	460.0803	443.0306	444.1168	457.2096	475.6386	504.0027	522.9231 (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	7.6900	10.6334	0.6300	0.7000	0.7700	24.9902 (74)
East	0.8400	19.6403	0.6300	0.7000	0.7700	5.0419 (76)
South	5.5800	46.7521	0.6300	0.7000	0.7700	79.7273 (78)

Solar gains	109.7594	188.1934	263.7214	342.0253	400.5188	406.2182	387.9918	342.4221	290.2098	209.3875	131.6194	93.8710 (83)
Total gains	643.3869	733.3642	786.9500	846.8849	880.5279	866.2985	831.0225	786.5389	747.4194	685.0261	635.6221	616.7941 (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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1849	56.3281	56.4691	57.1411	57.2686	57.8697	57.8697	57.9824	57.6366	57.2686	57.0112	56.7446	
alpha	4.7457	4.7552	4.7646	4.8094	4.8179	4.8580	4.8580	4.8655	4.8424	4.8179	4.8007	4.7830	
util living area													
	0.9913	0.9831	0.9671	0.9202	0.8166	0.6378	0.4754	0.5203	0.7525	0.9340	0.9826	0.9929	(86)
MIT	19.7075	19.9060	20.1743	20.5288	20.8078	20.9567	20.9914	20.9870	20.9034	20.5560	20.0777	19.6779	(87)
Th 2	19.9052	19.9076	19.9101	19.9215	19.9236	19.9335	19.9335	19.9354	19.9297	19.9236	19.9193	19.9148	(88)
util rest of house													
	0.9886	0.9778	0.9565	0.8943	0.7606	0.5459	0.3640	0.4059	0.6675	0.9070	0.9762	0.9906	(89)
MIT 2	18.4268	18.6794	19.0173	19.4557	19.7662	19.9096	19.9309	19.9310	19.8675	19.4982	18.9073	18.3960	(90)
Living area fraction									fLA = Living area / (4) =			0.2000	(91)
MIT	18.6829	18.9247	19.2487	19.6703	19.9745	20.1190	20.1430	20.1421	20.0746	19.7097	19.1413	18.6523	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6829	18.9247	19.2487	19.6703	19.9745	20.1190	20.1430	20.1421	20.0746	19.7097	19.1413	18.6523	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9843	0.9714	0.9482	0.8870	0.7635	0.5627	0.3863	0.4287	0.6802	0.9003	0.9698	0.9868	(94)
Useful gains	633.2640	712.3686	746.1505	751.2146	672.3021	487.4500	321.0020	337.1943	508.3608	616.7455	616.4433	608.6529	(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													
	1350.6017	1313.6171	1191.1186	994.4420	762.3009	503.1614	323.0135	340.5049	546.9056	839.2444	1114.3316	1343.7340	(97)
Space heating kWh													
	533.6992	404.0390	331.0563	175.1237	66.9591	0.0000	0.0000	0.0000	0.0000	165.5392	358.4796	546.9003	(98a)
Space heating requirement - total per year (kWh/year)												2581.7964	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	533.6992	404.0390	331.0563	175.1237	66.9591	0.0000	0.0000	0.0000	0.0000	165.5392	358.4796	546.9003	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2581.7964	
Space heating per m2										(98c) / (4) =		33.5037	(99)

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 %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	533.6992	404.0390	331.0563	175.1237	66.9591	0.0000	0.0000	0.0000	0.0000	165.5392	358.4796	546.9003	(98)
Space heating efficiency (main heating system 1)												79.8000	(210)
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	
Space heating fuel (main heating system)													
	578.2223	437.7454	358.6742	189.7332	72.5451	0.0000	0.0000	0.0000	0.0000	179.3490	388.3852	592.5247	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	230.7791	204.1412	217.2147	192.0415	186.8221	169.0832	167.5183	173.8263	175.3294	194.5944	205.7566	228.4210	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8762	85.5610	85.0019	83.8535	81.9926	79.8000	79.8000	79.8000	79.8000	83.6993	85.2921	85.9443	(217)
Fuel for water heating, kWh/month													
	268.7345	238.5915	255.5409	229.0201	227.8525	211.8837	209.9227	217.8275	219.7110	232.4922	241.2375	265.7779	(219)
Space cooling fuel requirement													
(221)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	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.7586	18.2578	16.4391	12.0440	9.3031	7.6007	8.4866	11.0312	14.3285	18.7997	21.2343	23.3911	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233a)m	-35.9881	-50.7064	-72.8491	-81.8734	-88.2620	-82.3780	-81.3565	-76.8106	-68.7909	-57.9571	-39.5524	-31.1171 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)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 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)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 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)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 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-20.4274	-42.9617	-85.3701	-128.1933	-169.4785	-170.2760	-168.2751	-142.4937	-104.4626	-61.4349	-27.2723	-16.1546 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)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 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)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 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)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 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2797.1791 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	2818.5921 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	183.6747 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1904.4418 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3981.0042 (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	2797.1791	0.2100	587.4076	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2818.5921	0.2100	591.9043	(264)
Space and water heating			1179.3120	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	183.6747	0.1443	26.5099	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-767.6414	0.1346	-103.3213	
PV Unit electricity exported	-1136.8003	0.1259	-143.1254	
Total			-246.4468	(269)
Total CO2, kg/year			971.3044	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6000	(273)

