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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

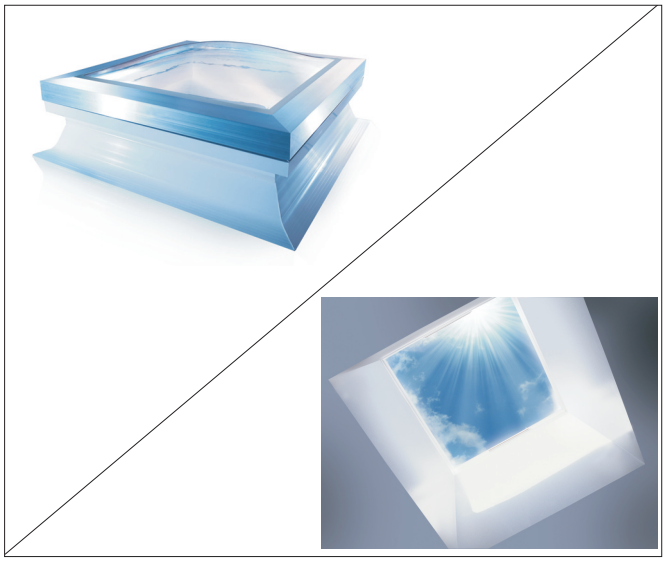
Agrément Certificate
06/4385
Product Sheet 1

BRETT MARTIN MARDOME ROOFLIGHTS AND KERBS

THE MARDOME ULTRA ROOFLIGHT

This Agrément Certificate Product Sheet(1) relates to The Mardome Ultra Rooflight, for use on flat roofs of domestic and non-domestic buildings, to provide natural light and ventilation.

(1) Hereinafter referred to as 'Certificate'.



CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Light and solar transmittance — the product provides natural lighting to the interior of a building (see section 6).

Thermal properties — for a typical 1.2 m by 1.2 m roof opening, triple-skinned products can achieve a U value of 1.9 $W \cdot m^{-2} \cdot K^{-1}$ (see section 7).

Condensation risk — the risk of condensation on the product's internal surface will depend on the building type and ventilator used (see section 8).

Strength and stability — the product can withstand wind and snow loads typical in the UK (see section 9).

Weathertightness — the product is weathertight (see section 10).

Behaviour in relation to fire — the polycarbonate domes can be classified as Tp(a) rigid in accordance with national Building Regulations. When tested to European classification EN 13501-1 : 2002, the polycarbonate dome achieved a European Class B, s1, d0 (see section 11).

Safety — the rooflight assembly is rated a Class B non-fragile assembly (see section 12).

Ventilation — opening rooflights can provide rapid ventilation and, when fitted, ventilators can provide background ventilation (see section 13).

Acoustic properties — triple-skinned polycarbonate rooflights resist the passage of sound generated by falling rainfall (see section 15).

Durability — the product will have a life of at least 15 years for the polycarbonate material and 35 years for the PVC-U kerb (see section 17).

The BBA has awarded this Agrément Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 12 February 2013

Originally certificated on 29 June 2007

Sean Moriarty — Head of Approvals
Energy and Ventilation

Greg Cooper
Chief Executive

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, The Mardome Ultra Rooflight, if installed, used and maintained in accordance with this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):

The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	**A1**	**Loading**
Comment:		When installed in accordance with the provisions of this Certificate, the product will have sufficient strength and stiffness to sustain the design load. See sections 9.1 and 9.2 of this Certificate.
Requirement:	**B2(1)**	**Internal fire spread (linings)**
Comment:		The polycarbonate sheets used in the rooflights can be classified as Tp(a) rigid material. Under European classifications the polycarbonate material achieved a European Class B, s1, d0 and will adequately resist the spread of flame over its surface. See sections 11.1 and 11.3 of this Certificate.
Requirement:	**B4(2)**	**External fire spread**
Comment:		The polycarbonate sheets used in the rooflights can be taken as classified Tp(a) rigid material. Under European classifications the polycarbonate sheets can be regarded as having a B_{ROOF}(t4) classification and will adequately resist the spread of flame over the roof and from one building to another. See sections 11.1, 11.2 and 11.4 of this Certificate.
Requirement:	**C2(b)**	**Resistance to moisture**
Comment:		When installed in accordance with this Certificate, the rooflights will not adversely affect the resistance of the roof to the passage of moisture. The product provides adequate resistance to the ingress of precipitation. See sections 10.1 and 10.3 of this Certificate.
Requirement:	**C2(c)**	**Resistance to moisture**
		The risk of surface condensation on the product will depend on the building humidity class. Ventilators incorporated in the kerbs will provide airflow to alleviate surface condensation in the rooflights. See sections 8.1 to 8.3 of this Certificate.
Requirement:	**F1**	**Means of ventilation**
Comment:		Opening rooflights and, when fitted, ventilators incorporated in the kerbs can meet or contribute to meeting the Requirement. See section 13 of this Certificate.
Requirement:	**L1(a)(i)**	**Conservation of fuel and power**
Comment:		See sections 7.1 to 7.6 of this Certificate. The product can also contribute to daylighting and solar transmittance. See section 6.1 of this Certificate.
Requirement:	**N3**	**Safe opening and closing of windows, skylights and ventilators**
Comment:		Opening rooflights can meet this requirement by the use of manual or powered actuators (see section 12.1 of this Certificate). This Requirement does not apply to dwellings.
Requirement:	**N4**	**Safe access for cleaning windows etc**
Comment:		Provisions must be made regarding the safe cleaning of rooflights (see section 16.3 of this Certificate). This Requirement does not apply to dwellings.
Regulation:	**7**	**Materials and workmanship**
Comment:		The product is acceptable when used in accordance with this Certificate. See sections 16.1, 16.3, 17 and the *Installation* part of this Certificate.
Regulation:	**26**	**CO_2 emission rates for new buildings**
Comment:		See sections 7.1 to 7.6 of this Certificate. The product can also contribute to daylighting and solar transmittance. See section 6.1 of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Fitness and durability of materials and workmanship**
Comment:		The product can contribute to a construction satisfying this Regulation. See sections 16.1, 16.3, 17 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	1.1(b)	Structure
Comment:		When installed in accordance with the provisions of this Certificate, the product will have sufficient strength and stiffness to sustain design loads, with reference to clause 1.1.1[(1)(2)]. See sections 9.1 and 9.2 of this Certificate.
Standard:	2.5	Internal linings
Comment:		The polycarbonate sheets used in the rooflights can be classified as Tp(a) rigid material, with reference to clauses 2.5.4[(1)(2)] and 2.5.6[(1)(2)]. See section 11.1 of this Certificate.
Standard:	2.8	Spread from neighbouring buildings
Comment:		The external glazing is classified 'low vulnerability' [B_{ROOF}(t4)] and the product is unrestricted by this Standard, with reference to clauses 2.8.1[(1)(2)], 2.C.3[(1)] and 2.F.3[(2)]. See sections 11.1 to 11.4 of this Certificate.
Standard:	3.10	Precipitation
Comment:		When installed in accordance with the provisions stated in this Certificate, the product provides adequate resistance to the ingress of precipitation, with reference to clause 3.10.1[(1)(2)]. See sections 10.1 and 10.3 of this Certificate.

