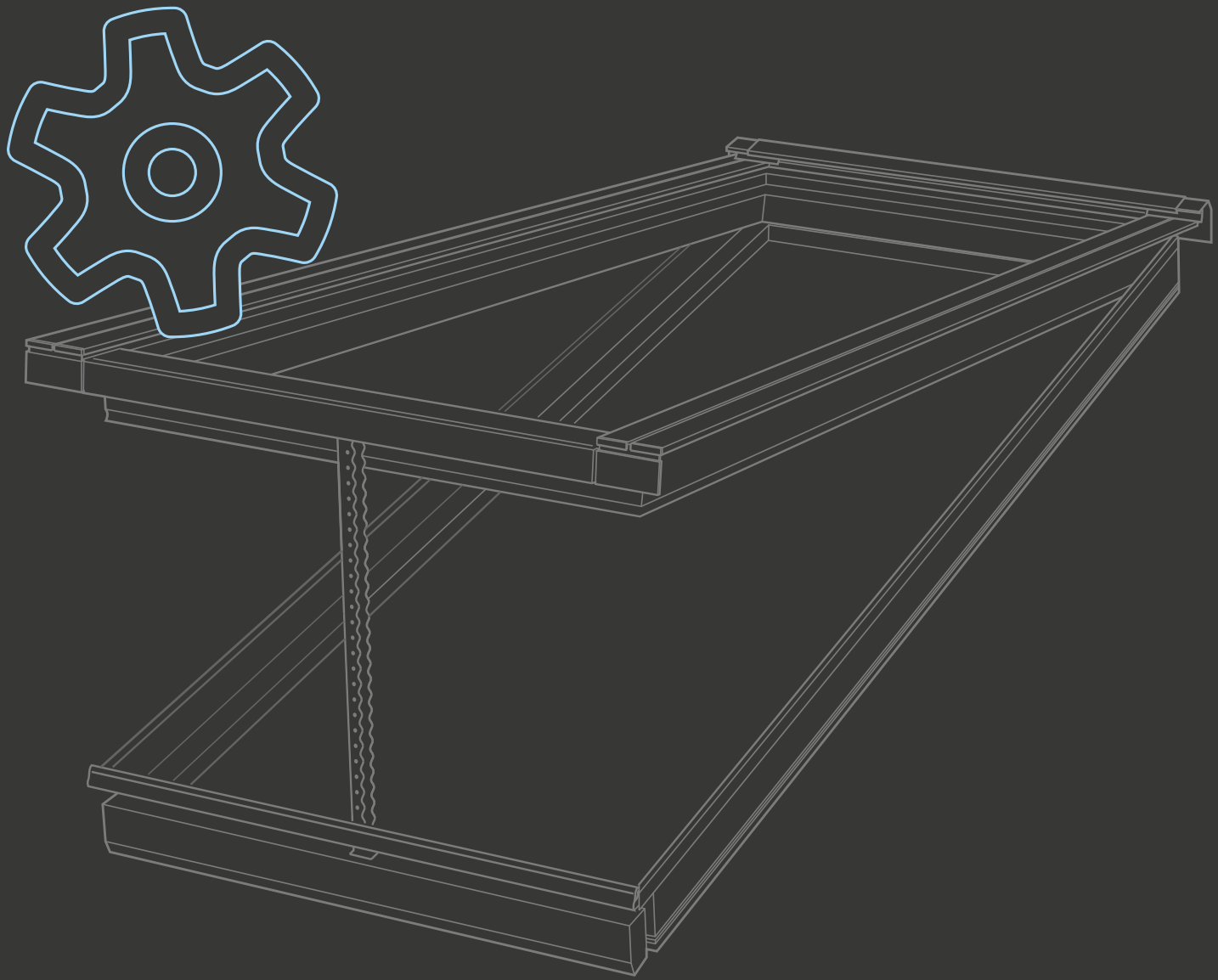
VELUX®

Commercial

VELUX Modular Skylights

Technical Handbook



Version 6.1

veluxcommercial.com

Northlights: UCo, Utrecht, The Netherlands, 2017
Photographer: Stijn Poelstra

VELUX Modular Skylights

VELUX modular skylights are sash-frame constructed single skylights with a high-insulating glazing unit. The modules are available as both fixed and venting skylights. All individual skylights are delivered as prefabricated modules with dedicated factory finished flashings to ensure watertightness in every solution.

VELUX modular skylights are CE-marked in accordance with the harmonized standard EN 14351-1 – Windows and doors.

The self-supporting Ridgelights are CE-marked in accordance with the European Assessment Document EAD 220013-01-0401 of 2017-03 as relevant harmonized technical specification. The load bearing capacity performance of the self-supporting Ridgelights is expressed in the European Technical Assessment ETA 14/0476 of 2018-01-23

In addition, the skylight modules have been tested and approved in accordance with EN 12101-2 – Smoke and heat control systems Part 2: Specification for natural smoke and heat exhaust ventilators.

This technical handbook for VELUX modular skylights describes the product characteristics and performance of the skylight module together with sun screening and control system.
For real life case studies and inspiration, please refer to: veluxcommercial.com

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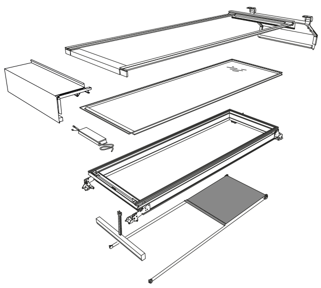
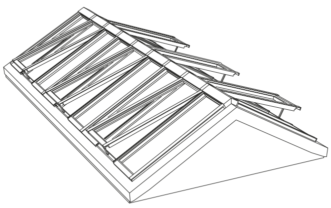


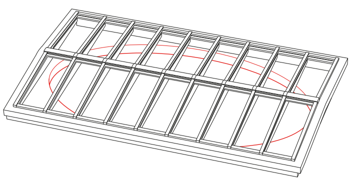
Modular System 7



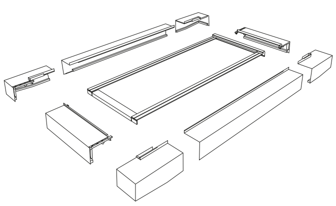
Solutions 41

NSHEV (Natural Heat and Smoke Exhaust Ventilators) - EN 12101-2:2003			
Geometric area	EN 12101-2:2003	Av [m²]	0,48 -1,89 depending on size
Aerodynamic area	EN 12101-2:2003 Annex B	Aa Roof [m²]	0,05-0,89 depending on size
Aerodynamic value	EN 12101-2:2003 Annex B	Cv0	0,08 - 0,52 depending on size
Snow load (SL)	EN 12101-2:2003 Annex E	SL [N/m²]	750 N/m2
Wind load (WL)	EN 12101-2:2003 Annex F	WL [N/m²]	3000 N/m2
Low ambient temperature (T)	EN 12101-2:2003 Annex E	T [°C]	T (-15)
Reliability (RE) (Dual purpose)	EN 12101-2:2003 Annex C	RE [Nr of opening]	1000 + 10000
Resistance to heat (B)	EN 12101-2:2003 Annex G	B [°C]	B300
Reaction to fire for NSHEV	EN 13501-1	Class	B-s1,d2 for IGU 55.2 **B-s1,d0 for IGU 33.2**

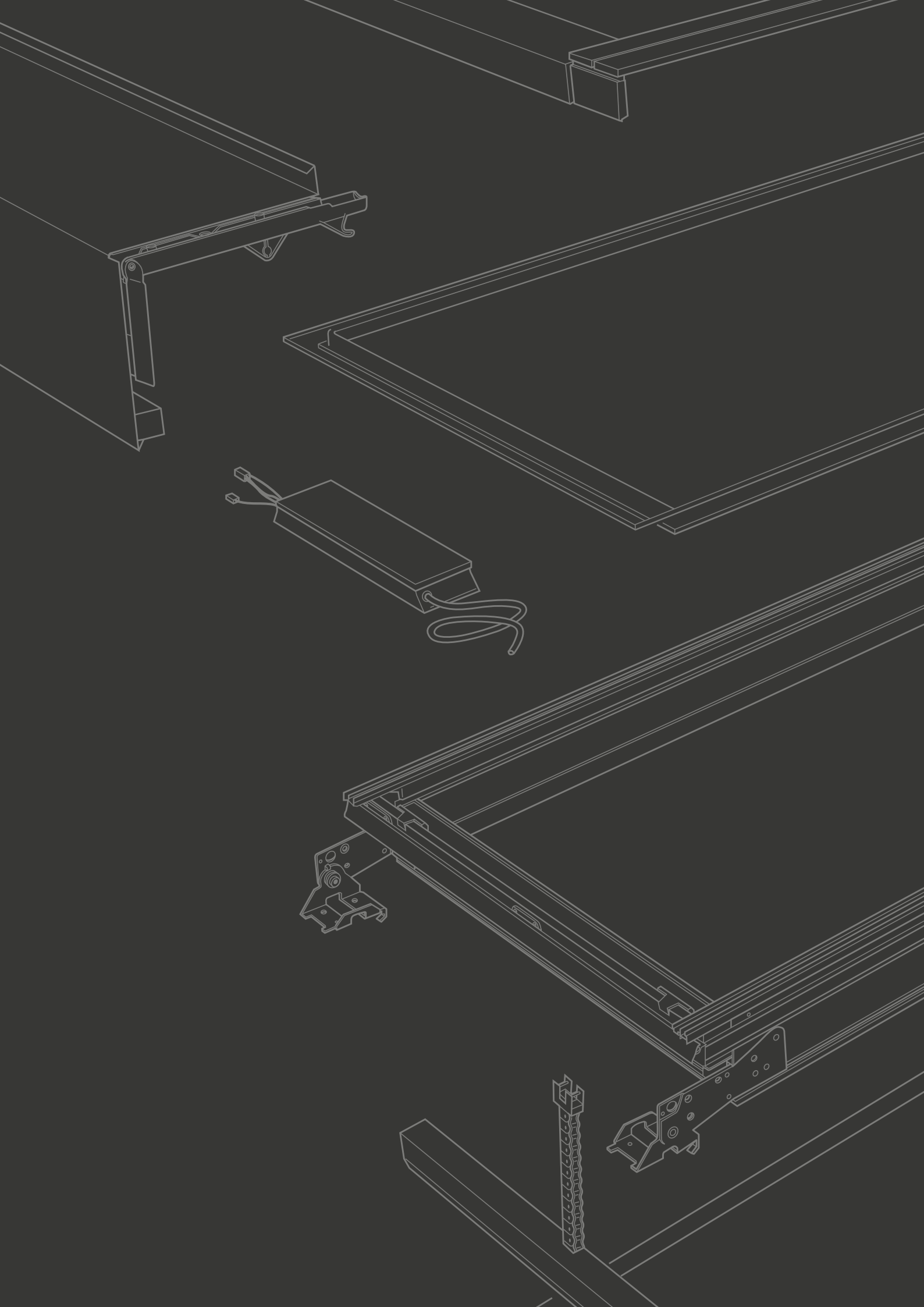
Product Data 69

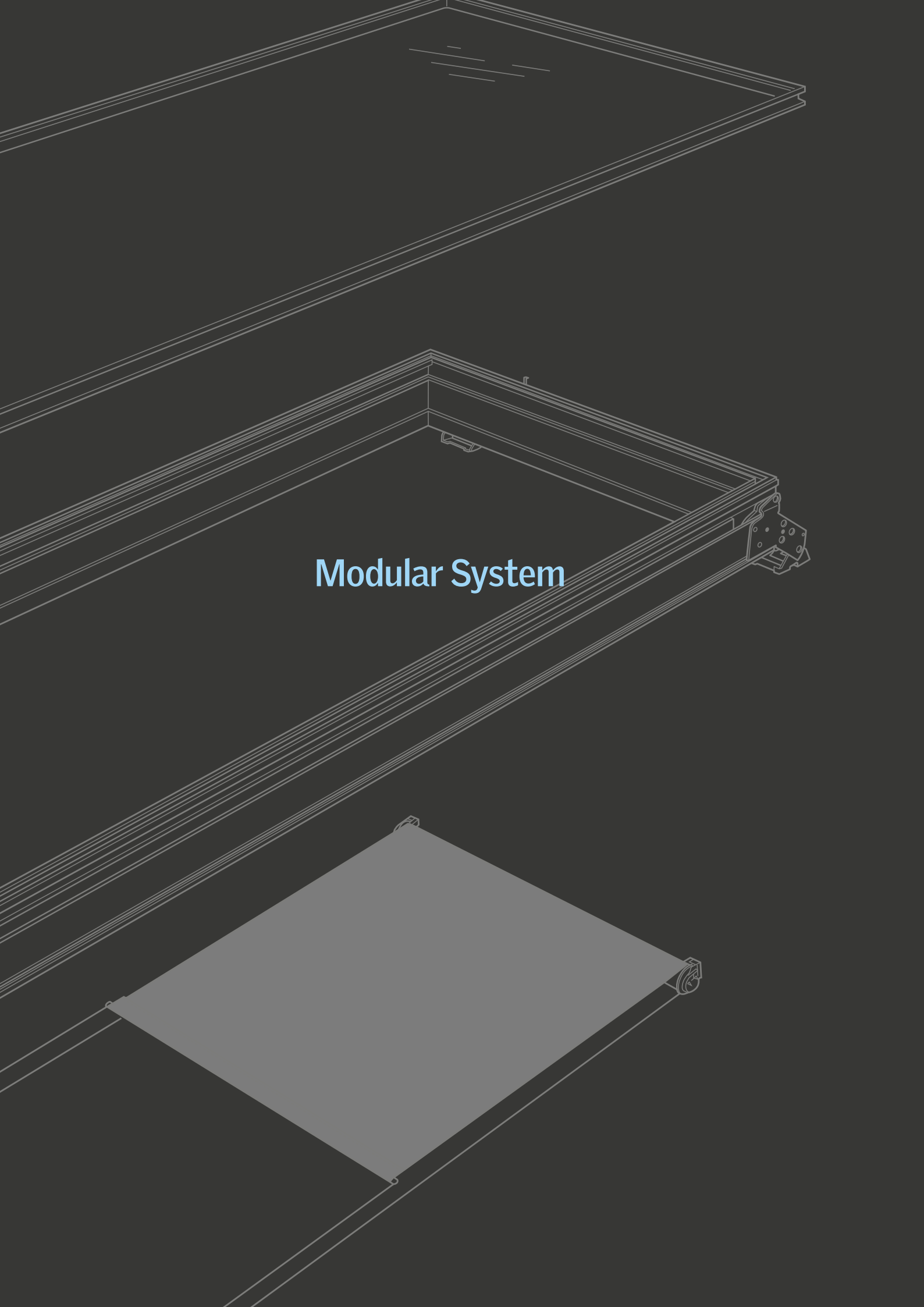


Additional Solutions 113



Product Codes 119





Modular System

Skylight Module

CE-marked VELUX modular skylights can be used in any building where the national, local and individual building requirements allow the use of skylight modules. Given the aesthetics and advanced performance of the products, VELUX modular skylights are commonly used in heated buildings and primarily in projects that support light commercial interests, e.g. hospitals, schools, shopping centres, offices, museums etc. However, all buildings that have a suitable structure and are large enough to host an installation, will support VELUX modular skylights.

Functions & Sizes

VELUX modular skylights are available as fixed and venting modules. Due to a hidden chain actuator, the fixed and venting modules appear to be visually identical in closed position.

Venting modules are top-hung and can be used for comfort ventilation, and in addition, certain types are approved for smoke ventilation in accordance with EN 12101-2.

HFC

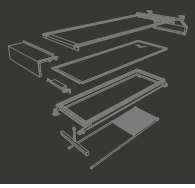
Fixed skylight module

HVC

Motorized comfort venting skylight module
Opens up to 410 mm

HVC -A

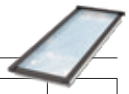
Motorized smoke venting skylight module
Opens up to 700 mm in less than 60 seconds
Only open system actuator available



Size Grid

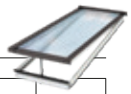
Standard size. Semi-Standard, functional limitations may apply. Non-Standard, available for certain projects.

Fixed modules



mm	675	750	800	900	1000
600	‡	‡	‡	‡	‡
800					
1000					
1200					
1400					
1600					
1800					
2000					
2200					
2400					
2600	* Δ	* Δ	*	*	*
2800	* Δ	* Δ	*	*	*
3000	* Δ	* Δ	*	*	*

Comfort ventilation



mm	675	750	800	900	1000
600					
800	O	O	O	O	O
1000					
1200					
1400					
1600					
1800					
2000					
2200					
2400					
2600	* Δ	* Δ	*	*	*
2800	* Δ	* Δ	*	*	*
3000	* Δ	* Δ	*	*	*

Smoke ventilation

mm	675	750	800	900	1000
600					
800	O	O	O	O	O
1000	O	O	O	O	O
1200	O	O	O	O	O
1400	O	O	O	O	O
1600	O	O	O	O	O
1800	O	O	O	O	O
2000	O	O	O	O	O
2200	O	O	O	O	O
2400	O	O	O	O	O
2600	* Δ O	* Δ O			
2800	* Δ O				

* Module height above 2400 mm is delivered with an extra strong glazing unit only.

Δ No roller blinds available.

O Only open system actuator available.

‡ Not available for Ridgelight.

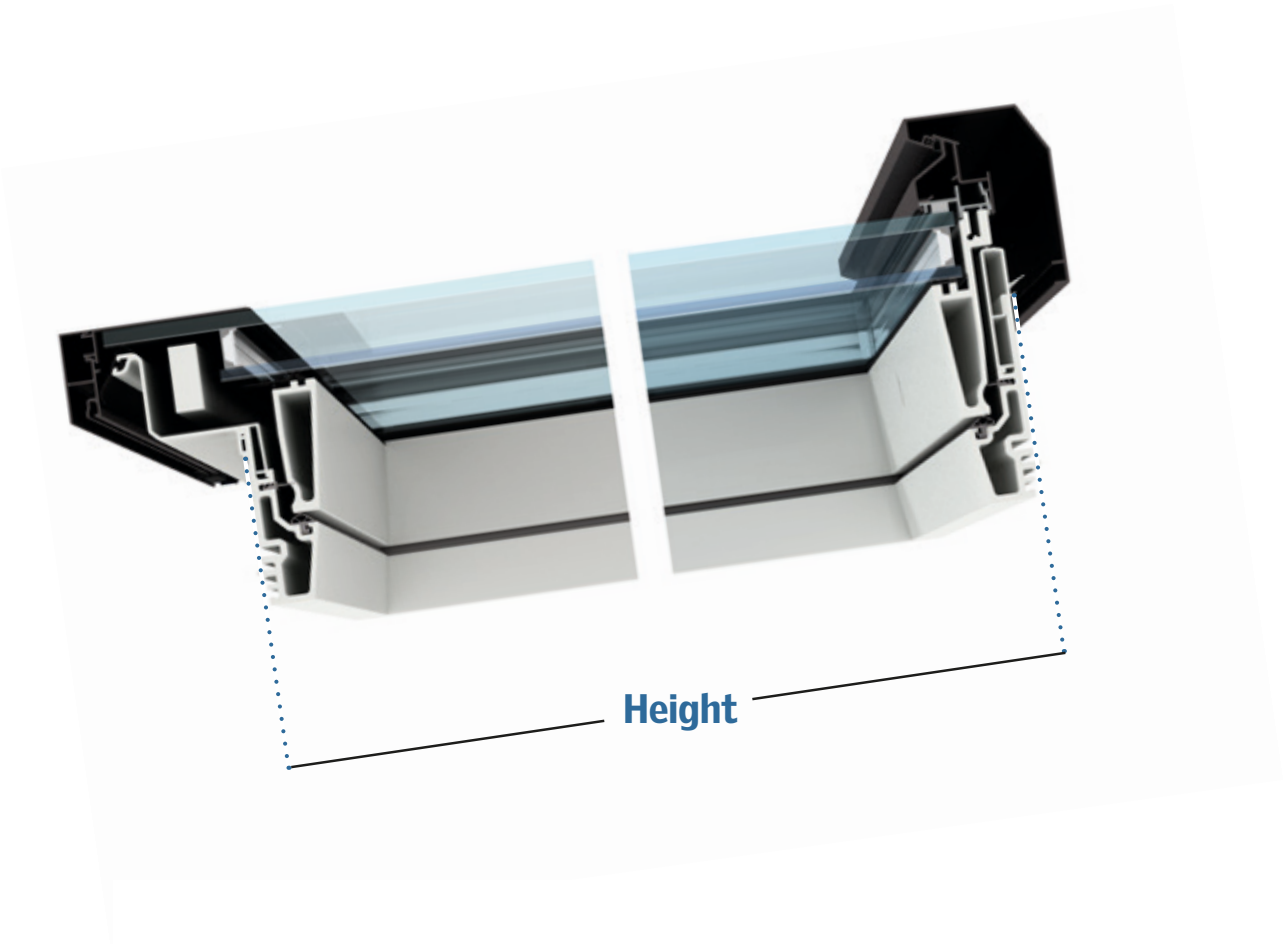
For size specific load capacity, please contact us.

If roller blinds are requested for smoke venting modules, please refer to local fire authorities for permission.

Wind deflector KCD 0080 is not available for sizes above 2400 mm.

How to Measure the Modules

Width and height of the modules are determined by the exterior dimensions of the frame – not the measurements of the cladding, flashing or brackets.


Height

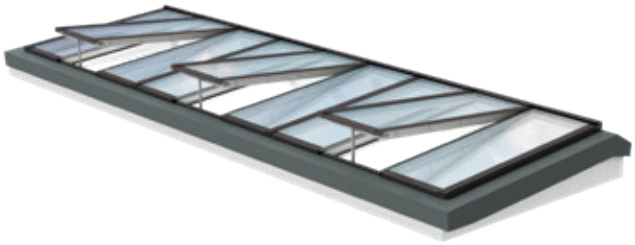

Width

Solutions

VELUX modular skylights can be combined in a number of configurations to create perfect solutions for a wide variety of building types, from narrow corridors and internal courts to studios and large circulation spaces. Each solution is delivered with a specially designed, prefabricated flashing ensuring a perfect system.

Mono pitched solutions

Longlight 5 - 30° **Page: 50**

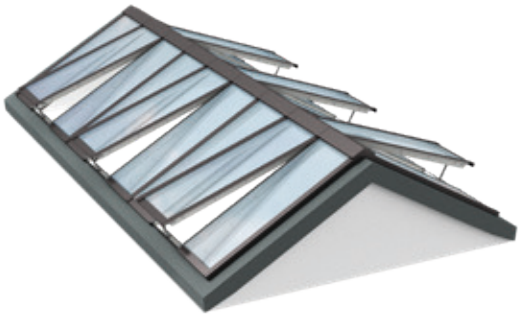


Wall-mounted Longlight 5 - 45° **Page: 52**

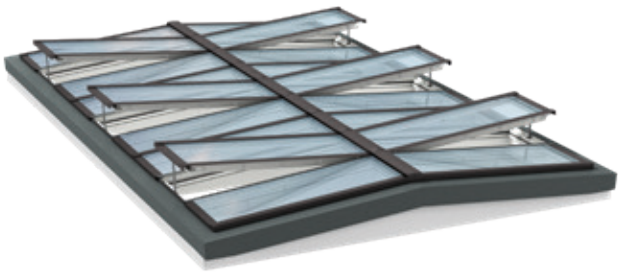
Northlight 25 - 90° **Page: 54**

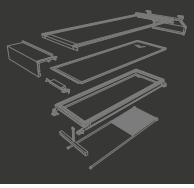
Dual pitched solutions

Ridgelight 25 - 40° **Page: 56**



Ridgelight at 5° with Beams **Page: 58**



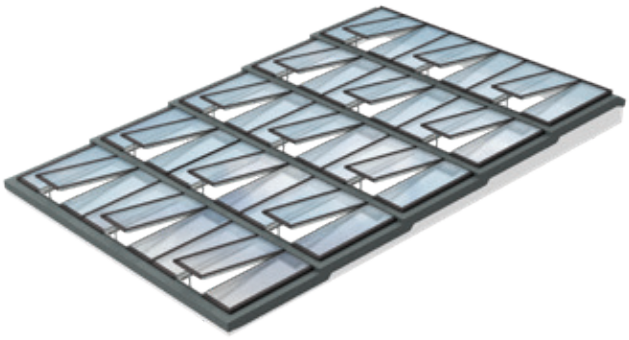


Step solutions are available from spring 2019*

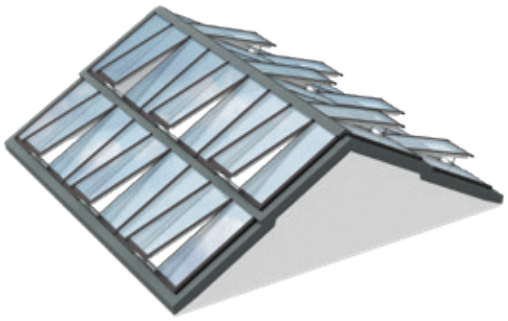
*Launch projects possible before that

Step solutions

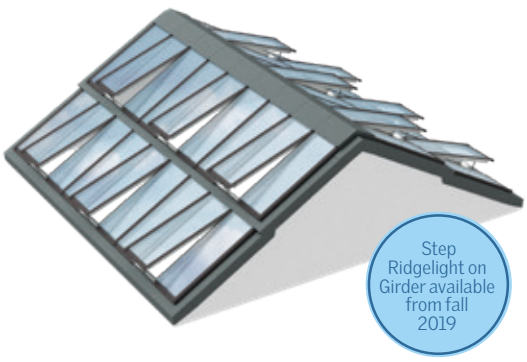
Step Longlight 5 - 25° **Page: 60**



Step Ridgelight 25° **Page: 62**

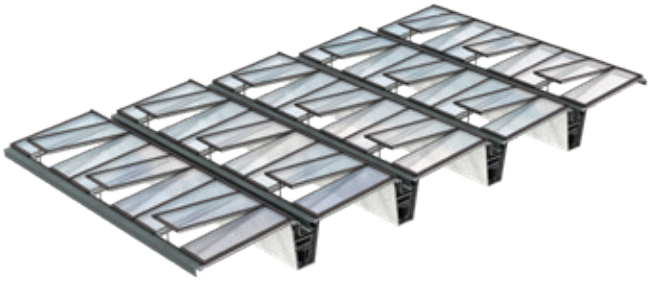


Step Ridgelight 5 - 25° on Girder **Page: 62**



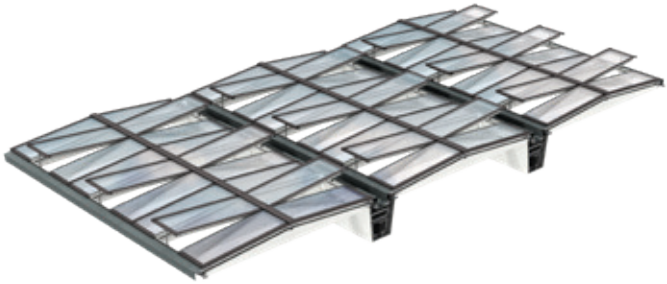
Atrium solutions

Atrium Longlight 5 - 30° **Page: 64**

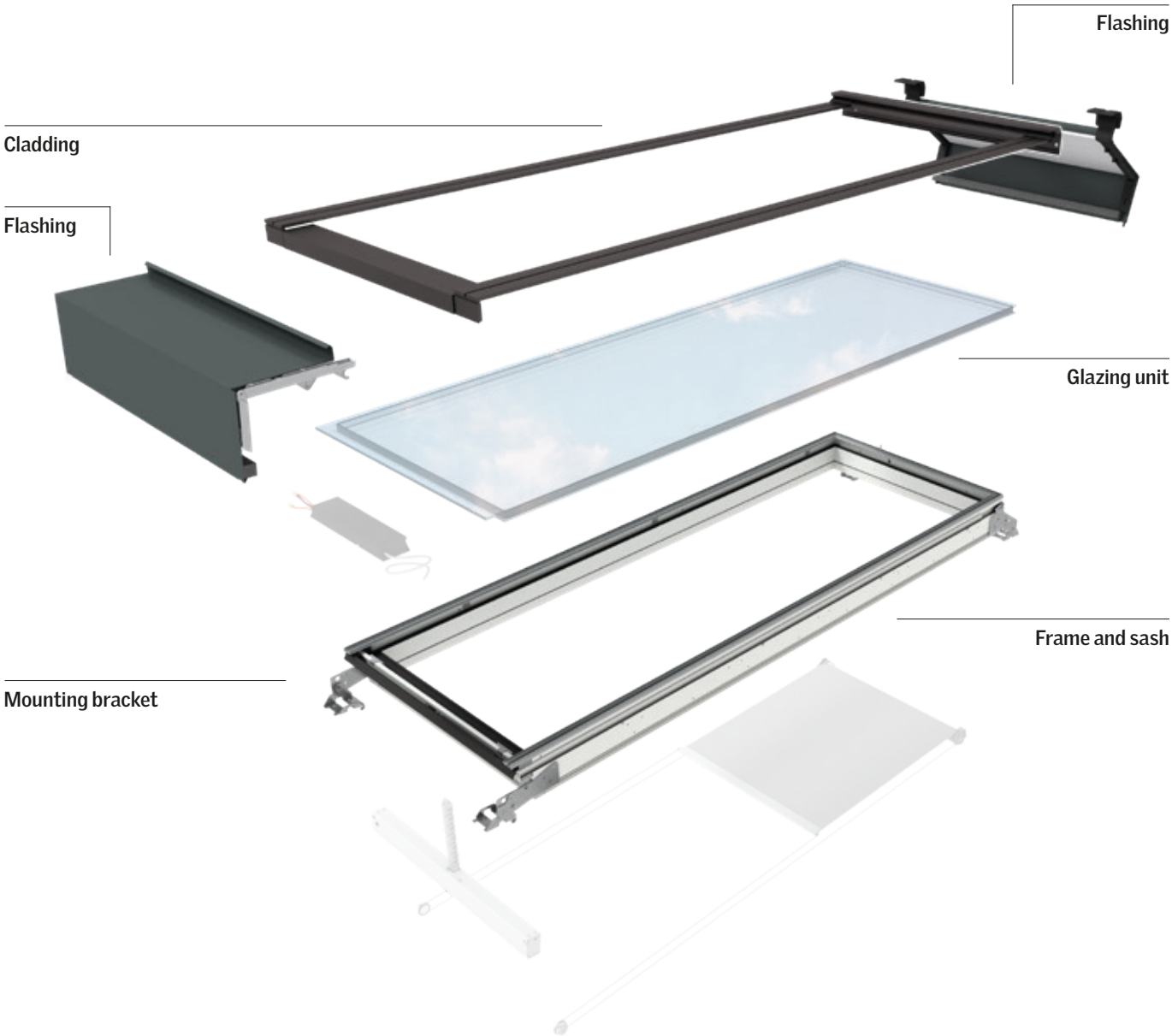


Atrium Ridgelight 25 - 40° **Page: 66**

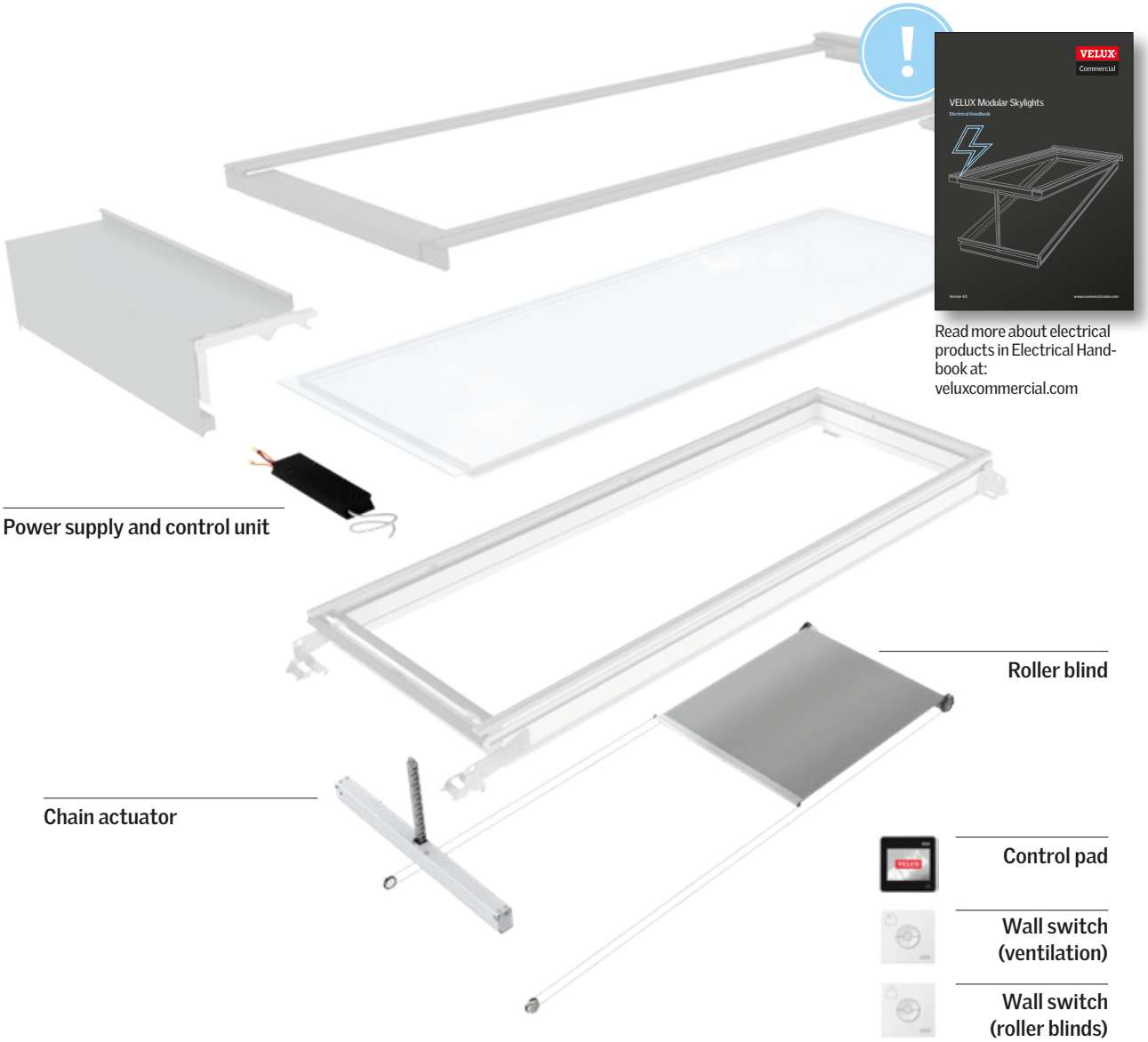
Atrium Ridgelight at 5° with Beams **Page: 66**