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	2797.1791	1.1300	3160.8124	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2818.5921	1.1300	3185.0090	(278)
Space and water heating			6345.8215	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	183.6747	1.5338	281.7264	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-767.6414	1.4974	-1149.5000	
PV Unit electricity exported	-1136.8003	0.4621	-525.3692	
Total			-1674.8691	(283)
Total Primary energy kWh/year			5082.7796	(286)
Target Primary Energy Rate (TPER)			65.9600	(287)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 27 Nov 2023 16:38:22

Project Information			
Assessed By	William Simpson	Building Type	House, Detached
OCDEA Registration	EES/014130	Assessment Date	2023-11-27

Dwelling Details			
Assessment Type	As designed	Total Floor Area	77 m^2
Site Reference	23-224	Plot Reference	23-224 Plot 72A
Address	Plot 72A Steamer Point Road, Nocton		

Client Details	
Name	Steve Dunn
Company	Steve Dunn Architecture
Address	

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.6 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	0.22 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*65.96 kWh_{PE}/m^2*	
Dwelling primary energy	17.68 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*40.9 kWh/m^2*	
Dwelling fabric energy efficiency	27.5 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.13	Walls (1) (0.13)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Heatloss Floor (0.1)	OK
Roofs	*0.16*	0.1	Roof (1) (0.1)	OK
Windows, doors, and roof windows	*1.6*	0.83	Front (1)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	108.481	0.13 **(!)**
Ground floor: Heatloss Floor , Heatloss Floor	38.53	0.1 **(!)**
Exposed roof: Roof (1)	38.53	0.1 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Front Door	2.31	South	N/A	1 **(!)**
Windows, Glazing	2.16	South	0.7	0.8 **(!)**
Windows, Glazing	1.38	South	0.7	0.8 **(!)**
Windows, Glazing	2.04	South	0.7	0.8 **(!)**
Windows, Glazing	1.5	North	0.7	0.8 **(!)**
Windows, Glazing	1.38	North	0.7	0.8 **(!)**
Windows, Glazing	2.184	North	0.7	0.8 **(!)**
Windows, Glazing	2.625	North	0.7	0.8 **(!)**
Side East, Glazing	0.84	East	0.7	0.8 **(!)**

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.056	Poss Hi-Therm Lintels
External wall	E3: Sill	Calculated by person with suitable expertise	0.015 **(!)**	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.01 **(!)**	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.097	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 **(!)**	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.062	
External wall	E10: Eaves (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.084	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	1 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	312.2%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	Heat Pump
Manufacturer	Grant Engineering (UK) Ltd
Model	AERONA3
Commissioning	
Secondary heating system: Closed room heater	
Fuel	Wood logs
Efficiency	65.0%
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	210 litres
Declared heat loss	1.63 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by device in PCDB	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	90 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.7 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	84%	OK
Manufacturer/Model	MTD-ERV 365	
Commissioning		

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	3 kWp
Orientation	South
Pitch	45°
Overshading	None or very little
Manufacturer	
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Appendix B – Design Stage EPC

Predicted Energy Assessment

elmhurst energy

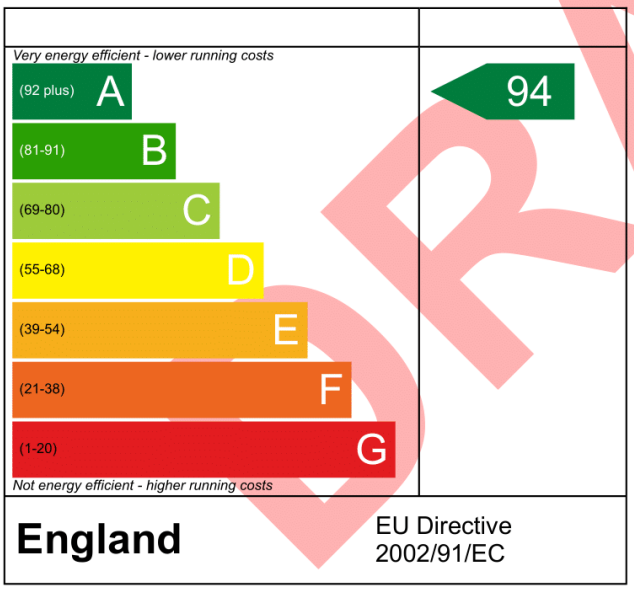
Plot 72A, Steamer Point Road, Nocton, Lincs