Standard:	3.14	Ventilation
Comment:		Opening rooflights and, when fitted, ventilators incorporated in the kerbs can meet or contribute to meeting this Standard, with reference to clauses 3.14.1[1][2] and 3.14.2[1][2]. Additionally, the rooflights can be opened using manual or powered actuators fitted to the kerbs. See section 13 of this Certificate.
Standard:	3.15	Condensation
Comment:		The risk of surface condensation on the product will depend on the humidity class of the building. When fitted, ventilators incorporated in the kerbs will provide airflow to alleviate surface condensation on the rooflights, with reference to clauses 3.15.1[1] and 3.15.4[1]. See sections 8.1 to 8.3 of this Certificate.
Standard:	3.16	Natural lighting
Comment:		In calculating the contribution of the product to natural lighting, with reference to clauses 3.16.1[1] and 3.16.3[1] to this Standard, the area of glazing given in Table 1 of this Certificate can be used.
Standard:	4.8(c)	Danger from accidents
Comment:		The provisions described in clause 4.8.3[1][2] of this Standard, regarding the safe cleaning of rooflights, must be taken into account. See section 16.3 of this Certificate.
Standard:	4.8(e)	Danger from accidents
Comment:		When fitted, manual or powered actuators incorporated in the kerbs can meet or contribute to meeting this Standard, with reference to clauses 4.8.5[1] and 4.8.6[2]. See section 12.1 of this Certificate.
Standard:	6.1(b)	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		With reference to clauses 6.1.2[1], 6.1.4[1][2], 6.2.1[1][2], 6.2.2[1], 6.2.3[1][2], 6.2.4[2], 6.2.5[2], 6.2.6[2] 6.2.7[1], 6.2.9[1][2], 6.2.10[1], 6.2.11[2] and 6.2.12[2], see sections 6.1 and 7.1 to 7.6 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The product can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition the product can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4[1][2] [Aspects 1[1][2] and 2[1]], 7.1.6[1][2] Aspects [1[1][2] and 2[1]] and 7.1.7[1][2] [Aspect 1[1][2]]. See sections 7.1 to 7.6 of this Certificate.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		All comments given for the product under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1[1][2] and Schedule 6[1][2].

(1) Technical Handbook (Domestic).

(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012

Regulation:	**23(a)(b)**	**Fitness of materials and workmanship**
Comment:		The product is acceptable when used in accordance with this Certificate. See sections 16.1, 16.3, 17 and the *Installation* part of this Certificate.
Regulation:	**28(b)**	**Resistance to moisture and weather**
Comment:		When installed in accordance with the provisions stated in this Certificate, the product will not adversely affect the resistance of the roof to the passage of moisture. See sections 10.1 and 10.3 of this Certificate.
Regulation:	**30**	**Stability**
Comment:		When installed in accordance with the provisions of this Certificate, the product will have sufficient strength and stiffness to sustain the design loads. See sections 9.1 and 9.2 of this Certificate.
Regulation:	**34**	**Internal fire spread — Linings**
Comment:		The polycarbonate sheets used in the rooflights can be classified as Tp(a) rigid material. Under European classifications the polycarbonate material achieved a European Class B, s1, d0 and will adequately resist the spread of flame over its surface. See sections 11.1 and 11.3 of this Certificate.
Regulation:	**36(b)**	**External fire spread**
Comment:		The polycarbonate sheets used in the rooflights can be classified as Tp(a) rigid material. Under European classifications the polycarbonate material achieved a European Class B, s1, d0 and will adequately resist the spread of flame over the roof and from one building to another. See sections 11.1 and 11.4 of this Certificate.
Regulation:	**39(a)(i)**	**Conservation measures**
Regulation:	**40(2)**	**Target carbon dioxide emission rate**
Comment:		See sections 7.1 to 7.6 of this Certificate. The product can also contribute to daylighting and solar transmittance. See section 6.1 of this Certificate.
Regulation:	**65**	**Means of ventilation**
Comment:		Opening rooflights and, when fitted, ventilators incorporated in the kerbs can meet or contribute to meeting the requirements of this Regulation. Additionally, the rooflights can be opened using manual or powered actuators fitted to the kerbs. See section 13 of this Certificate.
Regulation:	**98**	**Safe opening and closing of windows, skylights and ventilators**
Comment:		Opening rooflights can meet this requirement by the use of manual or powered actuators (see section 12.1 of this Certificate). This requirement does not apply to dwellings.
Regulation:	**99**	**Safe means of access for cleaning glazing**
Comment:		Provisions must made regarding the safe cleaning of rooflights. See section 16.3 of this Certificate.

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See section: 3 *Delivery and site handling* (3.1 and 3.3) of this Certificate.

Additional Information

NHBC Standards 2013

In the opinion of the BBA, the use of The Mardome Ultra Rooflight, in relation to this Certificate, is not subject to the requirements of these Standards.

General

This Certificate relates to The Mardome Ultra Rooflight, an individual polycarbonate dome or glazed rooflight with a PVC-U multi-walled kerb. The product is suitable for use on flat roofs of domestic and commercial buildings, to provide natural light and ventilation.

Technical Specification

1 Description

1.1 The Mardome Ultra Rooflight is designed and thermoformed from 3 mm minimum thickness polycarbonate sheets, with a co-extruded Marlon FSX UV protection.

