Sustainable Design & Construction Statement

18 – 20 Frognal
Camden
NW3 6AG

NOVEMBER 2014

REPORT REF: SDCS/FROG/201404/11 - AT

Disclaimer

The performances of renewable systems, especially wind and solar, are difficult to predict with any certainty. This is due to the variability of environmental conditions from location to location and from year to year. As such all budget/cost/sizings, which are based upon the best available information, are to be taken as an estimation only and should not be considered as a guarantee. This report relates to pre-planning stage therefore final specification must be provided by an M & E consultant after stage C.

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DOCUMENT CONTROL SHEET

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1. INTRODUCTION

1.1 NRG Consulting has been appointed by Papa Architects Ltd to undertake an Energy Statement on a proposed development in Camden.

1.2 The Floor Areas in this report have been taken from the Floor Plans provided by the Architects for the scheme. The scheme comprises of 13 dwellings.

1.3 This document has been produced to satisfy:

- Policy CS13 of the Camden Core Strategy
- Policy DP22: Promoting Sustainable Design and Construction of the Camden Local Development Framework

2. POLICY FRAMEWORK

2.1 With 13 residential refurbishment units proposed the development falls within the Government's "major" category of planning applications.

REGIONAL POLICIES

2.2 There are no regional policies which apply to an L1b development; therefore, this document will abide by the relevant local policies for the London Borough of Camden.

LOCAL POLICIES

2.6 **London Borough of Camden Core Strategy Policy CS13** states that:

CS13 - Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
b) promoting the efficient use of land and buildings;
c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
   - ensuring developments use less energy,
   - making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
   - generating renewable energy on-site; and
d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

London Borough of Camden Local Development Framework Policy DP22 states that:

Policy DP22 - Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.
d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;
e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;
g) limiting run-off;
h) reducing water consumption;
i) reducing air pollution; and
j) not locating vulnerable uses in basements in flood-prone areas.

The referenced paragraph 22.5 states that:

22.5 When a building is constructed, the accessibility of its location; its density and mix of uses; its detailed design taking into account the orientation of the site; and the mechanical services and materials chosen can all have a major impact on its energy efficiency. The Council will require all schemes to consider these general sustainable development principles, along with the detailed elements identified in the table below, from the start of the design process. Developments of 5 or more dwellings or 500sqm of any floorspace should address sustainable development principles in their Design

and Access statements or in a separate Energy Efficiency Statement, including how these principles have contributed to reductions in carbon dioxide emissions. When justifying the chosen design with regards to sustainability the following appropriate points must be considered:

Design	**Fabric/ Services**
• the layout of uses • floorplates size/depth • floor to ceiling heights • location, size and depth of windows • limiting excessive solar gain • reducing the need for artificial lighting • shading methods, both on or around the building • optimising natural ventilation • design for and inclusion of renewable energy technology • impact on existing renewable and low carbon technologies in the area • sustainable urban drainage, including provision of a green or brown roof • adequate storage space for recyclable material, composting where possible • bicycle storage • measures to adapt to climate change (see below) • impact on microclimate	• level of insulation • choice of materials, including - responsible sourcing, re-use and recycled content • air tightness • efficient heating, cooling and lighting systems • effective building management system • the source of energy used • metering • counteracting the heat expelled from plant equipment • enhancement of / provision for biodiversity • efficient water use • re-use of water • educational elements, for example visible meters • on-going management and review

Therefore, this document will demonstrate how the development is designed and constructed in a sustainable way. A BREEAM Domestic Refurbishment pre-Assessment has also been undertaken and can be found in Appendix 3.

The Domestic Refurbishment Pre-Assessment contains the following minimum credit allowances in line with Development Policy DP22:

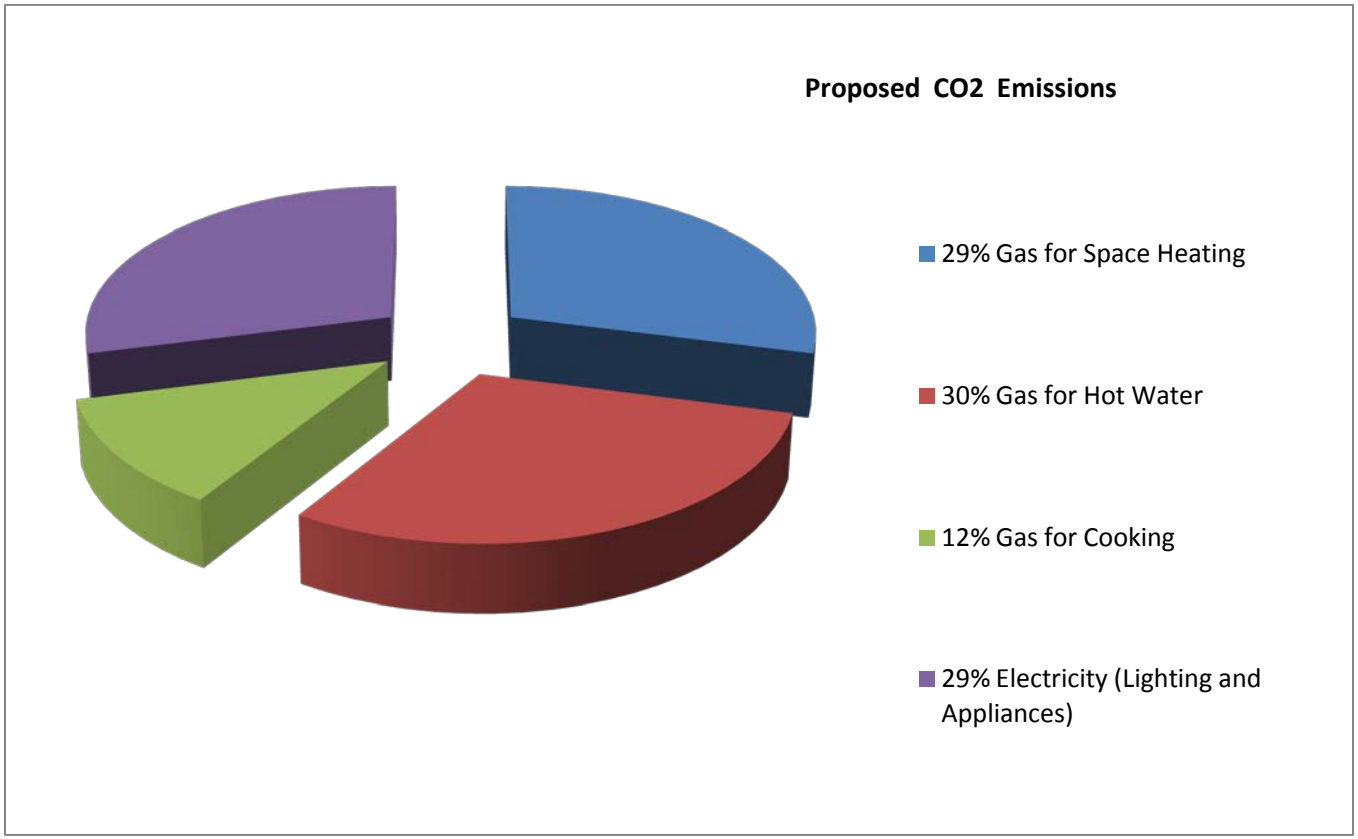
You are strongly encouraged to meet the following standards in accordance with Development Policy DP22 - *Promoting sustainable design and construction*:

Time period	**Minimum rating**	**Minimum standard for categories (% of un-weighted credits)**
2010-2012	'very good'	Energy 60% Water 60% Materials 40%
2013+	'excellent'	

3. PREDICTED ANNUAL CARBON DIOXIDE EMISSIONS

3.1 SAP calculations have been carried out on 2 refurbishment dwellings using the NHER Plan Assessor Version 6.0.1 (SAP v9.92) to gain the regulated emissions for the site. A licensed and OCDEA accredited SAP Assessor has carried out the calculations.

3.2 Typical CO_2 emissions for housing developments is broken down as follows



3.3 A table can be found in the Appendices which:

- Sets out the floor area of the dwellings,

- Shows the CO2 emissions of the building as it exists now before any works have taken place,

- Shows the Dwelling Emission Rate (DER) in terms of kg/m^2/year Pre- and Post-Development.

- Highlights the percentage difference between the DER Pre- and Post-Development.

- Displays the CO_2 saved through the proposed use of sustainability measures.

3.4.2 The Pre-Development Construction Details of the Site are as follows:

Elements	U Value	Further Information / Comment
Basement Floor	0.45 w/m2/k	No insulation
External Walls and basement walls	2.1 w/m2/k	Brick wall without insulation
Sheltered Walls	1.27 w/m2/k	No Insulation
Party Walls Between Dwellings	0 w/m2/k	
Roof	0.53 w/m2/k	
Roof (Basement floor: entrance above)	0.25 w/m2/k	
Windows	4.8 w/m2/k	Single Glazing
Doors	1.4 w/m2/k	SAP default
Air Permeability	N / A	Refurbishment project
Ventilation	System 1	Natural ventilation with intermittent extract fans
Heating	Community Gas Boiler	Mains Gas - 75% efficient
Controls	Flat rate charging, programmer and TRVs	Assumed
Emitters	Radiators	Assumed
Thermal Bridging	N / A	Refurbishment project
Low Energy Lighting	N / A	Standard Bulbs

3.4.2 Based upon the figures as set out in the Appendices, with a total gross internal floor area of **904m²** and the Pre-Development Construction Details in the table above**,** the development has a production of **75.9 tonnes CO_2/year** as it currently exists before any works have taken place based on SAP Appendix S.

3.4.3

	CO_2 Emissions - (Tonnes per Annum)
	Regulated
Pre-Development Dwelling Emissions Rate	**75.9**
Proposed Development Dwelling Emissions Rate	

4. ENERGY EFFICIENT DESIGN MEASURES

4.1 Proposed Construction Details have been selected to ensure that all fabric U-values exceed the requirements of Part L of the Building Regulations (2013). The proposed construction details for the refurbishment dwellings are as follows:

Elements	U Value	Further Information / Comment
Basement Floor	0.25 w/m2/k	Upgraded to comply with Part L 2013
External Walls and basement walls	0.30 w/m2/k	Upgraded to comply with Part L 2013
Sheltered Walls	1.27 w/m2/k	No Insulation
Party Walls Between Dwellings	0 w/m2/k	
Roof	0.16 w/m2/k	
Roof (Basement floor: entrance above)	0.25 w/m2/k	
Windows	1.6 w/m2/k	To comply with Part L
Doors	1.4 w/m2/k	SAP default
Air Permeability	N / A	Refurbishment project
Ventilation	System 1	Natural ventilation with intermittent extract fans
Heating	Gas Boiler	Individual Combi Boilers – Mains Gas - 88% SEDBUK 2009 efficiency
Controls	Programmer, room thermostat and TRVs	Assumed
Emitters	Radiators	Assumed
Thermal Bridging	N / A	Refurbishment project
Low Energy Lighting	75%	Low Energy **Bulbs** with a minimum luminous efficacy of greater than 45 lumens per circuit watt required.

4.3 The U-Values of all glazed elements will meet Building Regulations standards, and incorporate low emissivity coating, resulting in an efficient balance between passive solar gain and the thermal losses from each room.

Daylight levels are high throughout and are supplemented with low energy light bulbs. The orientation of the building reduces peak solar gain while ensuring optimum levels of daylight both morning and evening.

4.4 When taking into account proposed Construction Details and U Values the development has emissions of **27.3 tonnes CO_2/year**; a **64.07%** decrease in CO_2 emissions over the Pre-Development Dwelling Emission Rate.

	CO_2 Emissions - (Tonnes per Annum)
	Regulated
Pre-Development Dwelling Emissions Rate	**75.9**
Proposed Development Dwelling Emissions Rate	**27.3**

This is a *significant* decrease in carbon emissions. In addition this is before the imposition of the renewable technology outlined below.

4.5 As per the Camden Planning Guidance (2013) sustainability checklist for retrofitting measures, the following table lays out the projected improvements in more detail:

Measure	Specification	Estimated Cost of Measure
Overhauling/upgrading windows	As per emailed PDF's (Marin)	£5000 per/plot
New boiler	Vaillant Combi boilers to each flat	£3000 per plot
LED lighting	Low voltage downlights/MR16 lamp type	£550 per plot
Meters, timers, sensors, controls on heating or lighting	Bathroom lights controlled by PIR	£500 per plot
Mechanical ventilation	Mech extract ventilation to meet Part F	£800 per plot
Hot water tank & pipes insulation	25mm Armstrong Armaflex BS5422	£100 per plot
Roof insulation	Celotex GA4000 + Celotex FR 5000	£2000 per top floor plot
External wall insulaton	Gyplyner Universal with Kingspan Kooltherm 72.5mm	£3000 per plot
Solar PV Panels	27 x 327watt Panels	£2800 per kWp
Off-setting contribution £3000	If required	

Please see Appendix 4 for the Window specification and Appendix 5 for a sample PV Panel Datasheet and Roof Drawing showing 27 Panels on the Roof.

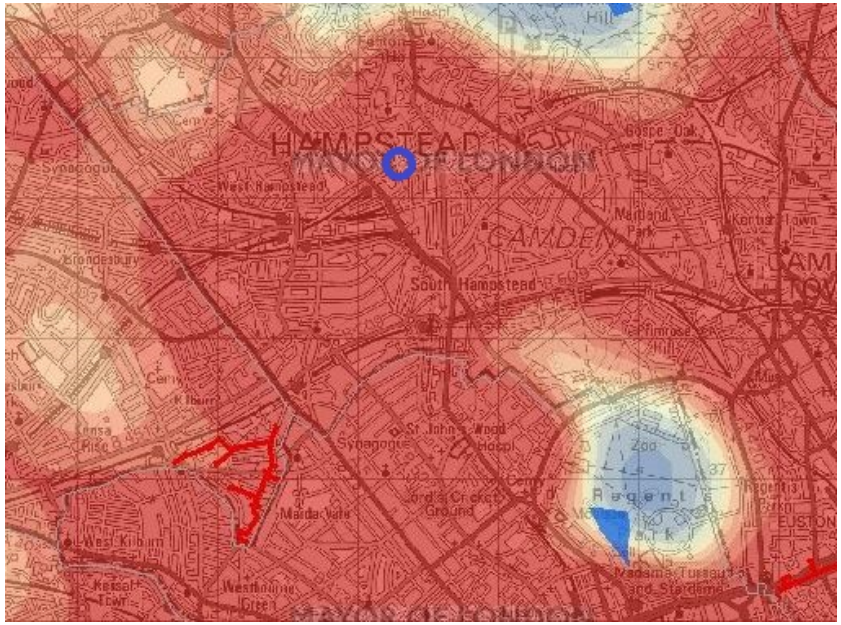
The estimated value of sustainability measures on this development based on the above figures is £200,050, over 10% of the total estimated value of the project which is £2million. Please see Appendix 6 for confirmation of projected value.

5. FEASIBILITY OF RENEWABLE ENERGY

Decentralised Energy

5.1.1 To the knowledge of the authors, there are no existing large scale CCHP/CHP distribution networks to connect into for the development.

5.1.2 The London Heat Map has been consulted and no viable local connections are available. The BLUE circle in the centre of the Picture is the Site. The Map picture is:



The red line is a planned District heating Network which does not exist yet. When completed it will still not be a viable option as this scheme comprises of a small number of individually heated units and it is a significant distance away.

Communal Heat and Power

5.2 A CHP is not a feasible technology for the development due to the number of units as per the latest GLA Guidance (April 2014):

"By way of general guidance, it is not expected that small purely residential developments (for example, less than 300 dwellings) include on-site CHP. Due to the small landlord electricity supplies, CHP installed to meet the base heat load would require the export of electricity to the grid. It is recognised that the administrative burden of managing CH electricity sales at this small scale, where energy services companies (EXCOs) are generally not active, is too great for operators of residential developments to bear. If CHP is installed but does not operate because arrangements for CHP electricity sales are not concluded, the projected CO2 savings will not materialise."

5.3 Therefore it has been proposed that the scheme reverts to high efficiency Gas boilers. These systems will be complemented with modern controls to reduce the bills of the tenants to the lowest possible level.

5.4 The potential renewable energy applicable to this development is:

- Solar PV
- Solar Hot Water
- Ground Source Heat Pump
- Air Source Heat Pump
- Biomass Boilers

The feasibility of these items is investigated below:

5.5 Photovoltaic Panels

Advantages	Disadvantages	Overall Feasibility
Can have significant impact on carbon by offsetting electricity which has a high carbon footprint. Low maintenance No noise issues associated with PV No additional land use from the installation of PV panels	High capital investment required Needs unobstructed space on roof	The development incorporates a pitched roof which is perfectly suited to PV. PV would be feasible as it can contribute to meet the on-site electrical demand and any unused electricity can be sent back to the grid.