Dwelling type:	House, Detached
Date of assessment:	27/11/2023
Produced by:	Kerry Simpson
Total floor area:	77.06 m²
DRRN:	

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

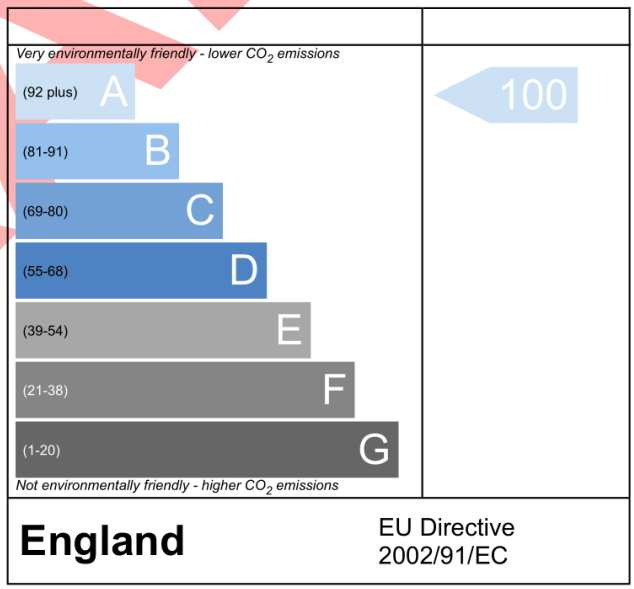
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

2709: Proposed Development at
27 Steamer Point Road, Nocton,
Lincoln, LN4 2DA
Energy Statement

SDA
STEVEN DUNN ARCHITECTS

Summary for Input Data

elmhurst energy

Property Reference	23-224	Issued on Date	27/11/2023
Assessment Reference	23-224 Plot 72A	Prop Type Ref	23-224 Plot 72A
Property	Plot 72A, Steamer Point Road, Nocton, Lincs		

SAP Rating	94 A	DER	0.22	TER	12.60
Environmental	100 A	% DER < TER			98.25
CO_2 Emissions (t/year)	0.01	DFEE	27.54	TFEE	40.91
Compliance Check	See BREL	% DFEE < TFEE			32.68
% DPER < TPER	73.20	DPER	17.68	TPER	65.96

Assessor Details	Mrs. Kerry Simpson	Assessor ID	Y750-0001
Client	, Steve Dunn		

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

Orientation	South
Property Tenture	1
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation
7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground floor:	24.98 m	38.53 m²	2.40 m
1st Storey:	24.98 m	38.53 m²	2.60 m

8.0 Living Area 15.41 m²

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Res	Shelter	Openings	Area Calculation Type
External Wall	Cavity Wall	Cavity wall : dense plaster, AAC block, filled cavity, any outside structure	0.13	70.00	124.90	108.48	0.00	None	16.42	Enter Gross Area

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, dense plaster	100.00	50.40
Internal Wall 2	Plasterboard on timber frame	9.00	81.60

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area(m²)	Nett Area (m²)	Shelter Code	Shelter Factor	Calculation Type	Openings
Plane Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	38.53	38.53	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings

Description	Storey	Construction	Area (m²)
Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	38.53

11.0 Heat Loss Floors

Description	Type	Storey Index	Construction	U-Value (W/m²K)	Shelter Code	Shelter Factor	Kappa (kJ/m²K)	Area (m²)
Heatloss Floor	Ground Floor - Solid	Lowest occupied	Slab on ground, screed over insulation	0.10	None	0.00	110.00	38.53

11.2 Internal Floors

Description	Storey Index	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	38.53

Summary for Input Data

elmhurst energy

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Glazing	Manufacturer	Window	Triple Low-E Hard 0.2			0.64		0.70	0.80
Front Door	Manufacturer	Solid Door							1.00

13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Front	Front Door	External Wall	South	2.31	
Windows	Glazing	External Wall	South	5.58	
Windows	Glazing	External Wall	North	7.69	
Side East	Glazing	External Wall	East	0.84	