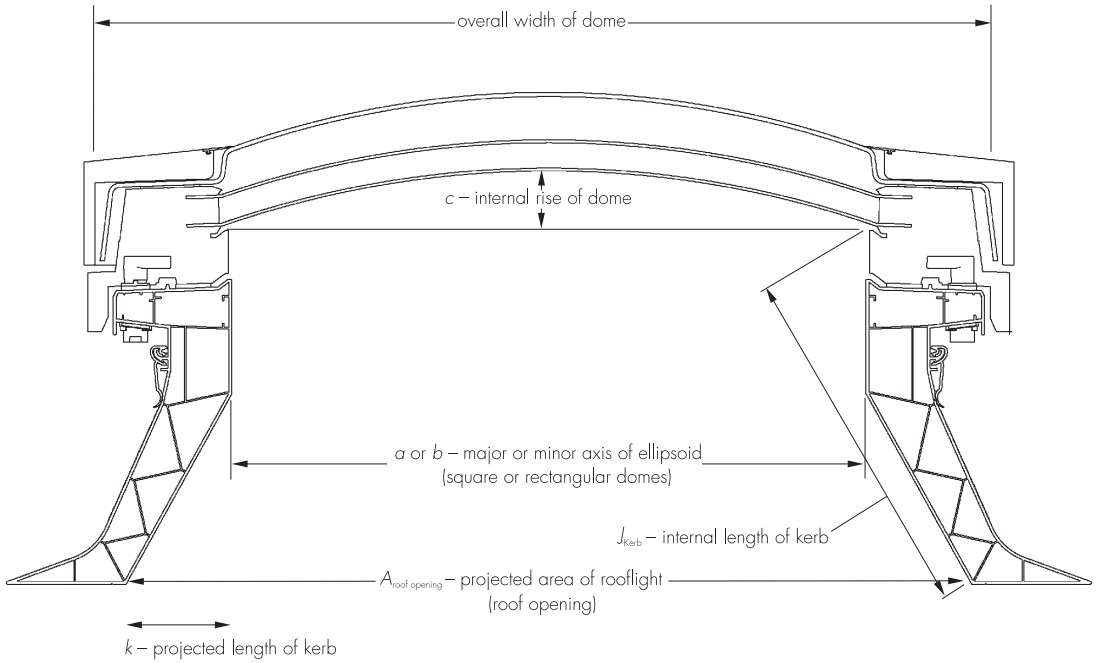
1.2 The polycarbonate rooflights have an anodized aluminium security frame encasing a PVC-U subframe and are available as single-, double- or triple-skin domes, in clear (smooth and textured finish), bronze and opal colours. They are fixed using a 'security latch' security system onto a multi-walled PVC kerb. Options with quad-skins, or with structured polycarbonate beneath standard polycarbonate domes or pyramids, are also available from the Certificate holder but these have not been assessed by the BBA.

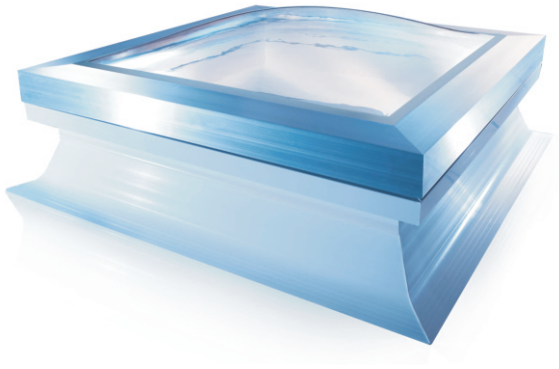
1.3 The polycarbonate glazing is available in a curved dome or a pyramid profile. Kerb adaptors are available from the Certificate holder when non-standard roof openings exist in order to provide a suitable fit onto the prepared builder's upstand. Rooflights are available in the styles and sizes listed in Table 1 and shown in Figure 1.

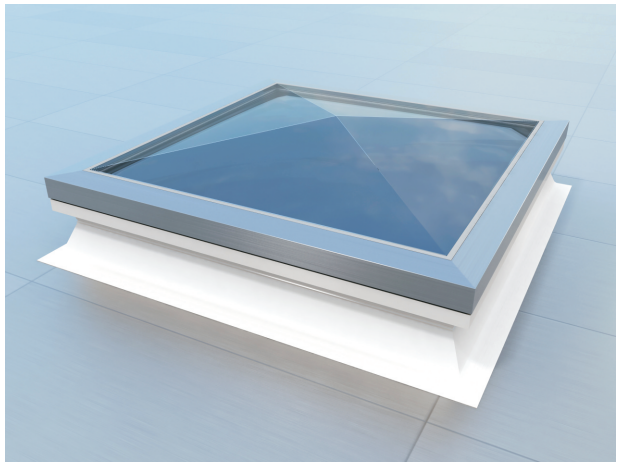
Table 1 Sizes and styles of rooflights

	Dome or pyramid rectangular base (mm)
Square	600 x 600
	750 x 750
	900 x 900
	1050 x 1050
	1200 x 1200
	1350 x 1350
	1500 x 1500
	1800 x 1800
Rectangular	600 x 900
	600 x 1200
	600 x 1500
	750 x 900
	750 x 1050
	900 x 1200
	900 x 1500
	900 x 1800
	1050 x 1350
	1050 x 1500
	1200 x 1500
	1200 x 1800
	1200 x 2400

Figure 1 Mardome Ultra rooflights







1.4 Other sizes within this size range can also be fabricated on request and are covered by this Certificate.

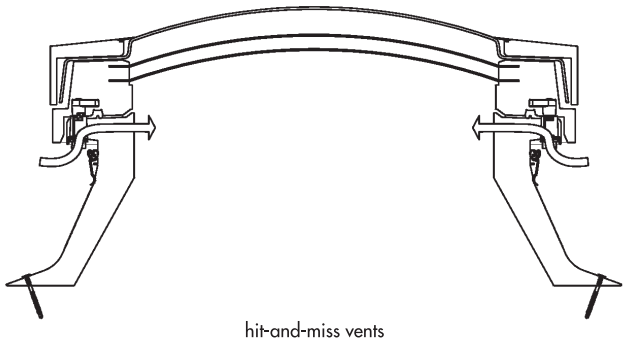
1.5 Mardome Ultra kerbs are manufactured from rigid, white PVC-U, with factory fitted security latches which lock the dome in place. These security latches are concealed from the opportunist intruder, and can only be opened by a key. The kerbs also include an integral factory fitted clamp, which snaps closed to secure the roof covering in place, sealing against water ingress.

1.6 Rooflight kerbs may be unvented or can incorporate vents (either hit-and-miss manually controlled, or automatic humidity controlled(1)). Mardome Ultra Rooflights can also be opened on concealed hinges using actuators (manual or powered) to create a large ventilation area, or on telescopic stays to provide an access hatch (see Figure 2).

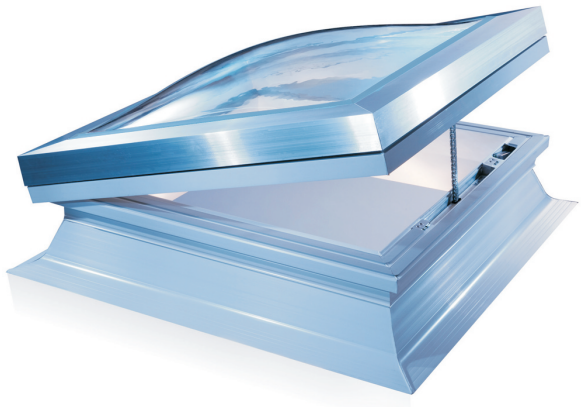
(1) Outside the scope of this Certificate

1.7 The full specifications and drawings for the materials and components covered by this Certificate are retained by the BBA.