Module – Main Components



Module – Electrical Components



Power supply and control unit	Rain and wind sensor set	Control pad	Wall switch	Switch interface (external wall switch)	Interface (external controls)
			 For ventilation  For roller blinds		
KLC 400	KLA S105	KLR 200	KLI 311/KLI 312	KLF 050	KLF 200

Frame & Sash

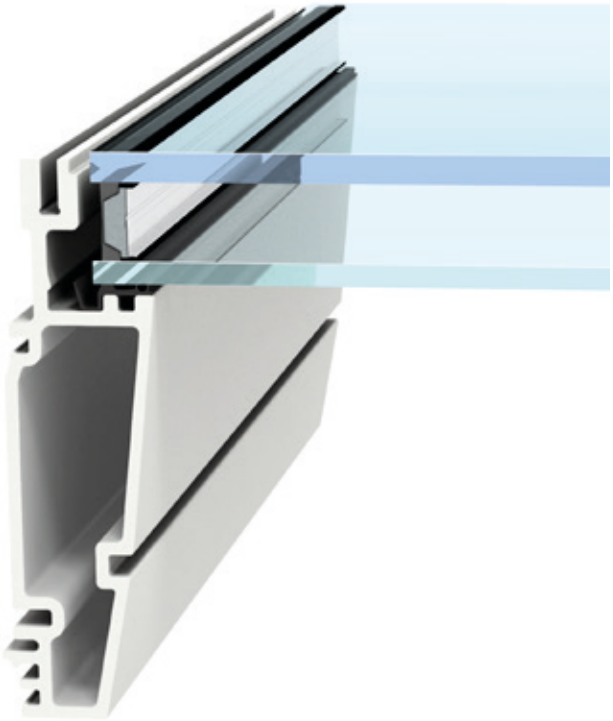
The main structural profiles of VELUX modular skylights consist of pultruded composite, containing approximately 80% continuous fibreglass threads and 20% two-component polyurethane resin.

The composite guarantees a high heat insulating performance (page 18, graph 1) and thermal stability (page 18, graph 2), as well as, excellent profile stiffness (page 19, graph 3) and strength (page 19, graph 4). Combined, the characteristics of the VELUX composite give the slim profiles self-supporting strength and an ability to support installations of considerable size. In addition, the material is maintenance-free, non-corrosive and electrically non-conductive.

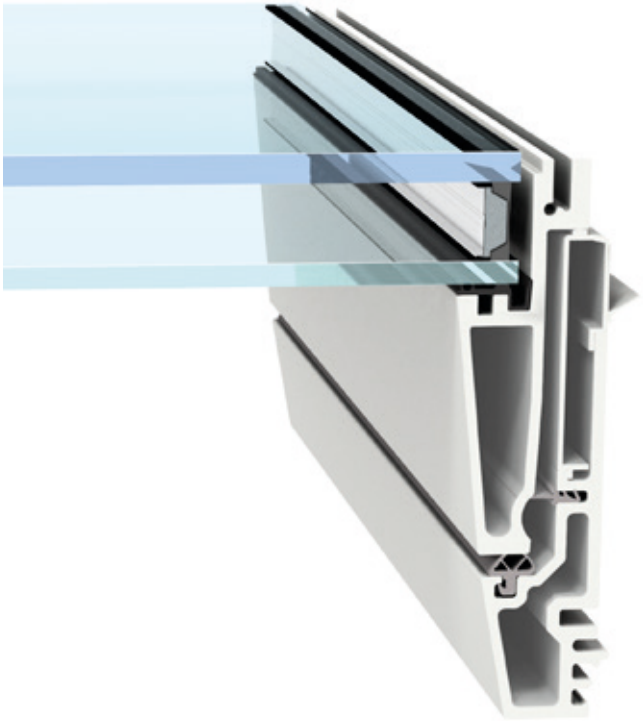
Combined with low-energy glazing units, the VELUX modular skylights have one of the lowest overall U-values for frame and glazing assemblies on the skylight market. The inner surface is treated with white paint as standard. However, other colours are available, see page 90.

Frame and sash assembled

Frame & Sash



HFC
Frame for fixed skylight module



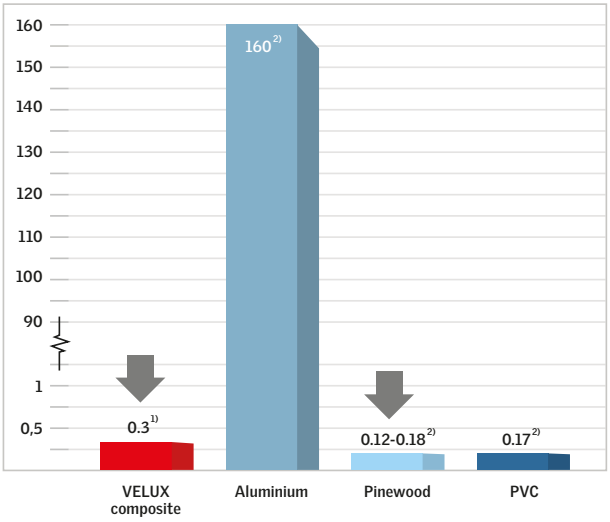
HVC
Frame and sash for venting skylight module

Frame & Sash

1 Thermal conductivity (W/mK)

– A low score means high insulating performance

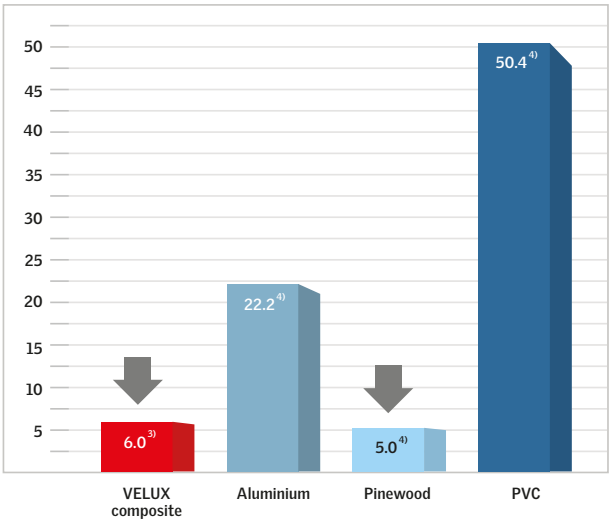
Profiles used for VELUX modular skylights consist of pultruded fibreglass and polyurethane composite, which result in a high insulating performance.



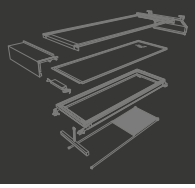
2 Linear expansion coefficient (10^{-6} m/mK)

– A low score means high thermal stability

Whereas traditional skylight materials are bound to fluctuations in form due to thermal changes, the composite of VELUX modular skylights will maintain its dimensional properties, ensuring tightness of joints and prolonging the expected lifetime of the application.



Source: 1) Accredited external tests 2) According to EN ISO 10077-2 3) Value identical to fibreglass 4) www.engineeringtoolbox.com 5) Internal VELUX test

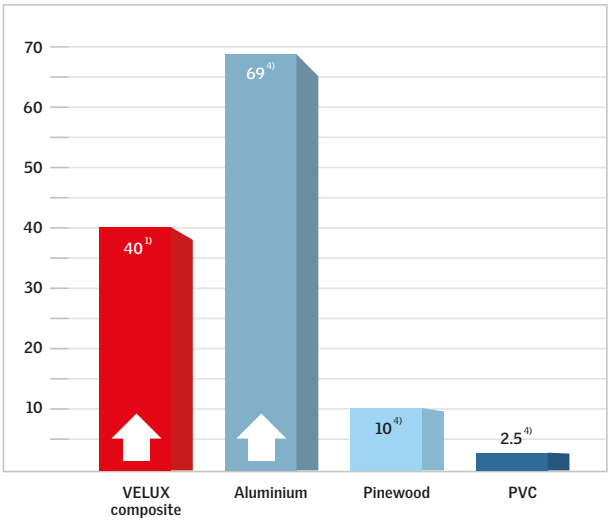


Frame & Sash

3 Flexural Modulus (E-Modulus) (GPa)

– A high score means low deflection

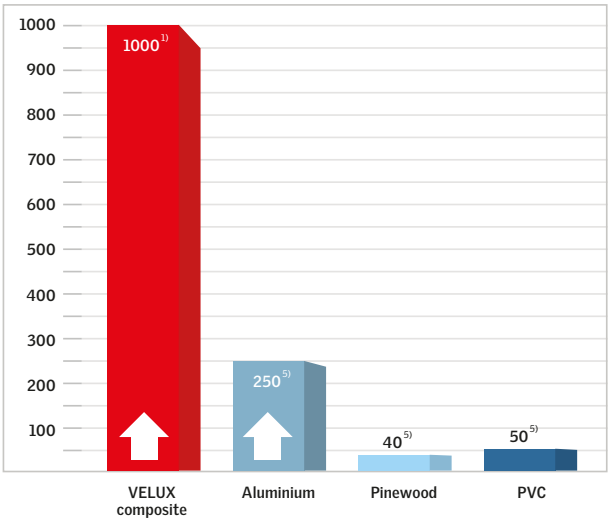
The high rigidity of the pultruded composite material results in a very stiff frame and sash, ensuring reliable performance with very little deflection of the profiles and better aesthetics of the skylight.



4 Flexural Strength (N/mm²)

– A high score means high strength

The very high strength of the pultruded composite material allows for design and production of longer and slimmer frame and sash profiles than traditional skylight materials allow. This enables design of large skylights with slim profiles resulting in better aesthetic performance.



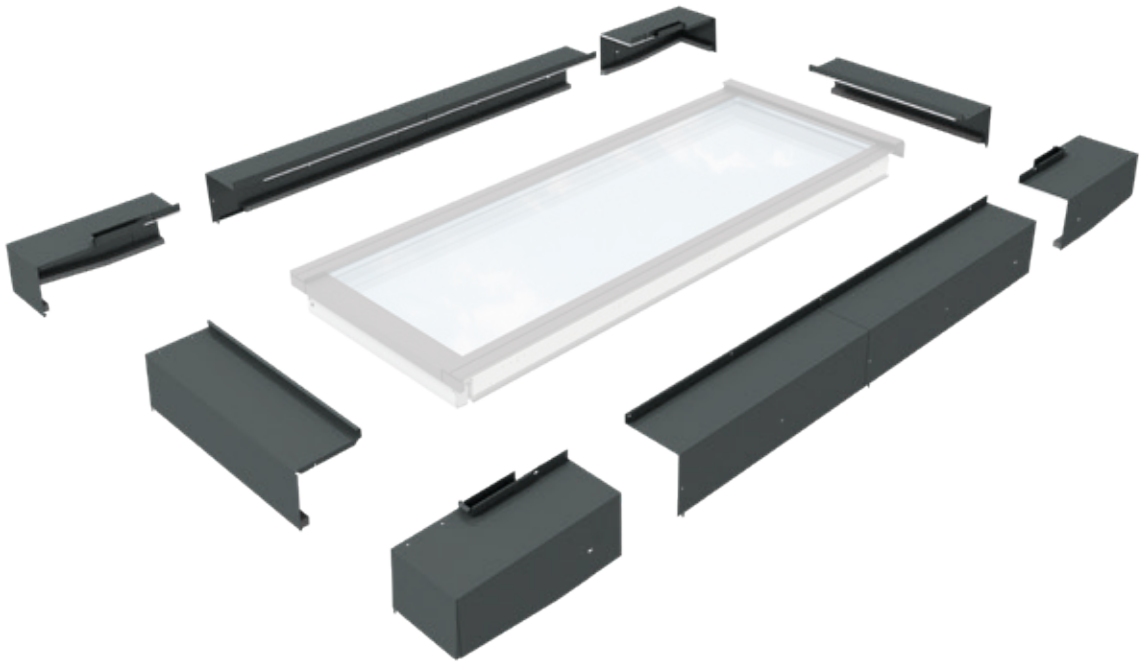
Source: 1) Accredited external tests 2) According to EN ISO 10077-2 3) Value identical to fibreglass 4) www.engineeringtoolbox.com 5) Internal VELUX test

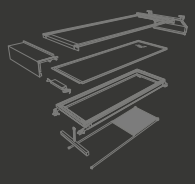
Cladding

Cladding
Each module has a specific set of claddings. Cladding components are attached on four sides of the skylight, ensuring a watertight connection between sash and frame for both fixed and ventilation modules. The cladding is made of extruded aluminium with a scratch resistant, granite grey powder coating for added weather protection and aesthetics. Other colours are available, see page 90.

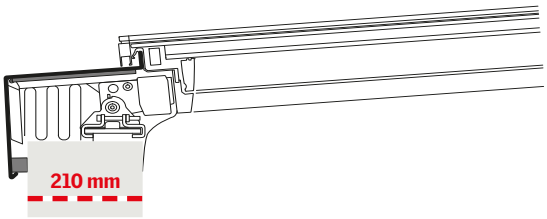
Flashing

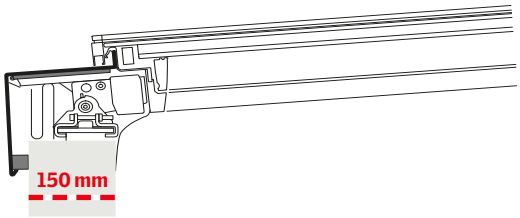
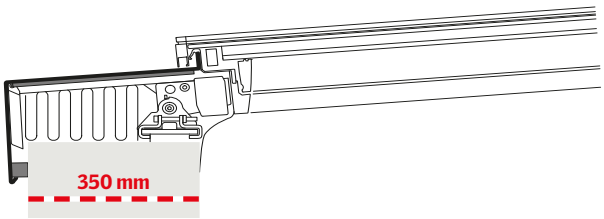
Flashing
VELUX modular skylights come with factory-finished flashings. The prefabrication of flashings ensures a high quality solution providing a watertight connection between roof, sub-construction and module, with a safe and fast installation process. The flashing has a top, side and bottom section made from aluminium with a grey paint finish.
Other colours are available, see page 90.





Flashing

Standard flashing	Cross-section of the bottom flashing
Standard flashing Standard top, bottom and side flashing suitable for a 210 mm sub-construction (measured from inside edge of the steel). See page 30.	

Semi-standard flashing	Cross-section of the bottom flashing
Narrow flashing Narrow top, bottom and side flashing that is suitable for a 150 mm wide sub-construction. Available at additional cost. Can be used for instance, if the extra slim sub-construction is required.	
Wide flashing Wide top, bottom and side flashing that is suitable for a 350 mm wide sub-construction. Available at additional cost. Can be used for instance, if the sub-construction is made of concrete and space for insulation is needed.	

Glazing Unit

VELUX modular skylights come with a low-energy double-glazing unit. Alternatively, the modules can be supplied with improved solar protection or an Argon or a Krypton filled triple-glazing unit for extra-low U-value. All glazing units include a toughened outer glass layer and a 3+3 or 5+5 mm inner safety glass layer with 2 x 0.38 mm interlayer PVB foil. For technical values on glazing units, please refer to the chapter about Product Data.

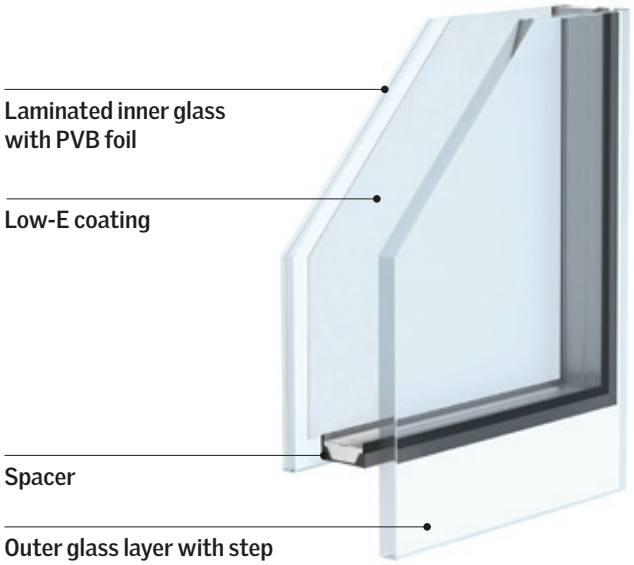
The triple-glazed units have a heat-strengthened middle glass layer. Heat strengthened glass is also used for the inner pane of triple-glazed units with a 5+5 mm inner pane.
The cavity between the panes of the glazing units is filled with Argon or Krypton gas as a default.

All glazing units have a warm edge spacer and are produced with warm edge technology to minimise the risk of condensation and to give the glazing units the most durable insulation capabilities.

Glazing Unit

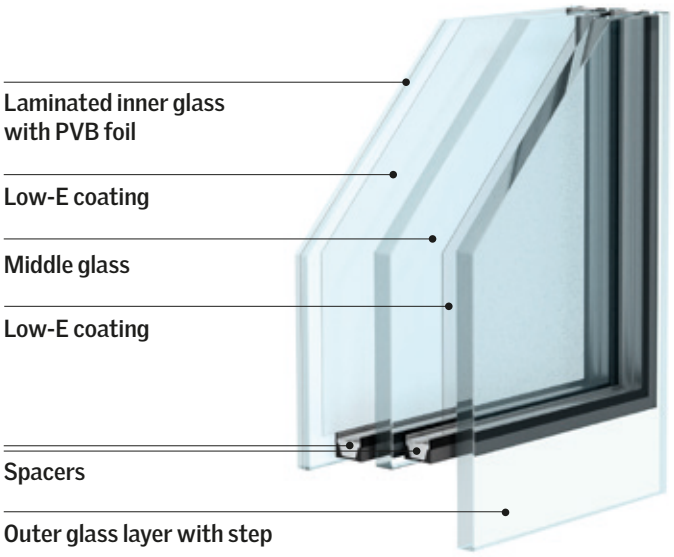
Example of double-glazed unit (LowE)

Variant 10



Example of triple-glazed unit (LowE)

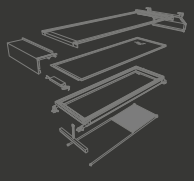
Variant 16



Note: Visual quality of glazing units.
Interference effects and/or effects specific to multiple glazing and/or anisotropy may occur in the visible glass surface due to the physics of the material and its production technologies.

Differentiating parameters of the coating variants

Coating options		Coating	Solar gain	Solar protection	Light transmit-tance	Colour rendering index
Low emissivity	When the highest light transmittance is needed and you would like to let in the heat from the sun during heating season.	**LowE**	☆☆☆	☆	☆☆☆	☆☆☆
Sun protection	When sun protection is required to keep out the heat from the sun for increased comfort during summer periods.	**Sun1**	☆☆	☆☆	☆☆	☆☆
Enhanced sun protection	When extra sun protection is required for increased comfort during summer periods and a reduced light transmittance can be accepted.	**Sun2**	☆	☆☆☆	☆	☆



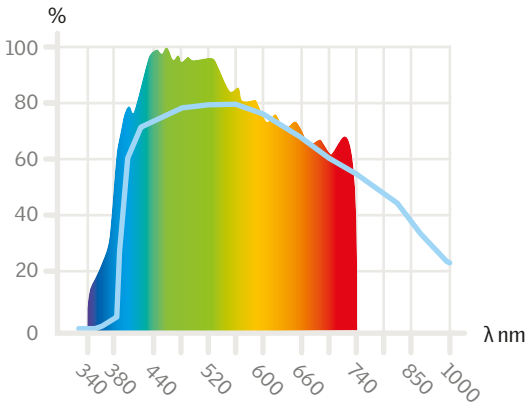
Glazing Unit

Colour renderings of double-glazed units
Additional glazing characteristics and glazing variants are shown on pages 86-88.

Glazing with low emissivity coating (LowE)

Variant 10

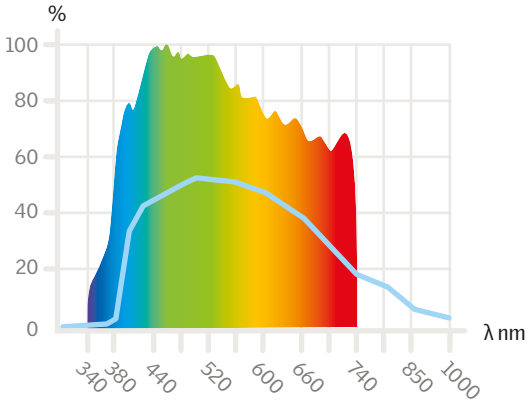
Light transmittance: T-value = 79%
Solar factor: g-value = 59%
Colour rendering index: R_a = 96

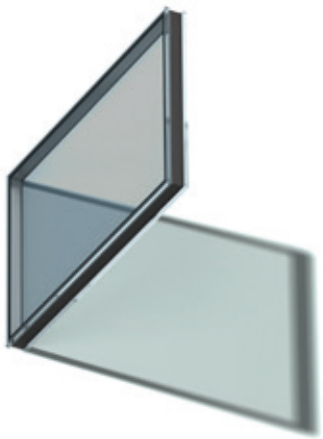


Glazing with light sun protection coating (Sun1)

Variant 11

Light transmittance: T-value = 50%
Solar factor: g-value = 28%
Colour rendering index: R_a = 91

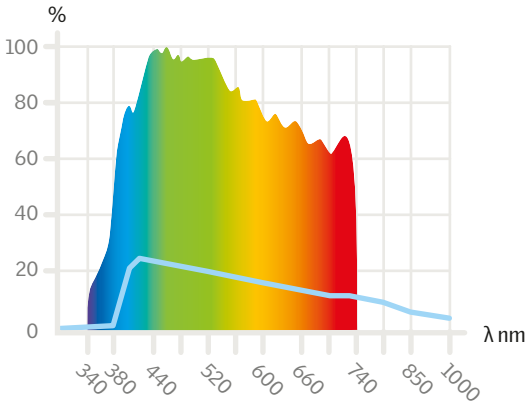




Glazing with enhanced sun protection coating (Sun2)

Variant 12

Light transmittance: T-value = 18%
Solar factor: g-value = 17%
Colour rendering index: R_a = 87



Spectral values (wave length in nm)
Visible daylight
tau

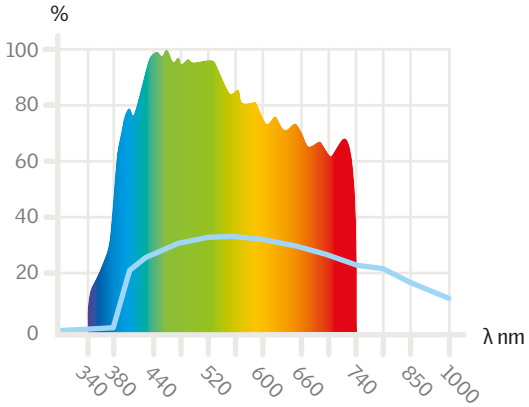
Glazing Unit with Low Emissivity Coating and Roller Blind RMM

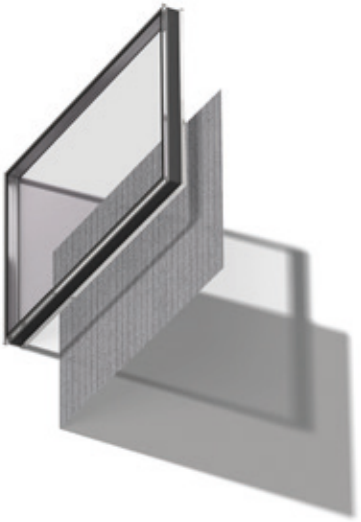
Colour renderings of double-glazed units
Additional glazing characteristics and glazing variants are shown on pages 86-88.

Glazing with low emissivity coating (LowE) and Roller Blind RMM 8806, White

Variant 10

Light transmittance: T-value = 30%
Solar factor: g-value = 34%
Colour rendering index: R_a = –

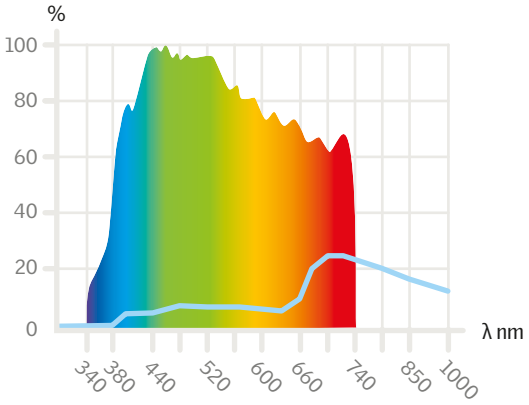


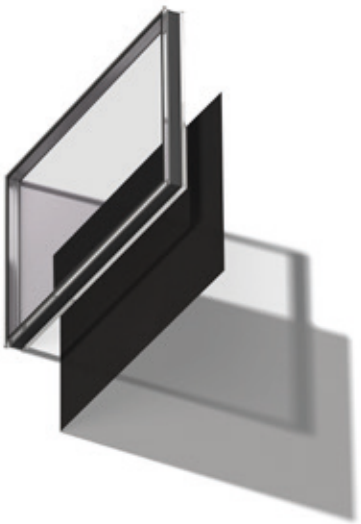


Glazing with low emissivity coating (LowE) and Roller Blind RMM 8805, Grey

Variant 10

Light transmittance: T-value = 8%
Solar factor: g-value = 41%
Colour rendering index: R_a = –

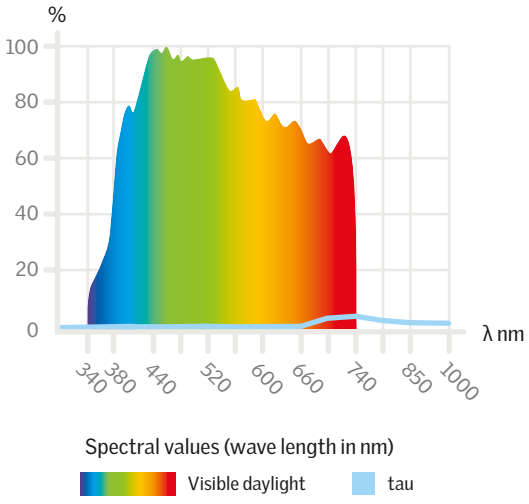




Glazing with low emissivity coating (LowE) and Roller Blind RMM 8807, Black

Variant 10

Light transmittance: T-value = 1%
Solar factor: g-value = 35%
Colour rendering index: R_a = –



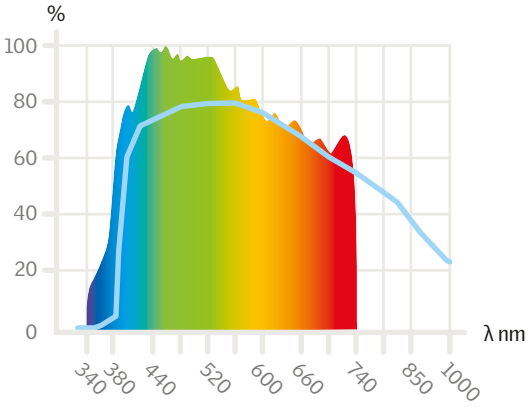
Glazing Unit with Fritted or Opal Surface

Colour renderings of double-glazed units
Additional glazing characteristics and glazing variants are shown on pages 86-88.