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

Bridge Type	Source Type	Length	Psi	Adjusted	Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	11.92	0.06	0.06	Poss Hi-Therm Lintels	Yes
E3 Sill	Independently assessed	9.57	0.01	0.01		No
E4 Jamb	Independently assessed	25.20	0.01	0.01		Yes
E5 Ground floor (normal)	Independently assessed	24.98	0.10	0.10		Yes
E6 Intermediate floor within a dwelling	Independently assessed	24.98	0.00	0.00		Yes
E16 Corner (normal)	Independently assessed	10.00	0.06	0.06		No
E10 Eaves (insulation at ceiling level)	Independently assessed	11.12	0.06	0.06		No
E12 Gable (insulation at ceiling level)	Independently assessed	13.86	0.08	0.08		No

Y-value	0.03	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	1.00	m³/(h.m²) @ 50 Pa
Test Method	Blower Door	

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500149
Configuration	2
MVHR Duct Insulated	Insulated Ducts
Manufacturer SFP	0.70
Duct Type	Flexible
MVHR Efficiency	84.00
Wet Rooms	2
SFP from Installer Commissioning Certificate	No
MVHR System Location	Outside heated envelope (not installed exclusively)

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System	No	

22.0 Lighting

No Fixed Lighting	No	

Name	Efficacy	Power	Capacity	Count
Lighting 1	90.00	5	450	20

24.0 Main Heating 1	Database	
Description	Air Source Heat Pump	
Percentage of Heat	100.00	%
Database Ref. No.	102740	
Fuel Type	Electricity	

In Winter	312.17	
In Summer	170.44	
Model Name	AERONA3	
Manufacturer	Grant Engineering (UK) Ltd	
System Type	Heat Pump	
Controls SAP Code	2208	
Is MHS Pumped	Pump in heated space	
Heating Pump Age	2013 or later	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Enter value	
Flow Temperature Value	35.00	

25.0 Main Heating 2	None	

26.0 Heat Networks	None	

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1										
Heat source 2										
Heat source 3										
Heat source 4										
Heat source 5										

27.0 Secondary Heating

Secondary Heating	SAP table	
SAP Code	633	
SHS efficiency	60.00	%
HETAS Approved System	Yes	

28.0 Water Heating

Water Heating	Main Heating 1	
SAP Code	901	
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	
Cold Water Source	From mains	
Bath Count	1	
Immersion Only Heating Hot Water	Yes	

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To

28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.63	kWh/day
Pipes insulation	Fully insulated primary pipework	

Summary for Input Data

elmhurst energy

In Airing Cupboard	No
31.0 Thermal Store	None
32.0 Photovoltaic Unit	One Dwelling
Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	No
Battery Capacity [kWh]	0.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
3.00	South	45°	None Or Little		No	1.00		

34.0 Small-scale Hydro None

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
£4,000 - £6,000	£60	A 96	A 100
		0	0
		0	0

Appendix C – Policy S7 Compliance Summary

Appendix C – Policy S7 Compliance Summary

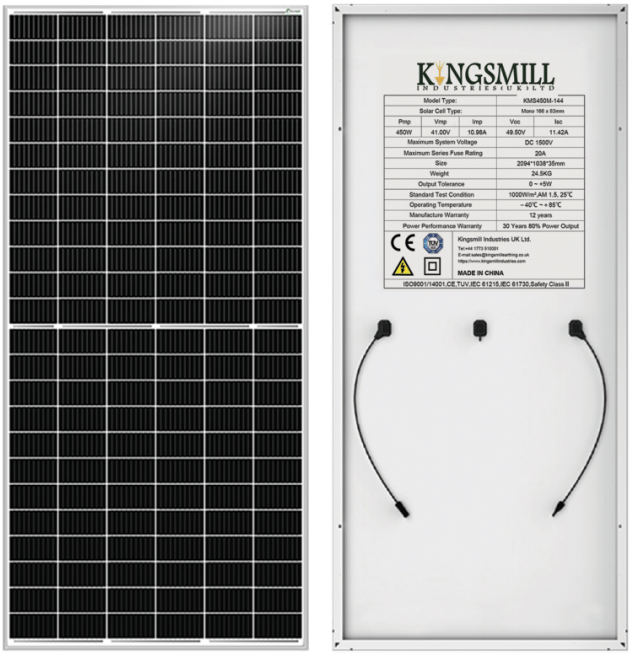
	Kwh/year	Property Size	Energy Demand kwh/m2/yr			Compliance Check
Total Space Heating Demand	447	77	5.81			Policy S7.2 – Site average space heating demand compliance
Taken from (211) SAP Calcs						
Total Hot Water Demand	1529	77	19.85			
Taken from (219) SAP Calcs						
Total Lighting Demand	180	77	2.34			
Taken from (232) SAP Calcs						
Total Electricity	279	77	3.62			
Taken from (231) SAP Calcs						
Total			31.62			Policy S7.2 – Total energy demand compliance
PV Installation	Kwh/year (Produced)	Property Size (sqm)	Kwh/m2/yr (Produced)	Energy Production Required	Total No Panels Required	
450 watt panel	382.52	77	4.99	31.62	6.34	Policy S7.1 – On site renewable generation compliance