5.6 Solar Thermal Collectors

Advantages	Disadvantages	Feasibility
No noise issues associated with Solar thermal collectors No additional land use from the installation of solar thermal collectors Low maintenance and easy to manage Low capital cost	The hot water cylinder will need to be larger than a traditional cylinder. Consideration will need to be given to the space required especially as combination boilers are planned. Needs unobstructed space on roof.	Solar thermal collectors are feasible for the development, however Photovoltaic Panels are cheaper and easier to install and have a higher CO2 reduction. Solar thermal collectors have therefore not been investigated further.

5.7 Biomass Heating

Advantages	Disadvantages	Feasibility
Potential to reduce large component of the total CO_2 A biomass boiler would replace a standard gas heating system so some of the cost may be offset through money saved on a traditional boiler.	Regular maintenance will be required Reliability of fuel may become a problem, therefore limited cost saving for residents A plant room and fuel store will be required which may take additional land from the proposed development or surroundings The fuel will need to be delivered, which can cause issues with access etc. Biomass is often not a favoured technology in new development due to the potential local impacts of NOx emissions and delivery vehicles.	This is a small tight site in an urban area. Biomass is not considered feasible for such a development due to the need for space to accommodate fuel storages, access for delivery vehicles and local NO_x emissions.

5.8 Ground Source Heat Pumps

Advantages	Disadvantages	Feasibility
Low maintenance and easy to manage Optimum efficiency with under- floor heating systems As heat pumps would replace standard heating systems, some of the cost may offset through money saved on a traditional boiler.	The heat pump has a noise level around 45-60dB so some attenuation may be required and it should be sensibly located Relatively high capital cost Requires electricity to run the pump, therefore limited carbon savings in most cases For communal systems plant room required which may take additional land from the proposed development/surroundings High payback.	Limited Space on site and large communal infrastructure needed would remove and reduce amenity space. For this reason, GSHP has not been investigated further.

5.9 Air Source Heat Pumps

Advantages	Disadvantages	Feasibility
ASHP systems are generally cheaper than ground source as there is no requirement for long lengths of buried piping. Low maintenance and easy to manage Optimum efficiency with under- floor heating systems As heat pumps would replace standard heating systems, some of the cost may offset through money saved on a traditional boiler.	The heat pump has a noise level around 50-60dB so some attenuation may be required and it should be sensibly located. The potential noise from the external unit may mean there is local opposition to their installation. Requires electricity to run the pump, therefore limited carbon savings in most cases For communal systems plant room required which may take additional land from the proposed development/surroundings Potential noise issues	With the cost of electricity increasing, the payback of ASHPs may be too great

6. WATER EFFICIENCY & RECYCLING

6.1 This development will meet and exceed a water efficiency target of 105 ltrs/person/day in line with Part G of the Building Regulations:

	House Type:	Type 1	
	Description:	18-20 Frognal	
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual	
WC	Full flush	6	8.76
	Part flush volume	4	11.84
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	6	11.06
Are both a Bath & Shower		Bath & Shower	
Bath	Capacity to overflow	156	17.16
Shower	Flow rate (litres / minute)	7	30.59
Kitchen sink taps	Flow rate (litres / minute)	8	13.88
Has a washing machine been specified?		No	
Washing Machine	Litres / kg		17.16
Has a dishwasher been		No	
Dishwasher	Litres / place setting		4.50
Has a waste disposal unit been specified?		No	0.00
Water Softener	Litres / person / day		0.00
	Calculated Use		114.9
	Normalisation factor		0.91
Code for Sustainable Homes	Total Consumption		104.6
	Mandatory level		Level 3/4
Building Regulations 17.K	External use		5.0
	Total Consumption		109.6
	17.K Compliance?		Yes

For full Part G compliance document visit here: www.planningportal.gov.uk/uploads/br/**water_efficiency_calculator**.pdf

a. WCs

i. Flushing capacity for the WC suite including consumption at full and part flush for dual flush WCs.

b. Taps

i. Flow rate of each tap, at full flow rate in litres per minute measured at a dynamic pressure of 3±0.2 bar (0.3±0.02 MPa) for high pressure (Type 1) taps, or at a dynamic pressure of 0.1±0.02 bar (0.01±0.002 MPa) for low pressure (Type 2) taps (BS EN 200:2008)

ii. For 'click taps' and other taps with a 'water break', the manufacturer's stated full flow rate should be used to perform calculations (measured as described above). Do not use the flow rate at the break point. A factor for percentage of flow rate is already assumed within the use factor for taps.

iii. Taps on baths should not be included in the calculation as the water consumption from bath taps is taken account of in the use factor for baths.

c. Baths

i. Total capacity of the bath to overflow, in litres (excluding displacement, this is already included in the use factor for baths).

d. Showers

i. Flow rate of each shower at the outlet using cold water ($T \leq 30^{\circ}$ C), in litres per minute measured at a dynamic pressure of 3±0.2 bar (0.3±0.02 MPa) or high pressure (Type 1) supply systems, or at a dynamic pressure of 0.1±0.05 bar (0.01±0.005 MPa) for low pressure (Type 2) supply systems (BS EN 1112:2008)

e Dishwashers

i. Litres per place setting derived from the figures quoted on the EU Energy Label.

ii. Where no dishwasher is to be provided and therefore consumption figures are unknown, a figure of 1.25 litres per place setting must be assumed.

f. Washing machines

i. Litres per kilogram of dry load derived from the figure quoted on the EU Energy Label.

ii. Where no washing machine is to be provided and therefore consumption figures are unknown, a figure of 8.17 litres per kilogram must be assumed.

6.2 Rainwater Harvesting has been considered but is not a practical measure due to the tight, urban Site which does not offer sufficient space to install the required systems.

7. BIODIVERSITY & ADAPTION TO CLIMATE CHANGE

7.1 The development is a refurbishment of a pre-existing property (a Hotel). There are no features of ecological value which would need protecting during construction beyond the Garden space which is being retained:

7.2 Efforts can be made to improve the ecological value of the development through the installation of bird or bat boxes on the finished dwelling and the planting of bee friendly flowers where possible.

7.3 The development as a whole will have a neutral impact on the ecological value of the Site.

7.4 As a further consequence of the development being a refurbishment rather than a new build, the existing surface water run-off levels will not be increased as the footprint of the building is not changing. As with the Ecology considerations, the position of the Site, and the fact that the footprint of the existing building is not changing, means that the run-off levels cannot actually be reduced through soft landscaping, a green roof, or more permeable paving.

Appendix 1

Carbon Emissions - 18 - 20 Frognal

1	2	3		4	5	6
PLOT	AREA	Existing Development		Building Reg	DER (After Passive Measures)	Total
		Emissions		Baseline		$kg/CO_2/yr$
		(based on SAP Appendix S)		Emissions		Regulated Only
		$kg/CO_2/m2/yr$		$kg/CO_2/yr$	$kg/CO_2/m2/yr$	
1	74.00	82.46		6,102	29.92	2,214
10	48.75	86.32		4,208	30.57	1,490
Total	122.75	83.99		10,310		3,704
				1m2 TER		1m2 DER
				83.99		***30.18***
Total Site (m2)	904		TOTAL DER PRE-DEVELOPMENT	75,930	TOTAL DER POST-DEVELOPMENT	27,281

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Appendix 2

Data Input Report
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Rothon	Assessor number	4282
Client		Last modified	25/09/2014
Address	Flat 1 Frognal, London, NW3		

Dwelling

Development:		House type:	
Property type:	Flat		
Flat type:	Ground floor	Year built:	1890
Tariff:	Standard	Assess summer overheating:	Yes
Thermal mass:	High	Thermal mass parameter:	450.00
Separated heated conservatory:	No	Degree day region:	Thames
Sheltered sides:	3	Terrain:	Dense Urban

Storeys:

Name	Area (m²)	Height (m)
Lowest occupied	74.00	2.40

Floors

Ref - Name	Type	Construction	Storey Location	Living Area (m²)	Area (m²)	U-value (W/m²K)
Floor 1 - basement floor	Basement	Solid	Lowest occupied	27.50	74.00	0.45

Living area that has no heat loss: 0.00

Walls

Ref - Name	Type	Construction	Gross Area (m²)	U-value (W/m²K)
Wall 1 - basement wall	Basement	Brick	6.24	2.10
Wall 2 - external	External	Brick	38.64	2.10
Wall 3 - party	Party	Solid	41.05	0.00
Wall 4 - sheltered wall	Sheltered	Brick	19.56	1.27

Roofs

Ref - Name	Construction	Gross Area (m²)	U-value (W/m²K)
Roof 1 - entrance above	Flat	6.40	0.25

Openings

Opening Ref: 1 Door to corridor, N/A, ' N/A', master: No, linked to: 0

Location:	Wall 4	Source:	From Manufacturer	Orientation:	South East
Overshading:	N/A	Width (m):	0.90	Height (m):	2.10
Frame:	Wood	Transmittance factor:	N/A	U-value (W/m²K):	1.40

Opening Ref: 2 Window, Single glazed, ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.85	U-value (W/m²K):	4.80

Opening Ref: 3 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	1.20	Height (m):	2.50
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 4 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	East
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 5 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	0.93	Height (m):	1.25
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 6 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	West
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 7 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	South West
Overshading:	Average / Unknown	Width (m):	1.20	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 8 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	South
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 9 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North West
Overshading:	Average / Unknown	Width (m):	0.50	Height (m):	1.40
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 10 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North West
Overshading:	Average / Unknown	Width (m):	0.90	Height (m):	2.10
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Thermal Bridging

Thermal bridge specification:	Default y value	y-value:	0.15

Ventilation

Air permeability entered:	No	Draught lobby:	N/A

Number of...	Open fireplaces	Open flues	Flueless gas fires	Extract fans	Passive vents
	0	0	0	2	0

Mechanical ventilation: Not present (natural)

Space heating

Main heating category:	Community scheme		
Secondary heating:	No	Open flue or chimney:	N/A
Unconnected gas point:	N/A	Smoke control area:	N/A

Heat source: Mains gas - Boilers

Fraction of heat:	1.00	Efficiency (%):	80.00

Community system:

User entered distribution loss factor:	No
Heat distribution system:	Unknown
Controls:	Flat rate charging, programmer and TRVs
Emitter:	Radiators

Water heating

Type:	From main	Cylinder in dwelling:	No

Renewables

No renewables present

Other

Internal lighting

Standard fittings:	6	Low energy fittings:	0	Total fittings:	6

Summer overheating

Thermal mass parameter (TMP):	450.00		
User defined air change rate:	No	Air change rate (ach):	N/A
Cross ventilation on most floors:	Yes	Window ventilation:	Fully open
Source of user defined values:	N/A		
Curtains closed in daylight hours:	No	Fraction curtains closed:	N/A
Blind/curtain type:	N/A		

Special features (Appendix Q)

No Appendix Q special features present

Cooling details

No space cooling present

L1A 2013 - Regulations Compliance Report
Design - Draft

This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix A of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Mr Neil Rothon	Assessor number	4282
Client		Last modified	25/09/2014
Address	Flat 1 Frognal, London, NW3		

Check	Evidence	Produced by	OK?
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target			
TER (kg $CO_2/m^2.a$)	Fuel = N/A Fuel factor = 1.00 TER = 17.70	Authorised SAP Assessor	
DER for dwelling as designed (kg $CO_2/m^2.a$)	DER = 74.89	Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 74.89 > TER 17.70 Excess emissions = 57.19 kg/m² (323.11%)	Authorised SAP Assessor	Failed
Is the fabric energy efficiency of the dwellling as designed less than or equal to the target?	DFEE 140.89 > TFEE 48.47 Variance = 92.42 kWh/m² (190.67%)	Authorised SAP Assessor	Failed
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits			
Fabric U-values			
Are all U-values better than the design limits in Table 2?	**Element** — **Weighted average** — **Highest** Wall — 1.80 (max 0.30) — 2.10 (max 0.70) Party wall — 0.00 (max 0.20) — N/A Floor — 0.45 (max 0.25) — 0.45 (max 0.70) Roof — 0.25 (max 0.20) — 0.25 (max 0.35) Openings — 1.80 (max 2.00) — 4.80 (max 3.30)	Authorised SAP Assessor	Failed
Thermal bridging			
How has the loss from thermal bridges been calculated?	Thermal bridging calculated using default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems			
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Community heating scheme Secondary heating system: None	Authorised SAP Assessor	N/A
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	No hot water cylinder in the dwelling	Authorised SAP Assessor	
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Flat rate charging, programmer and TRVs No hot water cylinder in the dwelling	Authorised SAP Assessor	Passed
Fixed internal lighting			

Check	Evidence	Produced by	OK?
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 6 Low energy lights = 0 Percentage of low energy lights = 0% Minimum = 75 %	Authorised SAP Assessor	Failed
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 450.00 Ventilation rate in hot weather = 6.00 ach Blinds/curtains = None	Authorised SAP Assessor	Passed
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability ($m^3/(h.m^2)$ at 50Pa)	No air permeability rate entered	Authorised SAP Assessor	
Mechanical ventilation system Specific fan power (SFP)	Not applicable	Authorised SAP Assessor	
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than $0.15W/m^2K$: • party (0.00)	Authorised SAP Assessor	

Data Input Report
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Neil Rothon	Assessor number	4282
Client		Last modified	25/09/2014
Address	Flat 1 Frognal, London, NW3		

Dwelling

Development:		House type:	
Property type:	Flat		
Flat type:	Ground floor	Year built:	1890
Tariff:	Standard	Assess summer overheating:	Yes
Thermal mass:	High	Thermal mass parameter:	450.00
Separated heated conservatory:	No	Degree day region:	Thames
Sheltered sides:	3	Terrain:	Dense Urban

Storeys:

Name	Area (m²)	Height (m)
Lowest occupied	74.00	2.40

Floors

Ref - Name	Type	Construction	Storey Location	Living Area (m²)	Area (m²)	U-value (W/m²K)
Floor 1 - basement floor	Basement	Solid	Lowest occupied	27.50	74.00	0.25

Living area that has no heat loss: 0.00

Walls

Ref - Name	Type	Construction	Gross Area (m²)	U-value (W/m²K)
Wall 1 - basement wall	Basement	Brick	6.24	0.30
Wall 2 - external	External	Brick	38.64	0.30
Wall 3 - party	Party	Solid	41.05	0.00
Wall 4 - sheltered wall	Sheltered	Brick	19.56	1.27

Roofs

Ref - Name	Construction	Gross Area (m²)	U-value (W/m²K)
Roof 1 - entrance above	Flat	6.40	0.25

Openings

Opening Ref: 1 Door to corridor, N/A, ' N/A', master: No, linked to: 0

Location:	Wall 4	Source:	From Manufacturer	Orientation:	South East
Overshading:	N/A	Width (m):	0.90	Height (m):	2.10
Frame:	Wood	Transmittance factor:	N/A	U-value (W/m²K):	1.40

Opening Ref: 2 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 3 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	1.20	Height (m):	2.50
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 4 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	East
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 5 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North East
Overshading:	Average / Unknown	Width (m):	0.93	Height (m):	1.25
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 6 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	West
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 7 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	South West
Overshading:	Average / Unknown	Width (m):	1.20	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 8 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	South
Overshading:	Average / Unknown	Width (m):	0.55	Height (m):	2.00
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 9 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North West
Overshading:	Average / Unknown	Width (m):	0.50	Height (m):	1.40
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Opening Ref: 10 Window, Double glazed (low-E), ' N/A', master: No, linked to: 0

Location:	Wall 2	Source:	From Manufacturer	Orientation:	North West
Overshading:	Average / Unknown	Width (m):	0.90	Height (m):	2.10
Frame:	Wood	Transmittance factor:	0.63	U-value (W/m²K):	1.60

Thermal Bridging

Thermal bridge specification:	Default y value	y-value:	0.15

Ventilation

Air permeability entered:	No	Draught lobby:	N/A

Number of...	Open fireplaces	Open flues	Flueless gas fires	Extract fans	Passive vents
	0	0	0	2	0

Mechanical ventilation: Not present (natural)

Space heating

Main heating category:	Individual system/s	Number of systems:	1
Secondary heating:	No	Open flue or chimney:	No
Unconnected gas point:	N/A	Smoke control area:	Not Known
Type:	Boiler	Efficiency source:	2009 winter summer SEDBUK
Product index:	N/A		
Product details:	N/A N/A N/A		
Boiler type:	N/A	Fuel:	Mains gas
Condensing:	Yes	Flue type:	Balanced
Fan assisted flue:	Yes		
Combi type:	Instantaneous	Uses electricity:	N/A
Keep hot power rating:	N/A		
System:	Condensing combi with automatic ignition (1998 or later)		
Controls:	Programmer, room thermostat and TRVs		
Interlock:	Yes	Delayed start thermostat:	No
Compensation:	None	Burner control:	Modulating
Emitter:	Radiators	Pump in heated space:	Yes

Flow Temp:	Unknown		
Installed 2013 or later:	Yes		
Efficiency Type:	2009 SEDBUK	Efficiency (%):	88.00
Manufacturer efficiency description:	a		
FGHRS:	No		

Water heating

Type:	From main	Fuel:	Mains gas
Water separately timed:	N/A	Water use ≤125 litres/person/day:	Yes
Heat pump uses immersion:	N/A	Summer immersion:	N/A
Thermal store type:	N/A		