Glazing with low emissivity coating (LowE)

Variant 10

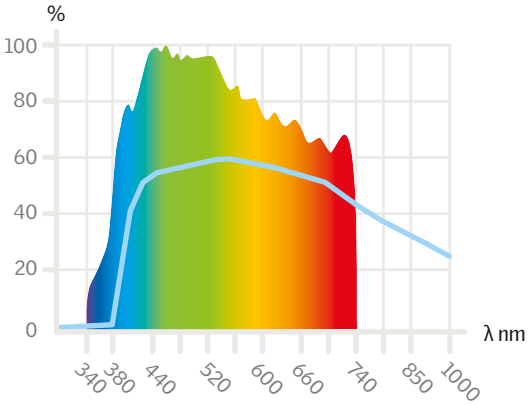
Light transmittance: T-value = 79%
Solar factor: g-value = 59%
Colour rendering index: R_a = 96

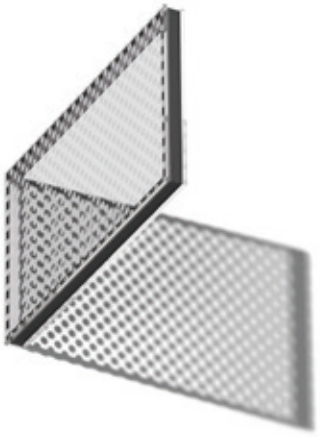


Glazing with low emissivity coating (LowE) and opal surface

Variant 10 + opal

Light transmittance: T-value = 57%
Solar factor: g-value = 38%
Colour rendering index: R_a = –

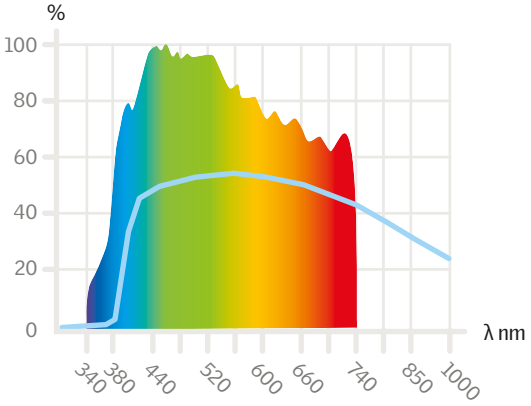




Glazing with low emissivity coating (LowE) and fritted surface

Variant 10 + fritted

Light transmittance: T-value = 53%
Solar factor: g-value = 35%
Colour rendering index: R_a = –



Brackets & Hinges

Material and surface treatment
Metal components in VELUX modular skylights are made of galvanized steel.

The majority of the steel components are electroplated according to European norm EN ISO 2081 table A1 – C: iridescent. Components fulfill corrosion resistance grade 4 in accordance with EN ISO 1670.

Based on these properties, VELUX modular skylights can be used where external weather conditions and indoor climate conditions are within the normal spectre of corrosiveness.

Note: VELUX modular skylights must NOT be used in indoor environments where the risk of condensation on metal components can lead to extreme corrosive attacks. These environments include buildings with swimming pools and other similar facilities that use highly corrosive substances, e.g. salt and/or chloride. Evaporation can lead to corrosive attacks on components, weaken the functionality and in the end compromise the structural integrity of the installation.

Brackets
VELUX modular skylights are supplied with mounting brackets and clamps and are ready to be installed on any preferred sub-construction made of steel, concrete or wood finished with a steel profile at the top. Mounting brackets are fixed during installation with a clamping system holding the skylight in place.

Using a steel profile on top of the sub-construction is an advantage, as the clamps at any time during installation can be released to allow minor positional adjustment of the modules.

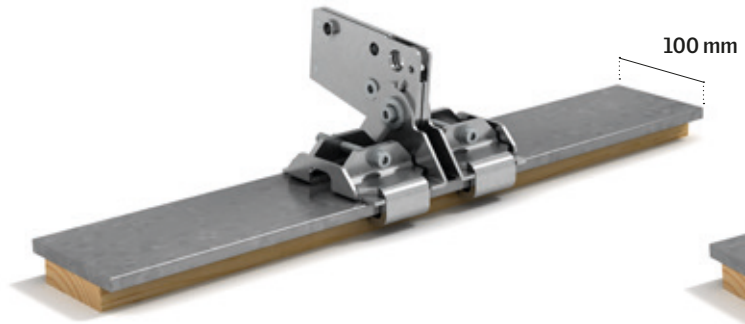
If the customer chooses not to use the mounting clamps, but to screw the mounting brackets directly into the wooden batten, please note that the screws are not included in the VELUX delivery, and therefore delivery and correct dimensioning must be ensured by the customer.

Hinges
The pre-fitted hinges of the venting modules are tested under the most severe conditions, by continuously opening and closing the largest and heaviest modules.

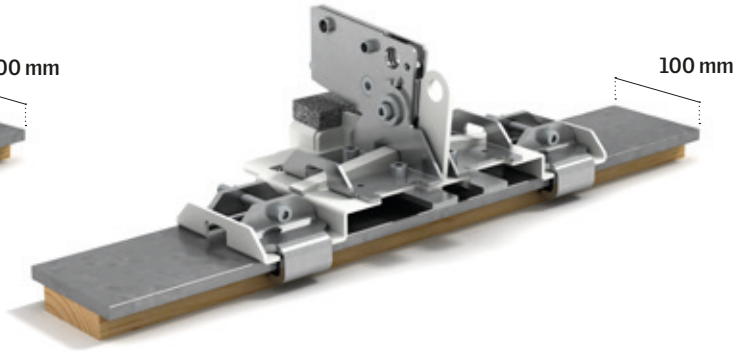
Examples of Brackets & Hinges

Top bracket for Longlight 5 - 30°

Clamp for fixing mounting bracket on steel profile

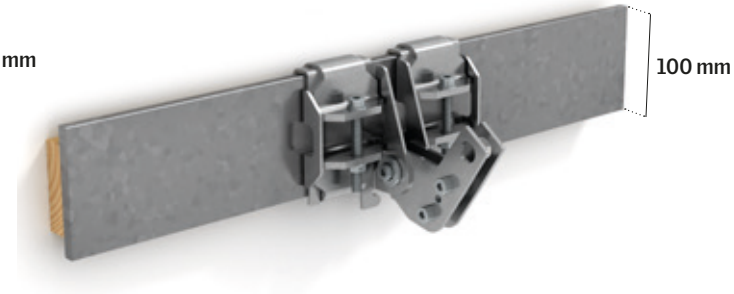


Bottom bracket for Longlight 5 - 30° and Ridgelight 25 - 40°



Bottom bracket for Ridgelight at 5° with Beams

Top bracket for Northlight 25 - 90°

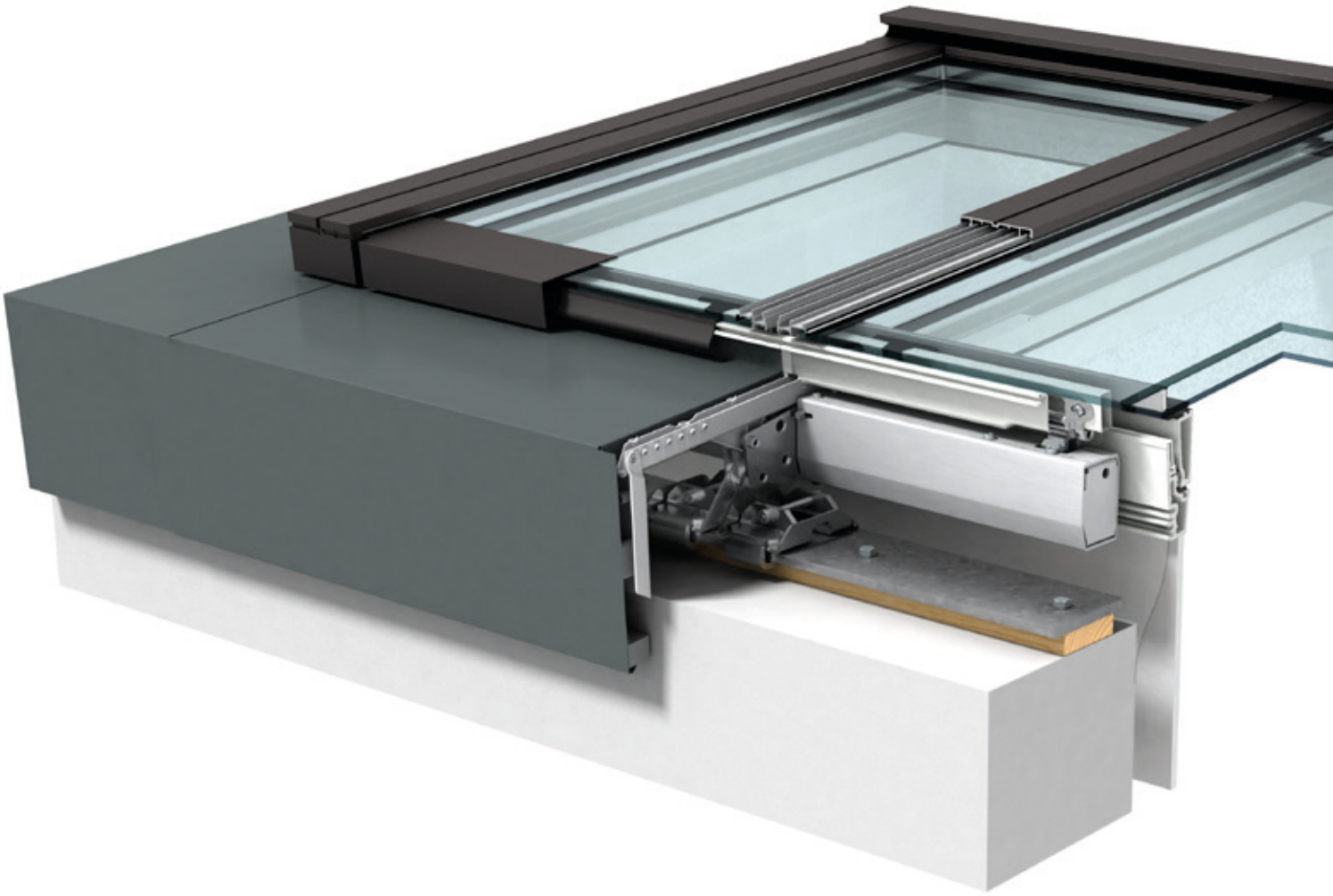


Top bracket for Wall-mounted Longlight 5 - 45°

Top bracket for Ridgelight at 5° with Beams

Top bracket for Ridgelight 25 - 40°

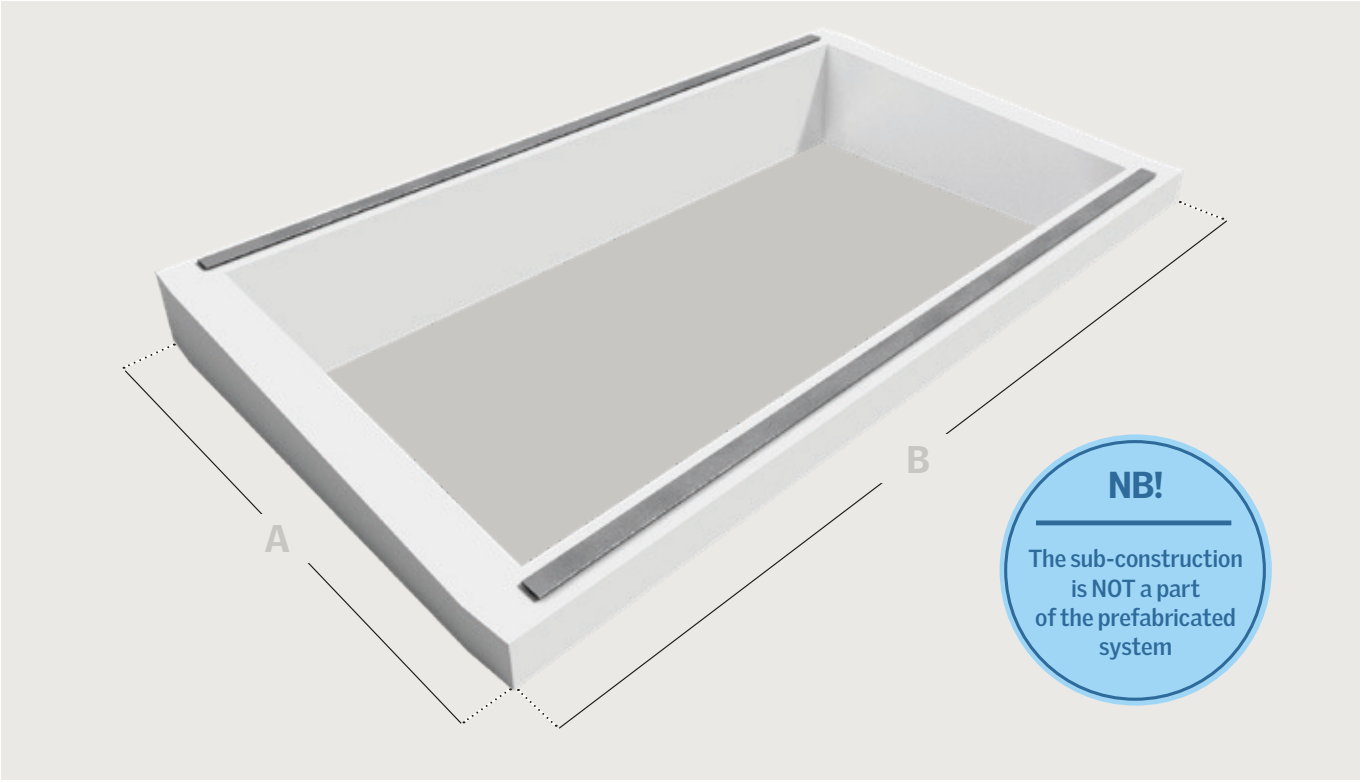
Module - Assembled



Sub-construction

Easy installation process
VELUX modular skylights require an accurate, fixed and dimensioned sub-construction. The strength of the sub-construction must also be calculated for the individual project, based on the building design and application size. It is the responsibility of the customer to have a static calculation of the sub-construction done by a static engineer.

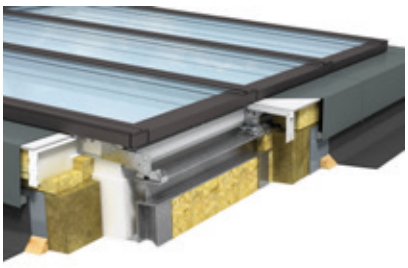
In this way, the sub-construction is not a part of the prefabricated modular skylight system. The VELUX Group is not responsible for the sub-construction.



Wood sub-construction finished with a steel profile at the top

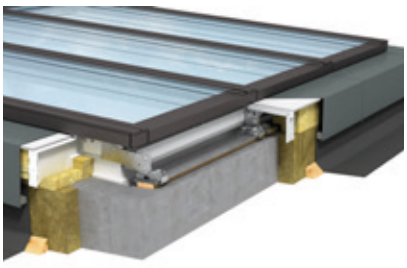
Wood is the most flexible choice for creating a light and economical sub-construction with maximum energy performance. However, it is not recommended for larger solutions and Ridgelight installations.

Steel sub-construction finished with a steel profile at the top



Steel offers flexibility in combination with great strength. Steel also allows a maximum amount of insulation to be used in the installation.

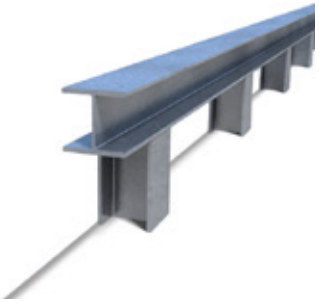
Concrete sub-construction finished with a steel profile at the top



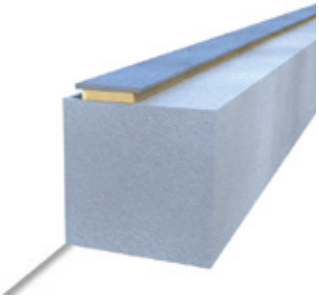
Concrete provides a strong, but heavy sub-construction and is mostly suited for concrete buildings. Concrete sub-constuctions are usually cast on site.

The steel profile
A steel profile is the most important link when mounting the modules to the sub-construction

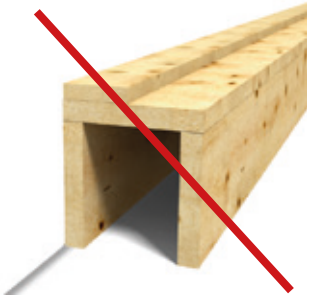
Steel profile on timber



Steel profile on steel

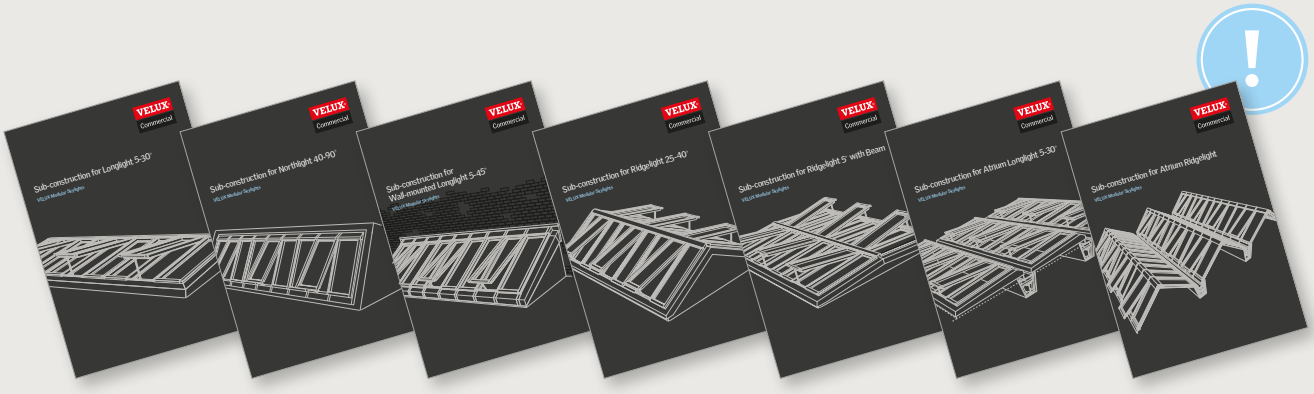


Steel profile on concrete



Wood profile on timber is not recommended by VELUX Commercial.

Download material and recommendations on sub-construction



See our large selections of material on Longlight, Wall-mounted Longlight, Northlight, Ridgelight, Ridgelight at 5° with Beams, Atrium and Step solution.

Read all about sub-constructions in the guides at: veluxcommercial.com

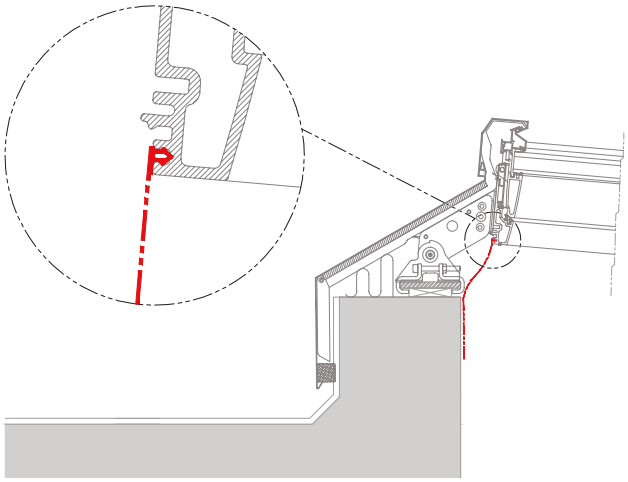
Vapour Barrier Connection Strip

To ensure a high quality installation of VELUX modular skylights and to prevent condensation occurring within the sub-construction, it is highly recommended to install BCX vapour barrier connection strip.

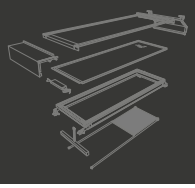
The factory-finished BCX creates the perfect connection between the VELUX modular skylights and the vapour barrier of the building. BCX is CE-marked in accordance with EN 13984.

The vapour barrier connection strip BCX is made of a diffusion-tight polyethylene membrane completed with a pre-fitted rubber gasket along one edge. With a perfect fit into the skylight frame rebate, installation is an easy job that guarantees a vapour-tight solution.

The factory-finished BCX



Position of BCX



Chain Actuator

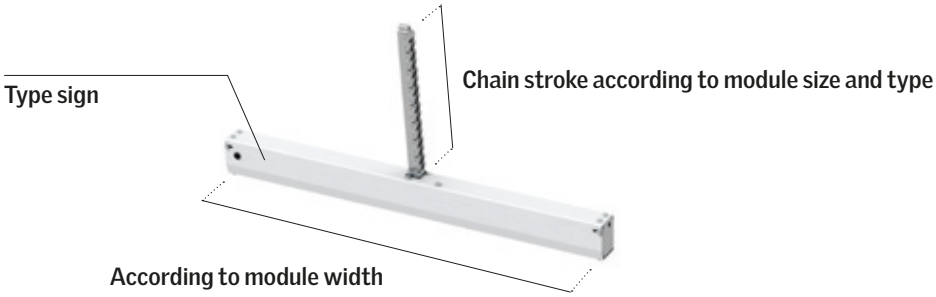
VELUX venting skylight modules are top-hung and have a hidden chain actuator integrated at the bottom profile. There are two variants of the chain actuator. You can either choose the VELUX INTEGRA® system based on the io-homecontrol® technology and use the VELUX INTEGRA® control pad KLR 200 for user-friendly control.

Alternatively, you can choose the open system variant and connect the installation to your preferred ± 24 V DC control system. The open system chain actuator can be programmed even after installation to suit specific needs, e.g. speed, tensile and compressive force.

These parameters can be changed via the green communication wire with WindowMaster MotorLink™.

The chain actuator for VELUX modular skylights has a built-in reversing function that prevents entrapment.

The chain actuator is accessible from the roof. Therefore, maintenance requires no access from the inside of the building.



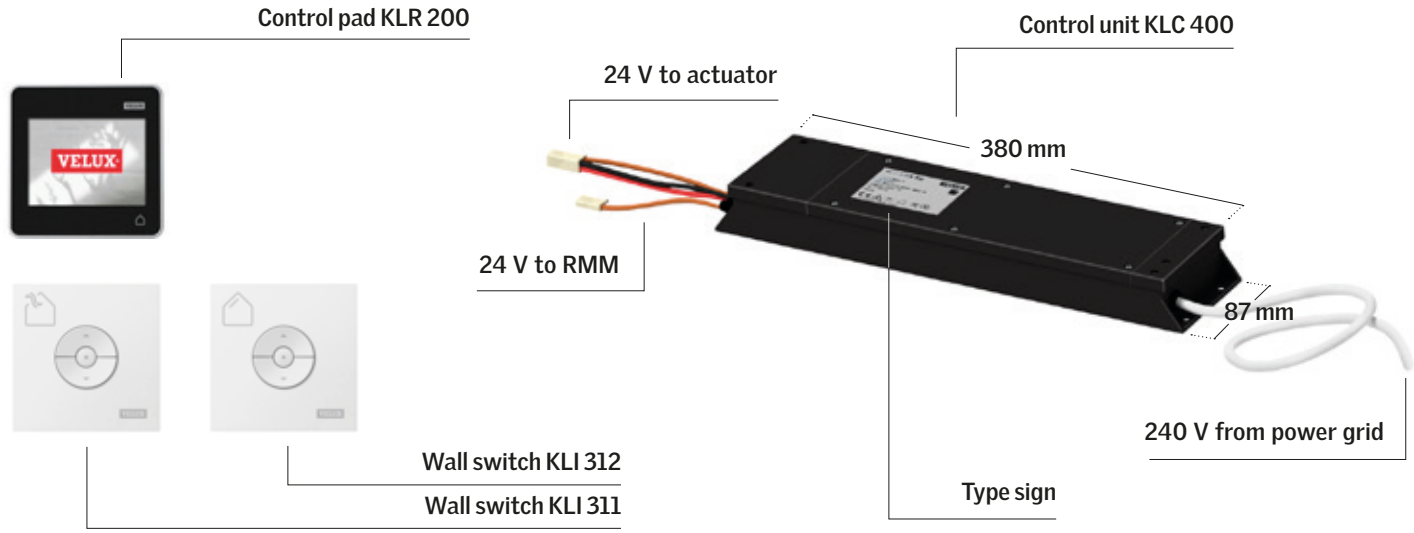
VELUX modular skylights have a recommended minimum installation height of 2.5 m above floor level (inside) and ground level (outside). In case of installation below that level, safety measures must be applied by the installer/user to prevent serious injury. No instruction or measure can eliminate the inherent hazards resulting from installation heights below 2.5 m.

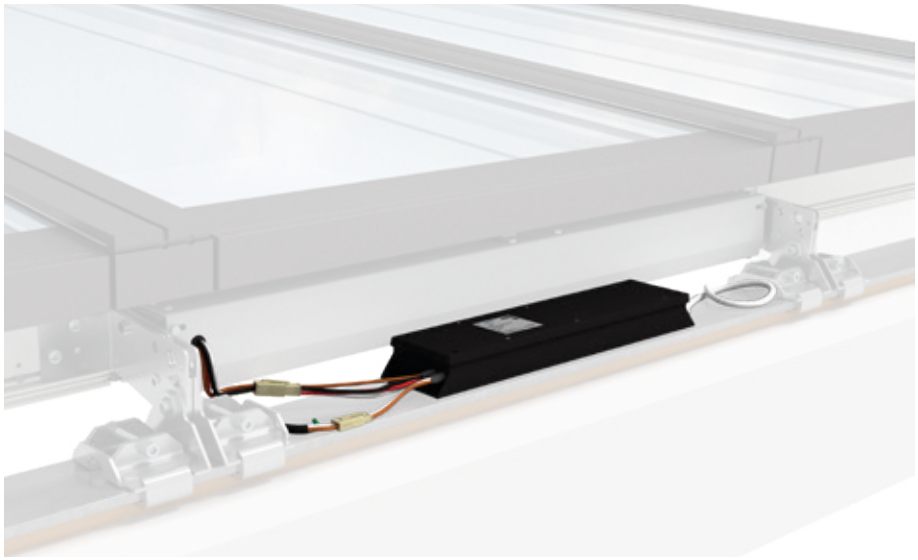
The VELUX Group will not accept responsibility for damages, injury or death resulting from such installation. The installer/user is ultimately responsible for own omissions and actions. Measures could for instance be to install a motion sensor that is able to disconnect power from the control unit in case of any movement in the immediate vicinity of the VELUX modular skylights.

Control System

VELUX INTEGRA®
Venting modular skylights and roller blinds controlled with the VELUX INTEGRA® system are powered and controlled from the control unit KLC 400. Each KLC 400 can operate one venting skylight module and up to four roller blinds individually, in groups or simultaneously.

Skylights and blinds installed with the VELUX INTEGRA® system are controlled with the VELUX INTEGRA® wall switches KLI 311/312 or control pad KLR 200.





Open system
Venting modular skylights and roller blinds controlled with the open system solution are connected to ± 24 V DC. In addition to ± 24 V DC, the open system skylights and roller blinds can be connected to and integrated in common building automation fieldbus systems, i.e. KNX, BACnet, LON and Modbus.

The connection to the skylight actuator is made through the integrated WindowMaster MotorLink™ technology that among other things enables exact position control and feedback.

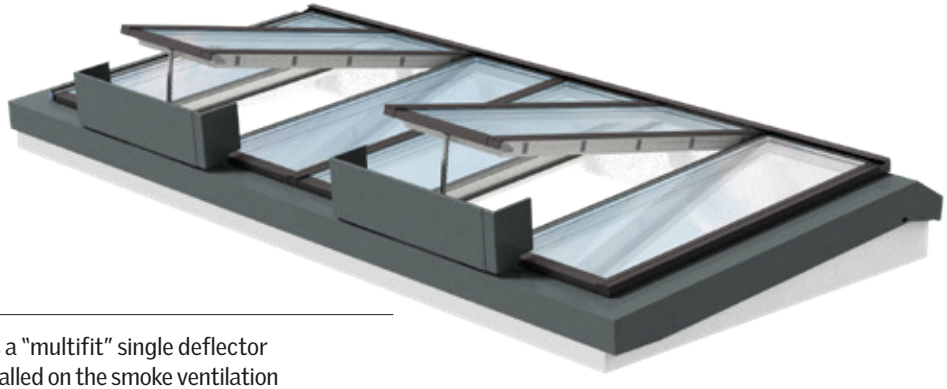
Wind Deflector for Smoke Ventilation Modules

The wind deflectors are intended for use with smoke ventilation modular skylights. The wind deflectors are designed to change the wind profile over the skylights in open position, in order to minimize the risk of air intake and allow outtake of smoke even under unfavorable wind conditions, and at the same time causing the least possible visual effect on the exterior of the skylight. The wind deflectors come in two variants: KCD W00H00 0040 that covers one smoke ventilation module and KCD 0080 that covers three modules, one smoke ventilating module in the middle of two fixed modules of the same width.

The deflectors are tested together with VELUX modular skylights in accordance with EN 12101-2.

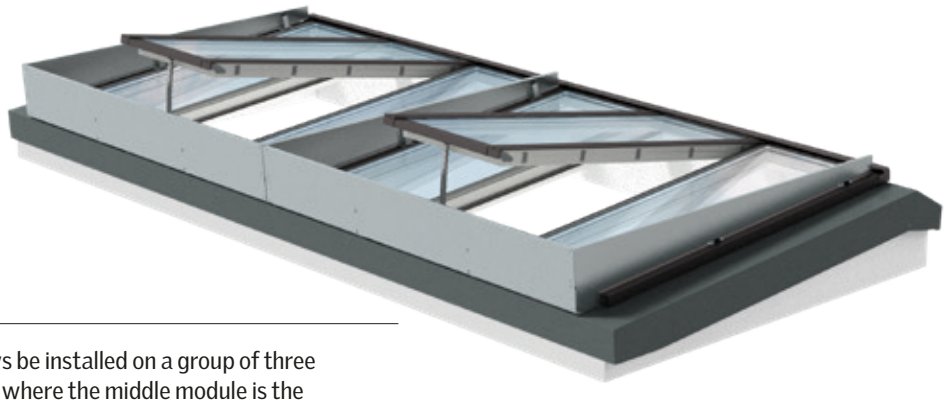
The wind deflector can be purchased and installed at the same time as the smoke ventilator, or they can be installed subsequently, if the skylight configuration allows this. In any case, the aerodynamic free area of the smoke ventilators is declared both with and without wind deflectors and the influence of the deflectors on the performance must be respected.