Appendix D – Solar PV Datasheet

Introduction

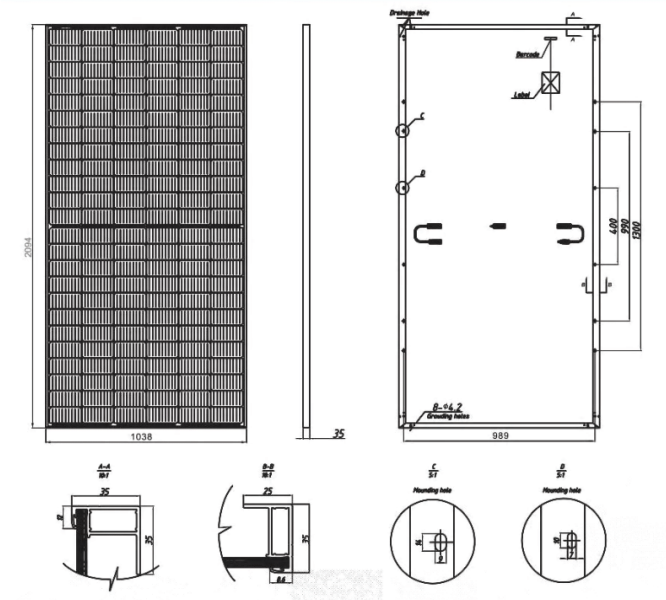
KMS450M-144 Photovoltaic Solar Panels are certified for the most challenging environmental conditions. This KMS450M-144. Photovoltaic high-power monocrystalline solar panel operates at 20.70% efficiency to maximize the light absorption area.

Product Options



Mono Solar Panel Features

- Widely using of the most popular and mature type of modules for solar system
- High power output and highest conversion efficiency of 20.70%
- Anti-reflective and anti-soiling surface reduces power loss from dirt and dust
- Outstanding Performance in low-light irradiance environments
- Excellent mechanical load resistance: Certified to withstand high wind loads (2400Pa) and Snow loads (5400Pa)
- Positive power tolerance: 0~+5W

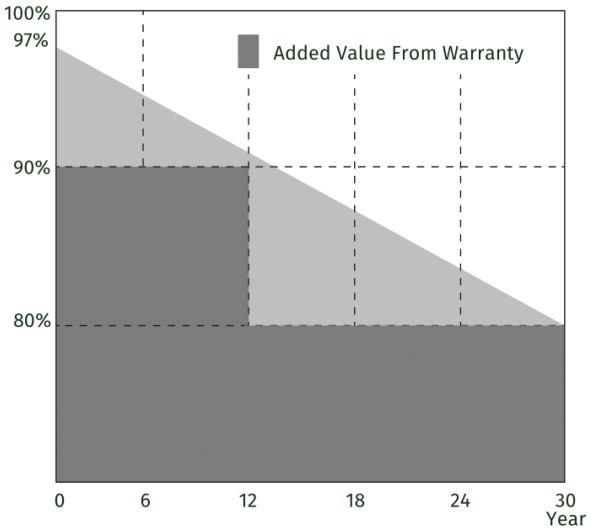


Electrical Characteristics(STC)	
Module Type	KMS450M-144
Maximum Power (Pmax)	450W
Maximum Power Voltage (Vmp)	41V
Maximum Power Current (Imp)	10.98
Open-circuit Voltage (Voc)	49.50
Short-circuit Current (Isc)	11.42
Module Efficiency (%)	20.70
Power Tolerance	0~+5W
Temperature Coeffcient of Isc	+0.05%/ºC
Temperature Coeffcient of Voc	-0.29%/ºC
Temperature Coeffcient of Pmax	-0.37%/ºC

Product Features

Warranty
12 years for product defects in materials & workmanship
12 years for 90% of warranted minimum power output
30 years for 80% of warranted minimum power output
30 years liner warranty