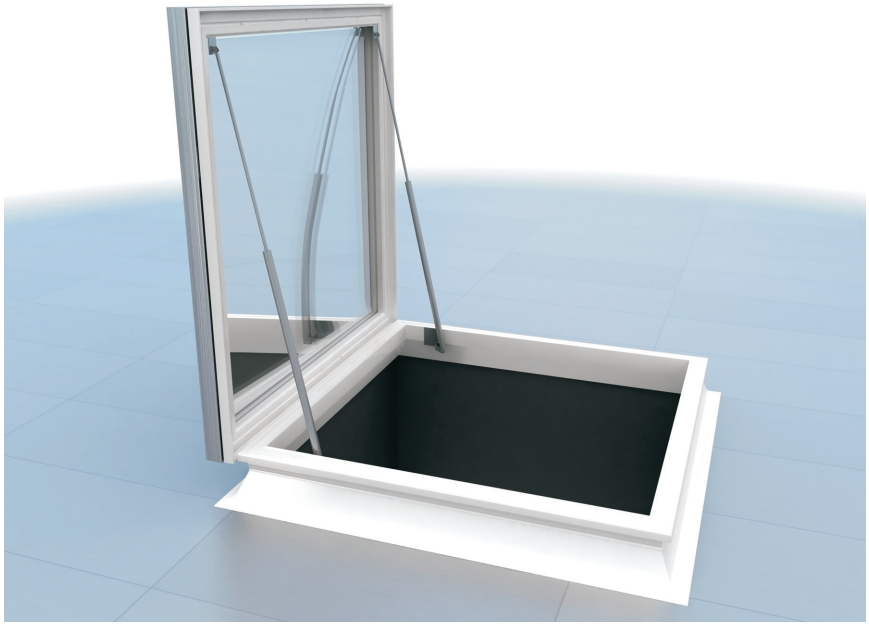
Figure 2 Mardome Ultra ventilation options



hit-and-miss vents



manual/powered actuators

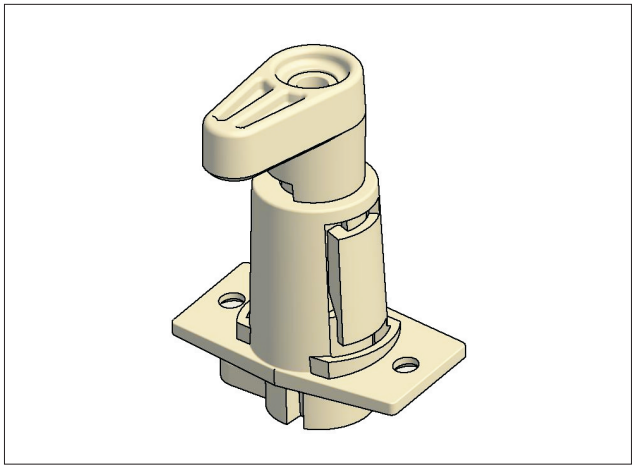


access hatch

1.8 The Product can be supplied complete with factory supplied Mardome Ultra PVC-U kerb, or the dome can be supplied with an adaptor kerb for fitting onto an existing upstand.

1.9 To prevent ingress of moisture, the polycarbonate rooflights are fixed onto the kerb using a series of 'security latches' (see Figure 3). When engaged the 'security latches' compress the foam seal between the kerb and the PVC-U subframe.

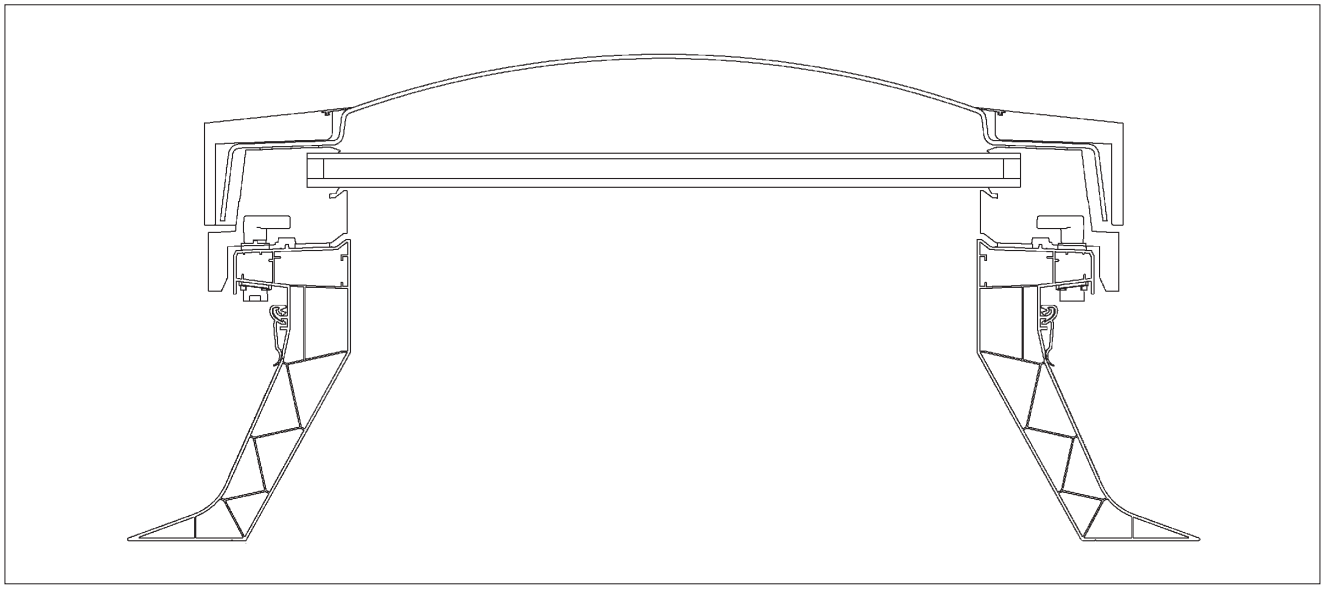
Figure 3 Security latch mechanism



Mardome Glass Rooflights

1.10 Mardome Glass Rooflights are available with a single-skin polycarbonate dome over a double-glazed glass unit as the rooflight section with a similar PVC-U multi-walled kerb (see Figure 4). The glass unit is manufactured in accordance with the relevant parts of BS EN 1279-2 : 2002 and BS EN 1279-3 : 2002.

Figure 4 Mardome Glass rooflight



2 Manufacture

2.1 Polycarbonate sheets are vacuum formed to the appropriate size. Frame and kerb materials are cut and welded together and hinges and other fittings attached to form the rooflight product.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Brett Martin Daylight Systems Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by SGS (Certificate GB92/1201).