For further information on the performance of smoke ventilation modular skylights, the influence of the deflector on the aerodynamic free area and the design possibilities, see pages 75-85.



Wind deflector KCD 0040

Wind deflector KCD W00H00 0040 is a "multifit" single deflector for all module sizes. The deflector is installed on the smoke ventilation module, one deflector for each module.



Wind deflector KCD 0080

Wind deflector KCD 0080 must always be installed on a group of three skylight modules with identical width, where the middle module is the smoke ventilator and the two modules at the sides are fixed modules. This deflector is manufactured to fit the size of the three modules it is installed on.

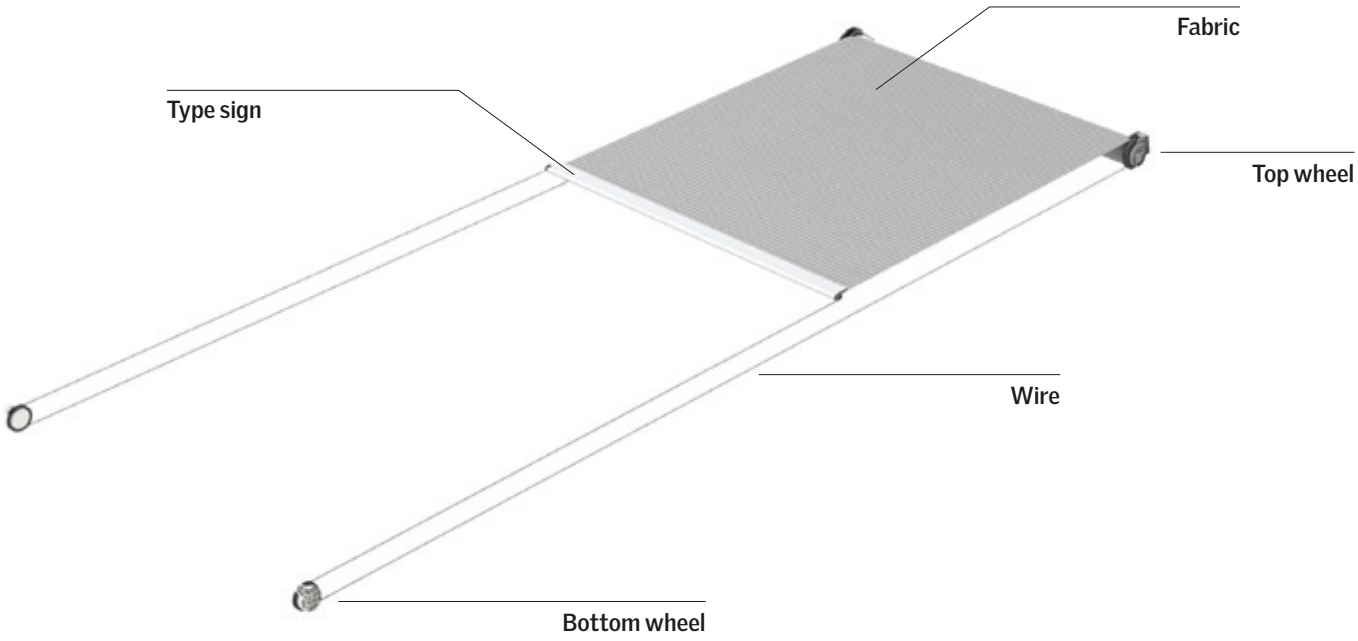
Roller Blind

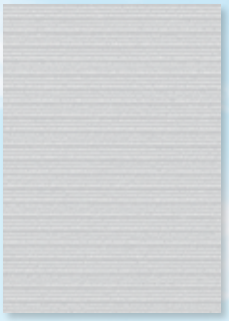
The internal roller blind RMM is designed for installation with VELUX modular skylights, and is available in all standard module sizes. The blind protects against heat and glare and helps to control the amount of light in the room.

The blind consists of four wheels, one in each corner of the skylight module and two steel wires, running along the module side frame. The two wires pull a lightweight polyester fabric available in three commonly used colours.

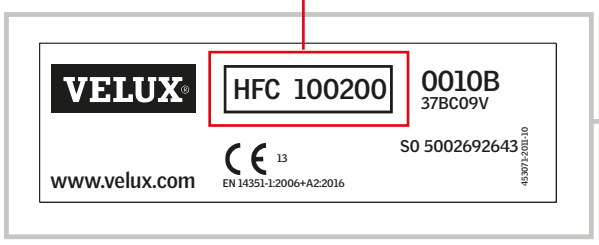
To support fast and safe installation of VELUX modular skylights, it is possible to order roller blinds pre-mounted from the factory, except on smoke ventilation modules.

VELUX modular skylights can be pre-fitted with cables for internal roller blinds, making the installation and connection to the module and to the power supply quick and easy.



Fire retardant sun screening			
			
Colour:	Grey	White	Black
Variant code:	RMM 8805	RMM 8806	RMM 8807

Order the right size
To order the right sizes see the type sign on the VELUX modular skylight.
How to read the type sign, see page 39.



Beam for Ridgelight at 5°

When installing VELUX modular skylights in a 5° Ridgelight solution, the modules are supported by a steel beam. The beam is included in the VELUX delivery and is ready for fast and easy installation with no further preparation.

VELUX beams are treated with final coating, white RAL 9010 as standard and are available for modules from 1200 to 3000 mm in height.

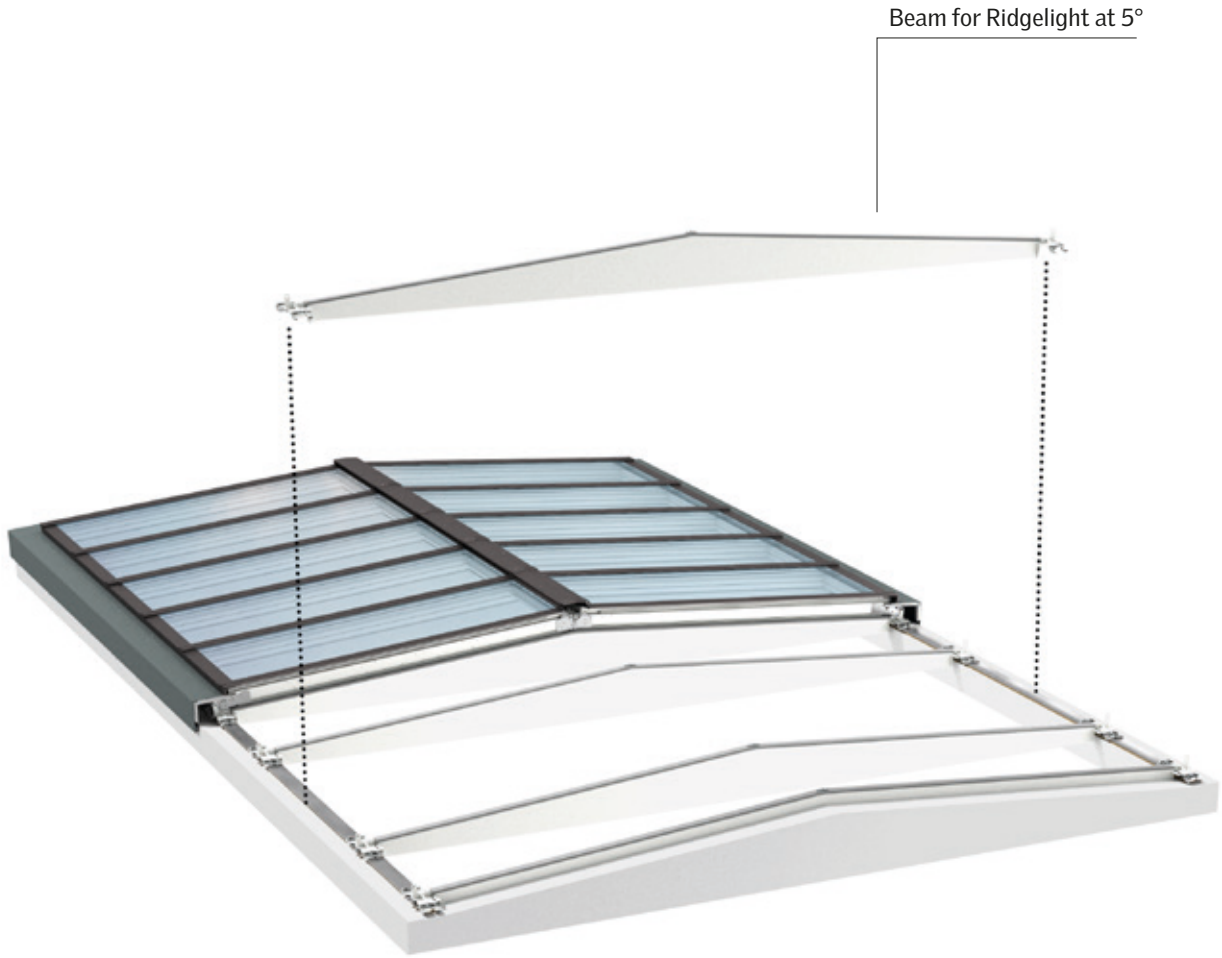
If the beam is required to meet increased demands for fire resistance, for instance used together with a fire resistant skylight module HFS, it must be treated with fire paint. If such a demand occurs, please be advised:
For up to 30 minutes of fire resistance, clients will need to:

a) purchase modules with fire resistant glazing units and intumescent strip (HFS).
b) purchase the corresponding beam variant coated with fire resistant paint system providing 30 minutes of resistance to fire to the whole application.

Clients are advised to inform the local VELUX sales company of such demands prior to order, as standard beams are not coated with fire resistant paint system but with standard paint as default, and the applied standard paint system is not compatible for post application of fire protection paint systems. Please note that fire paint will change the visual appearance of the beams slightly.

If there are no specific fire rating demands for the modules, but specific demands for the beams, only point b) is relevant.

Always take into consideration that it is only possible to make beams fire rated for up to 30 minutes. If fire rating demands exceed 30 minutes, 5° Ridgelight configurations are not suited for this installation.

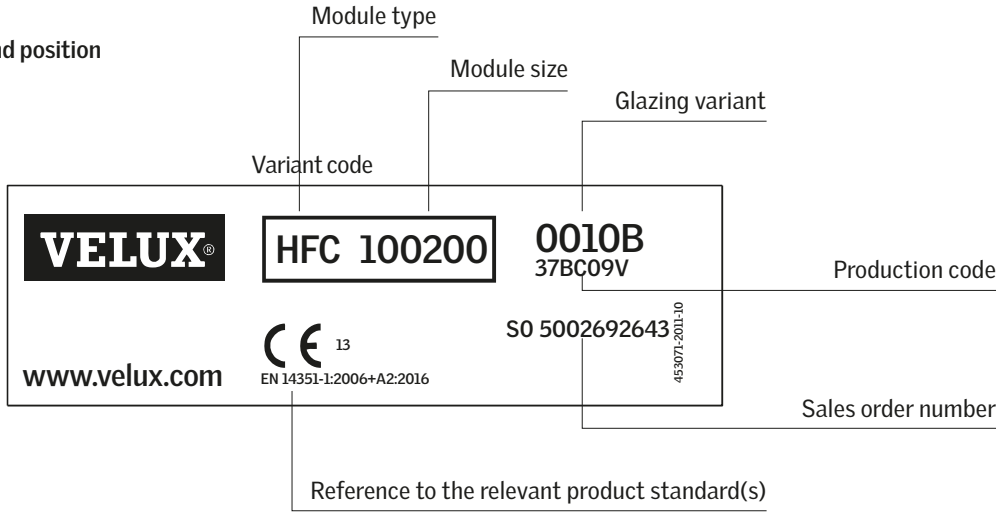


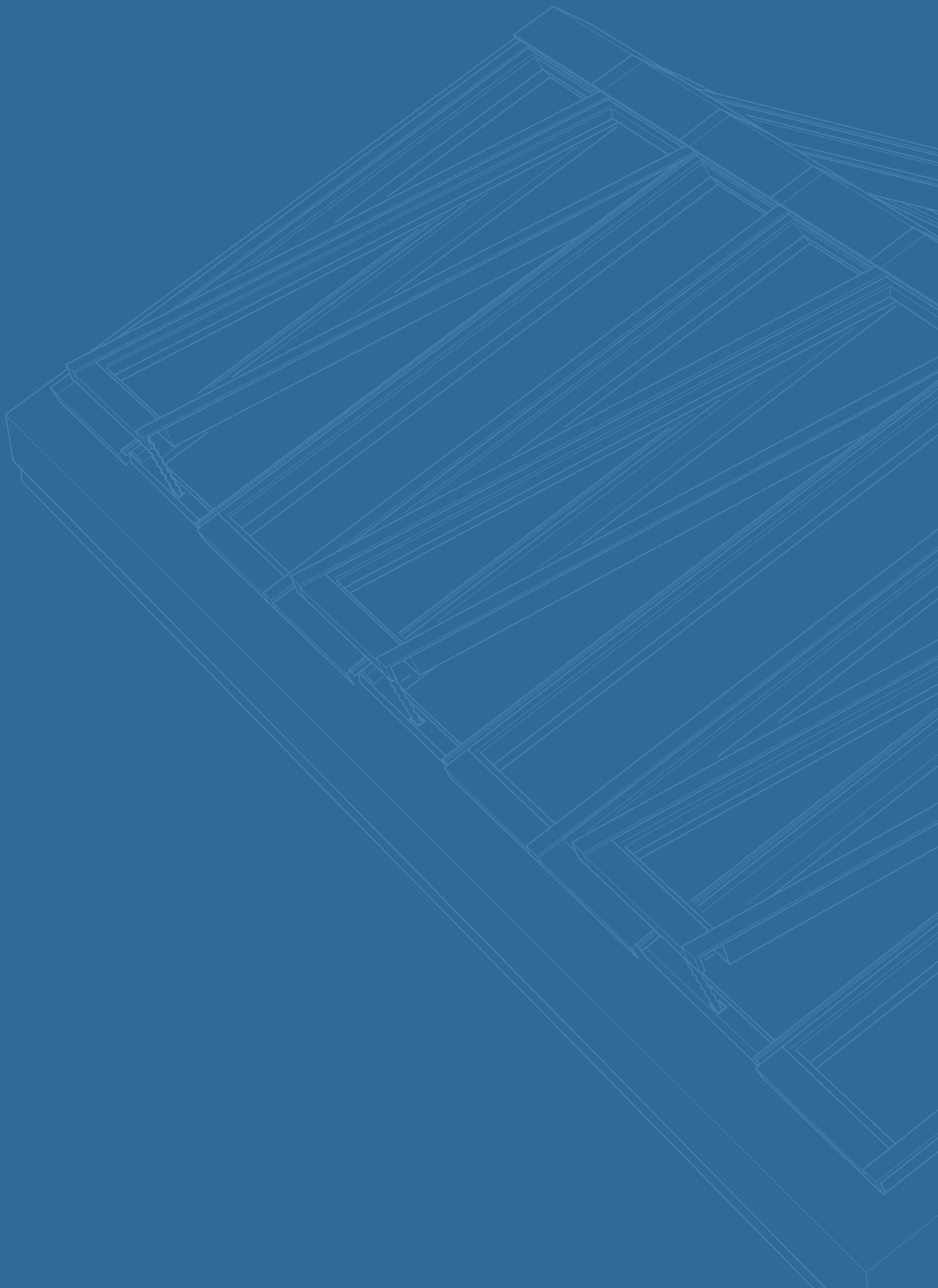
Type Sign

All VELUX modular skylights, electrical components and accessory products have a type sign sticker. The type sign helps to identify the product and must NOT be removed.

If a product is damaged or malfunctioning, the information on the type sign must be given to the VELUX sales company.

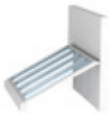
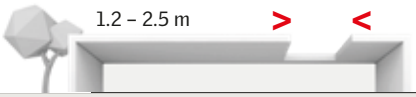
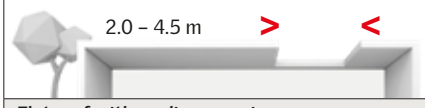
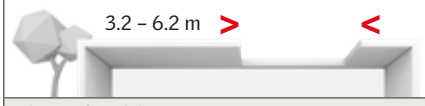
Example of type sign and position





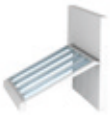
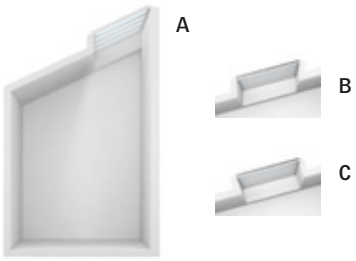
Solutions

Quick Overview of Skylight Solutions vs. Roof Constructions

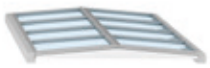
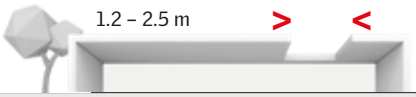
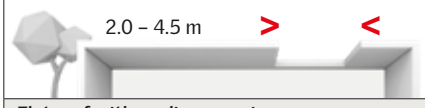
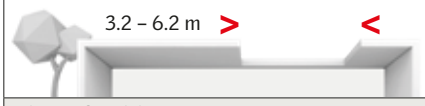
						
Solution*	**Longlight**		**Wall-mounted Longlight**		**Northlight**	
Installation pitch	5-30°		5-45°		25-90°	
HFC = fixed modules, HVC = venting modules	HFC	HVC	HFC	HVC	HFC	HVC
Opening width (Length = ∞) **	0.6 – 3.1 m	0.8 – 2.5 m	0.6 – 3.2 m	0.8 – 2.6 m	0.6 – 3.1 m	0.8 – 2.5 m
 1.2 – 2.5 m > < Flat roof with small opening	✓					
 2.0 – 4.5 m > < Flat roof with medium opening	✓					
 3.2 – 6.2 m > < Flat roof with large opening						
 Flat roof with extra large opening (Atrium)						
 Flat roof up against a wall			✓			
 Northlight					✓	
 Sloping roof with opening in the side	✓				✓	
 Sloping roof with opening as ridge						

* Please note that all solutions, regardless of roof construction, require installation on a sub-construction designed according to instructions given by the VELUX Group.
** Measurements are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Idea catalogue on alternative construction possibilities and light distribution

		
Longlight	**Wall-mounted Longlight**	**Northlight**
		
Daylight in both an office and a corridor	Newbuild extension with wall-mounted solution	Daylight will be restricted in a 90° solution
		
Asymmetric room with a sloaping roof	Buildings with different heights	A lower pitch creates more daylight inside
		
When a sloping roof cannot carry a Ridgelight	Opens up a corridor in a building	Northlight integrated in the roof construction
		
In a shaft between two buildings	Daylight into a basement	

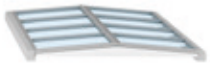
Quick Overview of Skylight Solutions vs. Roof Constructions

				
Solution*	**Ridgelight**		**Ridgelight at 5° with Beams**	
Installation pitch	25-40°		5°	
HFC = fixed modules, HVC = venting modules	HFC	HVC	HFC	HVC
Opening width (Length = ∞) **	1.4 – 4.5 m	1.4 – 4.5 m	1.8 – 6.2 m	1.8 – 5.0 m
 1.2 – 2.5 m > < Flat roof with small opening	✓			
 2.0 – 4.5 m > < Flat roof with medium opening	✓		✓	
 3.2 – 6.2 m > < Flat roof with large opening	✓		✓	
 Flat roof with extra large opening (Atrium)				
 Flat roof up against a wall				
 Northlight				
 Sloping roof with opening in the side				
 Sloping roof with opening as ridge	✓			

* Please note that all solutions, regardless of roof construction, require installation on a sub-construction designed according to instructions given by the VELUX Group.
** Measurements are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Idea catalogue on alternative construction possibilities and light distribution

Ridgelight



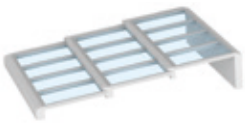
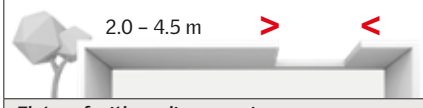
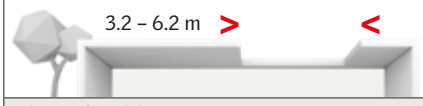
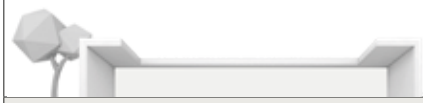
Ridgelight at 5° with Beams

On top of a pitched roof

Solution for a very wide opening

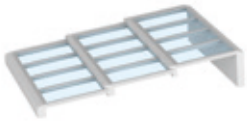
Asymmetric Ridgelight with infill panel on south side blocking the excess sun

Quick Overview of Skylight Solutions vs. Roof Constructions

						
Solution*	**Step Longlight**		**Step Ridgelight**		**Step Ridgelight on Girder**	
Installation pitch	5-25°		25°		5-25°	
HFC = fixed modules, HVC = venting modules	HFC	HVC	HFC	HVC	HFC	HVC
Opening width (Length = ∞) **	2.6 – 18 m	2.6 – 18 m	4.5 – 33 m	4.5 - 33 m	6 – 36 m	6 - 36 m
 1.2 – 2.5 m > < Flat roof with small opening						
 2.0 – 4.5 m > < Flat roof with medium opening						
 3.2 – 6.2 m > < Flat roof with large opening						
 Flat roof with extra large opening (Step solution)	✓		✓		✓	
 Flat roof up against a wall	✓					
 Northlight						
 Sloping roof with opening in the side	✓					
 Sloping roof with opening as ridge			✓		✓	

* Please note that all solutions, regardless of roof construction, require installation on a sub-construction designed according to instructions given by the VELUX Group.
** Measurements are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Idea catalogue on alternative construction possibilities and light distribution



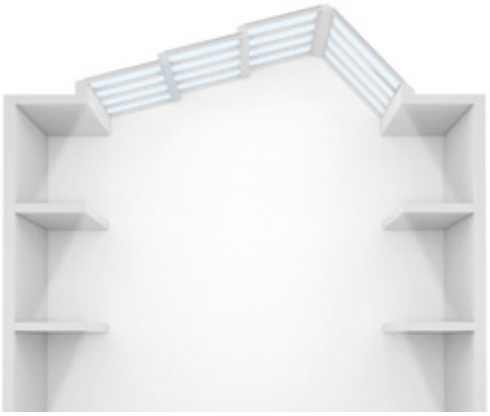
Step Longlight

Step Ridgelight

Step Ridgelight on Girder

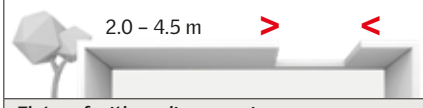
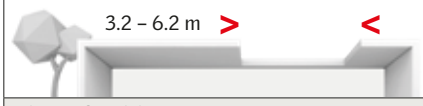
A roof in two levels with Step Longlight

A roof in two levels with Step Ridgelight on Girder



A flat roof with a Step Ridgelight on Girder

Quick Overview of Skylight Solutions vs. Roof Constructions

						
Solution*	**Atrium Longlight**		**Atrium Ridgelight**		**Atrium Ridgelight at 5° with Beams**	
Installation pitch	5-30°		25-40°		5°	
HFC = fixed modules, HVC = venting modules	HFC	HVC	HFC	HVC	HFC	HVC
Opening width (Length = ∞) **	0.6 – 3.1 m	0.8 – 2.5 m	1.4 – 4.5 m	1.4 – 4.5 m	1.8 – 6.2 m	1.8 – 5.0 m
 1.2 – 2.5 m > < Flat roof with small opening						
 2.0 – 4.5 m > < Flat roof with medium opening						
 3.2 – 6.2 m > < Flat roof with large opening						
 Flat roof with extra large opening (Atrium)	✓		✓		✓	
 Flat roof up against a wall						
 Northlight						
 Sloping roof with opening in the side						
 Sloping roof with opening as ridge						

* Please note that all solutions, regardless of roof construction, require installation on a sub-construction designed according to instructions given by the VELUX Group.
** Measurements are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Idea catalogue on alternative construction possibilities and light distribution

Atrium Longlight

Atrium Ridgelight

Atrium Ridgelight at 5° with Beams

Atrium Longlight with internal sun screening. Design ideas like internal vertical sun screening are not supplied by the VELUX Group

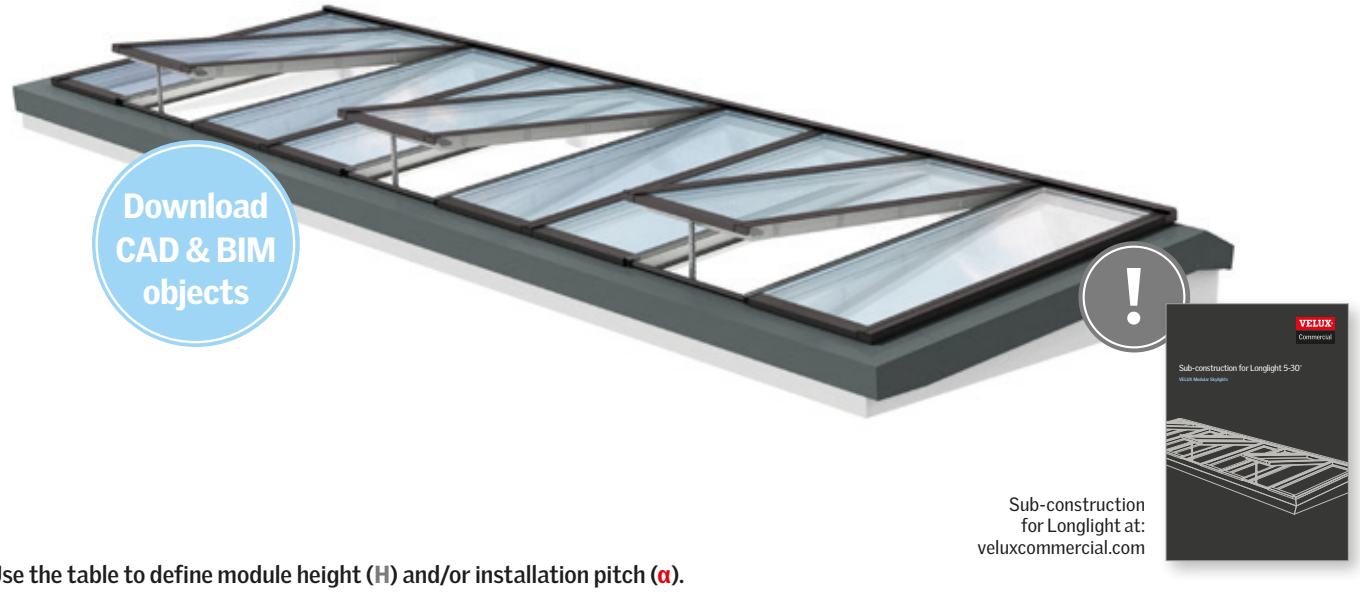
Atrium Longlight with external sun screening. Design ideas like vertical sun screening are not supplied by the VELUX Group

Atrium Longlight with sun louvres. Design ideas like sun louvres are not supplied by the VELUX Group

Longlight 5 - 30°

Longlights are bands of VELUX modular skylights, supplied with installation brackets and clamps that guarantee a fast and secure installation. The prefabricated flashing allows for configurations with a pitch of 5 to 30°.

Longlights are mounted on a standard steel profile, 100 mm wide (not a VELUX component). The brackets are fixed with a clamping system holding the skylights in place. It is also possible to install the mounting brackets of a Longlight directly onto a wooden batten without using the clamps.

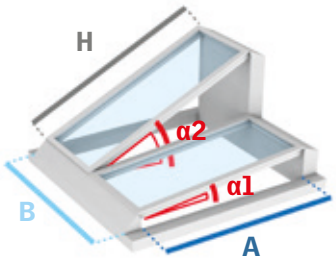


Sub-construction
for Longlight at:
veluxcommercial.com

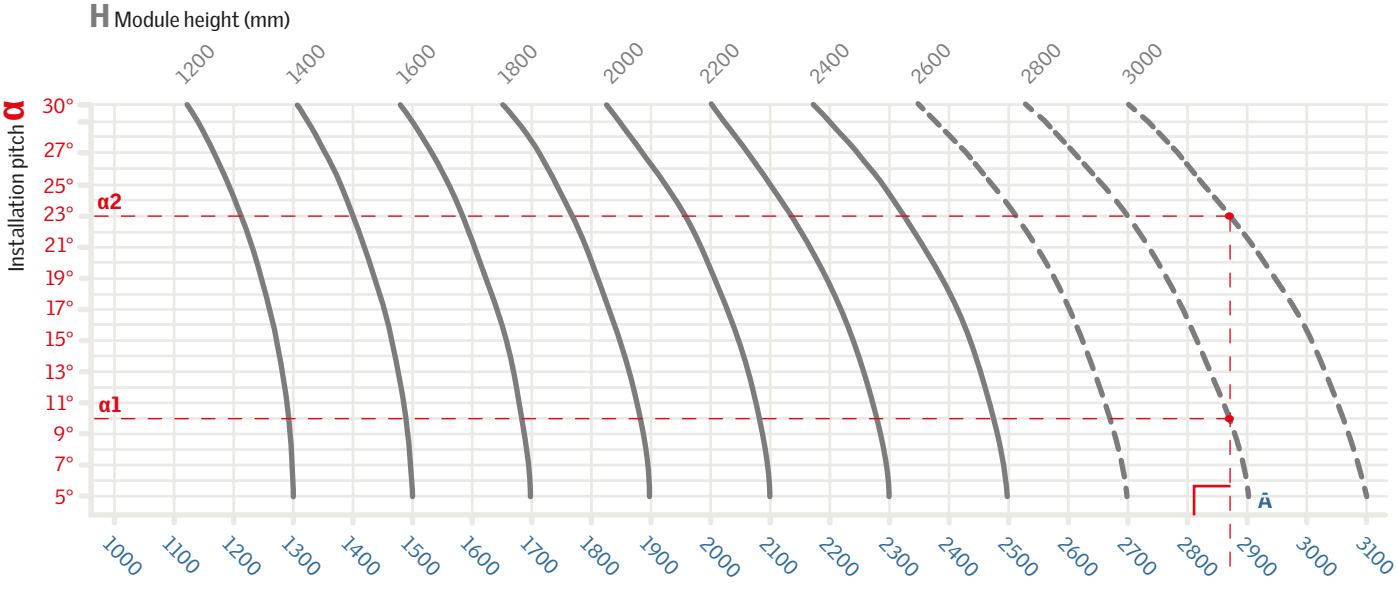
Use the table to define module height (H) and/or installation pitch (α).