Store details:

Cylinder volume (litres):	N/A		
Thermostat:	N/A	In heated space:	N/A
Primary pipework insulated:	N/A		

WWHRS:

WWHRS:	N/A

Renewables

No renewables present

Other

Internal lighting

Standard fittings:	1	Low energy fittings:	5	Total fittings:	6

Summer overheating

Thermal mass parameter (TMP):	450.00		
User defined air change rate:	No	Air change rate (ach):	N/A
Cross ventilation on most floors:	Yes	Window ventilation:	Fully open half the time
Source of user defined values:	N/A		
Curtains closed in daylight hours:	No	Fraction curtains closed:	N/A
Blind/curtain type:	N/A		

Special features (Appendix Q)

No Appendix Q special features present

Cooling details

No space cooling present

L1A 2013 - Regulations Compliance Report
Design - Draft

This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix A of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Mr Neil Rothon	Assessor number	4282
Client		Last modified	25/09/2014
Address	Flat 1 Frognal, London, NW3		

Check	Evidence	Produced by	OK?
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target			
TER (kg $CO_2/m^2.a$)	Fuel = N/A Fuel factor = 1.00 TER = 18.08	Authorised SAP Assessor	
DER for dwelling as designed (kg $CO_2/m^2.a$)	DER = 29.92	Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 29.92 > TER 18.08 Excess emissions = 11.84 kg/m² (65.49%)	Authorised SAP Assessor	Failed
Is the fabric energy efficiency of the dwellling as designed less than or equal to the target?	DFEE 86.59 > TFEE 48.46 Variance = 38.13 kWh/m² (78.68%)	Authorised SAP Assessor	Failed
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits			
Fabric U-values			
Are all U-values better than the design limits in Table 2?	**Element** / **Weighted average** / **Highest** Wall: 0.65 (max 0.30) / 1.27 (max 0.70) Party wall: 0.00 (max 0.20) / N/A Floor: 0.25 (max 0.25) / 0.25 (max 0.70) Roof: 0.25 (max 0.20) / 0.25 (max 0.35) Openings: 1.58 (max 2.00) / 1.60 (max 3.30)	Authorised SAP Assessor	Failed
Thermal bridging			
How has the loss from thermal bridges been calculated?	Thermal bridging calculated using default y-value of 0.15	Authorised SAP Assessor	
Heating and hot water systems			
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Main heating system: Mains gas, Combi boiler a Data from manufacturer Efficiency = 88.00% 2009 SEDBUK Minimum = 88.00% Secondary heating system: None	Authorised SAP Assessor	Passed
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	No hot water cylinder	Authorised SAP Assessor	
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Programmer, room thermostat and TRVs Hot water control: No hot water cylinder Boiler interlock (main system 1)	Authorised SAP Assessor	Passed

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 1 Low energy lights = 5 Percentage of low energy lights = 83% Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Slight Overheating risk (August) = Slight Region = Thames Thermal mass parameter = 450.00 Ventilation rate in hot weather = 3.00 ach Blinds/curtains = None	Authorised SAP Assessor	Passed
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability ($m^3/(h.m^2)$ at 50Pa)	No air permeability rate entered	Authorised SAP Assessor	
Mechanical ventilation system Specific fan power (SFP)	Not applicable	Authorised SAP Assessor	
Have the key features of the design been included (or bettered) in practice?	The following walls/wall have a U-value less than 0.15W/m^2K: • party (0.00)	Authorised SAP Assessor	

Appendix 3

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Section		Credits Awarded	*Out of*	Evidence to be provided
MAN 1	HOME USER GUIDE	**3**	*3*	To all dwellings a simple guide that covers information relevant to the 'non-technical' occupant on the operation and environmental performance of the dwelling as well as information on the Site and Surrounding Area will be supplied. Full content requirement of the Home User Guide can be found here.
MAN 2	RESPONSIBLE CONSTRUCTION PRACTICES	**2**	2	The Considerate Constructors Scheme (2013) is to be followed and a Beyond Best Practice score is to be achieved. This requires a score of at least 7 in each section and at least 35 points overall.

MAN 3	CONSTRUCTION SITE IMPACTS	**1**	1	The project is a large scale project so 4 items from Checklist A-4 need to be followed. The 4 items most suited to this job are: a. The Site Water usage is to be recorded. b. An Environmental Materials Policy is required from Developer (Air & Water) c. COC Certificates for all Site Timber need to be provided. d. Contractor to be ISO14001 Compliant.
MAN 4	SECURITY	**1**	*2*	The existing doors and windows are to be replaced as part of the refurbishment and will meet the following standards to achieve 1 Credit: - Doors – PAS-24 - Windows – BS7950 It is unknown at this time whether the requirements of Secure by Design section 2 are to be complied with and the recommendations of the Secure by Design Officer are to be incorporated into the development; therefore, the second Credit has not been awarded at this stage.
MAN 5	PROTECTION OF ECOLOGICAL FEATURES	**1**	*1*	A Site Survery is to be carried out to ensure that all Ecological Features present on Site are to be protected during the construction process. Therefore, 1 credit can be awarded in this section.

MAN 6	PROJECT MANAGEMENT	**2**	*2*	The Developer is to write a project implementation plan. This needs to contain: An initiation meeting to assign individual and shared responsibilities amongst the project team including all trades on site. It is the joint responsibility of the whole project team, to ensure the production and/or completion of the outlined tasks: a) End user requirements and building usage b) Design aims. c) Particular installation and construction requirements. d) Usability and manageability of design solutions for the installer and end user of the building. e) Project team communication methods. f) Supply chains. g) Documents as required in schedule of evidence sections An **Innovation Credit** has also been awarded for employing a BREEAM Domestic Assessor at an early stage, prior to the production of a refurbishment specification
HEA 1	DAYLIGHTING	**1**	*2*	A preliminary inspection shows that the development should result in a neutral impact on the dwellings daylight levels in the Kitchen, Living Room, Dining Room and Study, meaning that 1 Credit can be taken in this section. The second Credit has been withheld for now until full Daylight Calculations are completed at Design Stage.

HEA 2	SOUND INSULATION	**2**	*4*	2 Credits have been awarded based on Part E Compliance improvement over Part E to be confirmed by Pre-Completion Sound Testing.
HEA 3	VOLATILE ORGANIC COMPOUNDS	**0**	*1*	Credit not currently sought due to the complicated nature of achieving this Credit. Can be sought at a later date if extra Credits become necessary. If the Client wishes to achieve this Credit, then the standards contained in Table 15 must be met.
HEA 4	INCLUSIVE DESIGN	**1**	*2*	1 Credit has been assumed in this section based on the current Drawings. **All sections of Checklist A-8 are to be completed as far as possible to confirm this.**

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HEA 5	VENTILATION	**1**	*2*	For 1 Credit, the ventilation must comply with the following standards: - **Background** – all habitable rooms – Section 7, Building Regulations Approved Document Part F (2010) - **Extract** – all wet rooms – Section 5, Building Regulations Approved Document Part F (2010) - **Purge** – all habitable rooms & wet rooms - Section 7, Building Regulations Approved Document Part F (2010) **These are mandatory BREEAM Domestic Refurbishment standards.** The second Credit has not been awarded as only Part F requirements are being met and no MVHR is being installed to the development.
HEA 6	SAFETY	**1**	*1*	Written confirmation that a fire detection and alarm systems will be installed be in accordance with BS 5839–6:2004 and to at least a Grade D Category LD3 standard. Furthermore, a Carbon Monoxide detector and alarm system will be installed in accordance with and positioned in accordance to BS EN 50291–1:2001 and BS EN 50292:2002 and should carry a British or European approval mark. **These are mandatory Building Regulations standards.**

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ENE 1	IMPROVEMENT IN ENERGY EFFICIENCY RATING	**3**	*6*	An improvement to the dwelling's Energy Efficiency Rating of at least 26 is to be achieved based on sample SAP Calculations. This achieves 3 Credits. **Full SAP Calculations to confirm this score at Design Stage**
ENE 2	ENERGY EFFICIENCY RATING POST-REFURBISHMENT	**2.5**	*4*	The minimum average Energy Efficiency Rating of the development is to be 70 post-refurbishment based on sample SAP Calculations. This is to meet the minimum standards for an 'Excellent' rating, scoring 2.5 Credits. **Full SAP Calculations to confirm this score at Design Stage**
ENE 3	PRIMARY ENERGY DEMAND	**4**	*7*	The primary energy demand post-refurbishment is to be a minimum of 240 kWh/m^2/year based on sample SAP Calculations for a score of 4 Credits. **Full SAP Calculations to confirm this score at Design Stage**
ENE 4	RENEWABLE TECHNOLOGIES	**1**	*2*	1 credit has been awarded under the assumption that at least 10% of the annual energy demand of each dwelling will be offset by renewable energy. The pitched Roof Post-Refurbishment is well suited to PV Panels. **Full SAP Calculations to confirm this score at Design Stage**

NRG CONSULTING

ENE 5	ENERGY LABELLED WHITE GOODS	**1**	*2*	An EU Energy Efficiency Labelling Scheme Information Leaflet is to be provided to each dwelling. White Goods are an unnecessary for this development; therefore, the second Credit has been removed. Therefore, 1 Credit can be awarded in this section.
ENE 6	DRYING SPACE	**1**	*1*	A Tidy Drier of at least 6m in length is to be installed in the Bathroom of each Flat. This is to be in an internal heated space with adequate, controlled ventilation, complying with Building Regulations Approved Document F Ventilation 2006.

ENE 7	LIGHTING	**2**	*2*	The following Lighting is to be provided: **External Lighting** **Space Lighting** – All to be equipped with fluorescent fittings. Lobby, entrance and steps or pathway lighting to be controlled by a time clock or daylight sensor. Hallway, landing, stairwell, internal corridor and garage lighting to be controlled with push button timers/PIR sensors. Communal room lighting to be controlled by manual switches or occupant sensors. **Security Lighting** – To have a maximum wattage of 150 W and movement control devices (PIR) and daylight-cut off sensors. **Internal Lighting** **Internal Lighting** is also to be supplied to a maximum average wattage across the total floor area of **9 watts/m2** is to be installed in order to achieve the second Credit.

ENE 8	ENERGY DISPLAY DEVICE	**2**	*2*	An Energy Display Device is to be installed in order to achieve 2 Credits. The device must be fixed to the mains supply and be capable of displaying the following: • Current mains energy consumption (kilowatts and kilowatt hours) • Current emissions (g/kg CO2) • Current tariff • Current cost (in pounds and pence) • Projected cost (£ per month and £ per year) In addition, an **Innovation Credit** is available if the device is also capable of **recording** consumption data in addition to all criteria above. The Ewgeco H300 achieves all Credits, as well as a Credit for **WAT 3** should this exact unit be specified. As an alternative, certain energy companies such as E.ON also supply compliant devices.

ENE 9	CYCLE STORAGE	**0**	*2*	No Cycle Storage is present on the Drawings; therefore the Credits in this section have been withheld at this time.
ENE 10	HOME OFFICE	**1**	*1*	A Home Office is to be provided in the Second Bedroom (3 bed + flats) or Living Room (1 & 2 bed Flats) of each dwelling. This is to consist of: - Two double power sockets, - a telephone point, - window of a width and height of at least 450mm. - 1.8m of wall space is to be provided in order to fit in a desk, a chair, and a filing cabinet or bookcase.

<table>
<tr>
<td>WAT 1</td>
<td>INTERNAL WATER USE</td>
<td>2.5</td>
<td>3</td>
<td>Internal Water Usage will be kept to a maximum of 104.6 litres/person/day to meet and exceed the minimum standards for an ‘Excellent’ Assessment and achieve 2.5 credits.

<table>
<tr><td><u>≤107ltrs/person/day (2.5 credits)</u></td><td>Option 1</td></tr>
<tr><td>W/C</td><td>6/4</td></tr>
<tr><td>Basin Taps (Litres Per Min)</td><td>6</td></tr>
<tr><td>Kitchen Taps (Litres Per Min)</td><td>8</td></tr>
<tr><td>Shower (Litres Per Min)</td><td>7</td></tr>
<tr><td>Bath (Litres to Overflow)</td><td>156</td></tr>
<tr><td></td><td></td></tr>
<tr><td>TOTAL</td><td>104.6</td></tr>
</table>
</td>
</tr>
<tr>
<td>WAT 2</td>
<td>EXTERNAL WATER USE</td>
<td>1</td>
<td>1</td>
<td>A Water Butt is to be provided to the rainwater downpipe of each Ground Floor dwelling.

Minimum size of Water Butt is 200ltrs. The system is to have a lid, a tap, and provision for excess water to be returned to the main drainage system.

All other dwellings have Private Space which qualify for this credit by default.</td>
</tr>
</table>

WAT 3	WATER METER	**1**	*1*	If the Energy Display Device specified in ENE 08 (the Ewgeco H300) is installed to measure and record water consumption then this Credit can be achieved by default. If the Ewgeco model is not installed, the Water Meter must be capable of the following: - Recording and displaying historic water consumption - Monitor water consumption over time - Displaying current consumption levels either instantaneously or at half hourly intervals
MAT 1	ENVIRONMENTAL IMPACT OF MATERIALS	**12**	*25*	Based on a standard masonry and timber construction, 12 Credits have been preliminarily awarded based on retention and improvement of many existing elements. Full Construction Notes should be provided at Design Stage to confirm this.

MAT 2	RESPONSIBLE SOURCING OF MATERIALS	**8**	*12*	The following Materials will be responsibly sourced where applicable (i.e. FSC, PEFC, EMS certification) so as to achieve 8 Credits: - Brick - Concrete - Concrete blocks - Glass - Metals (Steel, Aluminium etc) - Plasterboard & Plaster - Timber - Bituminous Materials (Roofing Membranes, Asphalt etc) The product manufacturers as well as Types/Models of Materials are to be provided. In addition, all new Timber products are to be legally sourced.

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MAT 3	INSULATION	**8**	*8*	4 Credits can be awarded where >80% of the insulation in the following areas is responsibly sourced: - External Walls - Ground Floor - Roof - Building Services **Certificates are to be supplied to confirm this**. The second 4 Credits are to be achieved by: • Ensuring the Insulation Index for new insulation is >2 Where the Green Guide Ratings are determined using the Green Guide tool
WAS 1	HOUSEHOLD WASTE	**2**	*2*	The Local Authority provides a post-collection sorting recycling service. Recycling facilities comprised of 1 Bin of at least 30ltrs is to be supplied in the Kitchen of each dwelling. In addition, the Local Authority provides a Food Waste Collection Service; Therefore, space for a 7 ltr Caddy is to be provided in the Kitchen of each dwelling. In addition a Compost Bin is to be provided to the Communal Garden.

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WAS 2	REFURBISHMENT SITE WASTE MANAGEMENT	**3**	*3*	A full Level 2 Site Plan which abides by Compliance Notes 4, 7, 8 & 10 is to be provided on this development. In addition, the amount of waste generated against £100,000 of project value is also to be recorded in the SWMP
POL 1	NOX EMISSIONS	**3**	*3*	3 Credits have been awarded based on NO_x emissions of the boiler installed being less than 40mg/kWh (NO_x class 5 boiler). Make and Model of the boiler is to be finalised at Design Stage.
POL 2	SURFACE WTER MANAGEMENT	**1**	*3*	1 Credit can be awarded as there will be no increase in the impermeable area of this development following construction works. Further Credits can be achieved with the implementation of SUDS on the development.
POL 3	FLOODING	**2**	*2*	A Flood Risk Assessment is a mandatory requirement of an 'Excellent' Assessment and must be provided at Design Stage. The Site looks to be n a Low Flood Risk Zone; therefore 2 credits have been awarded.