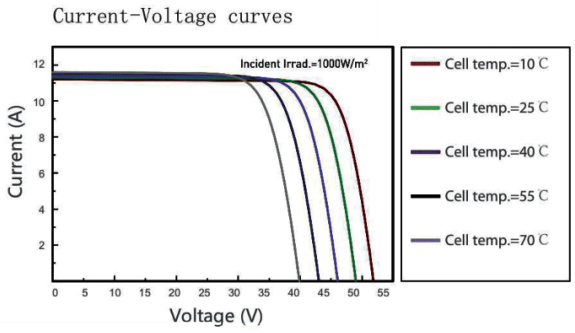
Reliable Quality
Positive power tolerance: 0~+5W
100% EL Double-inspection ensures modules are defects free
Modules Binned by Current to improve system performance
Potential induced Degradation (PID) Resistant

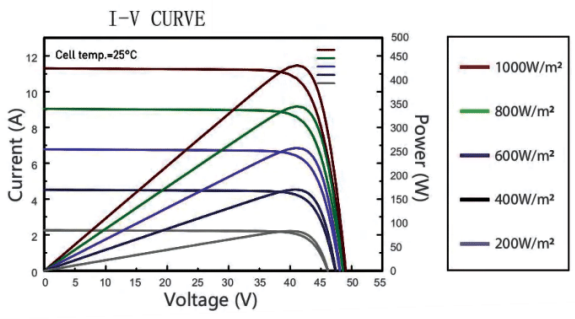


Mechanical Parameters	
Cell(mm)	9BB Mono 166*83
Weight(kg)	24.5kg
Glass Thickness	3.2mm,Low Iron Tempered Glass
Dimensions (L*W*H)(mm)	2094*1038*35mm
Cable Cross Section Size (mm²)	4
Cable Cross Section Length (mm)	300
No.of Cells and Connections	144(6*24)
Junction Box	IP67/68,3 Diodes
Connector	MC4 Compatiple

Working Conditions	
Maximum System Voltage	DC 1500V
Operating Temperature	-40°C~ +85°C
Maximum Series Fuse	20A
Maximum Static Load,Front (e.g.,snow and wind)	5400Pa (112 lb/ft²)
Maximum Static Load,Back (e.g.,wind)	2400Pa (50 lb/ft²)
NOCT	44±2°C
Positive power tolerance	0~ +5W
Application Class	Class A

I-V Curve





SOLAR PANELS

450W PHOTOVOLTAIC SOLAR PANEL

Product Features

GLASS

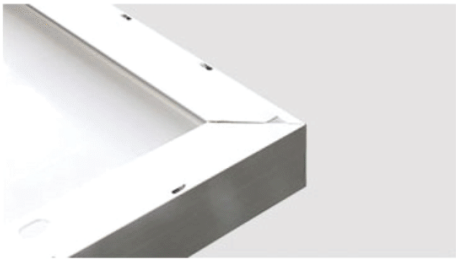
•Antireflective glass
•Translucency of normal luminance is increased by 2%
•Module efficiency is increased by 2%
•Self-cleaning option
•Service life as long as 25 years (30 years optional)

SOLAR CELL

•High efficiency PV cells
•Appearance consistency
•Color sorting ensure consistent appearance on each module
•Anti-PID

FRAME

•Conventinal frame
•Boost bearing capability and prolong service life
•Serrated-clip design tensile strength
•Seal-lip design glue injection



JUNCTION BOX

•Conventional standalone edition and engineering custom edition
•Quality diode ensures module running safety
•IP67 protection level
•Heat dissipation
•Long service life

More Information

All with A Grade for on-grid & off-grid use for residential and public rooftop and ground mounting
Solar panels are a clean source of energy that use the sun's rays to convert them into electricity or heat.

Our clean energy solutions provide electrical power as a way to decarbonize
and transition to clean energy in our mission to combat climate change.

Appendix E – Air Source Heat Pump Technical Specification

Heating | Product Information

MITSUBISHI ELECTRIC

PUZ-WM60VAA(-BS)

Ecodan R32

Monobloc Air Source Heat Pump

R32

Key Features:	Key Benefits:
A+++ high efficiency system	Ultra low running cost
Ultra quiet noise levels	Flexible product placement
Maintains full heating capacity at low temperatures	Confident and quick product selection
Zero carbon solution	Help to tackle the climate crisis
MELCloud enabled	Remote control, monitoring, maintenance and technical support

MELCloud

ecodan.co.uk

2709: Proposed Development at
27 Steamer Point Road, Nocton,
Lincoln, LN4 2DA
Energy Statement