Example:
A = 2500 mm

Result:
α1: H = 2400 mm at an installation pitch of **5°**
or
α2: H = 2600 mm at an installation pitch of **23.5°**

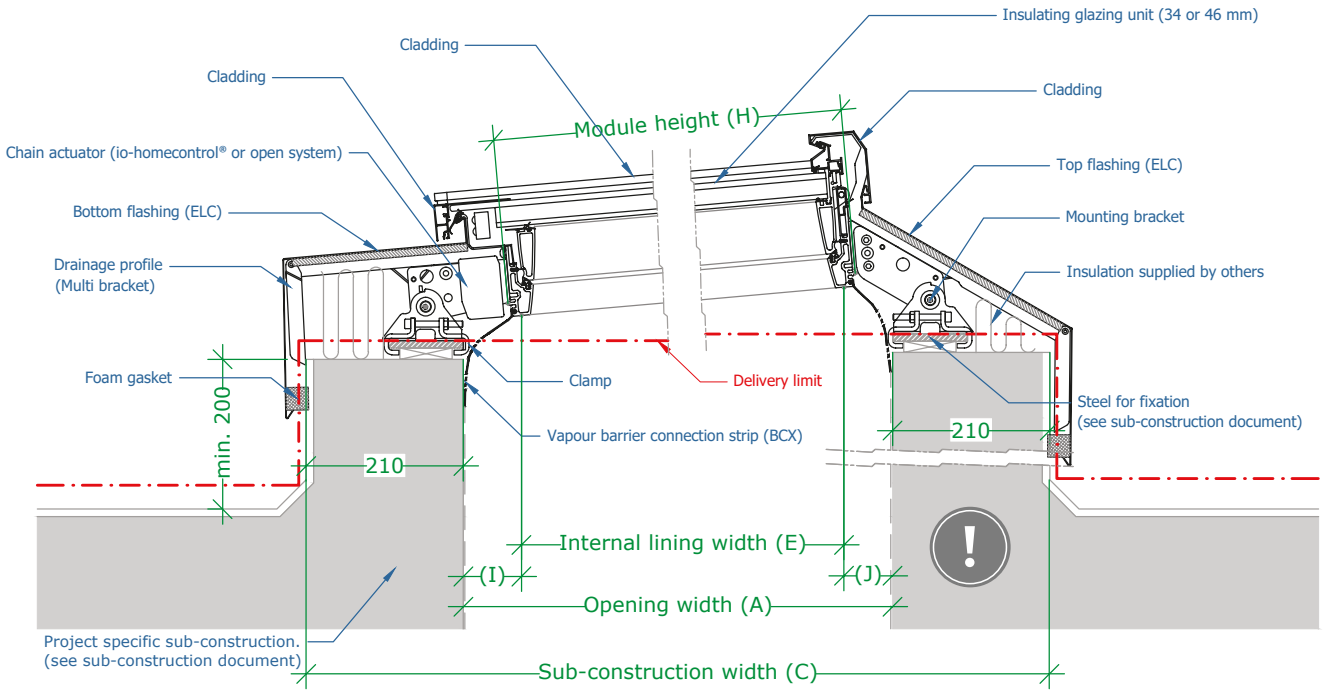


H: Module height
α: Installation pitch
A: Opening width
B: Opening length



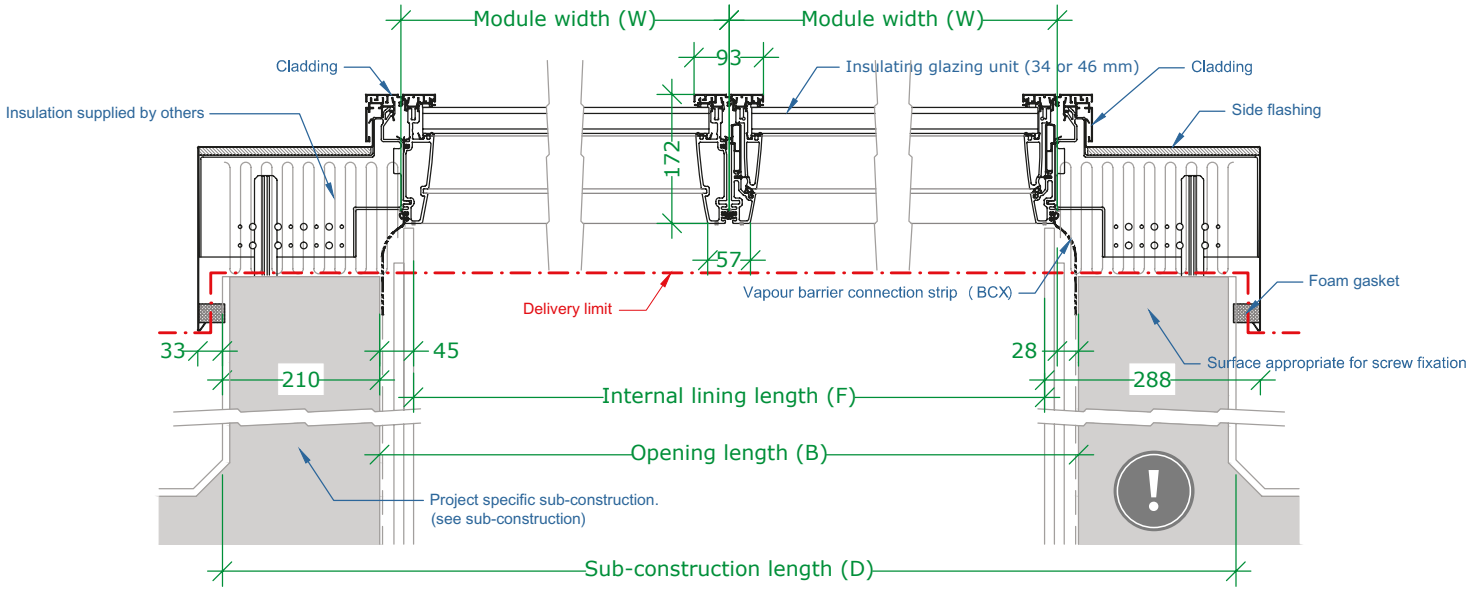
Not available as venting modules as default. Venting modules available as non-standard for certain projects.

Sectional Drawings



Cross-section – bottom

Cross-section – top

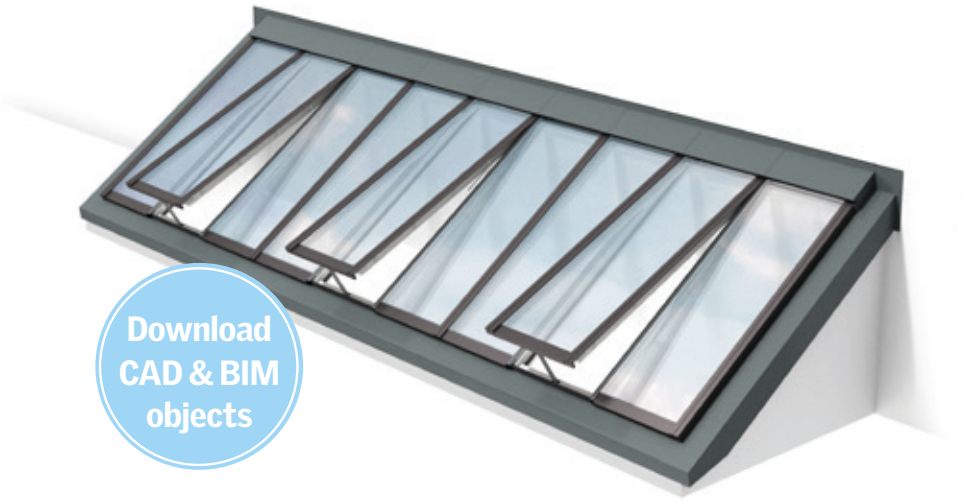


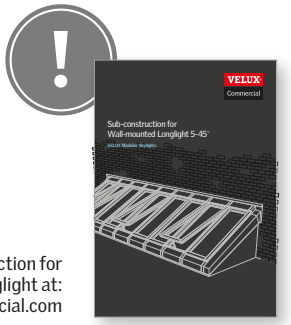
Longitudinal section

Wall-mounted Longlight 5 - 45°

Wall-mounted Longlights are bands of VELUX modular skylights mounted against a vertical wall. As the skylight modules are supplied with installation brackets and clamps, a fast and secure installation is guaranteed. The flashing allows for configurations with a pitch of 5° to 45°.

Wall-mounted Longlights are mounted on a standard steel profile, 100 mm wide at the wall. At the bottom, you can choose to mount the skylights on either a steel profile using the clamping system or directly onto a wooden batten without using the clamps. The steel profiles and wooden battens are not VELUX components.
Please observe a max. 3 m wall height above skylight module.



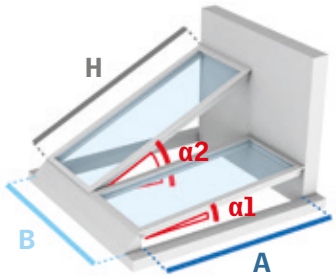


Sub-construction for
Wall-mounted Longlight at:
veluxcommercial.com

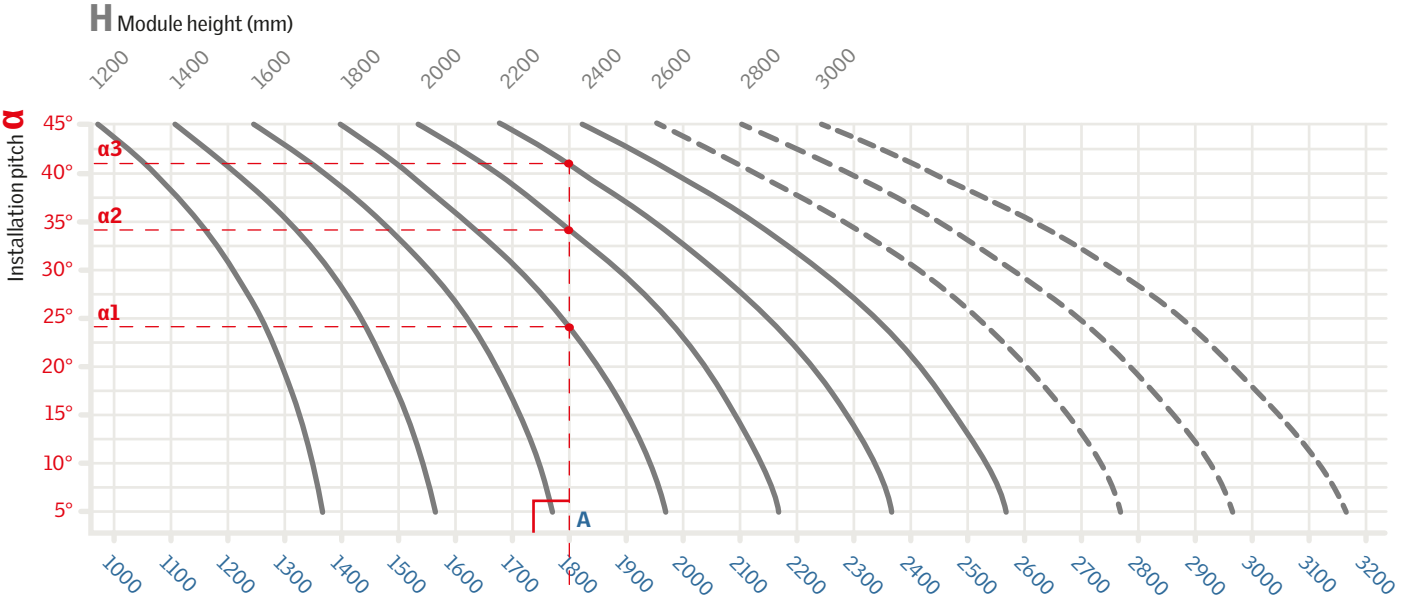
Use the table to define module height (H) and/or installation pitch (α).

Example:
A = 1800 mm

Result:
α1: H = 1800 mm at an installation pitch of **24°**
or
α2: H = 2000 mm at an installation pitch of **34°**
or
α3: H = 2200 mm at an installation pitch of **41°**

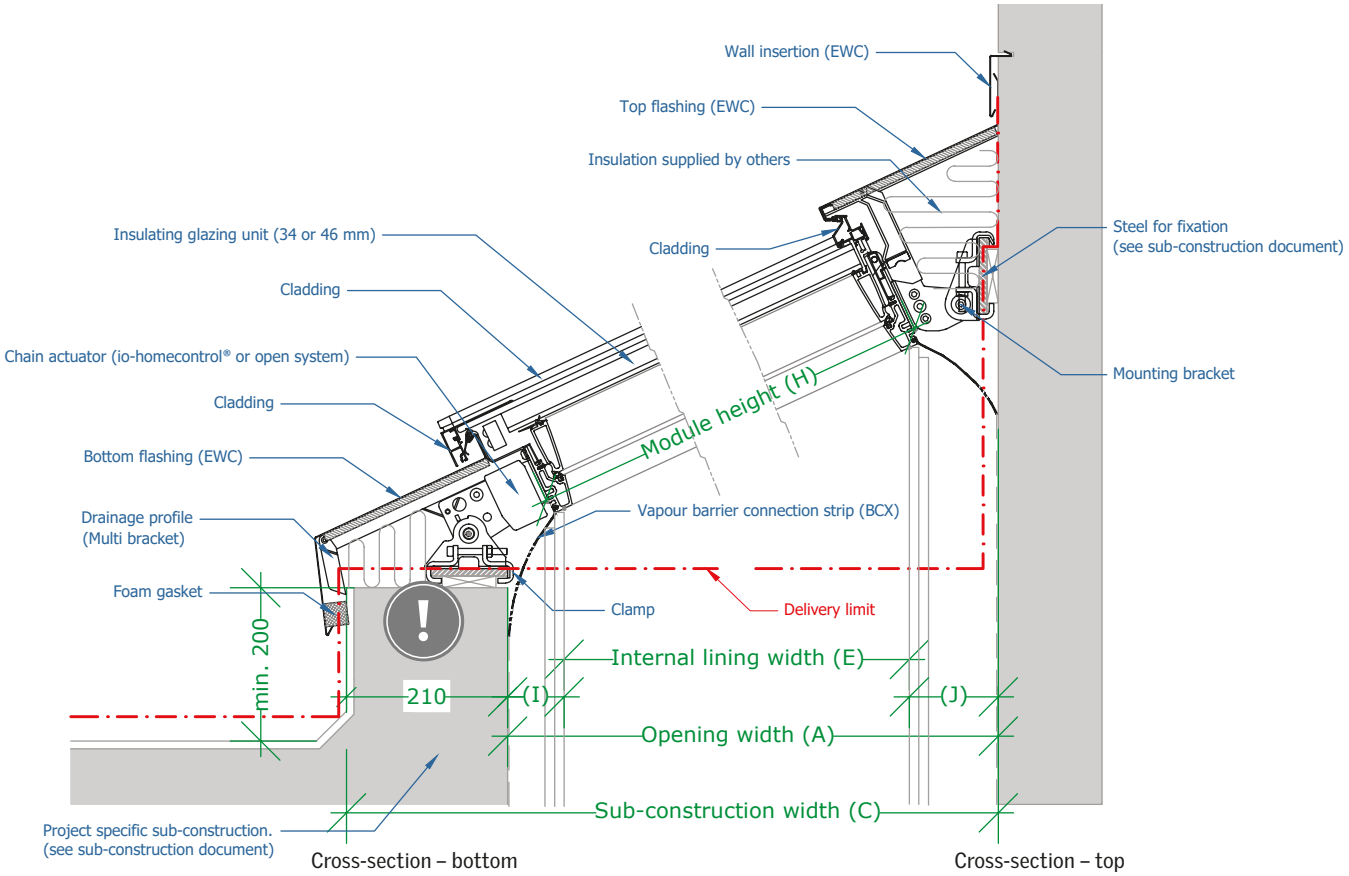


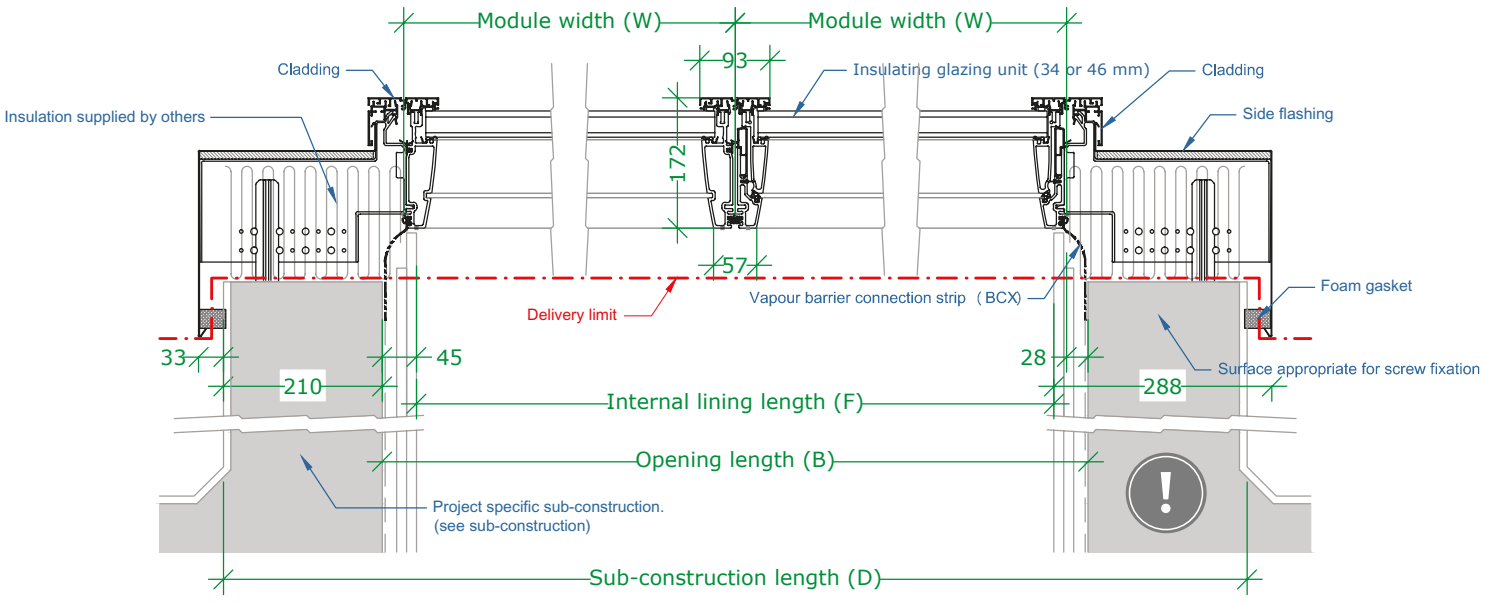
H: Module height
α: Installation pitch
A: Opening width
B: Opening length



Not available as venting modules as default.
Measurements in the above example are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Sectional Drawings





Longitudinal section

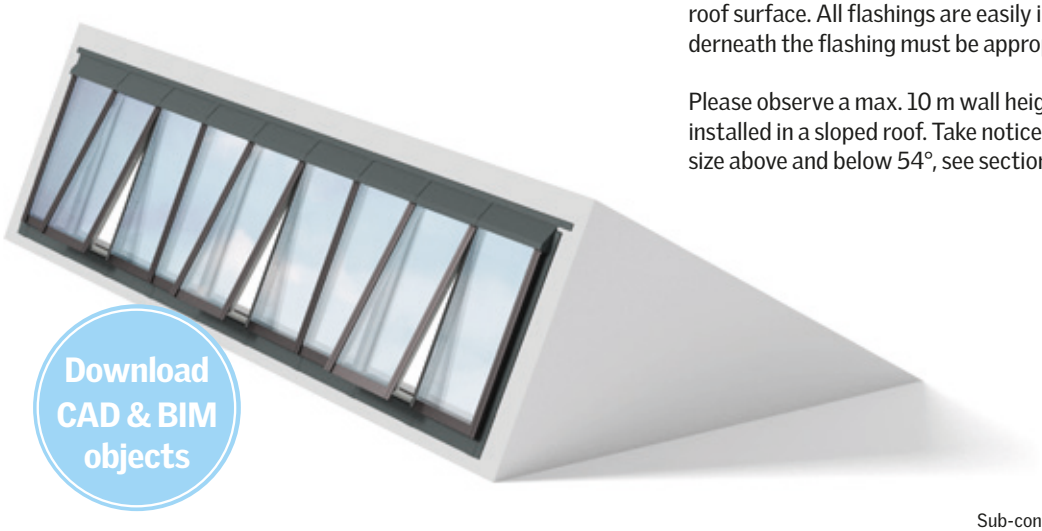
Northlight 25 - 90°

Similar to Longlights, Northlights are bands of VELUX modular skylights. The characteristic upright design is primarily for installations that are directed towards the northern hemisphere for soft and reflected lighting. Northlight installations are applicable for a pitch of 25 to 90°.

At the bottom, Northlights are mounted on a standard steel profile, 100 mm wide (not a VELUX component) and fixed with clamps holding the skylight in place. At the top, the brackets are fixed to the sub-construction with screws meant for wood.

The prefabricated modular flashing ensures easy integration in the roof surface. All flashings are easily installed. The roof surface underneath the flashing must be appropriate for screw fixation.

Please observe a max. 10 m wall height above skylight module, when installed in a sloped roof. Take notice that the top flashing changes in size above and below 54°, see sectional drawing page 55.



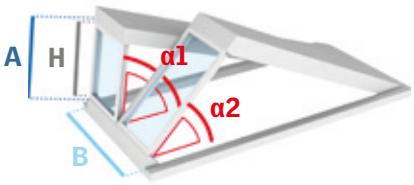
Download CAD & BIM objects

Sub-construction for Northlight at: veluxcommercial.com

Defining module size to your project

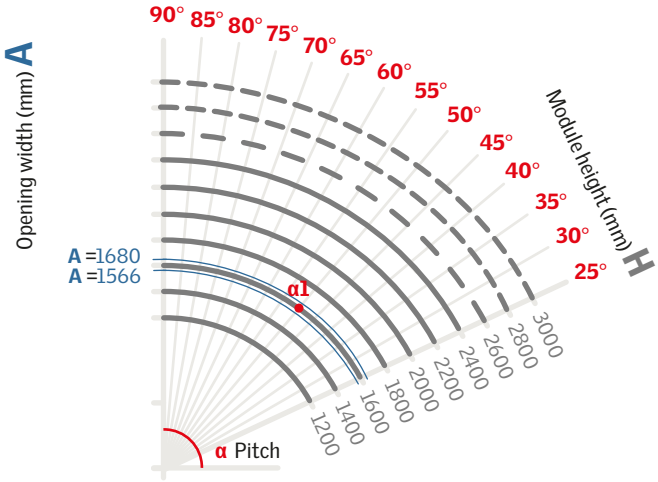
Example:
α1: **H** = 1600 mm at an installation pitch of **50°**

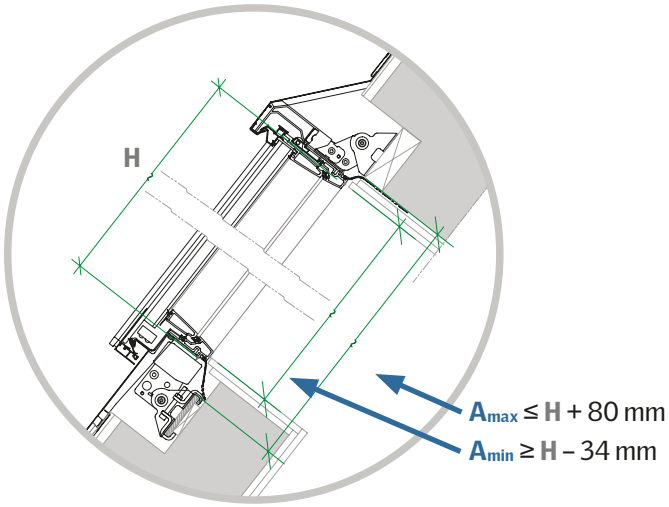
A_{max} = 1680 mm
A_{min} = 1566 mm



H: Module height
α: Installation pitch
A: Opening width
B: Opening length

Installation pitch **α**

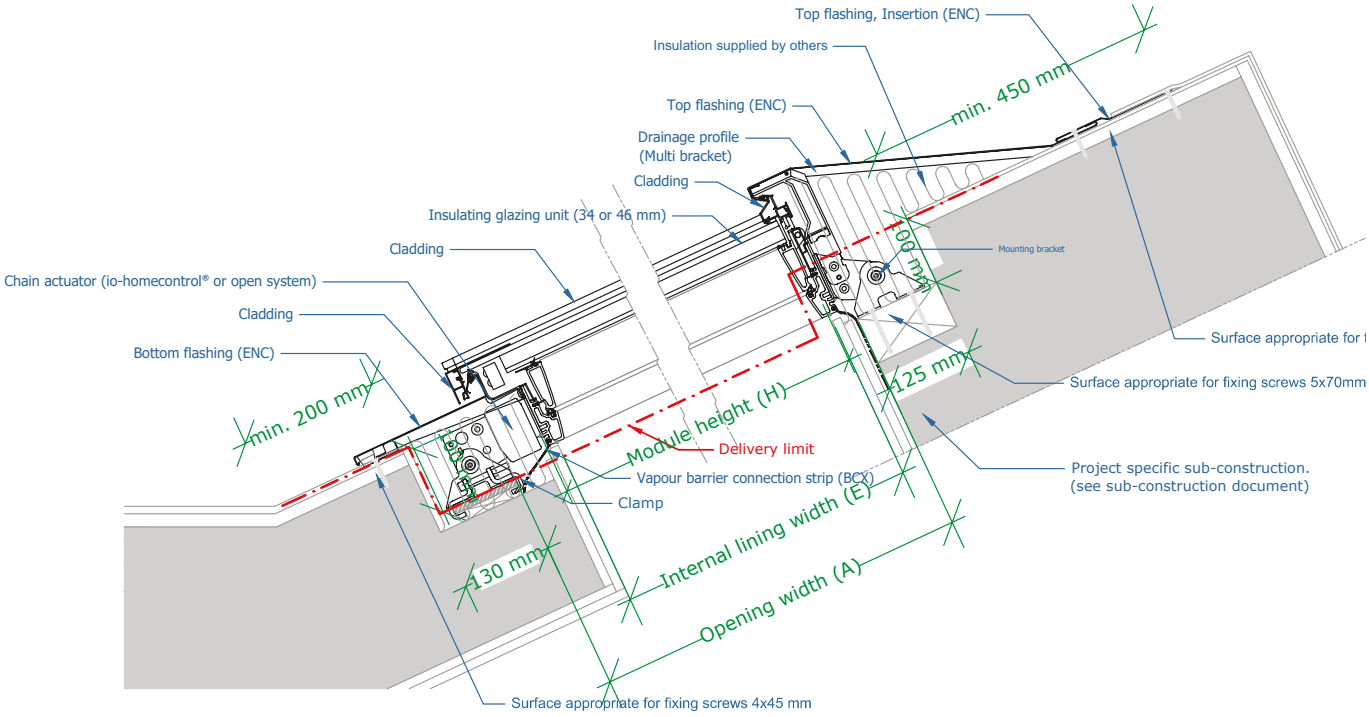




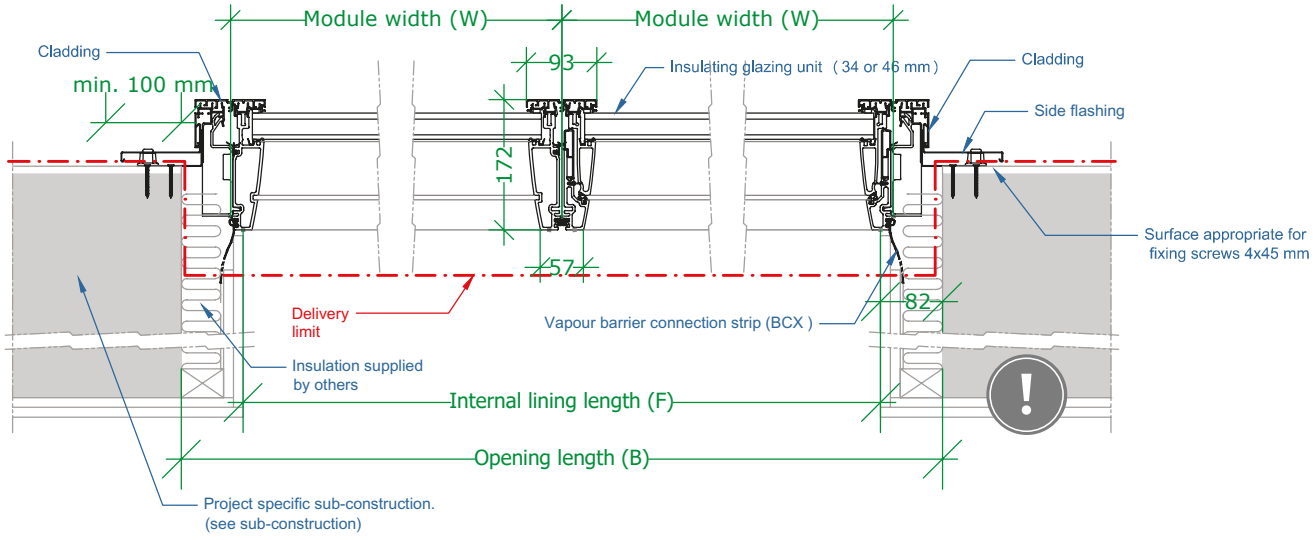
– – Not available as venting modules as default.