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INN	INNOVATION	**2**	*10*	Innovation Credits have been achieved in • ENE 08 – Energy Display Device • MAN 06 – Project Management

FINAL SCORE: **71.15%**

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BREEAM Domestic Refurbishment – Pre-Assessment
November 2014

BREEAM Domestic Refurbishment
Summary Score Sheet — **Site: 18 - 20 Frognal**

					Score assessment				
			Score	Credits available	Sub-total	Credits available	% achiev'd	Weighting factor	Credits Score
Management	**Man 1**	Home User Guide	3	3	10	11	90.9091	0.12	10.9090909
	Man 2	Responsible Construction Practices	2	2					
	Man 3	Construction Site Impacts	1	1					
	Man 4	Security	1	2					
	Man 5	Protection of Ecolgoical Features	1	1					
	Man 6	Project Management	2	2					
Health & Wellbeing	**Hea 1**	Daylighting	1	2	7	12	58.3	0.17	9.92
	Hea 2	Sound Insulation	2	4					
	Hea 3	Volatile Organic Compounds	1	1					
	Hea 4	Inclusive Design	1	2					
	Hea 5	Ventilation	1	2					
	Hea 6	Safety	1	1					
Energy	**Ene 1**	Improvement in Energy Efficiency Rating	3	6	17.5	29	60.3	0.43	25.95
	Ene 2	Energy Efficiency Rating Post Refurbishment	2.5	4					
	Ene 3	Primary Energy Demand	4	7					
	Ene 4	Renew able Technologies	1	2					
	Ene 5	Energy Labelled White Goods	1	2					
	Ene 6	Drying Space	1	1					
	Ene 7	Lighting	2	2					
	Ene 8	Energy Display Device	2	2					
	Ene 9	Cycle Storage	0	2					
	Ene 10	Home Office	1	1					
Water	**Wat 1**	Internal Water Usage	2.5	3	4.5	5	90.0	0.11	9.90
	Wat 2	External Water Usage	1	1					
	Wat 3	Water Meter	1	1					
Materials	**Mat 1**	Environmental Impact of Materials	12	25	28	45	62.2	0.08	4.98
	Mat 2	Responsible Sourcing of Materials	8	12					
	Mat 3	Insulation	8	8					
Waste	**Was 1**	Household Waste	2	2	5	5	100.0	0.03	3.00
	Was 2	Refurbishment Site Waste Managment	3	3					
	Pol 1	Nitrogen Oxide Emissions	3	3	6	8	75.0	0.06	4.50
Pollution	**Pol 2**	Surface Water Run Off	1	3					
	Pol 3	Flooding	2	2					
Innovation	**Inn 1**	Innovation	2	10	2	10	20.0	0.1	2.00
					Total	125		**Score:**	**71.15**
								Rating:	**Excellent**

Rating	**Score**
Good	45
Very Good	55
Excellent	70

NRG CONSULTING

Appendix 4

WOOD ULTIMATE DOUBLE HUNG

Mas. Opg. (mm)	2-0 1/2 (622)	2-4 1/2 (724)	2-8 1/2 (826)	2-10 1/2 (876)	3-0 1/2 (927)	3-2 1/2 (978)	3-4 1/2 (1029)	3-8 1/2 (1130)	4-0 1/2 (1232)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
2-10 9/16 (878) 2-9 1/2 (851) 2-9 (838) 12" (305)	WUDH1612	WUDH2012	WUDH2412	WUDH2612	WUDH2812	WUDH3012	WUDH3212	WUDH3612	WUDH4012
3-2 9/16 (980) 3-1 1/2 (953) 3-1 (940) 14" (356)	WUDH1614	WUDH2014	WUDH2414	WUDH2614	WUDH2814	WUDH3014	WUDH3214	WUDH3614	WUDH4014
3-6 9/16 (1081) 3-5 1/2 (1054) 3-5 (1041) 16" (406)	WUDH1616	WUDH2016	WUDH2416	WUDH2616	WUDH2816	WUDH3016	WUDH3216	WUDH3616	WUDH4016
3-10 9/16 (1183) 3-9 1/2 (1156) 3-9 (1143) 18" (457)	WUDH1618	WUDH2018	WUDH2418	WUDH2618	WUDH2818	WUDH3018	WUDH3218	WUDH3618	WUDH4018
4-2 9/16 (1284) 4-1 1/2 (1257) 4-1 (1245) 20" (508)	WUDH1620	WUDH2020	WUDH2420	WUDH2620	WUDH2820	WUDH3020	WUDH3220	WUDH3620	WUDH4020
4-6 9/16 (1386) 4-5 1/2 (1359) 4-5 (1346) 22" (559)	WUDH1622	WUDH2022	WUDH2422	WUDH2622	WUDH2822	WUDH3022	WUDH3222	WUDH3622	WUDH4022
4-10 9/16 (1488) 4-9 1/2 (1461) 4-9 (1448) 24" (610)	WUDH1624	WUDH2024	WUDH2424	WUDH2624	WUDH2824	WUDH3024	WUDH3224	WUDH3624	WUDH4024
5-2 9/16 (1589) 5-1 1/2 (1562) 5-1 (1549) 26" (660)	WUDH1626	WUDH2026	WUDH2426	WUDH2626	WUDH2826	WUDH3026	WUDH3226*	WUDH3626*	WUDH4026*
5-6 9/16 (1691) 5-5 1/2 (1664) 5-5 (1651) 28" (711)	WUDH1628	WUDH2028	WUDH2428	WUDH2628	WUDH2828	WUDH3028*	WUDH3228*	WUDH3628*	WUDH4028*

MULTIPLE ASSEMBLY CONVERSIONS

ROUGH OPENING		**MASONRY OPENING WITH BMC**	
Width	**Height**	**Width**	**Height**
Add all frame sizes plus 1" (25)	Add frame sizes plus 1/2" (13)	Add all frame sizes plus 3 1/8" (79)	Add frame sizes plus 1 9/16" (39)

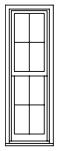
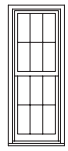
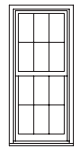
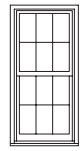
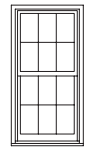
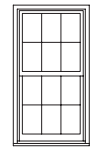
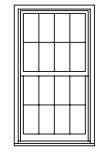
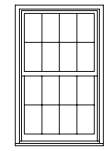
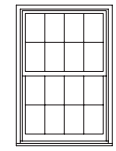
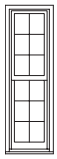
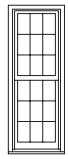
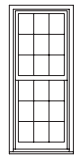
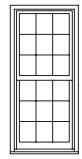
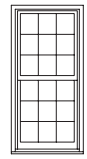
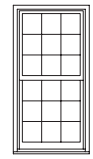
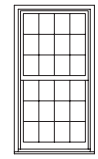
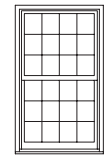
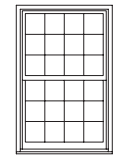
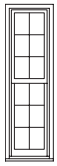
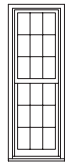
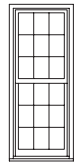
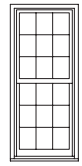
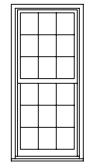
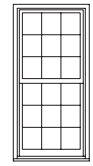
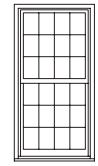
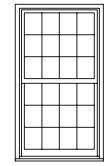
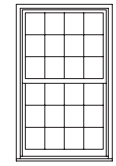
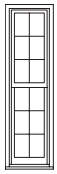
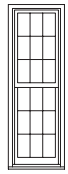
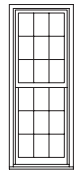
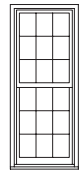
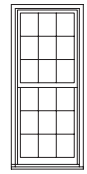
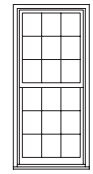
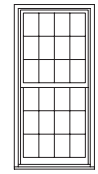
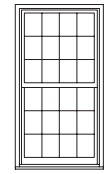
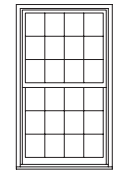
NOTES:

Lite patterns shown are 3/4" (19) grilles or 7/8" (22) SDL. Lite patterns for 1 1/8" (29) may vary.

* These windows meet national egress codes for fire evacuation. Local codes may differ.

NOT TO SCALE

WOOD ULTIMATE DOUBLE HUNG

Mas. Opg. (mm)	2-0 1/2 (622)	2-4 1/2 (724)	2-8 1/2 (826)	2-10 1/2 (876)	3-0 1/2 (927)	3-2 1/2 (978)	3-4 1/2 (1029)	3-8 1/2 (1130)	4-0 1/2 (1232)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
5-10 9/16 (1792) 5-9 1/2 (1765) 5-9 (1753) 30" (762)	 WUDH1630	 WUDH2030	 WUDH2430	 WUDH2630	 WUDH2830*	 WUDH3030*	 WUDH3230*	 WUDH3630*	 WUDH4030*
6-2 9/16 (1894) 6-1 1/2 (1867) 6-1 (1854) 32" (813)	 WUDH1632	 WUDH2032	 WUDH2432	 WUDH2632*	 WUDH2832*	 WUDH3032*	 WUDH3232*	 WUDH3632*	 WUDH4032*
6-6 9/16 (1996) 6-5 1/2 (1969) 6-5 (1956) 34" (864)	 WUDH1634	 WUDH2034	 WUDH2434*	 WUDH2634*	 WUDH2834*	 WUDH3034*	 WUDH3234*	 WUDH3634*	 WUDH4034*
6-10 9/16 (2097) 6-9 1/2 (2070) 6-9 (2057) 36" (914)	 WUDH1636	 WUDH2036	 WUDH2436*	 WUDH2636*	 WUDH2836*	 WUDH3036*	 WUDH3236*	 WUDH3636*	 WUDH4036*

COTTAGE STYLE

Mas. Opg. (mm)	2-0 1/2 (622)	2-4 1/2 (724)	2-8 1/2 (826)	2-10 1/2 (876)	3-0 1/2 (927)	3-2 1/2 (978)	3-4 1/2 (1029)	3-8 1/2 (1130)	4-0 1/2 (1232)
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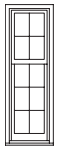
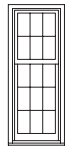
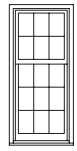
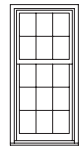
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
5-10 9/16 (1792) 5-9 1/2 (1765) 5-9 (1753) 24" (610) / 36" (914)	 WUDH1624/36	 WUDH2024/36	 WUDH2424/36	 WUDH2624/36	WUDH2824/36	WUDH3024/36	WUDH3224/36	WUDH3624/36	WUDH4024/36

WOOD ULTIMATE DOUBLE HUNG STORM COMBINATIONS

Measurement Conversion	**Width**	**Height**
Rough Opening to OM	-2 1/2" (64)	-2 3/16" (56)
Glass* to OM	+3 7/8" (98)	(Glass height x2) PLUS 7 5/16" (186)

*Glass size measurement conversions are valid for one lite units only.

NOTES:

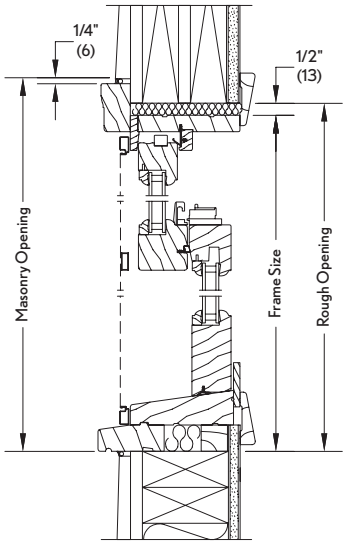
Lite patterns shown are 3/4" (19) grilles, 7/8" (22) SDL, or SG ADL. Lite patterns for 1 1/8" (29) grilles, SDL, or IG ADL may vary.

* These windows meet national egress codes for fire evacuation. Local codes may differ.

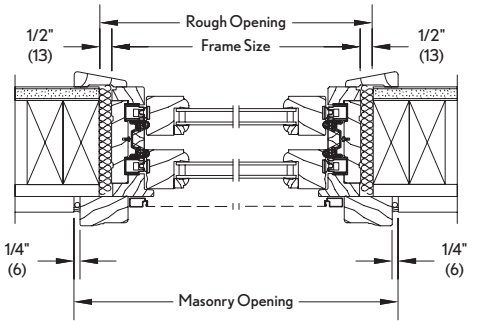
NOT TO SCALE

WOOD ULTIMATE DOUBLE HUNG

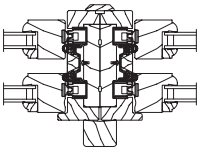
CONSTRUCTION DETAILS



HEAD JAMB AND SILL



JAMB



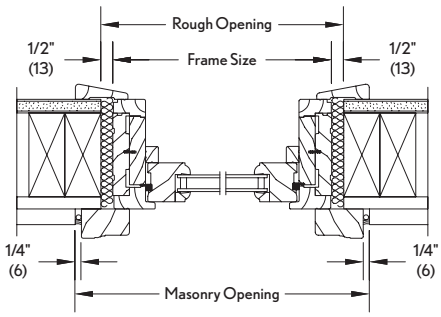
VERTICAL MULLION

NOT TO SCALE

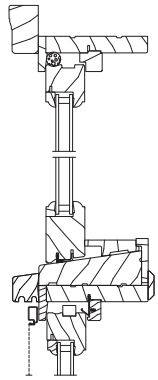
WOOD ULTIMATE DOUBLE HUNG TRANSOM UNIT

Mas. Opg. (mm)	2-0 1/2 (622)	2-4 1/2 (724)	2-8 1/2 (826)	2-10 1/2 (876)	3-0 1/2 (927)	3-2 1/2 (978)	3-4 1/2 (1029)	3-8 1/2 (1130)	4-0 1/2 (1232)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
1-6 15/16 (481) 1-5 7/8 (454) 1-5 3/8 (441) 12" (305)	WUDHT1612	WUDHT2012	WUDHT2412	WUDHT2612	WUDHT2812	WUDHT3012	WUDHT3212	WUDHT3612	WUDHT4012
2-2 15/16 (684) 2-1 7/8 (657) 2-1 3/8 (645) 20" (508)	WUDHT1620	WUDHT2020	WUDHT2420	WUDHT2620	WUDHT2820	WUDHT3020	WUDHT3220	WUDHT3620	WUDHT4020

CONSTRUCTION DETAILS



TRANSOM JAMB



TRANSOM MULLED OVER WOOD
ULTIMATE DOUBLE HUNG

NOTES:

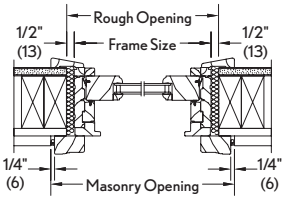
•Lite patterns shown are 3/4" (19) grilles, 7/8" (22) SDL, or SG ADL Lite patterns for 1 1/8" (29) grilles, SDL, or IG ADL may vary.

Transom heights do not include subsill. Add 1 3/32" (28) for stand alone heights if subsill is wanted.

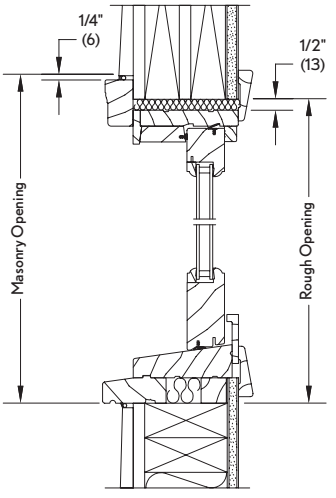
WOOD ULTIMATE DOUBLE HUNG PICTURE UNIT

Mas. Opg. (mm)	3-8 1/2 (1130)	4-4 1/2 (1334)	4-8 1/2 (1435)	5-4 1/2 (1638)	6-0 1/2 (1842)
Rgh. Opg. (mm)	3-6 3/8 (1076)	4-2 3/8 (1280)	4-6 3/8 (1381)	5-2 3/8 (1584)	5-10 3/8 (1788)
Frame Size (mm)	3-5 3/8 (1051)	4-1 3/8 (1254)	4-5 3/8 (1356)	5-1 3/8 (1559)	5-9 3/8 (1762)
Glass Size (mm)	36" (914)	44" (1118)	48" (1219)	56" (1422)	64" (1626)
3-6 9/16 (1081) 3-5 1/2 (1054) 3-5 (1041) 33 5/16" (846)	WUDHP4038	WUDHP4838	WUDHP5238	WUDHP6038	WUDHP6838
3-10 9/16 (1183) 3-9 1/2 (1156) 3-9 (143) 37 5/16" (948)	WUDHP4042	WUDHP4842	WUDHP5242	WUDHP6042	WUDHP6842
4-2 9/16 (1284) 4-1 1/2 (1257) 4-1 (1245) 41 5/16" (1049)	WUDHP4046	WUDHP4846	WUDHP5246	WUDHP6046	WUDHP6846
4-6 9/16 (1386) 4-5 1/2 (1359) 4-5 (1346) 45 5/16" (1151)	WUDHP4050	WUDHP4850	WUDHP5250	WUDHP6050	WUDHP6850
4-10 9/16 (1488) 4-9 1/2 (1461) 4-9 (1448) 49 5/16" (1253)	WUDHP4054	WUDHP4854	WUDHP5254	WUDHP6054	WUDHP6854
5-2 9/16 (1589) 5-1 1/2 (1562) 5-1 (1549) 53 5/16" (1354)	WUDHP4058	WUDHP4858	WUDHP5258	WUDHP6058	WUDHP6858
5-6 9/16 (1691) 5-5 1/2 (1664) 5-5 (1651) 57 5/16" (1456)	WUDHP4062	WUDHP4862	WUDHP5262	WUDHP6062	WUDHP6862

CONSTRUCTION DETAILS



1-5/8" (41) SASH PICTURE UNIT JAMB



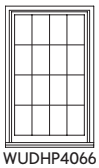
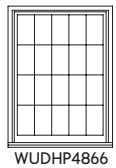
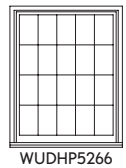
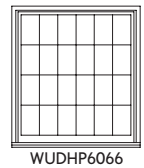
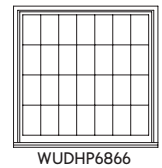
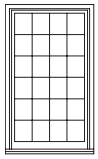
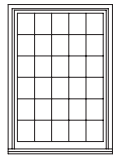
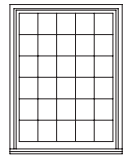
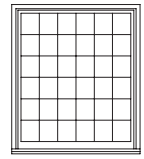
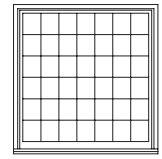
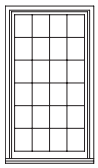
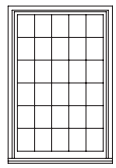
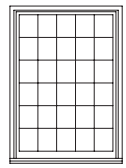
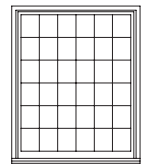
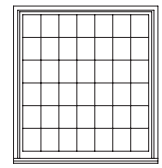
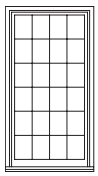
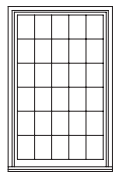
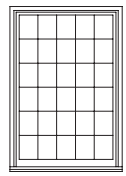
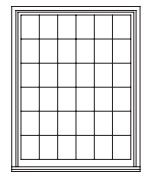
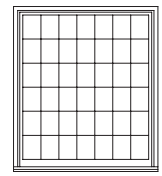
1-5/8" (41) SASH PICTURE UNIT HEAD JAMB

NOTES:

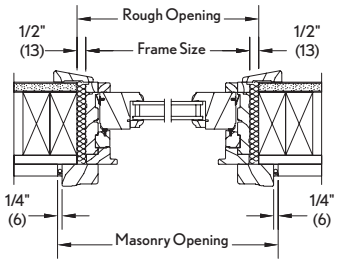
Lite patterns and glass sizes shown are for 1 5/8" picture units, 3/4" (19) grilles, 7/8" (22) SDL, or SG ADL. Lite patterns for 1 1/8" (29) grilles, SDL, or IG ADL may vary.