3 Delivery and site handling

3.1 The Certificate holder's recommendations for site handling and installation are provided with each delivery.

3.2 The rooflights and kerbs are delivered to site ready assembled or in kit form, wrapped in bubble wrap protective sheet ready for installation. Each rooflight carries a label bearing the company's mark and the job identification mark.

3.3 Smaller units may be manhandled to roof level but larger units will require lifting by crane.

3.4 If the rooflights are to be stored on site they should be stacked on edge with an air gap between each rooflight on a dry, flat, level surface under cover. Multi-skin rooflights must not be nested at any time.

3.5 Before installation the kerbs should be laid on timber packers placed on a level surface to avoid damage to finishes and accessories.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on The Mardome Ultra Rooflight.

Design Considerations

4 General

4.1 The Mardome Ultra Rooflight range is suitable for use on flat roofs of domestic or commercial buildings to provide natural light and ventilation. New roofs should be designed in accordance with BS 6229 : 2003.

4.2 The rooflights and kerbs are suitable for most existing roofs but it is important that the roof is checked by a suitably qualified and experienced individual to ensure that the possible removal of roof supporting members will not cause any problems and that it can bear additional loads imposed upon it by the installation of the product.

4.3 The rooflights are suitable for replacing existing rooflights. The suitability of existing upstands must be checked and be replaced if necessary. If the rooflights are to be fitted onto an upstand other than a factory supplied Mardome Ultra PVC-U kerb, an adaptor kerb from the Certificate holder should be used. Upstands other than a Mardome Ultra PVC-U kerb or adaptor kerb from the Certificate holder are outside the scope of this Certificate.

5 Practicability of installation

The product is designed to be installed by a competent general builder, or a contractor, experienced with this type of product.

6 Light and solar transmittance

6.1 For design purposes, the approximate light and solar transmission characteristics of new material at normal incidence are given in Table 2. These figures and the daylight opening areas given or directed in the *Thermal properties* section of this Certificate may be used in SAP and SBEM[1] calculations.

(1) Further guidance is given in *Designing with rooflights supporting the guidance in AD L2A and AD L2B* (2010), published by NARM (National Association of Rooflight Manufacturers). For guidance the reference AD in this document refers to Approved Document.

Table 2 Light and solar transmittance

Polycarbonate finish	Light transmittance (%)			Solar transmittance[1] ($g_\perp$)		
	Single-skin[2]	Double-skin	Triple-skin	Single-skin	Double-skin	Triple-skin
Clear	88	77	68	0.8	0.7	0.5
Opal	38	33	29	–	–	–
Bronze	58	51	45	–	–	–
Clear/textured	80	70	62	–	–	–

(1) Default values taken from SBEM.

(2) In accordance with BS EN ISO 13468-1 : 1997.

6.2 The methods outlined in CIBSE Guide A (2006) *Environmental design*, Sections 5.7 and 5.8 and Appendix 5 should be used if the total solar gain of the building incorporating the product presents a significant heat input.

7 Thermal properties

7.1 When considering rooflight requirements, designers should refer to the detailed guidance contained in the documents supporting the national Building Regulations. The U values shown in Table 3 or derived in accordance with 7.5 of this Certificate, indicate that typical design U values referred to in those supporting documents can be met (see section 7.4)

7.2 The thermal transmittance value (U value) of a Mardome Trade rooflight measuring 1.2 m by 1.2 m, incorporating PVC-U Mardome Trade non-vented kerb and triple-skin polycarbonate/polycarbonate/polycarbonate, as covered by Product Sheet 3 of this Certificate, when measured by the Guarded Hot Box method according to BS EN ISO 12567-2 : 2005, is 2.4 $W \cdot m^{-2} \cdot K^{-1}$[1]. This corresponds to a U_d value of 1.6 $W \cdot m^{-2} \cdot K^{-1}$[2]. In the opinion of the BBA the U value and U_d value of an equivalent Mardome Ultra triple-skinned polycarbonate rooflight would be similar in performance.

(1) Based on the opening in the roof using horizontal heat flow.

(2) Based on internal rooflight surface area.

7.3 The thermal transmittance (U value) of a Mardome Ultra triple-skin polycarbonate rooflight measuring 1.2 m by 1.2 m is given in Table 3 and is based on internal surface area and the information supplied can be used as input in the Simplified Building Energy Model (SBEM) to calculate the energy used by non-domestic buildings. When required, for example in SAP calculations, the U value associated to the opening area in the roof can be calculated by multiplying the U value given in Table 3 by the surface area ratio.

Table 3 Thermal transmittance (U value) of a standard size triple-skinned dome rooflight

Size		Roof opening area (projected)[1] (m^2)	Surface area ratio[1][2]	Rooflight U value ($W \cdot m^{-2} \cdot K^{-1}$)		
Width (m)	Length (m)			Double-skin[1][2]	Triple-skin[1][2]	Single-skin over double-glazed unit[1][2]
1.20	1.20	1.44	1.6	2.4	1.9	1.5

(1) iSBEM input.

(2) SAP input = rooflight U value multiplied by the surface area ratio (ie roof opening U value).

7.4 Rooflights with U values lower than (or the same as, for new dwellings in Scotland and new non-dwellings in England and Wales) the relevant 'notional' value specified in Tables 4, 5 and 6 of this Certificate will contribute to a building meeting its Target Emission Rate. Rooflights with higher U values may require additional

energy saving measures in the building envelope and/or services. For existing buildings, extensions, conversions etc, rooflights will be acceptable where they do not exceed the relevant U value in Tables 4, 5 and 6.

Table 4 Typical design U values[1] for rooflights — England and Wales

Construction	Mean U value ($W \cdot m^{-2} \cdot K^{-1}$)
Existing dwelling limit	1.6
Existing non-dwelling limit	1.8
New dwelling limit	2.0
Notional dwelling	2.0
New non-dwelling limit	2.2

(1) Flexible approaches on existing buildings and individual limit values are given in the Approved Documents.

Table 5 Typical design U values[1] for rooflights — Scotland

Construction	Mean U value ($W \cdot m^{-2} \cdot K^{-1}$)
Domestic extensions, alterations and conversion unheated building (into dwellings)	1.4[2]
Dwellings – notional[3] and simplified method	1.5
Conversions – unheated[4] and heated[5][6] buildings (into dwellings)	1.6
Domestic – extensions[4] and stand-alone buildings <50m^2	1.6
Domestic and non-domestic alterations[5]	1.6
Non-domestic conversions; unheated and heated[5]	1.6
Non-domestic extensions and alterations	1.6
Shell and fit out buildings	1.6
New dwelling limit (area weighted average for windows, doors and rooflights)	1.8
New non-dwelling limit (area weighted average for windows, doors and rooflights)	2.0
Notional non-domestic building	2.2
Individual element limit for new dwelling and non-dwellings conversion of heated buildings into dwellings[6], conversions of heated or unheated buildings into non-dwellings[7], domestic and non-domestic extensions, alterations to dwellings, stand-alone buildings <50m^2, shell and fit out buildings	3.3

(1) Flexible approaches on existing buildings and individual limit values are given in the Technical Handbooks.
(2) Where the U value of the existing wall and roof is worse than 0.7 and 0.25 $W \cdot m^{-2} \cdot K^{-1}$ respectively.
(3) Average value for all openings.
(4) Where (2) does not apply.
(5) Where new or replacement windows are fitted.
(6) The total area of windows, doors and rooflights, should not exceed 25% of the floor area of the dwelling created by conversion.
(7) The total area of rooflights should not exceed 20% of total roof area.