Sectional Drawings

Cross-section – top



Cross-section – bottom



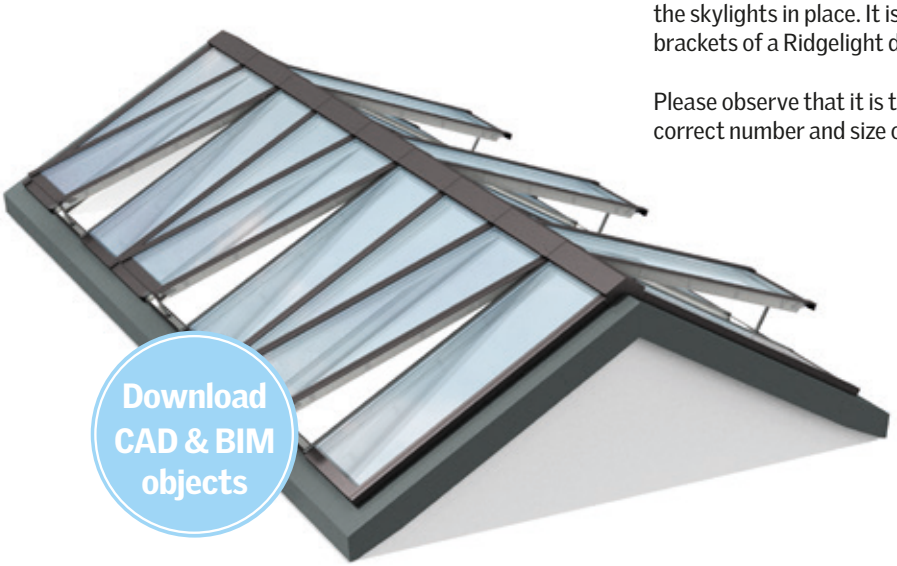
Longitudinal section

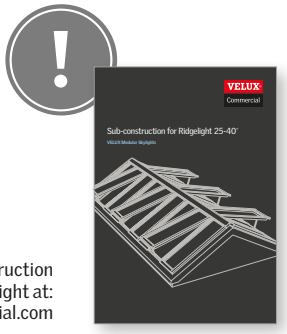
Ridgelight 25 - 40°

Ridgelight is a classic solution, consisting of two rows of skylights linked together at the ridge, creating a self-supporting structure. The flashing allows for installations with a pitch of 25 to 40°.

Due to horizontal forces, it is recommended to use a sub-construction of steel or concrete when mounting a Ridgelight. Ridgelights are mounted on a standard steel profile, 100 mm wide (not a VELUX component). The brackets are fixed with a clamping system holding the skylights in place. It is not recommended to fasten the mounting brackets of a Ridgelight directly onto a wooden batten with screws.

Please observe that it is the designers responsibility to calculate the correct number and size of fixing if a wooden batten is used.



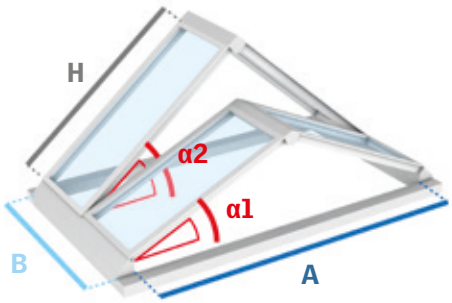


Sub-construction
for Ridgelight at:
veluxcommercial.com

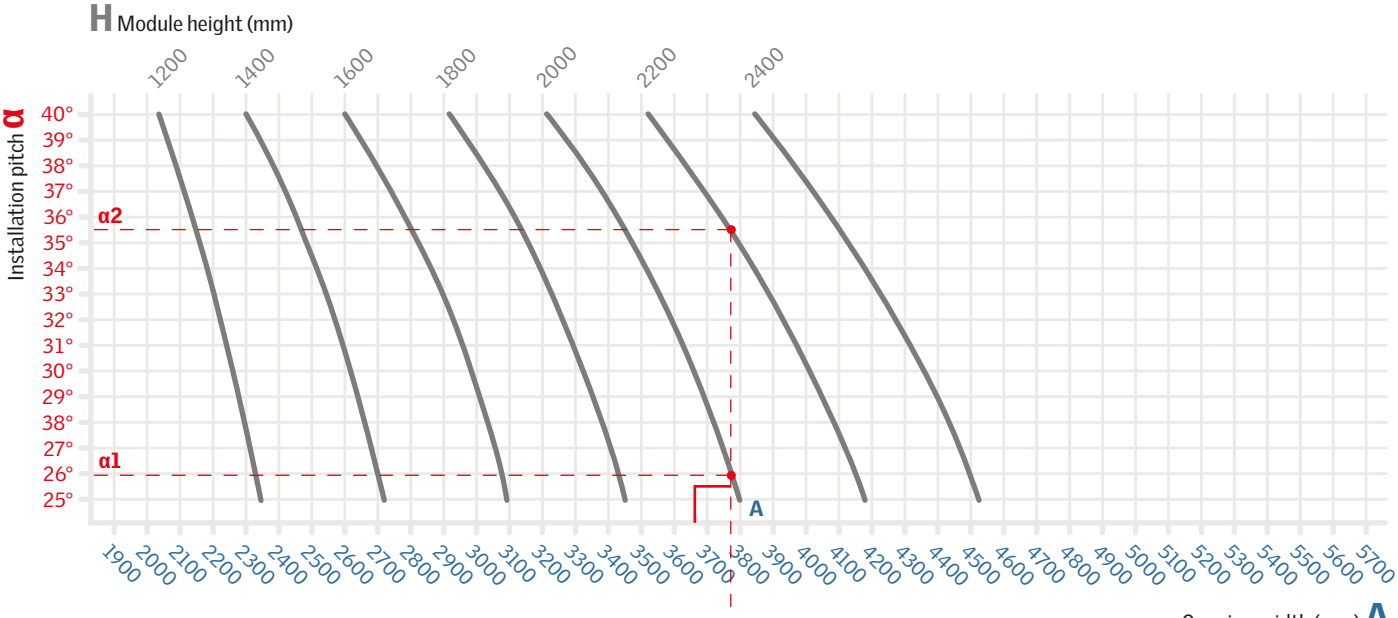
Use the table to define module height (H) and/or installation pitch (α).

Example:
A = 3775 mm

Result:
α1: **H** = 2000 mm at an installation pitch of **26°**
or
α2: **H** = 2200 mm at an installation pitch of **35.5°**

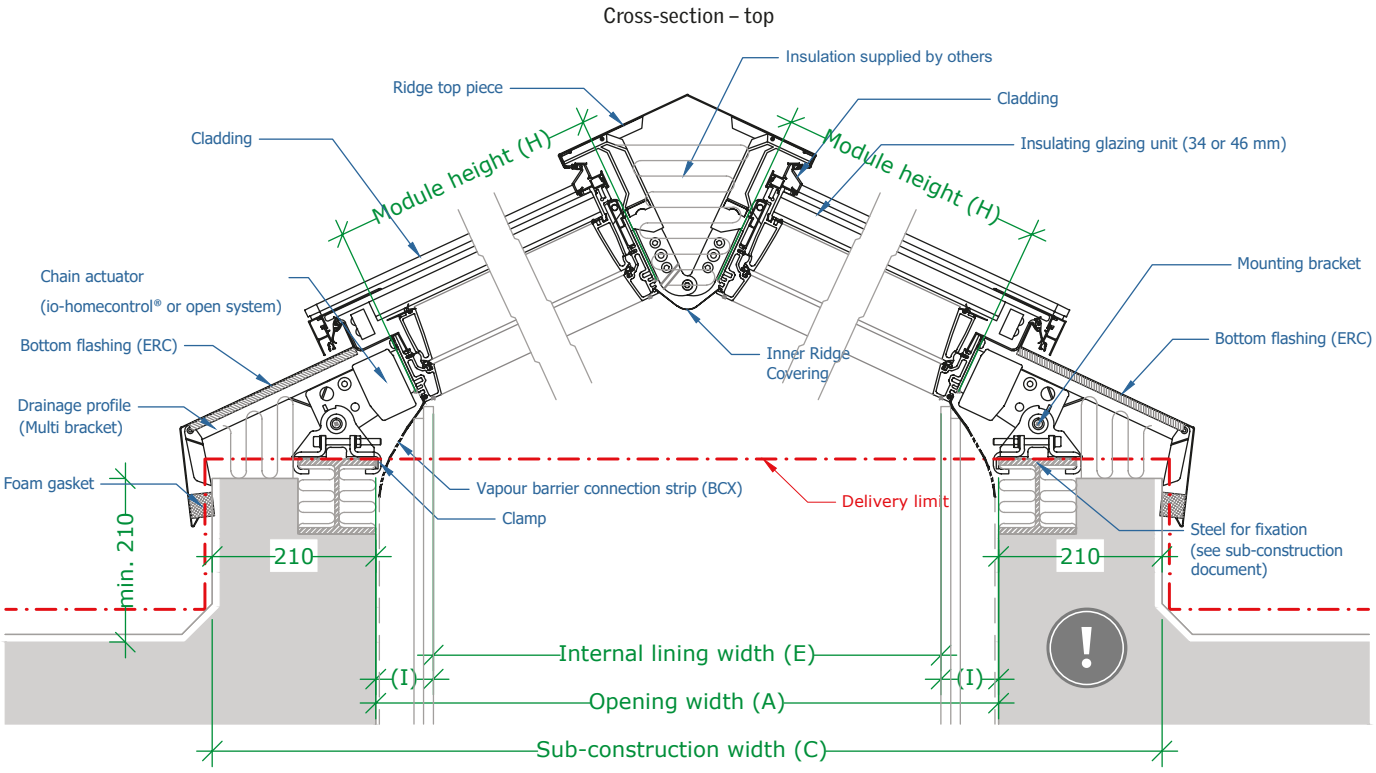


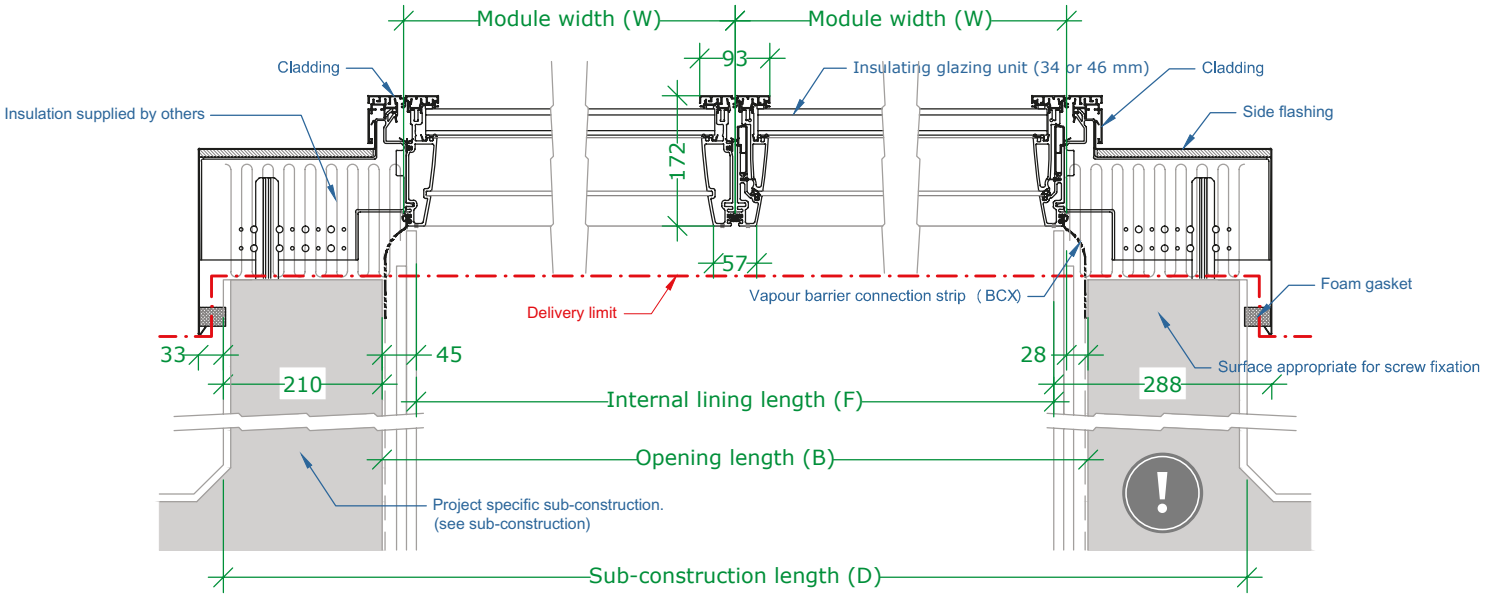
H: Module height
α: Installation pitch
A: Opening width
B: Opening length



Measurements in the above example are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Sectional Drawings

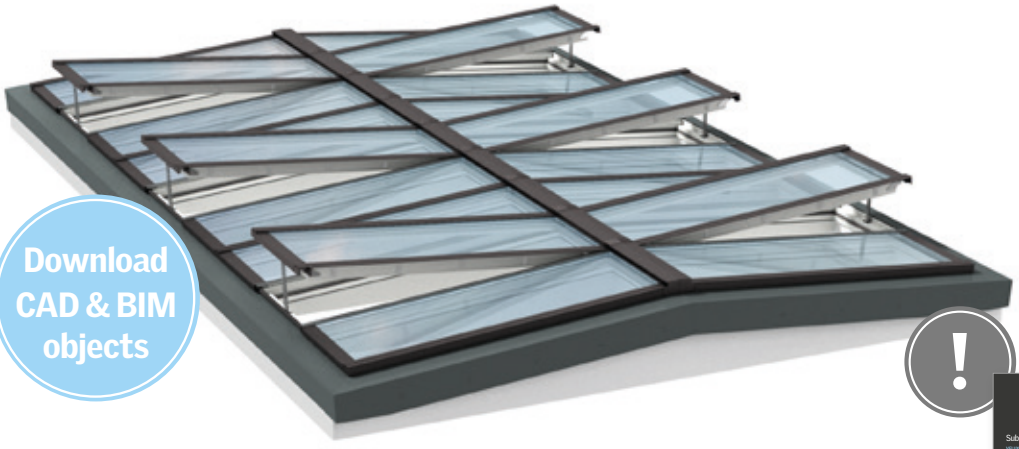




Longitudinal section

Ridgelight at 5° with Beams

Ridgelights at 5° pitch guarantee the illusion of a small glass roof with discreet transverse horizontal supporting beams.
The prefabricated VELUX beam supports the skylights and creates the 5° pitch. The beams are mounted on a standard steel profile, 100 mm wide (not a VELUX component), on top of the sub-construction.



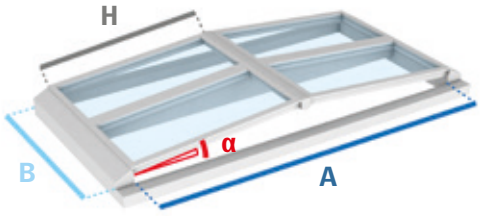
Download CAD & BIM objects

Sub-construction
for Ridgelight at 5° with Beams at:
veluxcommercial.com

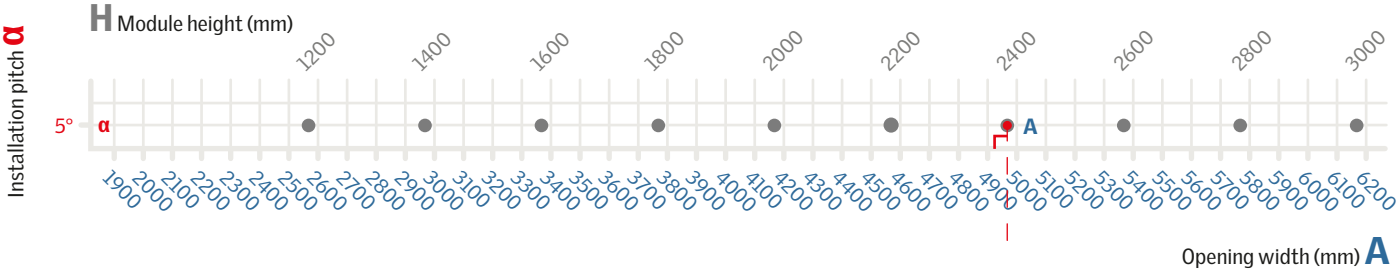
Use the table to define module height (H) and/or installation pitch (α).

Example:
A = 4975 mm

Result:
α: **H** = 2400 mm at an installation pitch of **5°**



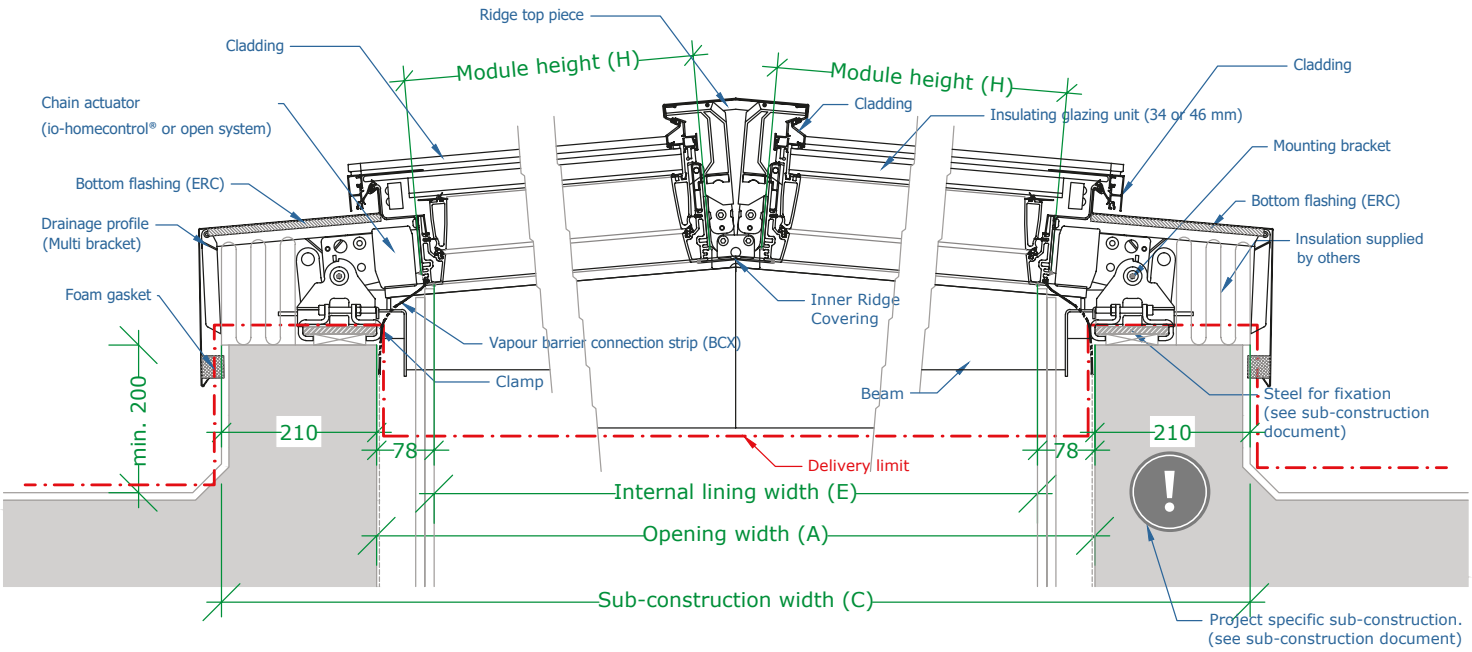
H: Module height
α: Installation pitch
A: Opening width
B: Opening length



Measurements in the above example are guidelines only. Exact numbers will be supplied by your VELUX sales company.

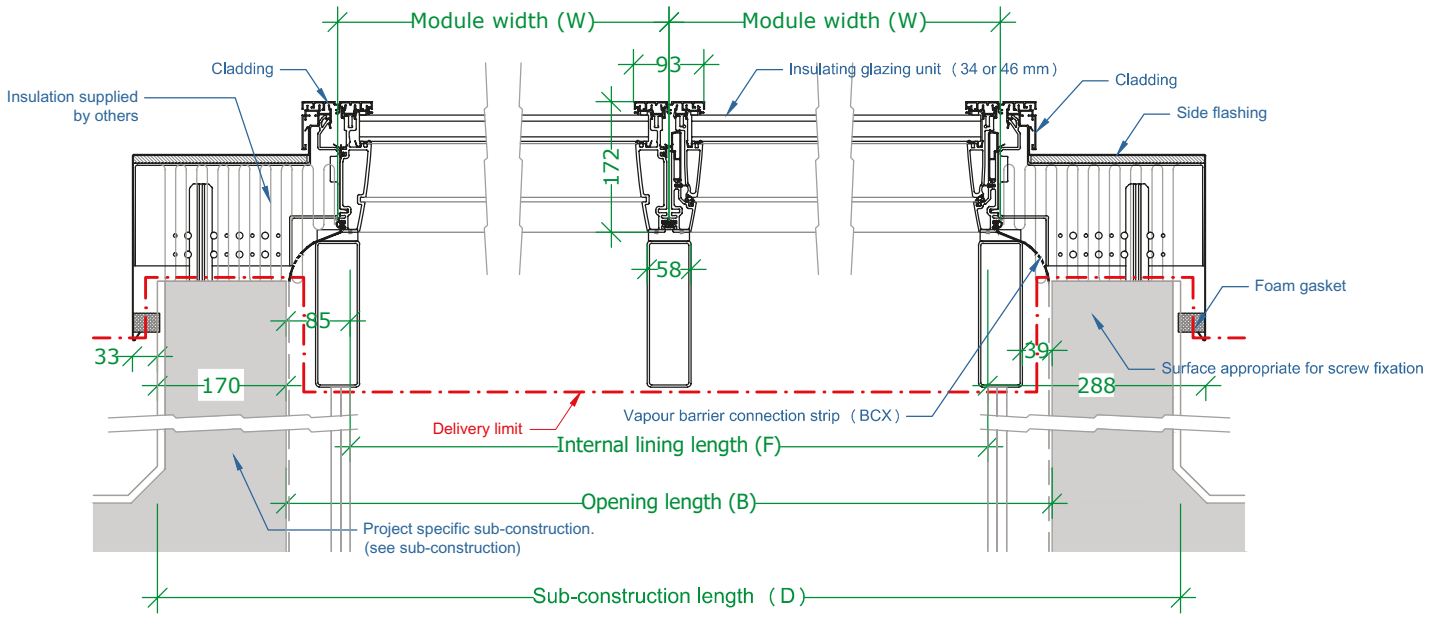
Sectional Drawings

Cross-section – top



Cross-section – bottom

Cross-section – bottom

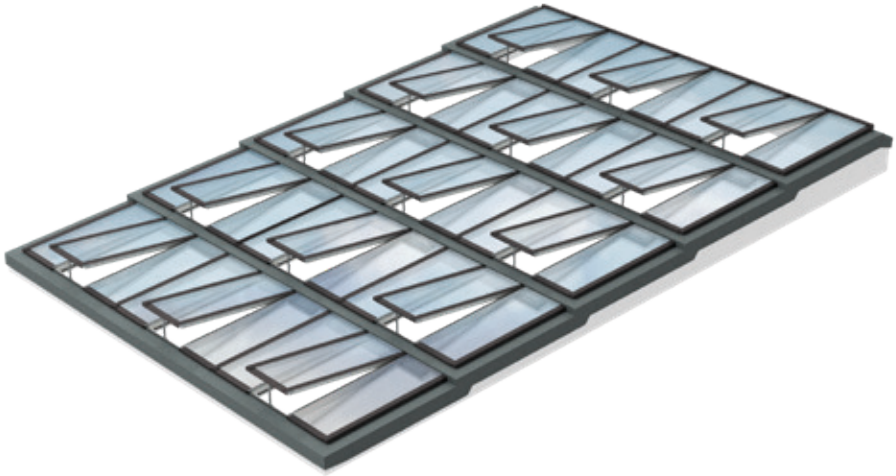


Longitudinal section

Step Longlight 5 - 25°

Longlights in a Step solution are multiple rows of VELUX modular skylights installed close to each other using joint brackets and a clamping system that guarantee a fast and secure installation. The prefabricated flashing allows for configurations with a pitch of 5 to 25°.

The Longlight Step solution is mounted on 100 mm wide standard steel profiles (not a VELUX component). Please observe maximum number of rows, see page 99.



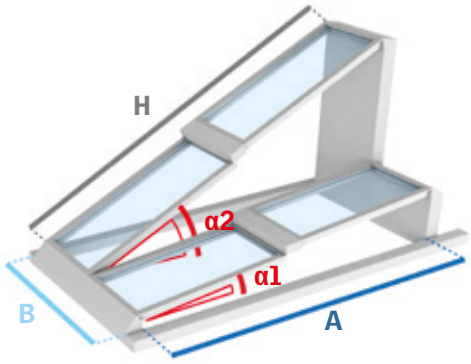
Step solutions are available from spring 2019*

*Brochure for sub-construction is coming soon

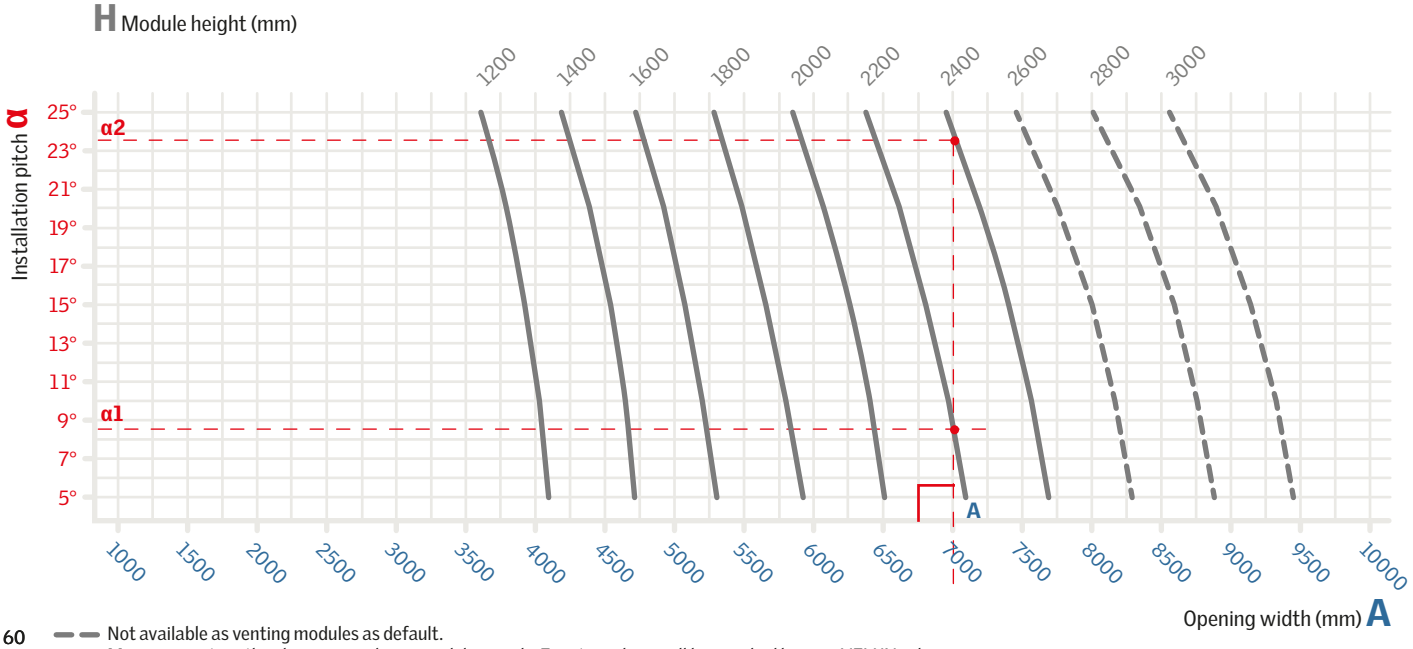
Use the table to define module height (H) and/or installation pitch (α).