NOT TO SCALE

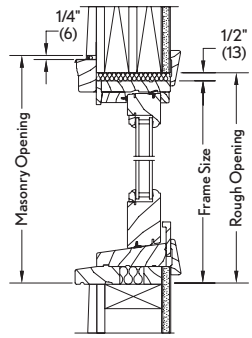
WOOD ULTIMATE DOUBLE HUNG PICTURE UNIT

Mas. Opg. (mm)	3-8 1/2 (1130)	4-4 1/2 (1334)	4-8 1/2 (1435)	5-4 1/2 (1638)	6-0 1/2 (1842)
Rgh. Opg. (mm)	3-6 3/8 (1076)	4-2 3/8 (1280)	4-6 3/8 (1381)	5-2 3/8 (1584)	5-10 3/8 (1788)
Frame Size (mm)	3-5 3/8 (1051)	4-1 3/8 (1254)	4-5 3/8 (1356)	5-1 3/8 (1559)	5-9 3/8 (1762)
Glass Size (mm)	36" (914)	44" (1118)	48" (1219)	56" (1422)	64" (1626)
5-10 9/16 (1792) 5-9 1/2 (1765) 5-9 (1753) 61 5/16" (1557)	 WUDHP4066	 WUDHP4866	 WUDHP5266	 WUDHP6066	 WUDHP6866
6-2 9/16 (1894) 6-1 1/2 (1867) 6-1 (1854) 65 5/16" (1659)	 WUDHP4070	 WUDHP4870	 WUDHP5270	 WUDHP6070	 WUDHP6870
6-6 9/16 (1996) 6-5 1/2 (1969) 6-5 (1956) 69 5/16" (1761)	 WUDHP4074	 WUDHP4874	 WUDHP5274	 WUDHP6074	 WUDHP6874
6-10 9/16 (2097) 6-9 1/2 (2070) 6-9 (2057) 73 5/16" (1862)	 WUDHP4078	 WUDHP4878	 WUDHP5278	 WUDHP6078	 WUDHP6878

CONSTRUCTION DETAILS



2" (51) SASH PICTURE UNIT
JAMB



2" (51) SASH PICTURE UNIT
HEAD JAMB

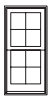
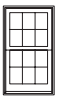
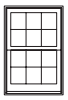
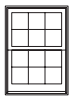
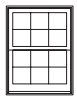
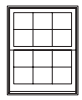
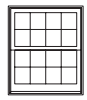
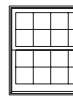
NOTES:

Lite patterns and glass sizes shown are for 1 5/8" picture units, 3/4" (19) grilles, 7/8" (22) SDL, or SG ADL. Lite patterns for 1 1/8" (29) grilles, SDL, or IG ADL may vary.

Transom heights do not include subsill. Add 1 3/32" (28) for stand alone heights if subsill is wanted.

NOT TO SCALE

CLAD ULTIMATE DOUBLE HUNG

Mas. Opg. (mm)	1-9 7/8 (556)	2-1 7/8 (657)	2-5 7/8 (759)	2-7 7/8 (810)	2-9 7/8 (860)	2-11 7/8 (911)	3-1 7/8 (962)	3-5 7/8 (1064)	3-9 7/8 (1165)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
2-8 5/8 (829) 2-8 7/8 (835) 2-8 3/8 (822) 12" (305)	 CUDH1612	 CUDH2012	 CUDH2412	 CUDH2612	 CUDH2812	 CUDH3012	 CUDH3212	 CUDH3612	 CUDH4012
3-0 5/8 (930) 3-0 7/8 (937) 3-0 3/8 (924) 14" (356)	 CUDH1614	 CUDH2014	 CUDH2414	 CUDH2614	 CUDH2814	 CUDH3014	 CUDH3214	 CUDH3614	 CUDH4014
3-4 5/8 (1032) 3-4 7/8 (1038) 3-4 3/8 (1026) 16" (406)	 CUDH1616	 CUDH2016	 CUDH2416	 CUDH2616	 CUDH2816	 CUDH3016	 CUDH3216	 CUDH3616	 CUDH4016
3-8 5/8 (1133) 3-8 7/8 (1140) 3-8 3/8 (1127) 18" (457)	 CUDH1618	 CUDH2018	 CUDH2418	 CUDH2618	 CUDH2818	 CUDH3018	 CUDH3218	 CUDH3618	 CUDH4018
4-0 5/8 (1235) 4-0 7/8 (1241) 4-0 3/8 (1229) 20" (508)	 CUDH1620	 CUDH2020	 CUDH2420	 CUDH2620	CUDH2820	CUDH3020	CUDH3220	CUDH3620	CUDH4020
4-4 5/8 (1337) 4-4 7/8 (1343) 4-4 3/8 (1330) 22" (559)	CUDH1622	CUDH2022	CUDH2422	CUDH2622	CUDH2822	CUDH3022	CUDH3222	CUDH3622	CUDH4022
4-8 5/8 (1438) 4-8 7/8 (1445) 4-8 3/8 (1432) 24" (610)	CUDH1624	CUDH2024	CUDH2424	CUDH2624	CUDH2824	CUDH3024	CUDH3224	CUDH3624	CUDH4024
5-0 5/8 (1540) 5-0 7/8 (1546) 5-0 3/8 (1534) 26" (660)	CUDH1626	CUDH2026	CUDH2426	CUDH2626	CUDH2826	CUDH3026	CUDH3226*	CUDH3626*	CUDH4026*
5-4 5/8 (1641) 5-4 7/8 (1648) 5-4 3/8 (1635) 28" (711)	CUDH1628	CUDH2028	CUDH2428	CUDH2628	CUDH2828	CUDH3028*	CUDH3228*	CUDH3628*	CUDH4028*

MULTIPLE ASSEMBLY CONVERSIONS

ROUGH OPENING		**MASONRY OPENING WITHOUT BMC**	
Width	**Height**	**Width**	**Height**
Add all frame sizes plus 1" (25)	Add frame sizes plus 1/2" (13)	Add all frame sizes plus 1/2" (13)	Add frame sizes plus 1/4" (6)

NOTES:

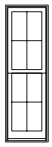
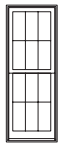
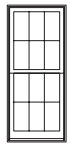
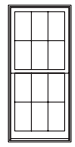
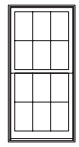
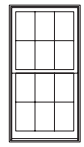
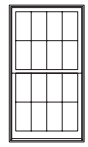
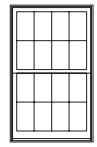
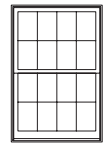
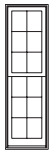
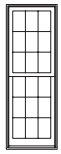
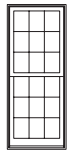
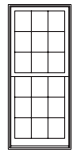
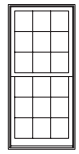
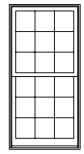
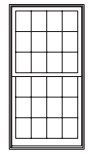
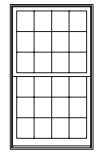
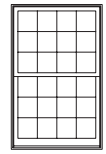
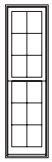
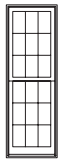
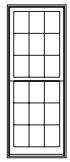
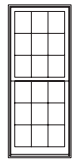
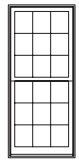
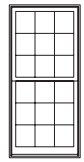
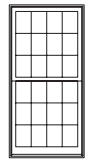
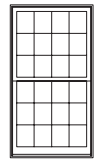
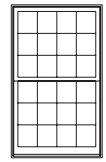
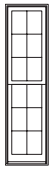
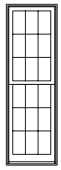
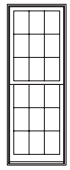
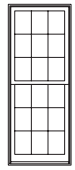
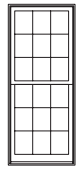
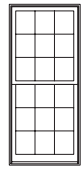
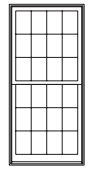
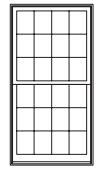
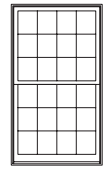
Lite patterns shown are 3/4" (19) grilles or 7/8" (22) SDL Lite patterns for 1 1/8" (29) may vary.

Please contact your local Marvin representative for masonry openings that include casings and subsills.

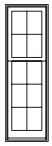
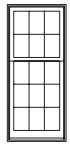
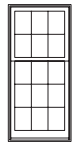
* These windows meet national egress codes for fire evacuation. Local codes may differ.

NOT TO SCALE

CLAD ULTIMATE DOUBLE HUNG

Mas. Opg. (mm)	1-9 7/8 (556)	2-1 7/8 (657)	2-5 7/8 (759)	2-7 7/8 (810)	2-9 7/8 (860)	2-11 7/8 (911)	3-1 7/8 (962)	3-5 7/8 (1064)	3-9 7/8 (1165)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
5-8 5/8 (1743) 5-8 7/8 (1749) 5-8 3/8 (1737) 30" (762)	 CUDH1630	 CUDH2030	 CUDH2430	 CUDH2630	 CUDH2830*	 CUDH3030*	 CUDH3230*	 CUDH3630*	 CUDH4030*
6-0 5/8 (1845) 6-0 7/8 (1851) 6-0 3/8 (1838) 32" (813)	 CUDH1632	 CUDH2032	 CUDH2432	 CUDH2632*	 CUDH2832*	 CUDH3032*	 CUDH3232*	 CUDH3632*	 CUDH4032*
6-4 5/8 (1946) 6-4 7/8 (1953) 6-4 3/8 (1940) 34" (864)	 CUDH1634	 CUDH2034	 CUDH2434*	 CUDH2634*	 CUDH2834*	 CUDH3034*	 CUDH3234*	 CUDH3634*	 CUDH4034*
6-8 5/8 (2048) 6-8 7/8 (2054) 6-8 3/8 (2042) 36" (914)	 CUDH1636	 CUDH2036	 CUDH2436*	 CUDH2636*	 CUDH2836*	 CUDH3036*	 CUDH3236*	 CUDH3636*	 CUDH4036*

COTTAGE STYLE

Mas. Opg. (mm)	1-9 7/8 (556)	2-1 7/8 (657)	2-5 7/8 (759)	2-7 7/8 (810)	2-9 7/8 (860)	2-11 7/8 (911)	3-1 7/8 (962)	3-5 7/8 (1064)	3-9 7/8 (1165)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
5-8 5/8 (1743) 5-8 7/8 (1749) 5-8 3/8 (1737) 24" (610) / 36" (914)	 CUDH1624/36	 CUDH2024/36	 CUDH2424/36	 CUDH2624/36	CUDH2824/36	CUDH3024/36	CUDH3224/36	CUDH3624/36	CUDH4024/36

CLAD ULTIMATE DOUBLE HUNG STORM COMBINATIONS

Measurement Conversion	Width	Height
Rough Opening to OM	-3" (76)	-2 11/32" (60)
Glass* to OM	+3 3/8" (86)	(Glass height x2) PLUS 6 17/32" (166)

Conversions are applicable for Marvin Clad Ultimate Double Hung only.

NOTES:

Lite patterns shown are 3/4" (19) grilles or 7/8" (22) SDL Lite patterns for 1 1/8" (29) may vary.

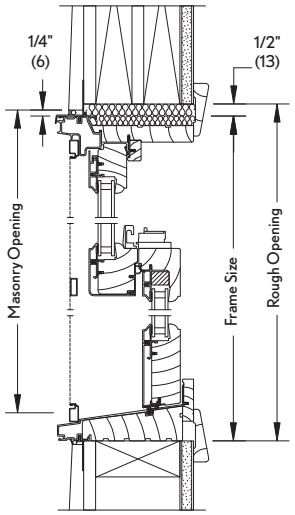
Please contact your local Marvin representative for masonry openings that include casings and subsills.

* These windows meet national egress codes for fire evacuation. Local codes may differ.

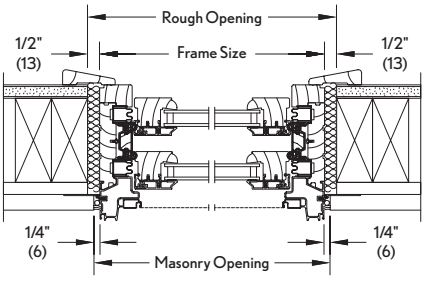
NOT TO SCALE

CLAD ULTIMATE DOUBLE HUNG

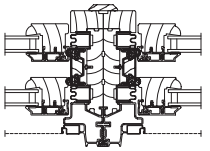
CONSTRUCTION DETAILS



HEAD JAMB AND SILL



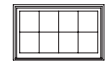
JAMB



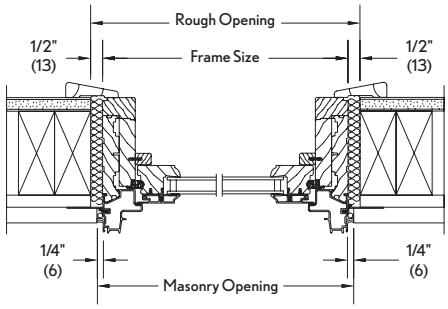
VERTICAL MULLION

NOT TO SCALE

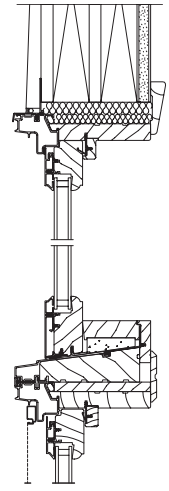
CLAD ULTIMATE DOUBLE HUNG TRANSOM UNIT

Mas. Opg. (mm)	1-9 7/8 (556)	2-1 7/8 (657)	2-5 7/8 (759)	2-7 7/8 (810)	2-9 7/8 (860)	2-11 7/8 (911)	3-1 7/8 (962)	3-5 7/8 (1064)	3-9 7/8 (1165)
Rgh. Opg. (mm)	1-10 3/8 (568)	2-2 3/8 (670)	2-6 3/8 (772)	2-8 3/8 (822)	2-10 3/8 (873)	3-0 3/8 (924)	3-2 3/8 (975)	3-6 3/8 (1076)	3-10 3/8 (1178)
Frame Size (mm)	1-9 3/8 (543)	2-1 3/8 (645)	2-5 3/8 (746)	2-7 3/8 (797)	2-9 3/8 (848)	2-11 3/8 (899)	3-1 3/8 (949)	3-5 3/8 (1051)	3-9 3/8 (1153)
Glass Size (mm)	16" (406)	20" (508)	24" (610)	26" (660)	28" (711)	30" (762)	32" (813)	36" (914)	40" (1016)
1-7 15/16 (506) 1-8 3/16 (513) 1-7 11/16 (500) 14" (356)	 CUDHT1612	 CUDHT2012	 CUDHT2412	 CUDHT2612	 CUDHT2812	 CUDHT3012	 CUDHT3212	 CUDHT3612	 CUDHT4012
2-3 15/16 (710) 2-4 3/16 (716) 2-3 11/16 (703) 22" (559)	 CUDHT1620	 CUDHT2020	 CUDHT2420	 CUDHT2620	 CUDHT2820	 CUDHT3020	 CUDHT3220	 CUDHT3620	 CUDHT4020