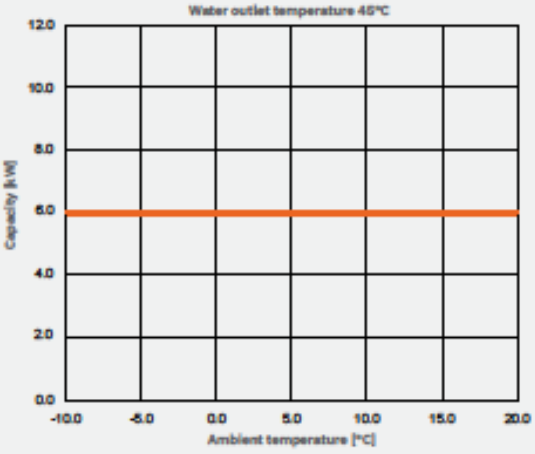
SDA
STEVEN DUNN ARCHITECTS

Heating | **Product Information**

PUZ-WM60VAA(-BS)
Ecodan R32
Monobloc Air Source Heat Pump

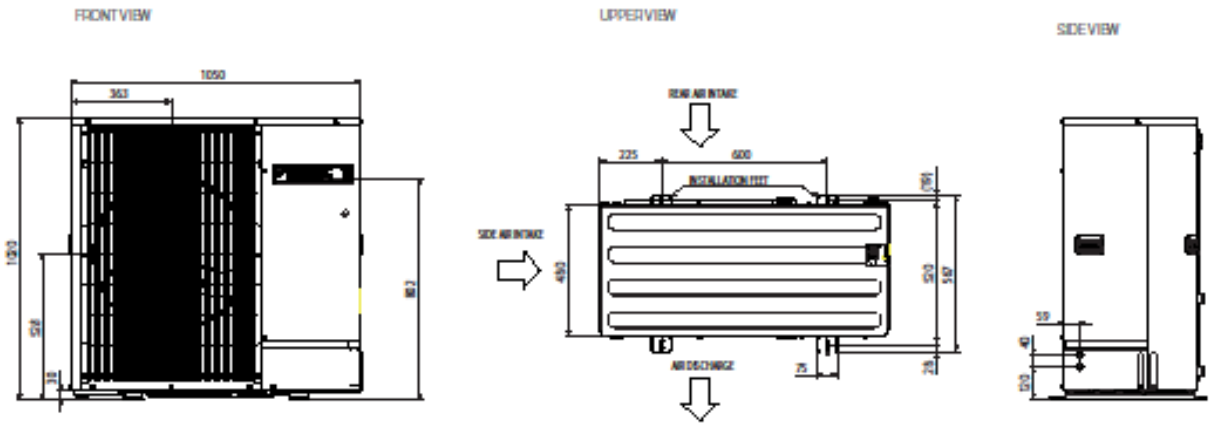
OUTDOOR UNIT		PUZ-WM60VAA(-BS)
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++
	η_s	142%
	SCOP (MCS)	3.57
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A+++
	η_s	190%
	SCOP (MCS)	4.81
HEAT PUMP COMBINATION HEATER - Large Profile*1	ErP Rating	A+
	η_{wh}	145%
HEATING*2 (A-7/W35)	Capacity (kW)	6.0
	Power Input (kW)	1.88
	COP	3.20
OPERATING AMBIENT TEMPERATURE (°C DB)		-20 ~ +35
SOUND DATA*4	Pressure Level at 1m (dBA)	45
	Power Level (dBA)*4	58
WATER DATA	Pipework Size (mm)	22
	Flow Rate (l/min)	17
	Water Pressure Drop (kPa)	8.0
DIMENSIONS (mm)	Width	1050
	Depth	480
	Height	1020
WEIGHT (kg)		98
ELECTRICAL DATA	Electrical Supply	220-240V, 50Hz
	Phase	Single
	Nominal Running Current (MAX) (A)*5	5.68 (13)
	Fuse Rating - MCB Sizes (A)*6	16
REFRIGERANT CHARGE (kg) / CO_2 EQUIVALENT (t)	R32 (GWP 675)	2.2 / 1.49

NOMINAL HEATING CAPACITY



Notes:
*1 Combination with ESPT30X Cylinder
*2 Under normal heating conditions: air outdoor temp: -7°C DB/ -8°C WB, outlet water temp 35°C, Inlet water temp 30°C.
*3 Under normal heating conditions: air outdoor temp: 7°C DB/ 6°C WB, outlet water temp 55°C, Inlet water temp 47°C as tested to BS EN14511.
*4 Sound power level tested to BS EN12102.
*5 Under nominal heating conditions: air outdoor temp: 7°C, outlet water temp: 35°C.
*6 MCB Sizes BS EN60898-2 & BS EN60947-2.
η_s is the seasonal space heating energy efficiency (55/45) η_{wh} is the water heating energy efficiency