Table 6 Typical design U values[1] for rooflights — Northern Ireland

Construction	Mean U value ($W \cdot m^{-2} \cdot K^{-1}$)
New fittings in domestic extensions[2] or material change of use[2]	1.8
New fittings in small non-domestic extensions[2]	1.8
Replacement fittings in existing dwellings[2]	2.0
New dwellings and non-domestic limit mean	2.2
Large non-domestic extension limit mean	2.2
Domestic and non-domestic notional building	2.2
Replacement fittings in existing non-dwellings[2]	2.2
Replacement fitting of plastic rooflights in non-dwellings	2.2
Individual element limit for new dwellings, new non-dwellings, large extensions	3.3

(1) Flexible approaches on existing buildings and individual limit values are given in the Technical Booklet.
(2) Or a centre pane U value of 1.2 $W \cdot m^{-2} \cdot K^{-1}$.

7.5 For rooflights with dimensions different to that in sections 7.2 and 7.3, the U values can be calculated using the following equations and glazing U values (see Table 7):

Rooflight U value suitable for SBEM input is given by:

(1) $$U_{rooflight} = \frac{\psi_{kerb}\, l_{kerb} + U_{glazing}\, A_{glazing}}{A_{internal}}$$

Opening area U value suitable for SAP input is given by:

(2) $U_{opening} = U_{rooflight} \times S$

Internal area of the rooflight is given by:

(3) $A_{internal} = A_{glazing} + l_{kerb} \times J_{kerb}$

The surface area ratio of internal and projected areas of the rooflight is given by:

(4) $$S = \frac{A_{internal}}{A_{roof\ opening}}$$

Where :

ψ_{kerb}	is the linear thermal transmittance of kerb (given in Table 8)
l_{kerb}	is the perimeter of kerb over which the linear thermal transmittance is taken. Calculated to equation (5) for square/rectangular domes or equation (8) for square/rectangular pyramids
$U_{glazing}$	is the thermal transmittance of the polycarbonate sheets (given in Table 7)
$A_{glazing}$	is the internal area of the glazing. Calculated to equation (6) for square/rectangular domes, or equation (9) for square/rectangular pyramids
$A_{internal}$	is the overall internal area of the rooflight (including kerb, glazing and opening frame)
S	is the surface area ratio between the internal and projected areas of the rooflight
$A_{roof\ opening}$	is the projected area of the rooflight. Calculated to equation (7) for square/rectangular domes or equation (10) for square/rectangular pyramids
J_{kerb}	is the internal length of the kerb (given in Table 8).

Table 7 Glazing U values

	Double-skin ($W \cdot m^2 \cdot K^{-1}$)	Triple-skin ($W \cdot m^2 \cdot K^{-1}$)	Single-skin over double-glazed unit ($W \cdot m^2 \cdot K^{-1}$)
Polycarbonate dome	2.68	1.67	0.97

Table 8 Linear thermal transmittance of kerb and opening frames

Rooflight	Height (mm)	Linear thermal transmittance, ψ_{kerb} ($W \cdot m^{-1} \cdot K^{-1}$)	Internal length of kerb, J_{kerb} (m)	Projected length of kerb, k (m)
Ultra	251	0.55	0.26	0.08

Dome (square rectangular):

(5) $l_{kerb} = 2(a + 2k + b)$

(6) $A_{glazing} = ab - \pi\,(ab/4) + 2\pi\,[\{(a/2)^p(b/2)^p + (a/2)^pc^p + (b/2)^pc^p\}/3]^{1/p}$

(7) $A_{roof\ opening} = ab + 2k\,(a+b) + 4k^2$

Pyramid (square and rectangular base):

(8) $l_{kerb} = 2(a + 2k + b)$

(9) $A_{glazing} = (ab/\cos\theta) + 2a\,[\{(b/2)^2 + (a\tan\theta/2)^2]^{1/2}$

(10) $A_{roof\ opening} = ab + 2k\,(a+b) + 4k^2$

Where:

k is the projected length of the kerb (given in Table 8)

a is the major axis of the ellipsoid (see Table 1 for rooflight ranges)

b is the minor axis of the ellipsoid (see Table 1 for rooflight ranges)

c is the internal rise of the dome (see Table 1 for rooflight ranges)

θ is the nominal angle of pitch in pyramidal rooflights = 15°

p is a constant = 1.6075

π is a constant = 3.14159.

Note: for square domes $a = b$

7.6 Rooflight assemblies are permeable to air at the junctions between the rooflight and kerb, particularly where an opening mechanism is present. Air permeability is beneficial for control of condensation but can also have an effect on thermal insulation properties. This may affect the airtightness of the building envelope.

7.7 Options with better thermal performance, including quad-skins, and options with multiwall structured polycarbonate beneath standard polycarbonate domes or pyramids, are also available from the Certificate holder and are likely to offer lower U values and U_d values than the example shown in sections 7.2 and 7.3, but these have not been assessed by the BBA.

7.8 Care must be taken in the design and detailing of kerb/roof junctions to minimise excessive heat loss.

8 Condensation risk

8.1 Modelling of the product in accordance with BS EN ISO 10211-1 : 1996 and BS EN ISO 10211-2 : 2001 indicates that Mardome Ultra Rooflight frames have an f_{Rsi} value of 0.77. This temperature factor is greater than any of the limiting temperature factors shown in Table 9, making the product suitable for use in any of the humidity classes defined in EN ISO 13788 : 2002, up to and including humidity class 5.

8.2 The risk of condensation forming on an interior surface of the rooflight is dependent on its temperature and the temperature and humidity of the adjacent air. This risk will be minimal when the rooflight's minimum temperature factor exceeds that shown in Table 10, for the relevant building type.

8.3 The temperature factor 0.67 applies to the whole of the frame of the Ultra rooflight. The performance of the frame is better than that of the glazing or kerb. If condensation occurs (eg in a particularly high-humidity environment), it would appear initially on areas of glazing and/or kerb and would not be detrimental to the product as these materials are non-absorbent and will not promote mould growth. By way of camparison, minimal temperature factors for typical PVC-U windows are between 0.50 and 0.65.