CONSTRUCTION DETAILS



JAMB



TRANSOM MULLED
OVER CLAD ULTIMATE DOUBLE HUNG

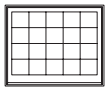
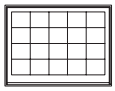
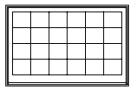
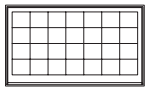
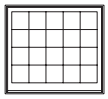
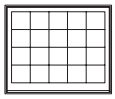
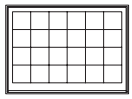
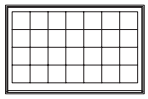
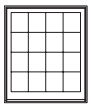
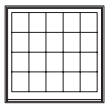
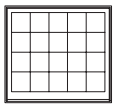
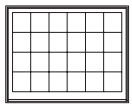
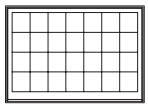
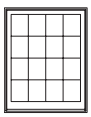
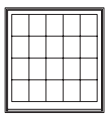
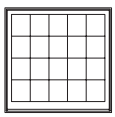
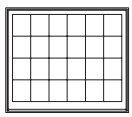
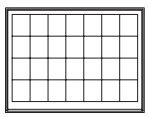
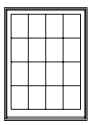
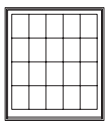
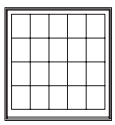
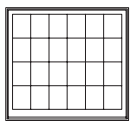
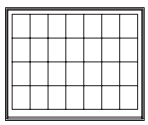
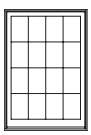
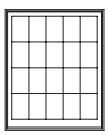
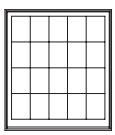
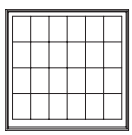
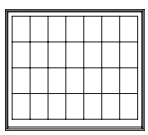
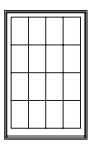
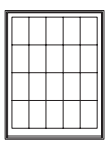
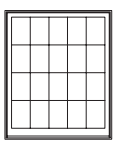
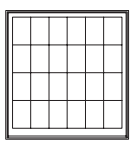
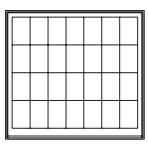
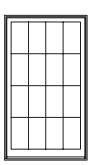
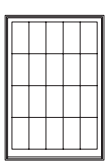
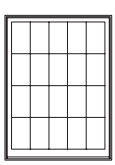
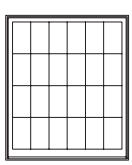
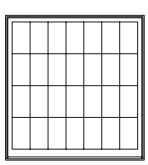
NOTES:

Lite patterns shown are 3/4" (19) grilles or 7/8" (22) SDL. Lite patterns for 1 1/8" (29) may vary.

Please contact your local Marvin representative for masonry openings that include casings and subsills.

NOT TO SCALE

CLAD ULTIMATE DOUBLE HUNG PICTURE UNIT

Mas. Opg. (mm)	3-5 7/8 (1064)	4-1 7/8 (1267)	4-5 7/8 (1368)	5-1 7/8 (1572)	5-9 7/8 (1775)
Rgh. Opg. (mm)	3-6 3/8 (1076)	4-2 3/8 (1280)	4-6 3/8 (1381)	5-2 3/8 (1584)	5-10 3/8 (1788)
Frame Size (mm)	3-5 3/8 (1051)	4-1 3/8 (1254)	4-5 3/8 (1356)	5-1 3/8 (1559)	5-9 3/8 (1762)
Glass Size (mm)	36" (914)	44" (1118)	48" (1219)	56" (1422)	64" (1626)
3-4 5/8 (1032) 3-4 7/8 (1038) 3-4 3/8 (1026) 33 3/8" (848)	 CUDHP4038	 CUDHP4838	 CUDHP5238	 CUDHP6038	 CUDHP6838
3-8 5/8 (1133) 3-8 7/8 (1140) 3-8 3/8 (1127) 37 3/8" (949)	 CUDHP4042	 CUDHP4842	 CUDHP5242	 CUDHP6042	 CUDHP6842
4-0 5/8 (1235) 4-0 7/8 (1241) 4-0 3/8 (1229) 41 3/8" (1051)	 CUDHP4046	 CUDHP4846	 CUDHP5246	 CUDHP6046	 CUDHP6846
4-4 5/8 (1337) 4-4 7/8 (1343) 4-4 3/8 (1330) 45 3/8" (1153)	 CUDHP4050	 CUDHP4850	 CUDHP5250	 CUDHP6050	 CUDHP6850
4-8 5/8 (1438) 4-8 7/8 (1445) 4-8 3/8 (1432) 49 3/8" (1254)	 CUDHP4054	 CUDHP4854	 CUDHP5254	 CUDHP6054	 CUDHP6854
5-0 5/8 (1540) 5-0 7/8 (1546) 5-0 3/8 (1534) 53 3/8" (1356)	 CUDHP4058	 CUDHP4858	 CUDHP5258	 CUDHP6058	 CUDHP6858
5-4 5/8 (1641) 5-4 7/8 (1648) 5-4 3/8 (1635) 57 3/8" (1457)	 CUDHP4062	 CUDHP4862	 CUDHP5262	 CUDHP6062	 CUDHP6862
5-8 5/8 (1743) 5-8 7/8 (1749) 5-8 3/8 (1737) 61 3/8" (1551)	 CUDHP4066	 CUDHP4866	 CUDHP5266	 CUDHP6066	 CUDHP6866

NOTES:

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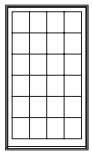
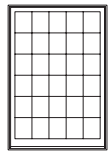
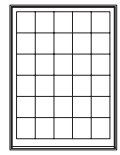
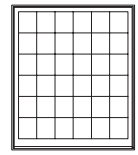
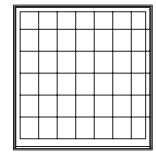
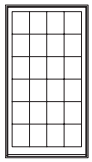
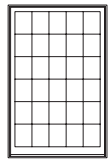
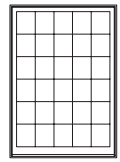
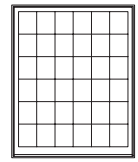
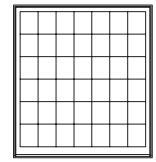
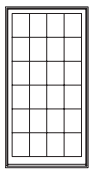
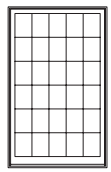
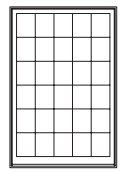
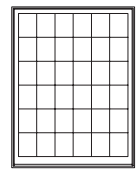
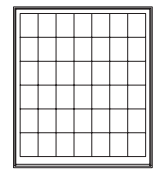
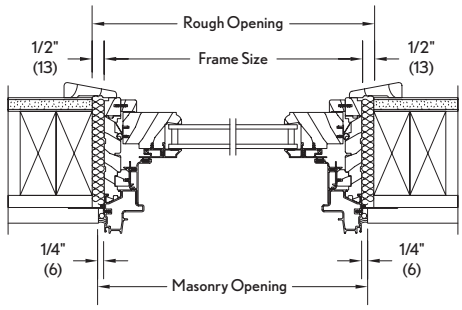
NOT TO SCALE

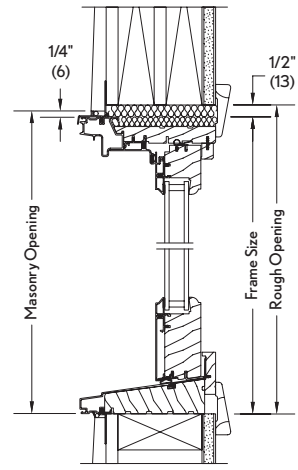
CLAD ULTIMATE DOUBLE HUNG PICTURE UNIT

Mas. Opg. (mm)	3-5 7/8 (1064)	4-1 7/8 (1267)	4-5 7/8 (1368)	5-1 7/8 (1572)	5-9 7/8 (1775)
Rgh. Opg. (mm)	3-6 3/8 (1076)	4-2 3/8 (1280)	4-6 3/8 (1381)	5-2 3/8 (1584)	5-10 3/8 (1788)
Frame Size (mm)	3-5 3/8 (1051)	4-1 3/8 (1254)	4-5 3/8 (1356)	5-1 3/8 (1559)	5-9 3/8 (1762)
Glass Size (mm)	36" (914)	44" (1118)	48" (1219)	56" (1422)	64" (1626)
6-0 5/8 (1845) 6-0 7/8 (1851) 6-0 3/8 (1838) 65 3/8" (1661)	 CUDHP4070	 CUDHP4870	 CUDHP5270	 CUDHP6070	 CUDHP6870
6-4 5/8 (1946) 6-4 7/8 (1953) 6-4 3/8 (1940) 69 3/8" (1762)	 CUDHP4074	 CUDHP4874	 CUDHP5274	 CUDHP6074	 CUDHP6874
6-8 5/8 (2048) 6-8 7/8 (2054) 6-8 3/8 (2042) 73 3/8" (1864)	 CUDHP4078	 CUDHP4878	 CUDHP5278	 CUDHP6078	 CUDHP6878

CONSTRUCTION DETAILS



JAMB



HEAD JAMB AND SILL

NOTES:

Lite patterns shown are 3/4" (19) grilles or 7/8" (22) SDL Lite patterns for 1 1/8" (29) may vary.

Please contact your local Marvin representative for masonry openings that include casings and subsills.

Product Performance

Contents

NOTE:
Specifications and technical data are subject to change without notice.
Illustrations are not to scale.
Allow 2 mm tolerance on all measurements.
All metric measurements are shown in millimetres unless otherwise noted.

For technical assistance about Marvin products call Marvin Architectural or visit our website:
Ireland: marvin-architectural.ie
UK: marvin-architectural.co.uk

Windows

Product and Configuration	Size Tested				Wind Load	Watertightness	Air Permeability
	Width	Height	Width	Height			
	Millimetre		Inches				
Clad Sliding Sash	1153	2042	45.375	80.375	B3	7A	3
Clad Sliding Sash with Combination	1153	2042	45.375	80.375	B3	E1200	3
Clad Sliding Sash Transom	0.700	IG	2016	703	79.375	27.688	C5
Clad Sliding Sash Magnum/SH Magnum	1508	3048	59.375	120.000	C4	7A	4
Clad Sliding Sash Magnum Picture	1559	2667	61.375	105.000	C5	7A	4
Clad Insert Double	1153	2042	45.375	80.375	B3	7A	3
Clad Insert Sliding Sash Transom	2016	703	79.375	27.688	C5	6A	3
Clad Insert Sliding Sash Picture	1559	2667	61.375	105.000	C5	7A	4
Clad Sliding Sash Round Top	1153	2042	45.375	80.375	B3	7A	3
Clad Sliding Sash Round Top Transom	2016	1016	79.375	40.000	C5	6A	3
Clad Sliding Sash Magnum Round Top	1508	3048	59.375	120.000	C4	7A	4
Wood Sliding Sash	1153	2057	45.375	81.000	B3	7A	3
Wood Sliding Sash with Combination	1153	2057	45.375	81.000	B3	E900	3
Wood Sliding Sash Transom 1 5/8" and Round	2016	703	79.375	27.688	C5	6A	3
Wood Sliding Sash Picture 1 5/8”	1559	1448	61.375	57.000	C5	6A	3
Wood Sliding Sash Magnum/SH Magnum	1508	3048	59.375	120.000	C4	7A	4
Wood Sliding Sash Picture 2"	1565	2678	61.625	105.438	C5	7A	4
Clad Casement	1016	2337	40.000	92.000	B4	8A	2
Clad Awning	1829	1603	72.000	63.125	A4	8A	4
Clad Casement Picture	2235	2442	88.000	96.125	C5	8A	4
Clad Replacement Casement	1016	2337	40.000	92.000	B4	8A	2
Clad Replacement Awning	1829	1603	72.000	63.125	A4	8A	4
Clad Casement Round Top	1016	2337	40.000	92.000	B2	8A	4
Clad Casement Round Top Picture	2235	2442	88.000	96.125	B2	8A	4
Wood Casement	1016	2337	40.000	92.000	B4	8A	2
Wood Awning	1829	1603	72.000	63.125	A4	8A	4
Wood Casement Picture	2235	2442	88.000	96.125	C5	8A	4
Clad Pushout Casement	1016	2337	40.000	92.000	B2	8A	4
Clad Pushout Awning	1829	1197	72.000	47.125	B2	8A	4
Clad Pushout Casement Picture	2235	2442	88.000	96.125	C5	8A	4
Clad Pushout Replacement Casement	1016	2337	40.000	92.000	B2	8A	4
Clad Pushout Replacement Awning	1829	1197	72.000	47.125	B2	8A	4
Wood Pushout Casement	1016	2337	40.000	92.000	B2	8A	4
Wood Pushout Awning	1829	1197	72.000	47.125	B2	8A	4
Wood Pushout Casement Picture	2235	2442	88.000	96.125	C5	8A	4
Clad Magnum Tilt–Turn	1219	1829	48.000	72.000	C5	9A	4
Wood Magnum Tilt–Turn	1219	1829	48.000	72.000	C5	9A	4
Clad Fixed Round Top	2134	2438	84.000	96.000	E2400	E1200	4
Wood Fixed Round Top	2134	2438	84.000	96.000	E2400	E1200	4
Clad Fixed Special Shape	2134	2438	84.000	96.000	E2400	E1200	4
Wood Fixed Special Shape	2134	2438	84.000	96.000	E2400	E1200	4

Doors

Product and Configuration	Size Tested				Wind Load	Watertightness	Air Permeability
	Width	Height	Width	Height			
	Millimetre		Inches				
Clad Inswing French Door–2 Panel	1845	2083	72.625	82.000	B3	6A	3
Clad Inswing French Door 3 or 4 Panel	3632	2426	143.000	95.500	B2	5A	3
Clad Inswing/Sliding French Door Transom and	3632	762	143.000	30.000	A5	3A	3
Wood Inswing French Door–2 Panel	1845	2083	72.625	82.000	B3	6A	3
Wood Inswing French Door–3 or 4 Panel	3632	2426	143.000	95.500	B2	5A	3
Wood Inswing/Sliding French Door Transom	3632	762	143.000	30.000	A5	3A	3
Clad Outswing and French Door–2 Panel	1845	2083	72.625	82.000	B3	6A	3
Clad Outswing and French Door 3 or 4 Panel	3632	2426	143.000	95.500	B2	0	3
Clad Outswing/French Door Transom and	3632	762	143.000	30.000	C4	5A	3
Wood Outswing and French Door–2 Panel	1845	2083	72.625	82.000	B3	6A	3
Wood Outswing and French Door–3 or 4 Panel	3632	2426	143.000	95.500	B2	0	3
Wood Outswing/French Door Transom and	3632	762	143.000	30.000	C4	5A	3
Clad Sliding French Door–2 Panel	1845	2083	72.625	82.000	A4	6A	3
Clad Sliding French Door–3 or 4 Panel	3727	2426	146.750	95.500	B2	6A	3
Wood Sliding French Door–2 Panel	1845	2083	72.625	82.000	A4	6A	3
Wood Sliding French Door–3 or 4 Panel	3727	2426	146.750	95.500	B2	6A	3
Clad Sliding Patio Door	3727	2435	146.750	95.875	B1	4A	3
Wood Sliding Patio Door	3727	2426	146.750	95.500	B1	4A	3
Clad 2 1/4" Inswing French Door	1845	3035	72.625	119.500	A3	3A	4
Clad 2 1/4" Outswing French Door	1845	3035	72.625	119.500	A4	4A	4
Wood 2 1/4" Inswing French Door	1845	3035	72.625	119.500	A3	3A	4
Wood 2 1/4" Outswing French Door	1845	3035	72.625	119.500	A4	4A	4

Thermal Performance

Aluminium Clad Wood Sliding Sash Window

Size	Millimetres	Inches
Sliding Sash	1153x2042	45.375x80.375

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 11.5 mm argon / 3.1 mm clr	18 mm (11/16") Dual	1.7	0.45	0.72	1.3	0.051	2.03
3.1 mm clr / 16.0 mm argon / LoĒ-180 3.1 mm	22 mm (7/8") Dual	1.7	0.70	0.79	1.3	0.054	1.91
3.1 mm LoĒ2-272® / 16.0 mm argon / 3.1 mm clr	22 mm (7/8") Dual	1.6	0.44	0.72	1.1	0.054	1.91
3.1 mm LoĒ3-366® / 16.0 mm argon / 3.1 mm clr	22 mm (7/8") Dual	1.6	0.31	0.65	1.1	0.054	1.91
3.9 mm clr / 14.5 mm argon / LoĒ-180 3.9 mm	22 mm (7/8") Dual	1.7	0.68	0.79	1.2	0.059	1.90
3.9 mm LoĒ2-272® / 14.5 mm argon / 3.9 mm clr	22 mm (7/8") Dual	1.6	0.44	0.72	1.1	0.059	1.90
3.9 mm LoĒ3-366® / 14.5 mm argon / 3.9 mm clr	22 mm (7/8") Dual	1.6	0.30	0.64	1.1	0.059	1.90
3.1 mm LoĒ-180 / 6.5 mm argon / 3.1 mm clr / 6.5 mm argon / LoĒ-180 3.1 mm	22 mm (7/8") Tripane	1.6	0.57	0.70	1.2	0.051	1.91
3.1 mm LoĒ-180 / 6.5 mm krypton–argon / 3.1 mm clr / 6.5 mm krypton–argon / LoĒ-180 3.1 mm	22 mm (7/8") Tripane	1.5	0.58	0.70	1.0	0.051	1.91
3.1 mm LoĒ2-272® / 6.5 mm argon / 3.1 mm clr / 6.5 mm argon / LoĒ2-272® 3.1 mm	22 mm (7/8") Tripane	1.6	0.39	0.58	1.1	0.051	1.91
3.1 mm LoĒ2-272® / 6.5 mm krypton–argon / 3.1 mm clr / 6.5 mm krypton–argon / LoĒ2-272® 3.1 mm	22 mm (7/8") Tripane	1.4	0.39	0.58	0.9	0.051	1.91