Example:
A = 7000 mm

Result:
α1: **H** = 3 rows x 2200 mm at an installation pitch of **8.5°**
or
α2: **H** = 3 rows x 2400 mm at an installation pitch of **23.5°**

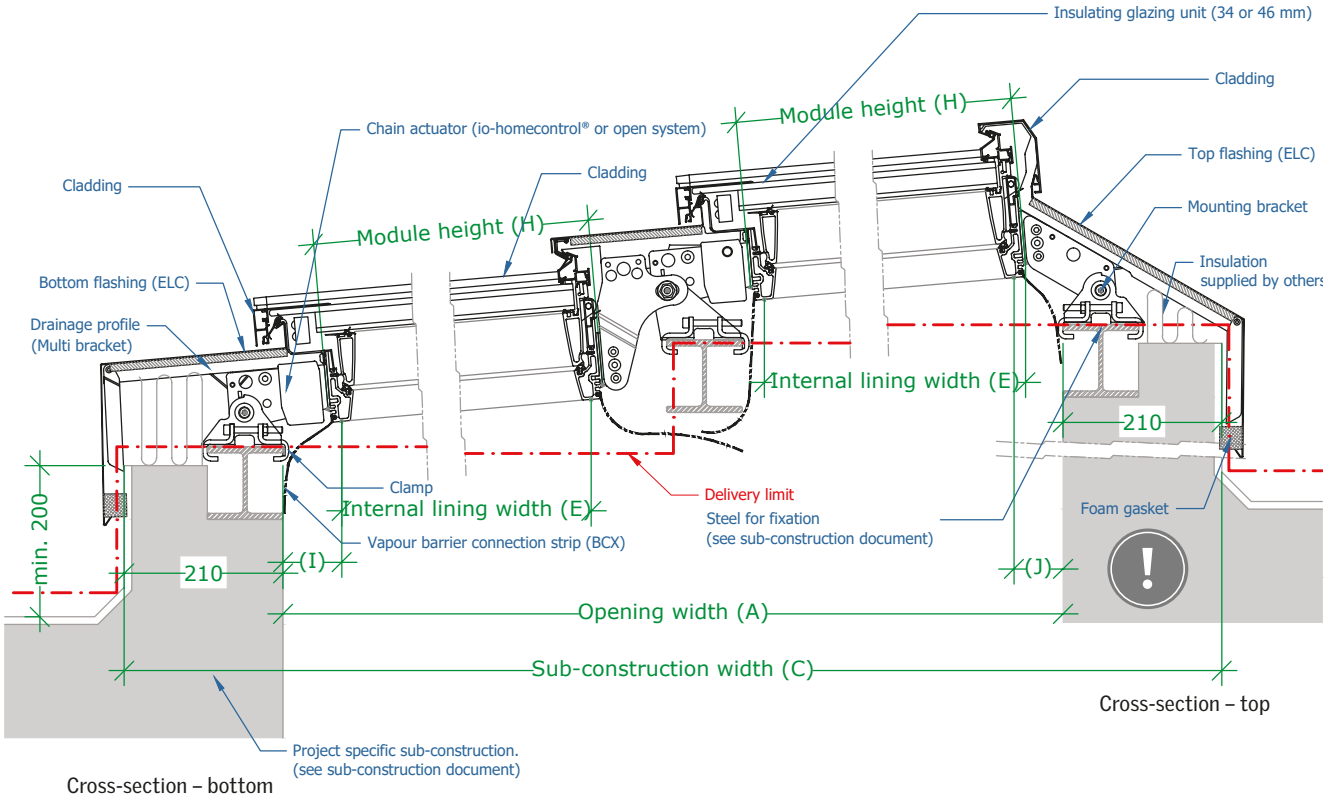


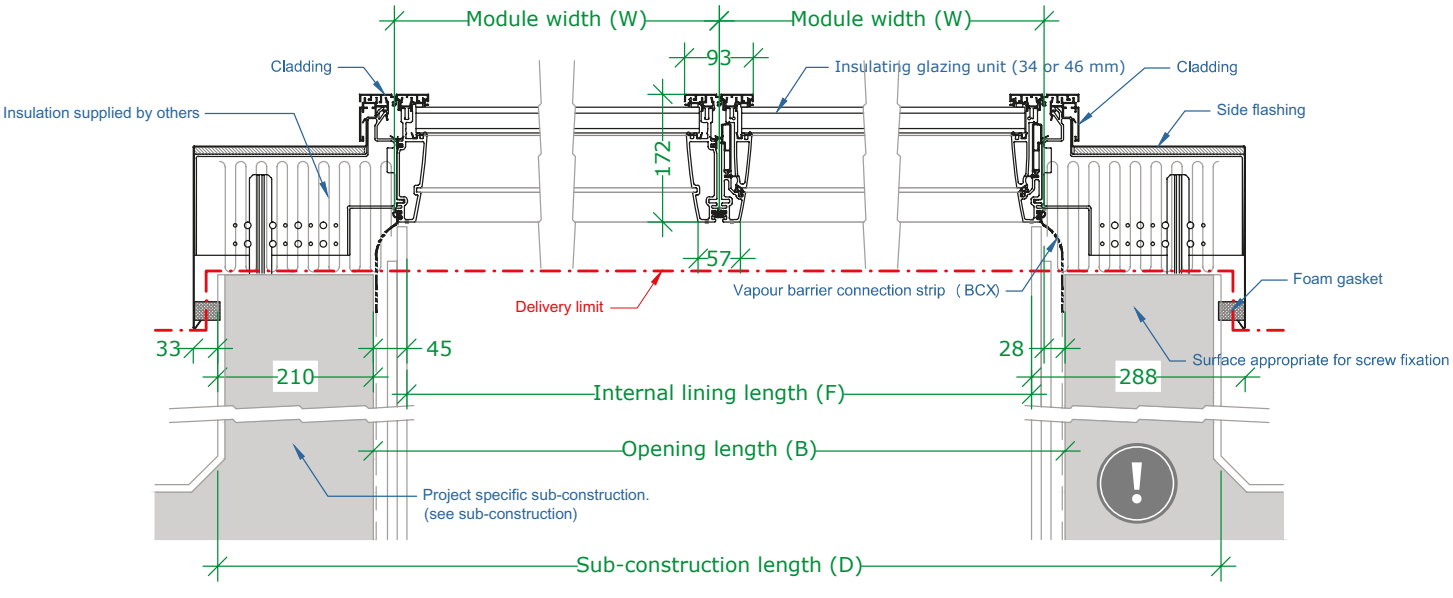
H: Module height
α: Installation pitch
A: Opening width
B: Opening length



Not available as venting modules as default.
Measurements in the above example are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Sectional Drawings

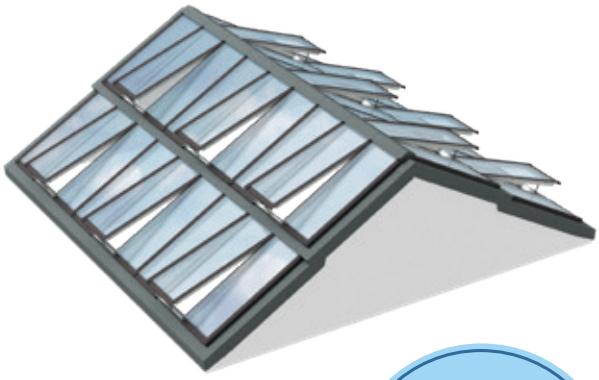




Step Ridgelight 25° & Step Ridgelight 5-25° on Girder

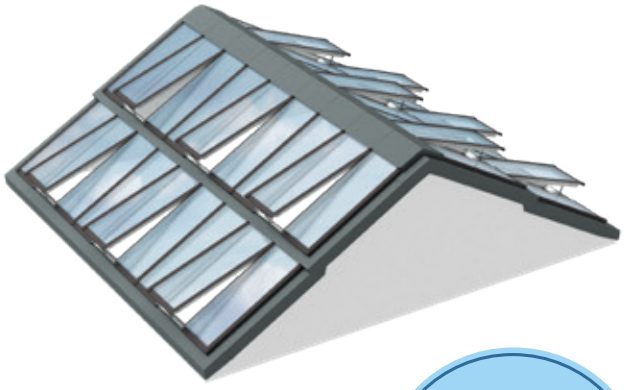
A Step Ridgelight 25° and a Step Ridgelight 5-25° on Girder, consist of a Ridgelight with one or more rows of Longlights below, on one or both sides, mounted close to each other using joint brackets and a clamping system that guarantee a fast and secure installation.
The prefabricated flashing allows for configurations with a pitch of 5° or 25°.

The Step Ridgelight 25° and the Step Ridgelight 5-25° on Girder solutions are mounted on 100 mm wide standard steel profiles (not a VELUX component). Please observe maximum number of rows, see page 99.



Step solutions are available from spring 2019*

*Brochure for sub-construction is coming soon



Step on Girder are available from fall 2019*

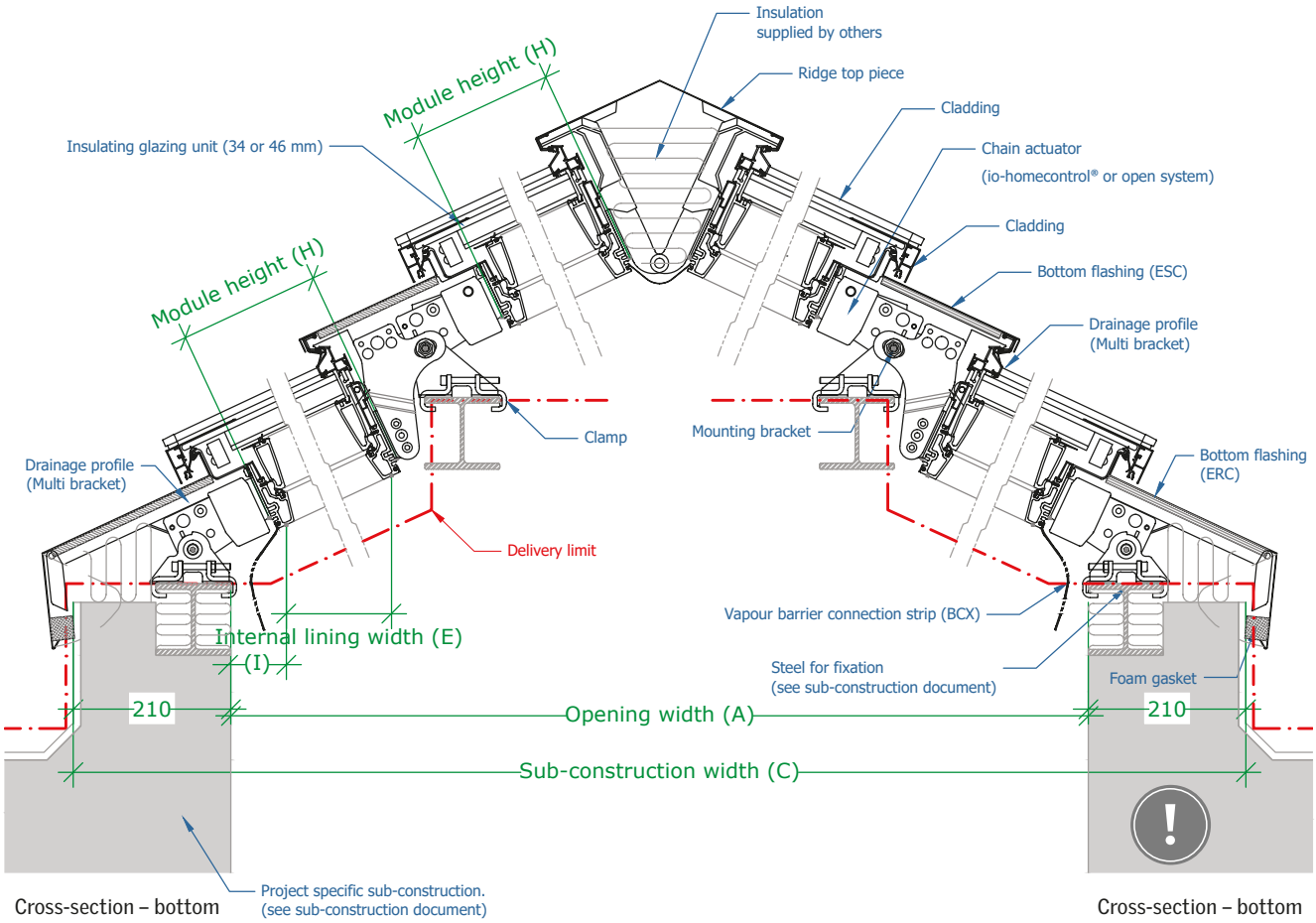
*Brochure for sub-construction is coming soon

Design your own grand ideas – Create a magnificent skylight

Ready to know if your ideas can become a reality?
Let us calculate your possibilities and give a price estimate for your chosen solution.
Contact your VELUX sales office for more details.

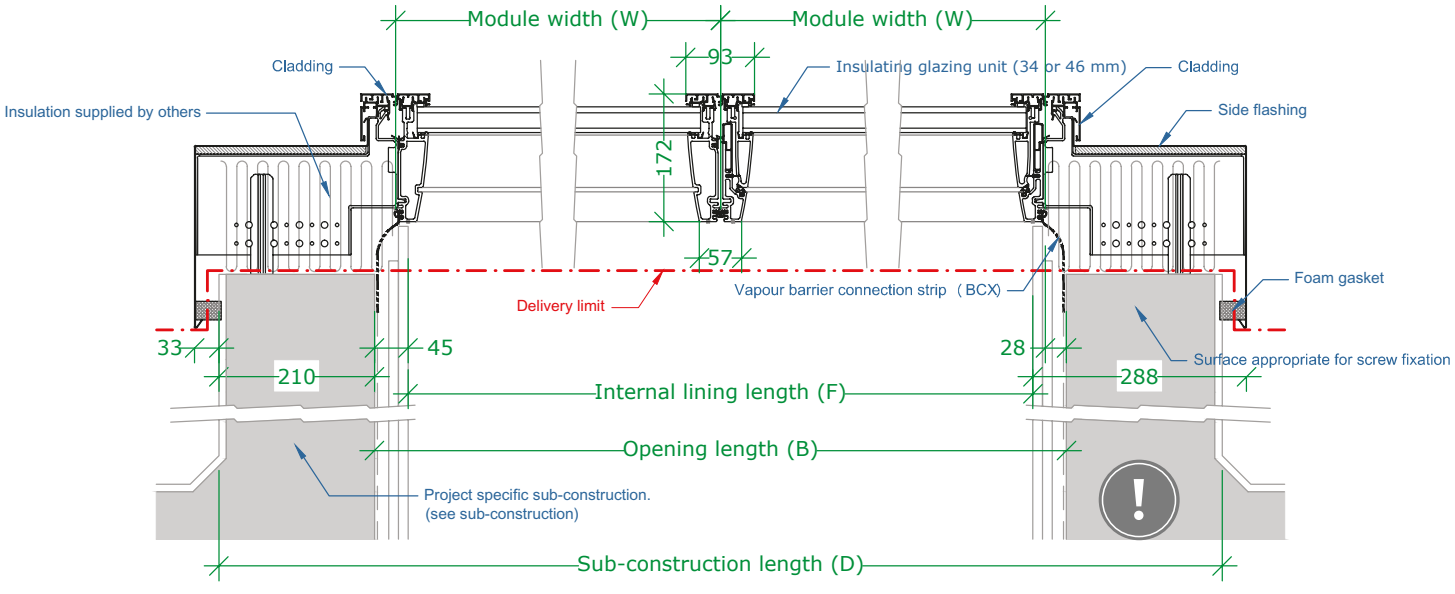
Sub-construction quality assurance (QA) document and specification document.

Sectional Drawings



Cross-section – bottom

Cross-section – bottom



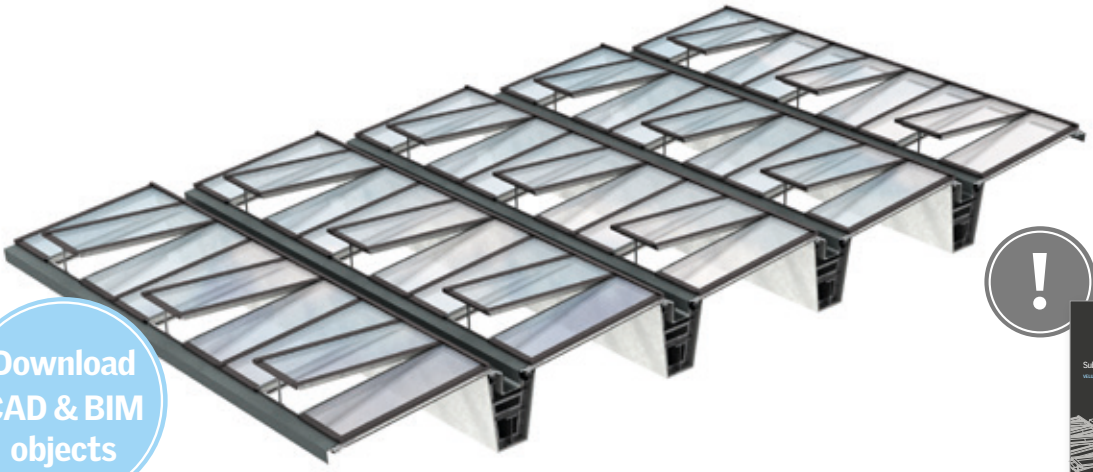
Longitudinal section

Atrium Longlight

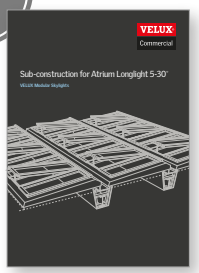
An Atrium solution consists of several Longlights attached to each other in the sub-construction. A drainage gutter separates each assembly.

The supporting beams are not included in the VELUX delivery. The support structure is part of the primary structure of the building and will have to be designed by a structural engineer.

The distance between the skylights depends on thickness of insulation, width of drainage gutter and pitch of skylights. The shown example of an Atrium is designed with 100 mm insulation and a 400 mm wide drainage gutter in a 5° pitch, resulting in a distance between skylights of 820 mm.



Download CAD & BIM objects

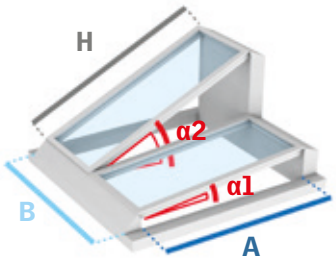


Sub-construction for Atrium Longlight at: veluxcommercial.com

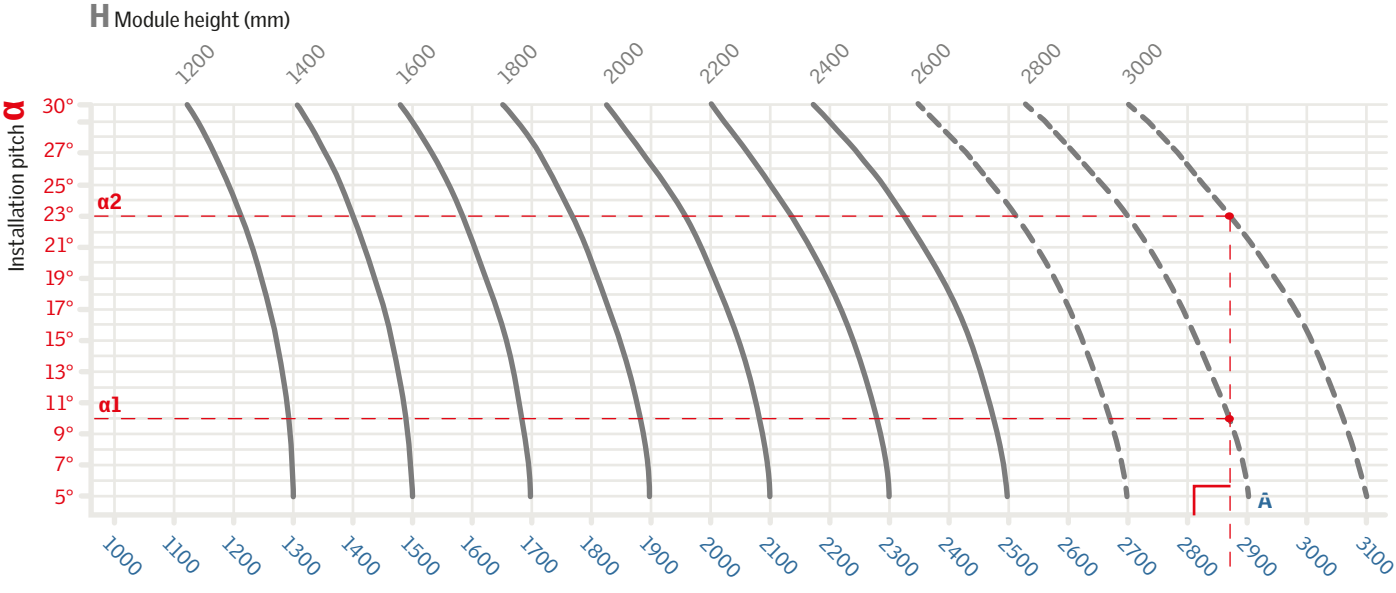
Use the table to define module height (H) and/or installation pitch (α).

Example:
A = 2870 mm

Result:
α1: H = 2800 mm at an installation pitch of **10°**
or
α2: H = 3000 mm at an installation pitch of **23°**

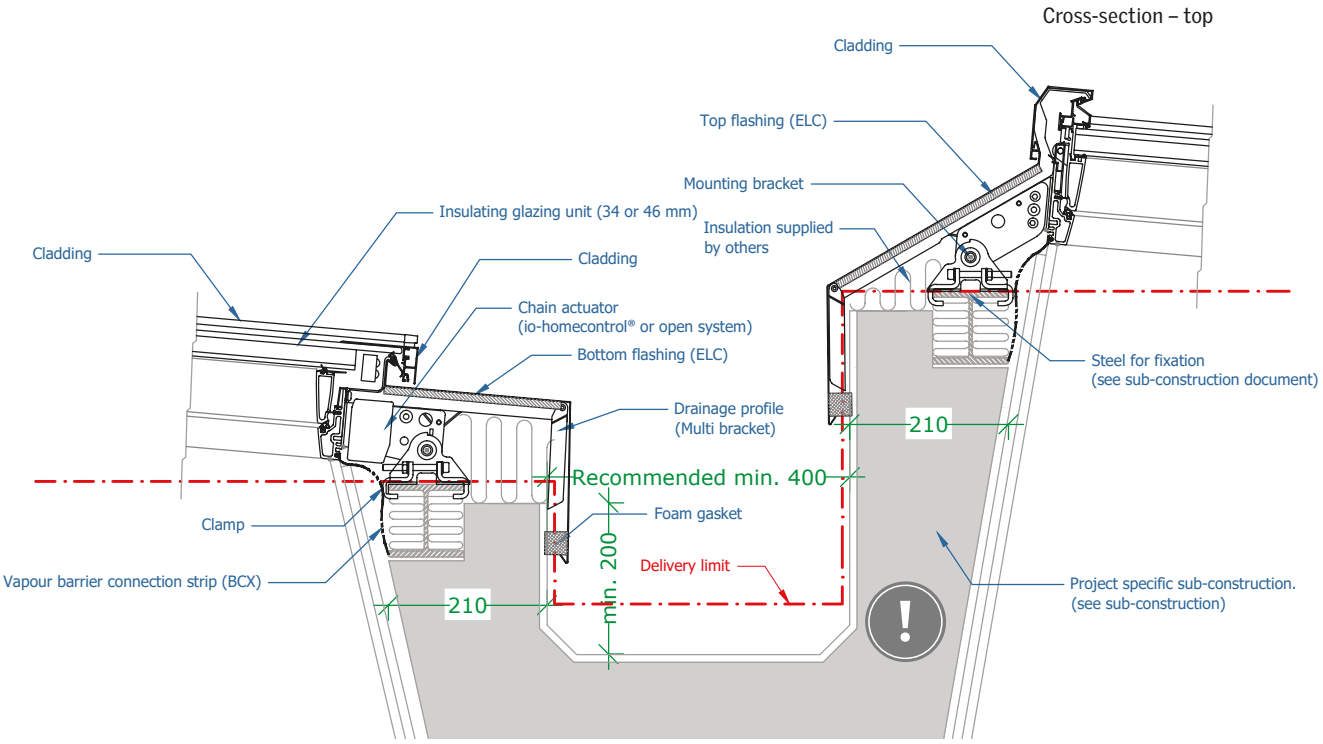


H: Module height
α: Installation pitch
A: Opening width
B: Opening length

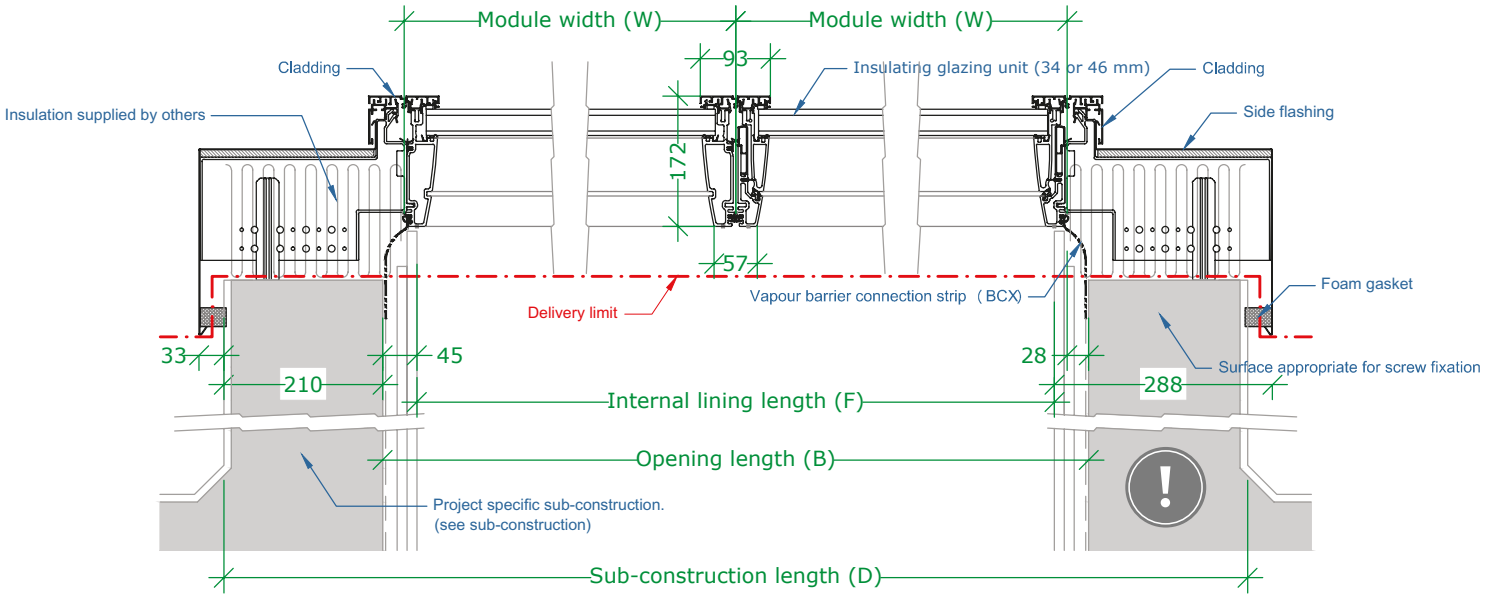


Not available as venting modules as default.

Sectional Drawings



Cross-section – bottom



Longitudinal section

Atrium Ridgelight & Atrium Ridgelight at 5° with Beams

An Atrium Ridgelight solution consists of several Ridgelights attached to each other in the sub-construction. A drainage gutter separates each strip.

The supporting steel beams are not included in the VELUX delivery. The support structure is part of the primary structure of a building and must be designed by a structural engineer.

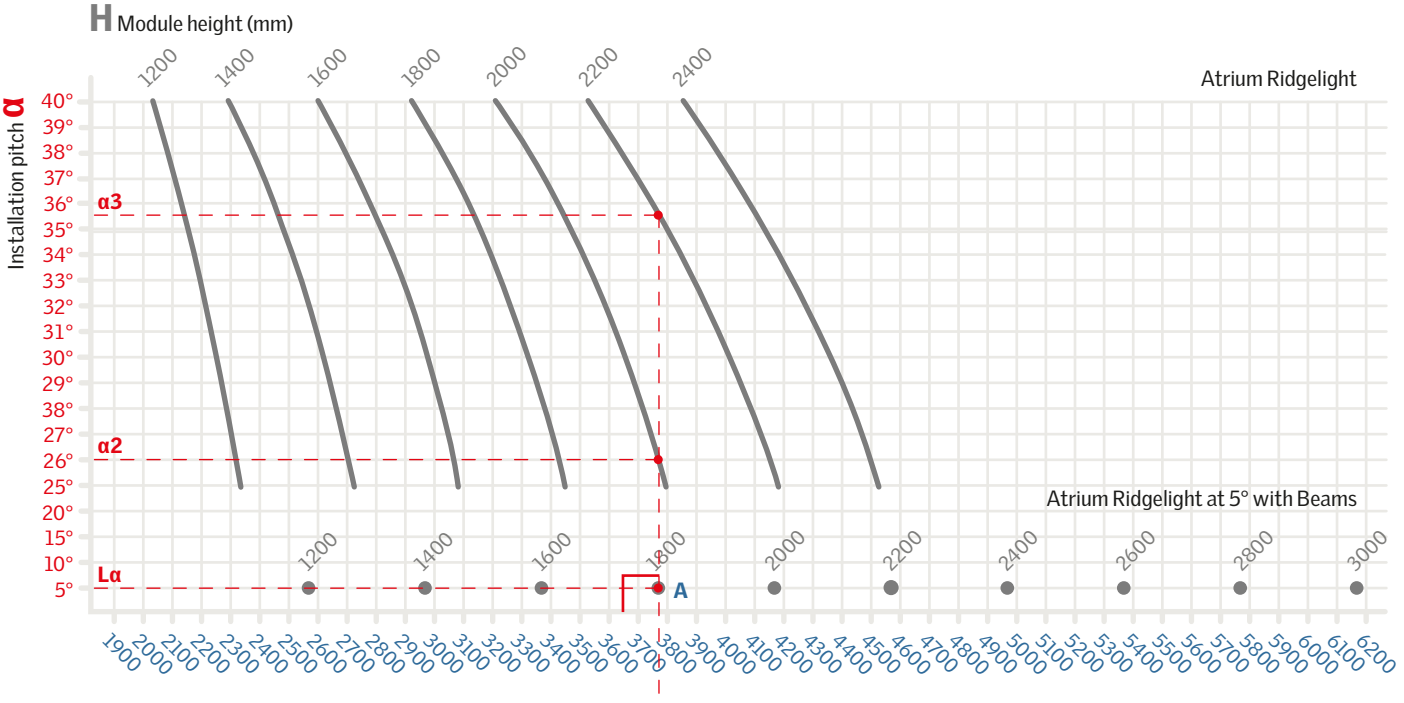
The distance between the skylights depends on thickness of insulation, width of drainage gutter and pitch of skylights. The shown example of an Atrium is designed with 100 mm insulation and a 400 mm wide drainage gutter in a 5° pitch, resulting in a distance between the skylights of 820 mm.

Sub-construction
for Atrium Ridgelight at:
veluxcommercial.com

Use the table to define module height (H) and/or installation pitch (α).