PUZ-WM60VAA(-BS) DIMENSIONS



All dimensions (mm)

Telephone: 01707 282880
email: heating@meuk.mee.com
heating.mitsubishielectric.co.uk

@meuk_kx @green_gateway | Mitsubishi Electric Living Environmental Systems UK | Mitsubishi Electric Cooling and Heating UK | mitsubishielectricuk_kx | Mitsubishi Electric Living Environmental Systems UK | thehub.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division, Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England. Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe, Westgate Business Park, Ballymount, Dublin 24, Ireland. Telephone: (01) 419 8800 Fax: (01) 419 8890 International code: (00353)

Note: Refer to 'Installation Manual' and 'Instruction Book' for further 'Technical Information'. The fuse rating is for guidance only and please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/ electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No 626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

Effective as of August 2020

Green Gateway greengateway.mitsubishielectric.co.uk

Appendix F – Glazing, Wall & Roof Specification

SDA
STEVEN DUNN ARCHITECTS

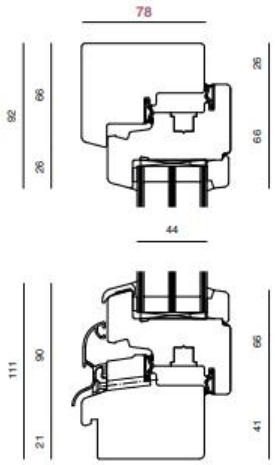
GBS-78

Suited to low energy projects

GBS-78 is an ideal choice for low energy projects, whether simply replacing your windows or specifying for a new home. With FSC® certified timber, low U values and a choice of designs and styles, this range will enhance your project at a competitive price. 78 refers to the depth of the window frame.

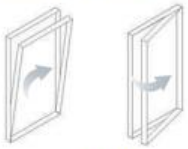
Inward opening

Tilt and turn window options



- **U value: 0.80 W/m²K**
- Triple unit: Argon fill 44mm
- Light transmission value: 73%
- Triple glazed as standard

Opening styles



Tilt & Turn

Outward opening typical maximum sizes: Fixed light: 2500 x 2500 mm, Side hung: 950 x 1520mm, Top hung: 1300 x 1650 mm. For sizes beyond this, please speak to a member of our team

*U values calculated for standard single window 1230 x 1480

Cavity Wall - Near Full Fill

High Street

01/02/2024

U Value

0.13 W/(m²·K)

Layer	Material	Thickness mm	Lambda W/(m·K)	R value m²·K/W
Internal Surface Resistance				0.130
Internal Finish	PLASTER (LIGHTWEIGHT)	13	0.180	0.072
Inner Leaf	AERATED BLOCK (k-value = 0.11 W/mK)	140	0.110	1.273
Mortar Bridging	MORTAR		0.800	0.000
Bridge percentage	7%			
Insulation	KOOLTHERM K106 (Polypropylene fleece (grey facing) to face outward)	115	0.019	6.053
Wall Ties	STAINLESS STEEL WALL TIES		17.000	
	Number of Anchors per m²	3		
	Diameter of Anchors (mm)	3.99 mm		
Residual Airspace	UNV. A/SPACE;	10		0.149
Outer Leaf	BRICKWORK FACING	102.5	0.770	0.133
External Surface Resistance				0.040
		Total Construction Thickness		380.5 mm

Pitched Roof - Insulation at ceiling level (between and over)

Steamer Point Road

01/02/2024

U Value

0.10 W/(m²·K)

Layer	Material	Thickness mm	Lambda W/(m·K)	R value m²·K/W
External Surface Resistance				0.040
Roof Finish	TILES / SLATES & BATTENS	30		0.000
Membrane	KINGSPAN NILVENT BREATHABLE MEMBRANE	0.5		0.000
Loft Space	VENTILATED LOFT SPACE	300		0.200
Insulation Over Joists	KOOLTHERM K107 (INSULATION OVER JOISTS)	100	0.019	5.263
Insulation Between Joists	KOOLTHERM K107 (BETWEEN JOISTS)	100	0.019	5.263
Bridging Joists	TIMBER JOISTS (47mm@400mm)	150	0.130	1.154
Bridge percentage	13%			
Residual Airspace	TIMBER JOIST CAVITY U/V. (47mm@400mm Low-E)	50		0.454
Vapour Barrier	POLYTHENE VAPOUR CONTROL LAYER	0.3		0.001
Plasterboard	PLASTERBOARD	12.5	0.190	0.066