Thermal Performance

Wood Sliding Sash Window

Size	Millimetres	Inches
Sliding Sash	1153x2057	45.375x81.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 11.5 mm argon / 3.1 mm clr	18 mm (11/16″) Dual	1.6	0.45	0.72	1.3	0.052	1.7
3.9 mm LoĒ2-272® / 9.8 mm argon / 3.9 mm clr	18 mm (11/16″) Dual	1.8	0.44	0.72	1.4	0.056	1.7
3.1 mm LoĒ2-272® / 16.0 mm argon / 3.1 mm clr	22 mm (7/8″) Dual	1.5	0.44	0.72	1.1	0.055	1.62
3.9 mm LoĒ2-272® / 14.5 mm argon / 3.9 mm clr	22 mm (7/8″) Dual	1.5	0.44	0.72	1.1	0.06	1.61
3.1 mm LoĒ-180' / 6.5 mm argon / 3.1 mm clr / 6.5 mm argon / LoĒ-180' 3.1 mm	22 mm (7/8″) Tripane	1.5	0.57	0.7	1.2	0.052	1.61
3.1 mm LoĒ-180' / 6.5 mm krypton–argon / 3.1 mm clr / 6.5 mm krypton–argon / LoĒ-180' 3.1 mm	22 mm (7/8″) Tripane	1.4	0.58	0.7	1	0.052	1.61
3.1 mm LoĒ2-272® / 6.5 mm argon / 3.1 mm clr / 6.5 mm argon / LoĒ2-272® 3.1 mm	22 mm (7/8″) Tripane	1.5	0.39	0.58	1.1	0.052	1.61
3.1 mm LoĒ2-272® / 6.5 mm krypton–argon / 3.1 mm clr / 6.5 mm krypton–argon / LoĒ2-272® 3.1 mm	22 mm (7/8″) Tripane	1.3	0.39	0.58	0.9	0.052	1.61

Thermal Performance

Aluminium Clad Wood Casement Window

Size	Millimetres	Inches
Casement	1153x2042	45.375x80.375

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.4	0.45	0.72	1.19	0.048	1.62
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.5	0.44	0.72	1.29	0.052	1.61
3.9 mm LoĒ2-272® / 17.5 mm argon / 3.9 mm clr	25 mm (1") Dual	1.4	0.44	0.72	1.15	0.052	1.6
5.9 mm LoĒ2-272® / 13.0 mm argon / 5.9 mm clr	25 mm (1") Dual	1.4	0.43	0.7	1.18	0.057	1.61
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.3	0.57	0.7	1.02	0.045	1.61
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.1	0.58	0.7	0.85	0.047	1.6
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.2	0.39	0.58	0.96	0.045	1.61
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.1	0.39	0.58	0.79	0.047	1.6
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.3	0.55	0.69	1.11	0.05	1.59
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.2	0.55	0.69	0.93	0.052	1.59
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.3	0.38	0.57	1.05	0.05	1.59
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.1	0.38	0.57	0.87	0.052	1.59
3.1 mm LoĒ-180' / 13.0 mm argon / 3.1 mm clr / 13.0 mm argon / LoĒ-180' 3.1 mm	35 mm (1 1/2") Tripane	1	0.57	0.7	0.73	0.044	1.6
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr / 13.0 mm argon / LoĒ2-272® 3.1 mm	35 mm (1 1/2") Tripane	1	0.39	0.58	0.66	0.044	1.6
3.9 mm LoĒ-180' / 11.5 mm argon / 3.9 mm clr / 11.5 mm argon / LoĒ-180' 3.9 mm	35 mm (1 1/2") Tripane	1.1	0.55	0.69	0.79	0.045	1.6
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr / 11.5 mm argon / LoĒ2-272® 3.9 mm	35 mm (1 1/2") Tripane	1	0.38	0.57	0.73	0.045	1.6

Thermal Performance

Wood Casement Window

Size	Millimetres	Inches
Casement	1016x2337	40.000x92.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.3	0.45	0.72	1.19	0.045	1.42
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.4	0.44	0.72	1.29	0.046	1.42
3.9 mm LoĒ2-272® / 17.5 mm argon / 3.9 mm clr	25 mm (1") Dual	1.3	0.44	0.72	1.15	0.046	1.34
5.9 mm LoĒ2-272® / 13.0 mm argon / 5.9 mm clr	25 mm (1") Dual	1.4	0.43	0.7	1.18	0.055	1.34
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.2	0.57	0.7	1.02	0.04	1.34
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.1	0.58	0.7	0.85	0.042	1.34
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.1	0.39	0.58	0.96	0.04	1.34
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1	0.39	0.58	0.79	0.042	1.34
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.3	0.55	0.69	1.11	0.044	1.33
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.1	0.55	0.69	0.93	0.047	1.33
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.2	0.38	0.57	1.05	0.044	1.33
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.1	0.38	0.57	0.87	0.047	1.33

Thermal Performance

Aluminium Clad Wood Tilt-Turn Window

Size	Millimetres	Inches
Tilt-Turn	1219x1829	48.000x72.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.5	0.44	0.72	1.14	0.048	2.09
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.5	0.44	0.72	1.13	0.054	2.08
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.4	0.57	0.7	1.02	0.045	2.06
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.3	0.58	0.7	0.85	0.047	2.06
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.4	0.39	0.58	0.96	0.045	2.06
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.3	0.39	0.58	0.79	0.047	2.06
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.5	0.55	0.69	1.11	0.05	2.05
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.4	0.55	0.69	0.93	0.052	2.05
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.5	0.38	0.57	1.05	0.05	2.05
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.3	0.38	0.57	0.87	0.052	2.05

Thermal Performance

Wood Tilt-Turn Window

Size	Millimetres	Inches
Tilt-Turn	1219X1829	48.000X72.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4″) Dual	1.3	0.44	0.72	1.14	0.043	1.49
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4″) Dual	1.3	0.44	0.72	1.13	0.049	1.49
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1″) Tripane	1.3	0.57	0.7	1.02	0.04	1.47
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1″) Tripane	1.1	0.58	0.7	0.85	0.041	1.47
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1″) Tripane	1.2	0.39	0.58	0.96	0.04	1.47
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1″) Tripane	1.1	0.39	0.58	0.79	0.041	1.47
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1″) Tripane	1.3	0.55	0.69	1.11	0.045	1.47
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1″) Tripane	1.2	0.55	0.69	0.93	0.047	1.47
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1″) Tripane	1.3	0.38	0.57	1.05	0.045	1.47
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1″) Tripane	1.2	0.38	0.57	0.87	0.047	1.47

Thermal Performance

Aluminium Clad Wood Fixed Round Top Window

Size	Millimetres	Inches
Round Top	2134x2438	84.000X96.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.3	0.45	0.72	1.19	0.049	2.23
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.4	0.44	0.72	1.29	0.054	2.21
3.9 mm LoĒ2-272® / 17.5 mm argon / 3.9 mm clr	25 mm (1") Dual	1.3	0.44	0.72	1.15	0.049	1.99
5.9 mm LoĒ2-272® / 13.0 mm argon / 5.9 mm clr	25 mm (1") Dual	1.3	0.43	0.7	1.18	0.062	2
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.2	0.57	0.7	1.02	0.064	1.99
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.1	0.58	0.7	0.85	0.096	1.99
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.1	0.39	0.58	0.96	0.064	1.99
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1	0.39	0.58	0.79	0.096	1.99
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.3	0.55	0.69	1.11	0.067	1.91
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.2	0.55	0.69	0.93	0.102	1.91
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.2	0.38	0.57	1.05	0.067	1.91
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.1	0.38	0.57	0.87	0.102	1.91
3.1 mm LoĒ-180' / 13.0 mm argon / 3.1 mm clr / 13.0 mm argon / LoĒ-180' 3.1 mm	35 mm (1 1/2") Tripane	0.9	0.57	0.7	0.73	0.048	1.65
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr / 13.0 mm argon / LoĒ2-272® 3.1 mm	35 mm (1 1/2") Tripane	0.8	0.39	0.58	0.66	0.048	1.65
3.9 mm LoĒ-180' / 11.5 mm argon / 3.9 mm clr / 11.5 mm argon / LoĒ-180' 3.9 mm	35 mm (1 1/2") Tripane	0.9	0.55	0.69	0.79	0.052	1.73
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr / 11.5 mm argon / LoĒ2-272® 3.9 mm	35 mm (1 1/2") Tripane	0.9	0.38	0.57	0.73	0.052	1.73

Thermal Performance

Wood Fixed Round Top Window

Size	Millimetres	Inches
Round Top	2134x2438	84.000X96.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.3	0.45	0.72	1.19	0.04	1.26
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.4	0.44	0.72	1.29	0.044	1.26
3.9 mm LoĒ2-272® / 17.5 mm argon / 3.9 mm clr	25 mm (1") Dual	1.2	0.44	0.72	1.15	0.04	1.21
5.9 mm LoĒ2-272® / 13.0 mm argon / 5.9 mm clr	25 mm (1") Dual	1.3	0.43	0.7	1.18	0.051	1.22
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.1	0.57	0.7	1.02	0.05	1.19
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1	0.58	0.7	0.85	0.052	1.19
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.1	0.39	0.58	0.96	0.05	1.19
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	0.9	0.39	0.58	0.79	0.052	1.19
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.2	0.55	0.69	1.11	0.053	1.19
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1	0.55	0.69	0.93	0.056	1.19
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.1	0.38	0.57	1.05	0.053	1.19
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1	0.38	0.57	0.87	0.056	1.19

Thermal Performance

Aluminium Clad Wood Fixed Special Shape Window

Size	Millimetres	Inches
Special Shape	2134x2438	84.000X96.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value (Largest)	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.3	0.45	0.72	1.19	0.045	2.02
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.4	0.44	0.72	1.29	0.047	1.99
3.9 mm LoĒ2-272® / 17.5 mm argon / 3.9 mm clr	25 mm (1") Dual	1.3	0.44	0.72	1.15	0.047	1.82
5.9 mm LoĒ2-272® / 13.0 mm argon / 5.9 mm clr	25 mm (1") Dual	1.3	0.43	0.7	1.18	0.057	1.84
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.2	0.57	0.7	1.02	0.042	1.82
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1	0.58	0.7	1.85	0.043	1.84
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1.1	0.39	0.58	0.96	0.042	1.82
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	0.9	0.39	0.58	0.79	0.043	1.84
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.2	0.55	0.69	0.11	0.047	1.81
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.1	0.55	0.69	0.93	0.049	1.81
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.2	0.38	0.57	1.05	0.047	1.81
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1	0.38	0.57	0.87	0.049	1.81
3.1 mm LoĒ-180' / 13.0 mm argon / 3.1 mm clr / 13.0 mm argon / LoĒ-180' 3.1 mm	35 mm (1 1/2") Tripane	0.9	0.57	0.7	0.73	0.043	1.6
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr / 13.0 mm argon / LoĒ2-272® 3.1 mm	35 mm (1 1/2") Tripane	0.8	0.39	0.58	0.66	0.043	1.6
3.9 mm LoĒ-180' / 11.5 mm argon / 3.9 mm clr / 11.5 mm argon / LoĒ-180' 3.9 mm	35 mm (1 1/2") Tripane	0.9	0.55	0.69	0.79	0.044	1.61
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr / 11.5 mm argon / LoĒ2-272® 3.9 mm	35 mm (1 1/2") Tripane	0.9	0.38	0.57	0.73	0.044	1.61

Thermal Performance

Wood Fixed Special Shape Window

Size	Millimetres	Inches
Special Shape	2134x2438	84.000X96.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value (Largest)	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.3	0.45	0.72	1.19	0.038	1.25
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.4	0.44	0.72	1.29	0.039	1.24
3.9 mm LoĒ2-272® / 17.5 mm argon / 3.9 mm clr	25 mm (1") Dual	1.2	0.44	0.72	1.15	0.04	1.2
5.9 mm LoĒ2-272® / 13.0 mm argon / 5.9 mm clr	25 mm (1") Dual	1.3	0.43	0.7	1.18	0.049	1.2
3.1 mm LoĒ-180' / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	1.1	0.57	0.7	1.02	0.034	1.2
3.1 mm LoĒ-180' / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ-180' 3.1 mm	25 mm (1") Tripane	0.9	0.58	0.7	0.85	0.036	1.19
3.1 mm LoĒ2-272® / 8.0 mm argon / 3.1 mm clr / 8.0 mm argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	1	0.39	0.58	0.96	0.034	1.2
3.1 mm LoĒ2-272® / 8.0 mm krypton–argon / 3.1 mm clr / 8.0 mm krypton–argon / LoĒ2-272® 3.1 mm	25 mm (1") Tripane	0.9	0.39	0.58	0.79	0.036	1.19
3.9 mm LoĒ-180' / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1.2	0.55	0.69	1.11	0.038	1.19
3.9 mm LoĒ-180' / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ-180' 3.9 mm	25 mm (1") Tripane	1	0.55	0.69	0.93	0.041	1.18
3.9 mm LoĒ2-272® / 7.0 mm argon / 3.9 mm clr / 7.0 mm argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1.1	0.38	0.57	1.05	0.038	1.19
3.9 mm LoĒ2-272® / 7.0 mm krypton–argon / 3.9 mm clr / 7.0 mm krypton–argon / LoĒ2-272® 3.9 mm	25 mm (1") Tripane	1	0.38	0.57	0.87	0.041	1.18

Thermal Performance

Aluminium Clad Wood Inswing French Door

Size	Millimetres	Inches
Inswing French	1845x2083	72.625x82.000

Certified Thermal Unit Values					
Glass Options	**Glass Thickness**	**U Value**	**G Value (Solar Gain)**	**Visible Transmittance**	**Ug**
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.7	0.45	0.72	1.2
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.7	0.44	0.72	1.3

Thermal Performance

Wood Inswing French Door

Size	Millimetres	Inches
Inswing French	1845x2083	72.625x82.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.6	0.45	0.72	1.2
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.7	0.44	0.72	1.3

Thermal Performance

Aluminium Clad Wood Outswing French Door

Size	Millimetres	Inches
Outswing French	1845x2083	72.625x82.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.6	0.45	0.72	1.2
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.7	0.44	0.72	1.3

Thermal Performance

Wood Outswing French Door

Size	Millimetres	Inches
Outswing French	1845x2083	72.625x82.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value	G Value (Solar Gain)	Visible Transmittance	Ug
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.6	0.45	0.72	1.2
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.7	0.44	0.72	1.3

Thermal Performance

Aluminium Clad Wood Sliding French Door

Size	Millimetres	Inches
Sliding French	1845x2083	72.625x82.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value (Largest)	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.6	0.45	0.72	1.19	0.06	1.97
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.7	0.44	0.72	1.29	0.066	1.97

Thermal Performance

Wood Sliding French Door

Size	Millimetres	Inches
Sliding French	1845x2083	72.625x82.000

Certified Thermal Unit Values

Glass Options	Glass Thickness	U Value (Largest)	G Value (Solar Gain)	Visible Transmittance	Ug	PSI	Uf
3.1 mm LoĒ2-272® / 13.0 mm argon / 3.1 mm clr	19 mm (3/4") Dual	1.6	0.45	0.72	1.19	0.053	1.82
3.9 mm LoĒ2-272® / 11.5 mm argon / 3.9 mm clr	19 mm (3/4") Dual	1.6	0.44	0.72	1.29	0.059	1.82

CE certified Wood sliding sash windows:

Supplier to be Marvin Architectural Ltd,

Stephen St. Dunlavin, Co. Wicklow 045 401000;

Product referral; Wood Ultimate Double Hung; Species Pinus Ponderosa, knot and defect free;

Sash & frame to be Bare wood Ponderosa Pine;

Double –Vac wood *preservative* to give 60 years services life.

Surface mounted Open style crescent sash lock with tilt in feature for easy cleaning capacity;

Block & Tackle balance system;

Continuous leaf weather-stripping at head jamb; dual bulb at checkrail; weather-strip and bottom rail;

Jamb extensions and shutters finishes available, contact Marvin Architectural for details;

Insect and combination storm screens available, contact Marvin Architectural for details;

Glazing bars, available in simulated divided light with/without spacer bars, grilles between glass, interior grille option, coloured perimeter and spacer bar options,

Glazing bar widths are available in 16mm, 22mm, 28mm, 61mm and for custom option availability contact Marvin Architectural for details.