Table 9 Minimum temperature factors(1) to minimise the risk of surface condensation

Humidity Class	Building type	Temperature factors (f_{CRsi}) for 20°C internal temperature and humidity range in EN ISO 13788 : 2002, Figure A.1 (section 5.4)
1	Storage areas	≤0.20
2	Office, shops	0.21 – 0.40
3	Dwellings with low occupancy	0.41 – 0.57
4	Dwellings with high occupancy, sports halls, kitchens, canteens; buildings heated with unflued gas heaters	0.58 – 0.71
5	Special buildings, eg laundry, brewery, swimming pools	≥0.72

(1) The ratio of temperature drop between the internal rooflight surface and the external environment and the total temperature drop between internal and external environments.

8.4 In all cases, the risk of surface condensation can be reduced by limiting activities which produce large amounts of moisture and providing means of adequate ventilation; in particular air flow from kerb mounted ventilators, when fitted, can alleviate localised surface condensation.

9 Strength and stability

9.1 The product can be selected to have adequate resistance to wind loads calculated in accordance with BS EN 1991-1-4 : 2005.

9.2 Test conditions showed that rooflights withstood an imposed load of 1125 $N \cdot m^{-2}$. The magnitude of the actual snow load imposed will depend upon a number of factors, such as height above sea level, geographical location, roof arrangement, type and configuration of rooflights. Therefore, it is recommended that BS EN 1991-1-3 : 2003 is used to calculate the actual snow load when the roof is used in situations where a load greater than 1125 $N \cdot m^{-2}$ can be expected.

9.3 Details of the connections between the kerb and the roof must be entrusted to a suitably qualified and experienced individual. Guidance is available from the Certificate holder.

9.4 The polycarbonate rooflight material has a good resistance to impact from hard bodies, such as hailstones, or impacts due to vandalism. Tests on typical rooflight samples showed that an impact energy of 2.5 J did not cause damage when applied at various points of the rooflights.

9.5 Tests have shown that resistance to imposed snow loads and wind loads by the rooflights is dependent on size and configuration. As a guide, small pyramid-shape rooflights are more resistant to imposed loads, whilst large, domed rooflights are the least resistant. Rooflights, therefore, should be selected according to the loads expected for a particular location. The results of tests for selected rooflights carried out in accordance with BS EN 1873 : 2005 are given in Table 10.

Table 10 Resistance to snow and wind loads

Rooflight type	Dimensions (mm)	Snow load ($N \cdot m^{-2}$)	Wind load ($N \cdot m^{-2}$)
Domed	1200 x 2400	1125[1][2]	1500[3]
Pyramid	1500 x 1500	1750[1]	3000[3]

(1) Downward load.

(2) Buckling occurred at this load, but the shape of the rooflight was restored after the load was removed. Snow load was simulated by the use of air pressure.

(3) Upward load.

9.6 Fixing the rooflight to the kerb is described in the *Installation* part of this Certificate. Adequate resistance to wind uplift is achieved by this type of fixing.

9.7 The product has adequate resistance to soft body impacts, such as a person accidentally falling against a rooflight. The results of tests for selected rooflights, carried out in accordance with ACR[M]001 : 2005, are given in Table 11.

Table 11 Resistance to soft-body impact

Rooflight type	Dimensions (mm)	Classification (non-fragility)
Domed polycarbonate	1200 x 2400	Class B
Pyramid polycarbonate	605 x 605	Class B
Double-glazed glass	1250 x 1250	Class B[1]

(1) Test results indicate a non-fragility rating of Class A. However, the Certificate holder claims only a Class B.

10 Weathertightness

10.1 When installed in accordance with the manufacturer's instructions and section 19 and 20 of this Certificate, the rooflights and kerbs will provide adequate resistance to the ingress of precipitation.

10.2 Particular attention must be paid to the correct fitting of all components and to the detailing of sealants and roofing materials.

10.3 The installation of vents will affect the air permeability performance. The type of vent specified should take into account the prevailing weather conditions, for example, in locations when driving snow is likely. All vents are closeable for this product.

11 Behaviour in relation to fire

11.1 When tested to European classification EN 13501-1 : 2002 the polycarbonate material achieved a European Class B, s1, d0.

11.2 Under European classifications the polycarbonate sheets can be regarded as having a $B_{ROOF}(t4)$ classification and will adequately resist the spread of flame over the roof and from one building to another.

11.3 For the purposes of classifying the performance of ceiling linings, the rooflights' internal glazing is classified as TP(a) rigid and the frames and kerbs need not be considered.

11.4 In respect of external fire spread on roofs, the rooflights' external glazing is classified as TP(a) rigid (and low vulnerability in Scotland). The product may therefore be used as follows:

England and Wales and Northern Ireland — The product may not be used over a protected stairway or less than 6 m from a relevant boundary, except over spaces described in Approved Documents B, Volumes 1 and 2, Tables 7 and 18, 2a, b, respectively and in Technical booklet E, Table 4.8, 2a, b or c, but otherwise is unrestricted by these Requirements/Regulations

Scotland — The product is unrestricted by Mandatory Standard 2.8, with reference to clauses 2.8.1[1][2], 2.C.3[1] and 2.F.3[2]

(1) Technical Handbook (Domestic)

(2) Technical Handbook (Non-Domestic).

11.5 The external rating of the kerb will depend on the performance of the roof weatherproofing finish covering it. The performance of individual roof weatherproofings is outside the scope of this Certificate.

12 Safety

12.1 The product features manual or powered actuators allowing the rooflight to be opened for ventilation or as an access hatch shown in Figure 2.

12.2 If the rooflight is located on a roof which is generally accessible to the public, provision must be made to prevent people falling onto the glazed part (eg guard rails). If, as the result of an accidental fall, contact is made with the polycarbonate rooflight, the polycarbonate material shows good resistance to impact and the rooflight is rated a Class B non-fragile assembly (see section 9.7).

12.3 When subjected to normal atmospheric agents, movement of the structure, hygrothermal stresses, or vibrations, the polycarbonate rooflights will not collapse or result in falling debris that would cause injury to occupants or passers-by.

13 Ventilation

13.1 Opening rooflights can contribute to providing purge (natural) ventilation. This contribution will depend on the daylight area of the rooflight, the accessibility of the actuator and the floor area of the ventilated space.

13.2 If fitted, ventilators installed in pairs on opposite sides of the long edges of kerbs will provide ventilation to the room below the rooflight. The ventilator openings can provide or contribute to providing the background ventilation (trickle ventilation) open area requirements given in the documents supporting the national Building Regulations. Additionally, the rooflights can be opened using manual or powered actuators fitted to the kerbs.

14 Security against intrusion

14.1 Mardome Ultra Rooflights are supplied with 'security latches'. This security lock mechanism can only be opened with the use of a key. Manipulation of the 'security latches' by an opportunist intruder without the opening device to open the rooflight is virtually impossible (see Figure 3).