Soft coast low E 272 with warm edge space,

Glazing to conform to EN1279;

This window product is to conform to EN 14351-1 :2006

To Meet or exceed on Air permeability EN 12207, class 3

Water-tightness EN 12208, class 7A,

Resistance to wind load EN 12210, class B3,

Light Transmittance, 0.72.

Solar Heat Gain, 0.49.

Thermal Transmittance between 1.2 & 1.8,

Appendix 5

SUNPOWER

E20/333 and E20/327 SOLAR PANELS

20% EFFICIENCY

SunPower E20 panels are the highest efficiency panels on the market today, providing more power in the same amount of space

TRANSFORMERLESS INVERTER COMPATIBILITY

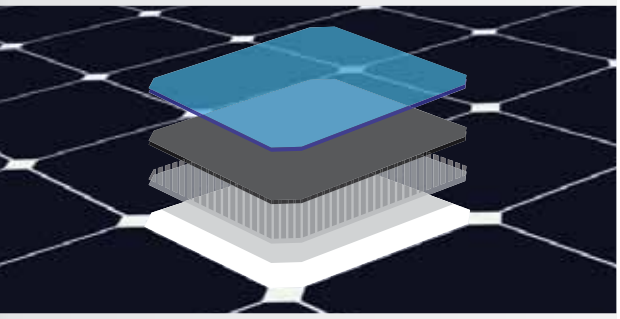
Comprehensive inverter compatibility ensures that customers can pair the highest-efficiency panels with the highest-efficiency inverters, maximizing system output

POSITIVE POWER TOLERANCE

Positive tolerance ensures customers receive the rated power or higher for every panel

RELIABLE AND ROBUST DESIGN

SunPower's unique Maxeon™ cell technology and advanced module design ensure industry-leading reliability



MAXEON™ CELL TECHNOLOGY

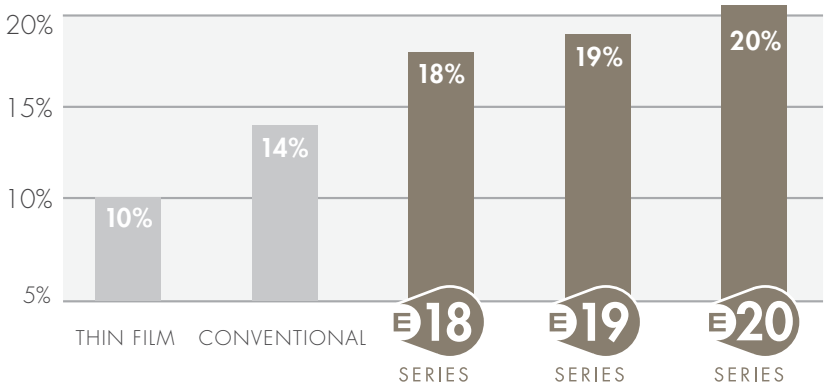
Patented all-back-contact solar cell, providing the industry's highest efficiency and reliability.

E20 SERIES

THE WORLD'S STANDARD FOR SOLAR™

SunPower™ E20 Solar Panels provide today's highest efficiency and performance. Powered by SunPower Maxeon™ cell technology, the E20 series provides panel conversion efficiencies of up to 20.4%. The E20's low voltage temperature coefficient, anti-reflective glass and exceptional low-light performance attributes provide outstanding energy delivery per peak power watt.

SUNPOWER'S HIGH EFFICIENCY ADVANTAGE



www.sunpowercorp.co.uk

SUNPOWER

E20/333 and E20/327 SOLAR PANELS

MODELS: SPR-333NE-WHT-D, SPR-327NE-WHT-D

ELECTRICAL DATA

Measured at Standard Test Conditions (STC): Irradiance 1000W/m², AM 1.5, and cell temperature 25° C

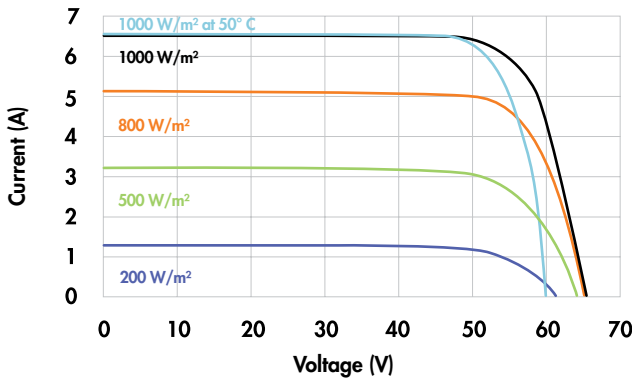
Nominal Power (+5/-0%)	P_{nom}	333 W	327 W
Cell Efficiency	η	22.9 %	22.5 %
Panel Efficiency	η	20.4 %	20.1 %
Rated Voltage	V_{mpp}	54.7 V	54.7 V
Rated Current	I_{mpp}	6.09 A	5.98 A
Open-Circuit Voltage	V_{oc}	65.3 V	64.9 V
Short-Circuit Current	I_{sc}	6.46 A	6.46 A
Maximum System Voltage	IEC	1000 V	
Temperature Coefficients	Power (P)	– 0.38 %/K	
	Voltage (V_{oc})	– 176.6 mV/K	
	Current (I_{sc})	3.5 mA /K	
NOCT		45° C +/– 2° C	
Series Fuse Rating		20 A	
Limiting Reverse Current (3 strings)	I_R	16.2 A	
Grounding		Positive grounding not required	

ELECTRICAL DATA

Measured at Nominal Operating Cell Temperature (NOCT): Irradiance 800W/m², 20° C, wind 1 m/s

Nominal Power	P_{nom}	247 W	243 W
Rated Voltage	V_{mpp}	50.4 V	50.4 V
Rated Current	I_{mpp}	4.91 A	4.82 A
Open-Circuit Voltage	V_{oc}	61.2 V	60.8 V
Short-Circuit Voltage	I_{sc}	5.22 A	5.22 A

I-V CURVE



Current/voltage characteristics with dependence on irradiance and module temperature.

TESTED OPERATING CONDITIONS

Temperature	– 40° C to +85° C
Max load	550 kg/m² (5400 Pa), front (e.g. snow) w/specified mounting configurations
	245 kg/m² (2400 Pa) front and back (e.g. wind)
Impact Resistance	Hail: 25 mm at 23 m/s

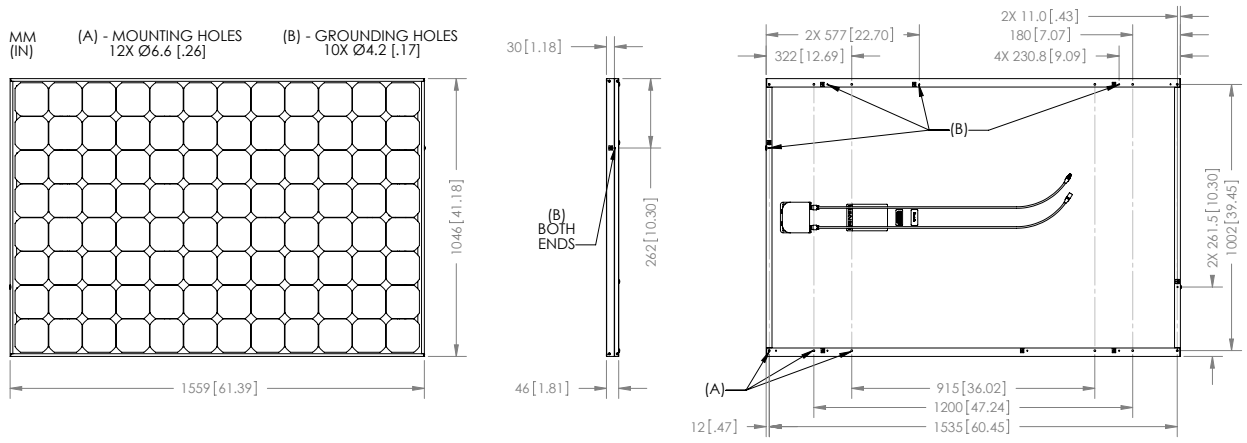
WARRANTIES AND CERTIFICATIONS

Warranties	25-year limited power warranty
	10-year limited product warranty
Certifications	IEC 61215 Ed. 2, IEC 61730 (SCII)

MECHANICAL DATA

Cells	96 SunPower Maxeon™ cells
Front Glass	High-transmission tempered glass with anti-reflective (AR) coating
Junction Box	IP-65 rated with 3 bypass diodes
	32 x 155 x 128 mm
Output Cables	1000 mm cables / Multi-Contact (MC4) connectors
Frame	Anodised aluminium alloy type 6063 (black)
Weight	18.6 kg

DIMENSIONS



Please read safety and installation instructions before using this product, visit sunpowercorp.com for more details.

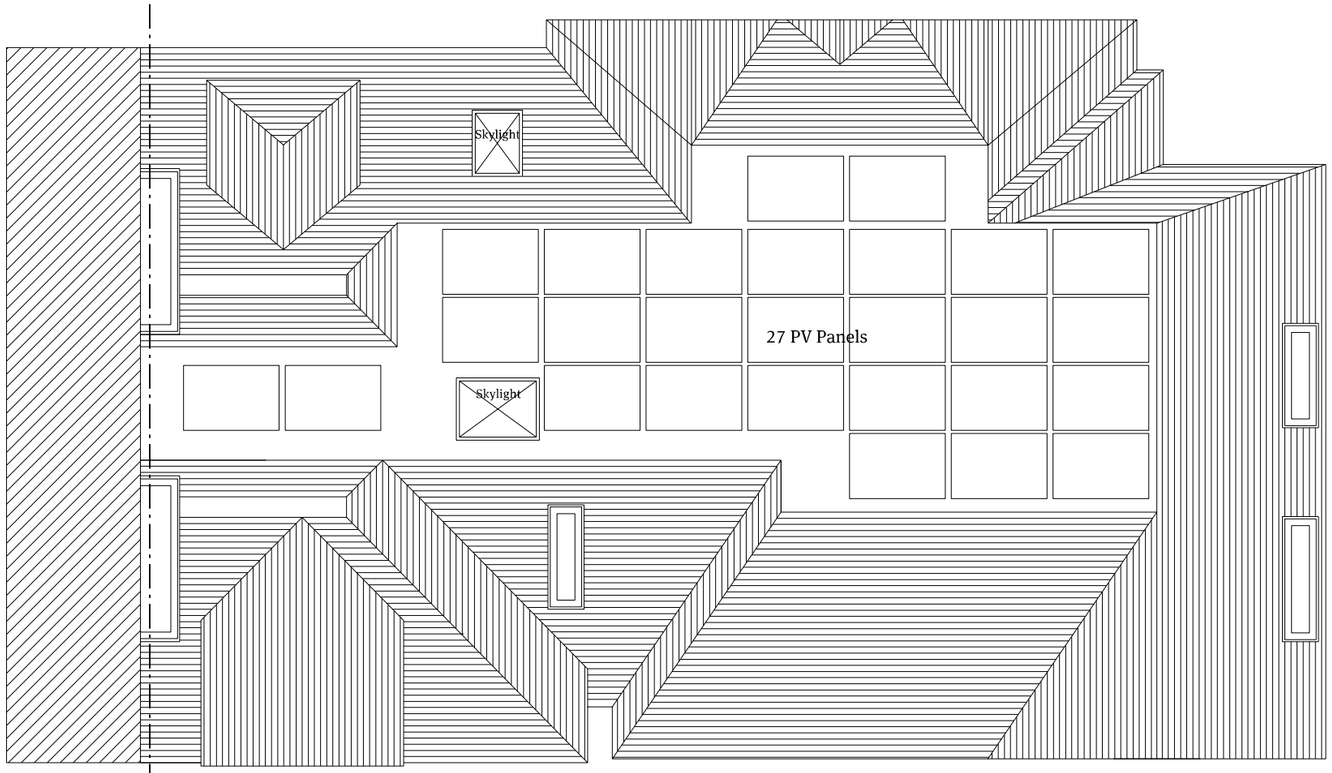
sunpowercorp.com
Document #001-65483 Rev*B / A4_EN
CS 11_263

03 00 211 Elevation

ref. to drg. 1303 00 211 Elevation 03 00 211

04 00 213 Elevation

ref. to drg. 1303 00 212 Elevation 02 00 212



01 Proposed Roof Plan
1:100@A3

Elevation ref. to drg. 1303 00 213 04 00 213

Elevation 02 00 212

01 00 210 Elevation

01 00 210

Notes

Do not scale this drawing. All dimensions must be checked and Papa Architects are to be informed of any discrepencies prior to construction. Any DWG's issued by PAPA architects are to be read in conjunction with the associated PDF versionsThis drawing and any of the details therein remain the copyright of Papa Architects Ltd.

Rev	Date	Reason For Issue	Chk

0 1 2 3 m

PAPA

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Client

Address

18-20 Frognal
NW3 6AG

Drawing title

Proposed Roof Plan

Project No.	Date	Scale
1303	March 14	1:100@A3

Drawing No.	Current Rev
00 206	

Appendix 6

Alex Timperley

From: Andy Paps [Andy.Paps@papaarchitects.co.uk]
Sent: 06 October 2014 11:11
To: Alex Timperley
Cc: Margaret Lazar
Subject: RE: 18 - 20 Frognal

Hi Alex

I am out of the office preparing for a committee hearing. I will do my best to have a look at this on my return, Wednesday afternoon. However Refurb costs are approx £2m. Savills will be preparing an order of costs as part of their viability statement, so I will no more once this is received.

In the meantime Margaret is preparing the roof plan and will issue to you later today.

Kind Regards,

Andrew Paps
Director
andy@papaarchitects.co.uk

Papa Architects Ltd Office: 020 8348 8411
222 Archway Road, Highgate, London N6 5AX
http://www.papaarchitects.co.uk

From: Alex Timperley [mailto:alex.timperley@nrgconsulting.org]
Sent: 06 October 2014 09:14
To: Andy Paps; Nicholas Papas
Subject: Fwd: 18 - 20 Frognal

Morning Andy,

Have you had a chance to look at the below email and attachment yet?

Regards,

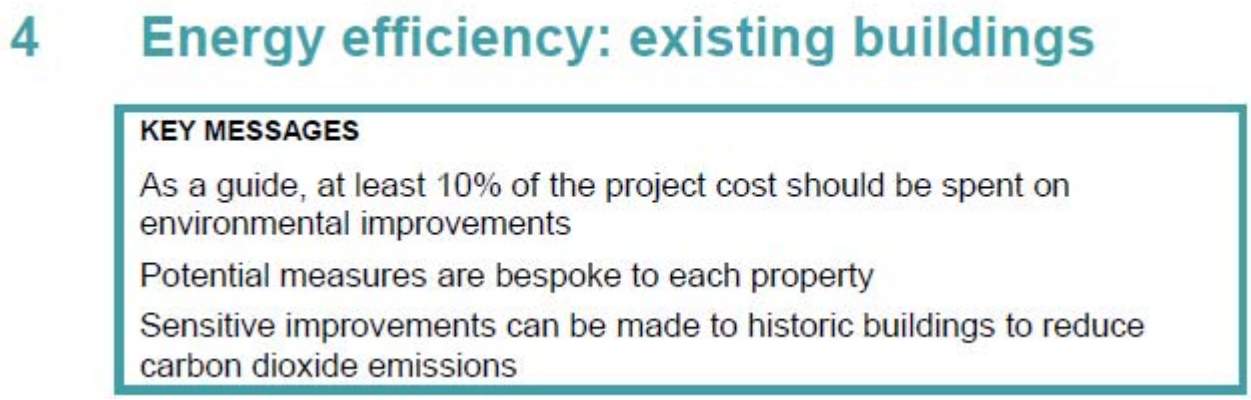
Alex

---------- Forwarded message ----------
From: "Alex Timperley" <alex.timperley@nrgconsulting.org>
Date: 30 Sep 2014 09:20
Subject: 18 - 20 Frognal
To: "Nicholas Papas" <Nicholas@papaarchitects.co.uk>
Cc: "Andy Paps" <Andy.Paps@papaarchitects.co.uk>

Morning Gents,

The Frognal report is progressing but I've hit a slight snag I need your help with. The gist of it is that the London Plan (regional policy) has no real provision for a major refurbishment job (over 9 units) so we have to rely on the local policies of the relevant Borough. In this case, Camden has something a bit strange which I can't answer on my own.

The local policy states that:



So I will need to know what the total project cost is. I will also need you to fill in the relevant parts of the attached Checklist. If you could fill in all elements which will be included to your knowledge and include the approximate cost of each in the "Evidence" column then return that by email with a short statement saying that the costs are correct at this stage (for my paper trail) that would be much appreciated.

If you have any questions then I am in the office all day so please give me a call.

Regards,

Alex

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