14.2 Mardome Ultra Rooflights resist the likely methods of intrusion by an opportunist intruder using basic hand tools when tested according to PAS 24 : 2012, Annex C.4.3

14.3 Polycarbonate rooflights have a good resistance to impact, making breakage very difficult.

15 Acoustic properties

15.1 Triple-skinned polycarbonate rooflights resist the passage of sound such that when subjected to heavy rainfall at a rate of 38 $mm \cdot h^{-1}$ to 42 $mm \cdot h^{-1}$ the global area-weighted sound intensity level L_{IA} is 62 dB when tested according to BS EN ISO 140-18 : 2006.

15.2 Mardome Glass Rooflights that feature a polycarbonate dome over an inner double-glazed glass unit offer better resistance to the passage of sound, such that the area-weighted sound intensity level L_{IA} is reduced to 54 dB.

15.3 An acoustic kit is available from the Certificate holder for fixed unvented rooflights which further reduce sound levels but this has not been assessed by the BBA.

16 Maintenance

16.1 If damage occurs, the rooflights can be re-glazed and the fixings replaced, but these operations should be carried out using the materials recommended by the Certificate holder and approved by the BBA.

16.2 Cleaning of the rooflights should be carried out using water containing household non-abrasive, neutral detergent. To avoid scratching of the surface, only soft cloths should be used when cleaning.

16.3 Under no circumstances should anyone venture onto a polycarbonate rooflight. The external surfaces of the rooflight cannot normally be cleaned from the inside of the building. For maintenance and cleaning purposes special precautions must be taken, such as the provision of a catwalk, to allow safe access and to prevent the possibility of falling through the polycarbonate rooflight, even though the rooflight may support such a load.

17 Durability

Available test data and knowledge of the materials suggest that the product, when installed in accordance with this Certificate, should have a life of at least 15 years for the polycarbonate material and 35 years for the PVC-U kerb material in most non-corrosive environments. Minor changes in surface appearance and light transmission may occur during this period.

18 Reuse and recyclability

The product comprises PVC-U, aluminium and polycarbonate each of which can be recycled.

Installation

19 General

19.1 Installation of the Mardome Ultra Rooflight must be carried out in accordance with the Certificate holder's installation instructions.

19.2 Prior to installation of the rooflight, the roof must be checked by means of calculations or testing to ensure that it can carry the additional loads the installation may impose, strengthening the roof if necessary. This work must be carried out by a suitably qualified and experienced individual.

19.3 The rooflight kerb should be checked dimensionally to ensure the fit, and the rooflight should be checked for size before the unit is lifted to the roof.

19.4 A rooflight should never be left in position without ensuring all of its fixings are present and fully tightened.

19.5 Where the roof covering is dressed below the rooflight and on top of an existing upstand, precautions should be taken to prevent bitumen damaging internal finishes.

19.6 Fixings for securing the Mardome Ultra kerbs or kerb adaptors onto the roof structure are supplied by the Certificate holder.

20 Procedure

20.1 The Mardome Ultra kerb is placed over the roof opening and fixed through the foot of the kerb using 55 mm fixings supplied by the Certificate holder, ensuring a secure base.

20.2 The roofing covering is installed as specified in the manufacturers instructions, and laid up the side of the Mardome Ultra kerb, terminating against the lip beneath the kerb clamp. The kerb clamp is then closed and pushed firmly into place to secure the roof covering, providing a watertight finish.

20.3 The Mardome Ultra dome is placed onto the kerb and secured into place by engaging each of the security latches. This is achieved by a simple 90 degree turn of the security latch so that the lever is parallel to the kerb. The levers can be removed by turning back to the original position; this does not release the latches, which can only be opened with the special key.

Technical Investigations

21 Tests

21.1 Tests were carried out on The Mardome Ultra Rooflight in accordance with BS EN 1873 : 2005 and PAS 24 : 2012 to determine:

- air infiltration
- watertightness
- effect of wind loads
- effect of snow loads
- effect of impacts
- light transmission and haze
- resistance to intrusion (PAS 24 : 2012, Annex C.4.3)
- suitability of materials.

21.2 Tests were carried out on triple-skinned polycarbonate rooflights in accordance with BS EN ISO 140-18 : 2006 to determine the Rain Generated Impact Sound Transmission.

22 Investigations

22.1 The manufacturing process was examined, including the methods adopted for quality control, and details were obtained relating to the quality and composition of the materials.

22.2 Computer calculations for assessing the risk of condensation and calculating the thermal transmittance of the rooflights were carried out.

22.3 An examination was made of existing data in relation to the PVC-U kerb material and performance in fire.

22.4 Components were assessed for resistance to corrosion.

Bibliography

BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*

BS EN 1279-2 : 2002 *Glass in building — Insulating glass units — Long term test method and requirements for moisture penetration*

BS EN 1279-3 : 2002 *Glass in building — Insulating glass units — Long term test method and requirements for gas leakage rate and for gas concentration tolerances*

BS EN 1873 : 2005 *Prefabricated accessories for roofing — Individual roof lights of plastics — Specification and test methods*

BS EN 1991-1-3 : 2003 *Eurocode 1 : Actions on structures — General actions — Snow loads*

BS EN 1991-1-4 : 2005 *Eurocode 1 : Actions on structures — General actions — Wind actions*

BS EN ISO 140-18 : 2006 *Acoustics — Measurement of sound insulation in buildings and of building elements — Laboratory measurements of sound generated by rainfall in building elements*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

BS EN ISO 10211-1 : 1996 *Thermal bridges in building construction — Heat flows and surface temperatures — General calculation methods*

BS EN ISO 10211-2 : 2001 *Thermal bridges in building construction — Calculation of heat flows and surface temperatures — Linear thermal bridges*

BS EN ISO 12567-2 : 2005 *Thermal performance of windows and doors — Determination of thermal transmittance by hot box method — Roof windows and other projecting windows*

BS EN ISO 13468-1 : 1997 *Plastics — Determination of the total luminous transmittance of transparent materials — Single-beam instrument*

EN 13501-1 : 2002 *Fire classification of construction products and building elements — Classification using test data from reaction to fire tests*

EN ISO 13788 : 2002 *Hygrothermal performance of building components and building elements — Internal surface temperature to avoid critical surface humidity and interstitial condensation — Calculation methods*

PAS 24 : 2012 *Enhanced security performance requirements for doorsets and windows in the UK — External doorsets and windows intended to offer a level of security suitable for dwellings and other buildings exposed to comparable risk*

ACR[M]001 :2005 *Test for Non-Fragility of Profiled Sheeted Roofing Assemblies [third edition]*

23 Conditions

23.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

23.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

23.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

23.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

23.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

23.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

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