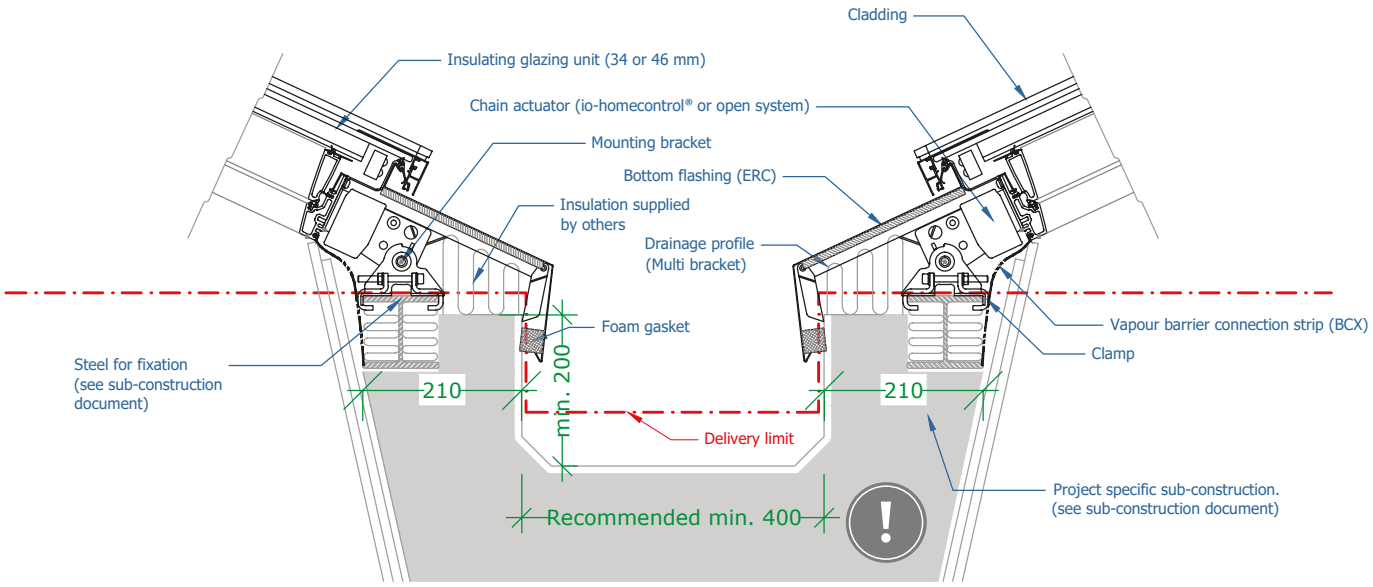
Example:
A = 3775 mm

Result:
α1: H = 1800 mm at an installation pitch of **5°**
α2: H = 2000 mm at an installation pitch of **26°**
or
α3: H = 2200 mm at an installation pitch of **35.5°**



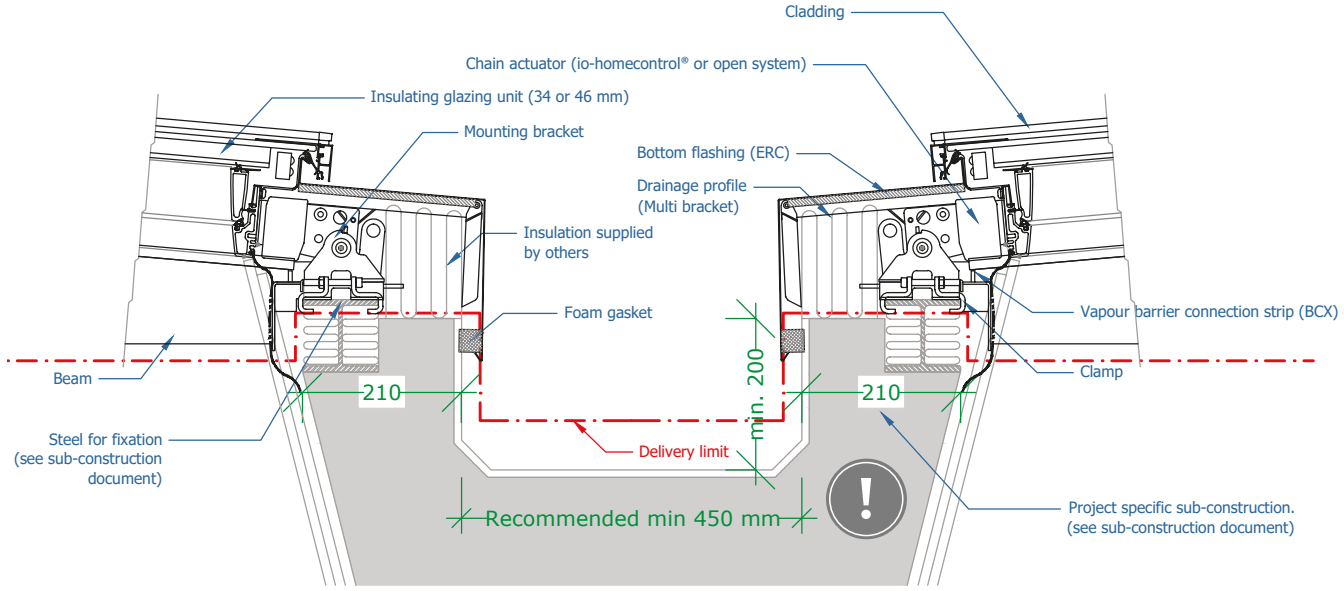
Measurements in the above example are guidelines only. Exact numbers will be supplied by your VELUX sales company.

Sectional Drawings



Cross-section – bottom

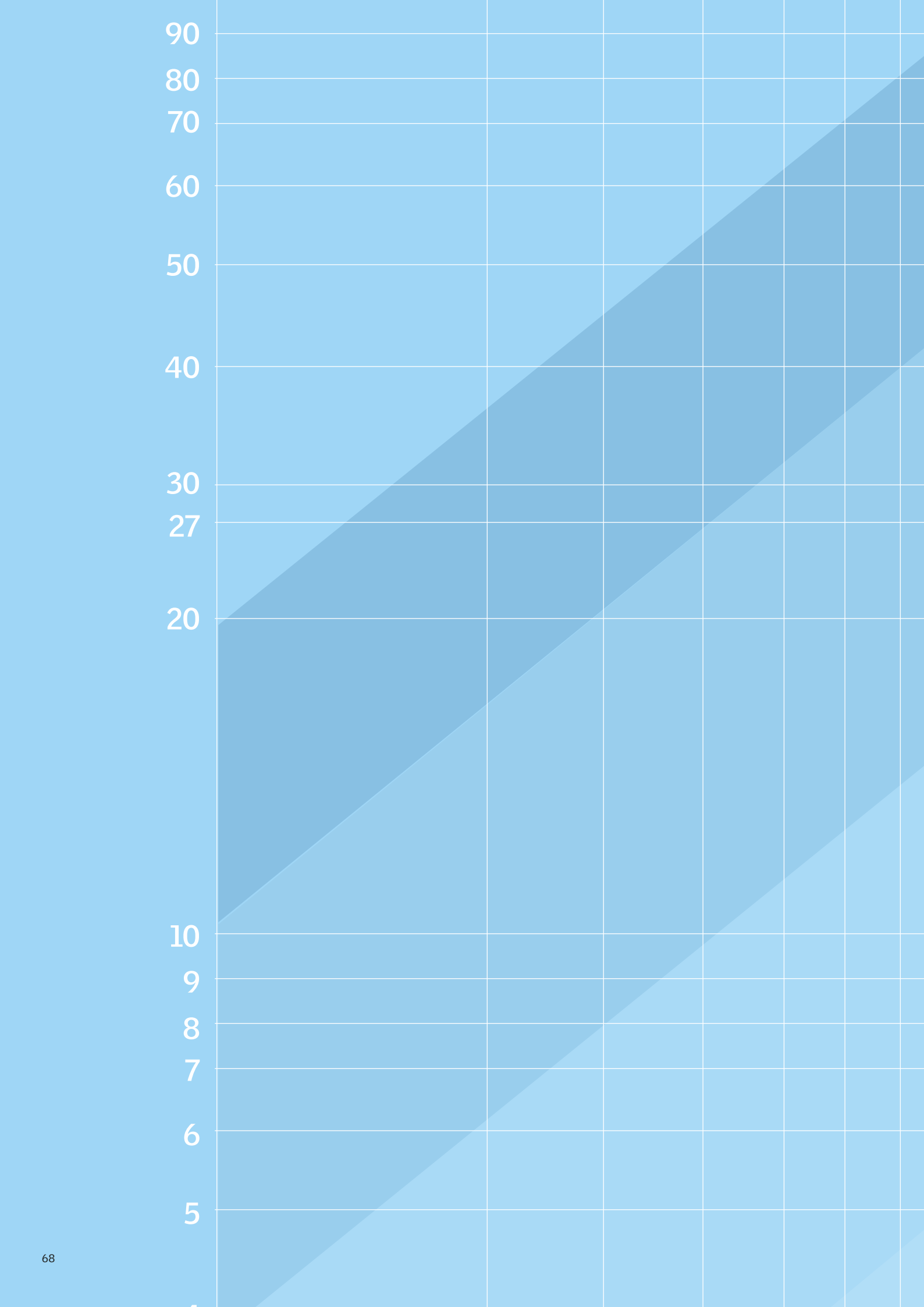
Cross-section – bottom



Cross-section – bottom

Cross-section – bottom

For longitudinal section drawings for Atrium Ridgelight and Atrium Ridgelight 5°, see pages 57 and 59.


90
80
70
60
50
40
30
27
20
10
9
8
7
6
5

Class 1

15

12.5

10

Class 2

6.75

Product Data

5.0

Class 3

2.5

2.2

2.0

Skylight Module

Essential characteristic performances for CE-marked skylight modules (EN 14351-1)		
H-C ------ -------		
Essential characteristics	**Performance**	
Resistance to wind load	Class C5[1)]	
Resistance to snow load	See glazing variant construction	
Reaction to Fire*	Class B**	
External fire performance***	B_{ROOF}(t1) ; B_{ROOF}(t4)	
Watertightness****	E1200	
Impact resistance	NPD	
Load-bearing capacity of safety devices	NPD[2)]	
Acoustic performance	35 (-1; -5) - 38 (-1; -4) dB[3)]	
Thermal transmittance	Double glazing 1.3-1.5 W/m²K[3)]	Triple glazing: 0.86-1.1 W/m²K[3)]
Solar factor	0.60 - 0.13[3)]	
Light transmittance	0.79 - 0.16[3)]	
Air permeability*****	Class 4	

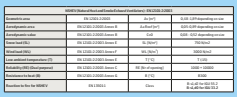
[1)] For skylight height > 2400 mm: NPD
[2)] No safety device on VELUX modular skylights
[3)] For specific types and sizes, see the table with glazing variants on page 88

Note:
The performances in the above table and the attached notes to these are valid for the size grid shown on page 9.
For sizes outside the size grid, altering performances may apply. The changes in performances depend on the actual size and are therefore to be identified individually.

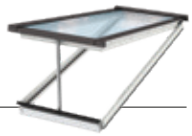
* For explanation of test method and results, please refer to section on Reaction to Fire
** Variants with inner pane of 55.2 lamination have a sub-class s1-d0
Variants with inner pane of 33.2 and 44.2 lamination have a sub-class s1-d2
*** For explanation of test method and results, please refer to section on External fire performance
**** For explanation of test method and results, please refer to section on Watertightness
***** For explanation of test method and results, please refer to section on Air Permeability

Performance of fire resistant skylight modules (EN 13501-2)	
HFS ------ -------	
Essential characteristics	**Performance**
Resistace to Fire HFS (fixed)	REI30

Note:
The fixed fire resistant modules HFS are tested in accordance with EN 1365-2. The classifications are expressed in accordance with EN 13501-2. The tests are carried out without roller blinds by default. If a customer wishes to install roller blinds on the fire resistant modules subsequently, the VELUX Group recommends that the customer obtains written approval from the local fire authorities. HFS has an intumescent seal strip between the fire resistant glazing and frame and between the modules. The strip expands when exposed to heat in order to contain the fire for a longer time. For more information on the performance characteristics of fire resistant skylight modules, see pages 88 and 105.



Skylight Module



Essential characteristic performances for CE-marked smoke ventilation skylight modules (EN 12101-2)	
H-C ------ -----AB	
Essential characteristics	**Performance**
Nominal activation system/sensitivity	passed
Response delay (response time)	< 60 s
Operational reliability	Re 1000 + 10 000
Aerodynamic free area (A_a) [m^2]	See ventilation tables on pages 78, 79, 82 and 83
Resistance to heat	B300
Mechanical stability	passed
Opening under load	See tables on the next page (Opening under load)
Low ambient temperature	T(-15)
Stability under wind load	WL 3000
Resistance to wind-induced vibration (where included)	passed
Reaction to Fire*	Class B**

* For explanation of test method and results, please refer to section of Reaction to Fire
** Variants with inner pane of 55.2 lamination have a sub-class s1-d0
Variants with inner pane of 33.2 and 44.2 lamination have a sub-class s1-d2

Skylight module opening under load (Snow Load)
Smoke ventilation skylight modules can in production be configured with 5 different motor force levels enabling variable snow load performance (Opening under load) and electric current requirement (Amp requirement) per size and glazing thickness. Choose motor force programme according to your project specific snow load need. **See tables on the next three pages.**

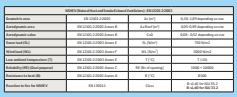
Skylight Module

Opening under load

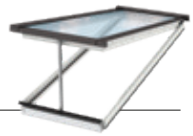
Snow load with double-glazing unit (10, 11 and 12)																		
Glazing unit infill with a total glass thickness of 14 mm																		
Product ID			HVC 067---			HVC 075---			HVC 080---			HVC 090---			HVC 100---		
	Size [mm]	Width	675			750			800			900			1000		
	Height	Motor program	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]
HVC ---080	800	N0800	353	2.5	1984	353	2.5	1768	353	2.5	1644	353	2.5	1434	353	2.5	1263
		N1000		3.0	2603		3.0	2332		3.0	2177		3.0	1913		3.0	1698
		N1100		3.0	2913		3.0	2615		3.0	2444		3.0	2153		3.0	1916
		N1200		3.0	3223		3.0	2897		3.0	2710		3.0	2393		3.0	2133
		N1300		3.0	3533		3.0	3179		3.0	2976		3.0	2632		3.0	2351
HVC ---100	1000	N0800	410	2.5	1533	439	2.5	1359	439	2.5	1260	439	2.5	1090	439	2.5	952
		N1000		3.0	2034		3.0	1815		3.0	1690		3.0	1477		3.0	1303
		N1100		3.0	2284		3.5	2043		3.5	1905		3.5	1671		3.5	1479
		N1200		3.0	2534		3.5	2271		3.5	2120		3.5	1864		3.5	1655
		N1300		4.0	2785		3.5	2499		3.5	2336		3.5	2058		3,5	1831
HVC ---120	1200	N0800	410	2.5	1228	460	3.0	1082	526	3.0	999	526	3.0	857	526	3.0	741
		N1000		3.0	1648		3.0	1465		3.5	1360		3.5	1182		3.5	1036
		N1100		3.0	1858		3.5	1656		3.5	1540		3.5	1344		3.5	1184
		N1200		3.0	2068		3.5	1847		4.0	1721		4.0	1506		4.0	1331
		N1300		4.0	2278		4.0	2039		4.0	1902		4.0	1669		4.0	1479
HVC ---140	1400	N0800	410	2.5	1008	460	3.0	882	530	3.0	811	610	3.5	689	610	3.5	589
		N1000		3.0	1369		3.0	1212		3.5	1122		4.0	968		4.0	843
		N1100		3.0	1550		3.5	1377		3.5	1277		4.0	1108		4.0	970
		N1200		3.0	1731		3.5	1541		4.0	1432		4.0	1248		4.0	1097
		N1300		4.0	1912		4.0	1706		4.0	1588		4.0	1388		4.0	1224
HVC ---160	1600	N0800	410	2.5	841	460	3.0	731	530	3.0	668	610	3.5	561	700	3.5	474
		N1000		3.0	1159		3.0	1020		3.5	941		4.0	807		4.0	697
		N1100		3.0	1317		3.5	1165		3.5	1078		4.0	930		4.5	809
		N1200		3.0	1476		3.5	1310		4.0	1214		4.0	1052		4.5	920
		N1300		4.0	1635		4.0	1454		4.0	1351		4.0	1175		5.0	1032
HVC ---180	1800	N0800	410	2.5	711	460	3.0	613	530	3.0	557	610	3.5	462	700	3.5	384
		N1000		3.0	994		3.0	871		3.5	800		4.0	681		4.0	583
		N1100		3.0	1135		3.5	1000		3.5	922		4.0	790		4.5	682
		N1200		3.0	1277		3.5	1128		4.0	1044		4.0	899		4.5	782
		N1300		4.0	1418		4.0	1257		4.0	1165		4.0	1009		5.0	881
HVC ---200	2000	N0800	410	2.5	606	460	3.0	518	530	3.0	467	610	3.5	382	700	3.5	312
		N1000		3.0	861		3.0	750		3.5	687		4.0	579		4.0	491
		N1100		3.0	989		3.5	866		3.5	796		4.0	678		4.5	581
		N1200		3.0	1116		3.5	983		4.0	906		4.0	776		4.5	670
		N1300		4.0	1244		4.0	1099		4.0	1016		4.0	875		5.0	760
HVC ---220	2200	N0800	410	2.5	520	460	3.0	439	530	3.0	394	610	3.5	316	700	3.5	252
		N1000		3.0	752		3.0	651		3.5	594		4.0	495		4.0	415
		N1100		3.0	868		3.5	757		3.5	693		4.0	585		4.5	497
		N1200		3.0	984		3.5	863		4.0	793		4.0	675		4.5	579
		N1300		4.0	1101		4.0	969		4.0	893		4.0	765		5.0	660
HVC ---240	2400	N800	410	2.5	447	460	3.0	374	530	3.0	332	610	3.5	261	700	3.5	202
		N1000		3.0	661		3.0	569		3.5	516		4.0	426		4.0	352
		N1100		3,0	768		3.5	666		3.5	607		4.0	508		4.5	427
		N1200		3.0	874		3.5	763		4.0	699		4.0	591		4.5	502
		N1300		4.0	981		4.0	860		4.0	791		4.0	673		5.0	577
HVC ---260	2600	N0800	410	2.5	386	460	3.0	319									
		N1000		3.0	584		3.0	498									
		N1100		3.0	682		3.5	588									
		N1200		3.0	781		3.5	678									
		N1300		4.0	879		4.0	768									
HVC ---280	2800	N0800	410	2.5	334												
		N1000		3.0	517												
		N1100		3.0	609												
		N1200		3.0	701												
		N1300		4.0	792												

The tables illustrate the performance for modules opening under load in accordance with EN 12101-2. The provided performance is NOT equal to structural load bearing capacity of an actual application. The design of a roof light must therefore be dimensioned to fit the specific building project, local architectural style and practice.

Standard size. Special sizes, functional limitations may apply.



Skylight Module



Opening under load

Snow load with double-glazing unit (10T, 11T and 12T)																		
Glazing unit infill with a total glass thickness of 18 mm																		
Product ID			HVC 067---			HVC 075---			HVC 080---			HVC 090---			HVC 100---		
	Size [mm]	Width	675			750			800			900			1000		
	Height	Motor program	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]
HVC ---080	800	N0800	353	2.5	1911	353	2.5	1693	353	2.5	1569	353	2.5	1357	353	2.5	1184
		N1000		3.0	2530		3.0	2258		3.0	2102		3.0	1836		3.0	1620
		N1100		3.0	2840		3.0	2540		3.0	2368		3.0	2076		3.0	1837
		N1200		3.0	3150		3.0	2822		3.0	2634		3.0	2316		3.0	2055
		N1300		3.0	3460		3.0	3105		3.0	2901		3.0	2555		3.0	2273
HVC ---100	1000	N0800	410	2.5	1459	439	2.5	1284	439	2.5	1183	439	2.5	1012	439	2.5	872
		N1000		3.0	1960		3.0	1740		3.0	1613		3.0	1399		3.0	1224
		N1100		3.0	2210		3.5	1968		3,5	1829		3.5	1593		3,5	1400
		N1200		3.0	2460		3.5	2196		3.5	2044		3.5	1786		3.5	1576
		N1300		4.0	2710		3.5	2424		3.5	2259		3.5	1980		3.5	1751
HVC ---120	1200	N0800	410	2.5	1153	460	3.0	1006	526	3.0	921	526	3.0	778	526	3.0	661
		N1000		3.0	1573		3.0	1388		3.5	1282		3.5	1103		3.5	956
		N1100		3.0	1783		3.5	1580		3.5	1463		3.5	1265		3.5	1103
		N1200		3.0	1993		3.5	1771		4.0	1644		4.0	1427		4.0	1251
		N1300		4.0	2203		4,0	1962		4.0	1824		4.0	1590		4.0	1398
HVC ---140	1400	N0800	410	2.5	932	460	3.0	805	530	3.0	733	610	3.5	609	610	3.5	508
		N1000		3.0	1294		3,0	1135		3.5	1044		4.0	889		4.0	762
		N1100		3.0	1475		3.5	1299		3.5	1199		4.0	1028		4.0	889
		N1200		3.0	1655		3.5	1464		4.0	1354		4.0	1168		4.0	1016
		N1300		4.0	1836		4.0	1629		4.0	1510		4.0	1308		4.0	1143
HVC ---160	1600	N0800	410	2.5	765	460	3.0	654	530	3.0	590	610	3.5	481	700	3.5	393
		N1000		3.0	1083		3.0	943		3.5	863		4.0	727		4.0	616
		N1100		3.0	1241		3.5	1088		3.5	999		4.0	850		4.5	727
		N1200		3.0	1400		3.5	1232		4.0	1136		4.0	972		4.5	839
		N1300		4.0	1559		4.0	1377		4.0	1272		4.0	1095		5.0	950
HVC ---180	1800	N0800	410	2.5	634	460	3.0	535	530	3.0	478	610	3.5	381	700	3.5	302
		N1000		3.0	917		3.0	793		3.5	721		4.0	600		4.0	501
		N1100		3.0	1059		3.5	922		3.5	843		4.0	710		4.5	600
		N1200		3.0	1200		3.5	1051		4.0	965		4.0	819		4.5	700
		N1300		4.0	1342		4.0	1179		4.0	1086		4.0	928		5.0	799
HVC ---200	2000	N0800	410	2.5	529	460	3.0	440	530	3.0	388	610	3.5	301	700	3.5	230
		N1000		3.0	784		3.0	672		3.5	608		4.0	498		4.0	409
		N1100		3.0	912		3.5	788		3.5	717		4.0	597		4.5	499
		N1200		3.0	1040		3.5	905		4.0	827		4.0	696		4.5	588
		N1300		4.0	1167		4.0	1021		4.0	937		4.0	794		5.0	678
HVC ---220	2200	N0800	410	2.5	443	460	3.0	361	530	3.0	314	610	3.5	235	700	3.5	170
		N1000		3.0	675		3.0	573		3.5	514		4.0	415		4.0	333
		N1100		3.0	792		3.5	679		3.5	614		4.0	504		4.5	415
		N1200		3.0	908		3.5	785		4.0	714		4.0	594		4.5	496
		N1300		4.0	1024		4.0	891		4.0	814		4.0	684		5.0	578
HVC ---240	2400	N800	410	2.5	371	460	3.0	296	530	3.0	253	610	3.5	180	700	3.5	120
		N1000		3.0	584		3.0	490		3.5	436		4.0	345		4.0	270
		N1100		3.0	691		3.5	587		3.5	528		4.0	427		4.5	345
		N1200		3.0	797		3.5	684		4.0	620		4.0	510		4.5	420
		N1300		4.0	904		4.0	782		4.0	711		4.0	592		5.0	495
HVC ---260	2600	N0800	410	2.5	309	460	3.0	240									
		N1000		3.0	507		3.0	420									
		N1100		3.0	605		3.5	510									
		N1200		3.0	704		3.5	599									
		N1300		4.0	802		4.0	689									
HVC ---280	2800	N0800	410	2.5	257												
		N1000		3.0	440												
		N1100		3.0	532												
		N1200		3.0	623												
		N1300		4.0	715												

The tables illustrate the performance for modules opening under load in accordance with EN 12101-2. The provided performance is NOT equal to structural load bearing capacity of an actual application. The design of a roof light must therefore be dimensioned to fit the specific building project, local architectural style and practice.

Standard size.

Special sizes, functional limitations may apply.

Skylight Module

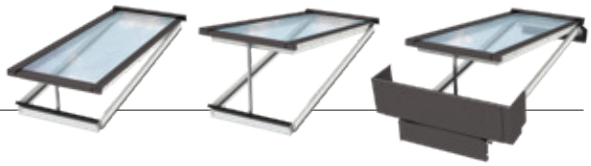
Opening under load

Snow load with triple-glazing unit (16, 16K, 16T, 17, 17K, 17T, 18 and 18T)																		
Glazing unit infill with a total glass thickness of 22 mm																		
Product ID			HVC 067---			HVC 075---			HVC 080---			HVC 090---			HVC 100---		
	Size [mm]	Width	675			750			800			900			1000		
	Height	Motor program	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]	Chain stroke [mm]	Electric current requirement [AMP]	Snow Load [Pa]
HVC ---080	800	N0800	353	2.5	1850	353	2.5	1630	353	2.5	1504	353	2.5	1289	353	2.5	1114
		N1000		3.0	2470		3.0	2194		3.0	2037		3.0	1769		3.0	1549
		N1100		3.0	2780		3.0	2477		3.0	2303		3.0	2008		3.0	1767
		N1200		3.0	3089		3.0	2759		3.0	2569		3.0	2248		3.0	1985
		N1300		3.0	3399		3.0	3041		3.0	2836		3.0	2487		3.0	2203
HVC ---100	1000	N0800	410	2.5	1394	439	2.5	1216	439	2.5	1114	439	2.5	941	439	2.5	799
		N1000		3.0	1895		3.0	1672		3.0	1544		3.0	1328		3.0	1150
		N1100		3.0	2145		3.5	1900		3.5	1760		3.5	1521		3.5	1326
		N1200		3.0	2395		3.5	2128		3.5	1975		3.5	1715		3.5	1502
		N1300		4.0	2646		3.5	2356		3.5	2190		3.5	1908		3.5	1678
HVC ---120	1200	N0800	410	2.5	1086	460	3.0	936	526	3.0	850	526	3.0	704	526	3.0	585
		N1000		3.0	1505		3.0	1318		3.5	1211		3.5	1029		3.5	880
		N1100		3.0	1715		3.5	1510		3.5	1392		3.5	1191		3.5	1028
		N1200		3.0	1925		3.5	1701		4.0	1572		4.0	1354		4.0	1175
		N1300		4.0	2135		4.0	1892		4.0	1753		4.0	1516		4.0	1323
HVC ---140	1400	N0800	410	2.5	862	460	3.0	733	530	3.0	659	610	3.5	533	610	3.5	431
		N1000		3.0	1224		3.0	1063		3.5	970		4.0	813		4.0	685
		N1100		3.0	1405		3.5	1227		3.5	1126		4.0	953		4.0	812
		N1200		3.0	1586		3.5	1392		4.0	1281		4.0	1093		4.0	939
		N1300		4.0	1766		4.0	1557		4.0	1437		4.0	1233		4.0	1066
HVC ---160	1600	N0800	410	2.5	694	460	3.0	580	530	3.0	515	610	3.5	404	700	3.5	314
		N1000		3.0	1011		3.0	869		3.5	788		4.0	650		4.0	537
		N1100		3.0	1170		3.5	1014		3.5	925		4.0	773		4.5	649
		N1200		3.0	1329		3.5	1159		4.0	1061		4.0	895		4.5	760
		N1300		4.0	1487		4.0	1303		4.0	1198		4.0	1018		5.0	872
HVC ---180	1800	N0800	410	2.5	562	460	3.0	460	530	3.0	402	610	3.5	303	700	3.5	223
		N1000		3.0	845		3.0	718		3.5	645		4.0	522		4.0	422
		N1100		3.0	986		3.5	847		3.5	767		4.0	632		4.5	521
		N1200		3.0	1128		3.5	976		4.0	889		4.0	741		4.5	620
		N1300		4.0	1269		4.0	1105		4.0	1011		4.0	850		5.0	720
HVC ---200	2000	N0800	410	2.5	456	460	3.0	364	530	3.0	311	610	3.5	222	700	3.5	149
		N1000		3.0	711		3.0	596		3.5	531		4.0	420		4.0	329
		N1100		3.0	838		3.5	713		3.5	641		4.0	518		4.5	418
		N1200		3.0	966		3.5	829		4.0	750		4.0	617		4.5	508
		N1300		4.0	1094		4.0	945		4.0	860		4.0	716		5.0	598
HVC ---220	2200	N0800	410	2.5	368	460	3.0	285	530	3.0	237	610	3.5	155	700	3.5	89
		N1000		3.0	601		3.0	497		3.5	437		4.0	335		4.0	252
		N1100		3.0	717		3.5	602		3.5	537		4.0	425		4.5	334
		N1200		3.0	833		3.5	708		4.0	637		4.0	515		4.5	416
		N1300		4.0	950		4.0	814		4.0	737		4.0	605		5.0	497
HVC ---240	2400	N800	410	2.5	295	460	3.0	219	530	3.0	174	610	3.5	100	700	3.5	38
		N1000		3.0	509		3.0	413		3.5	358		4.0	265		4.0	188
		N1100		3.0	616		3.5	510		3.5	450		4.0	347		4.5	263
		N1200		3.0	722		3.5	607		4.0	542		4.0	430		4.5	338
		N1300		4.0	829		4.0	705		4.0	633		4.0	512		5.0	413
HVC ---260	2600	N0800	410	2.5	234	460	3.0	162									
		N1000		3.0	431		3.0	342									
		N1100		3.0	529		3.5	432									
		N1200		3.0	628		3.5	522									
		N1300		4.0	727		4.0	612									
HVC ---280	2800	N0800	410	2.5	180												
		N1000		3.0	364												
		N1100		3.0	455												
		N1200		3.0	547												
		N1300		4.0	639												

The tables illustrate the performance for modules opening under load in accordance with EN 12101-2. The provided performance is NOT equal to structural load bearing capacity of an actual application. The design of a roof light must therefore be dimensioned to fit the specific building project, local architectural style and practice.

Standard size. Special sizes, functional limitations may apply.

Skylight Module

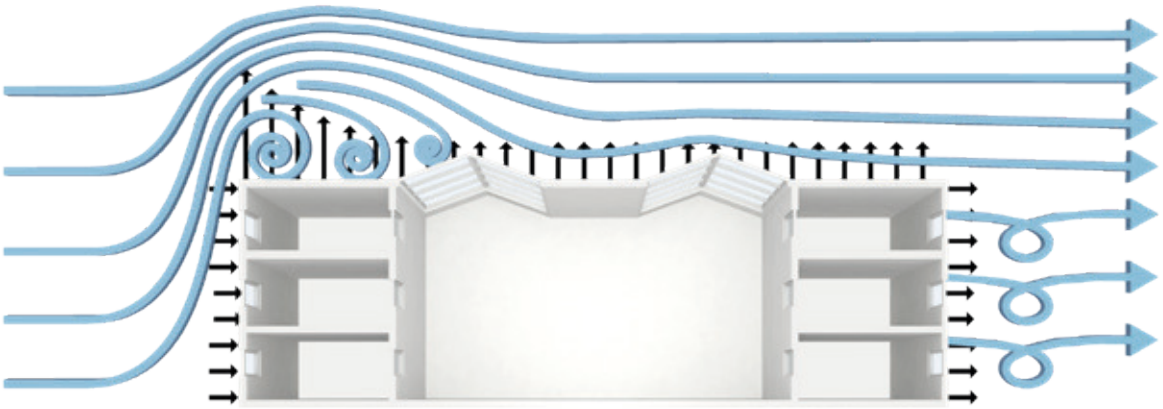


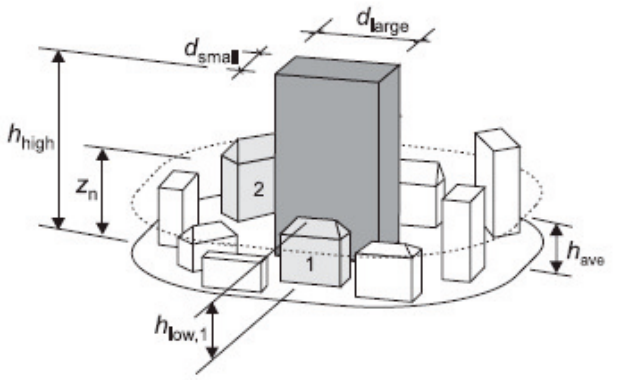
Smoke Ventilation Systems
A smoke ventilation system always has a building specific design, incorporating smoke ventilators, controls, air inlets and mechanical ventilation.

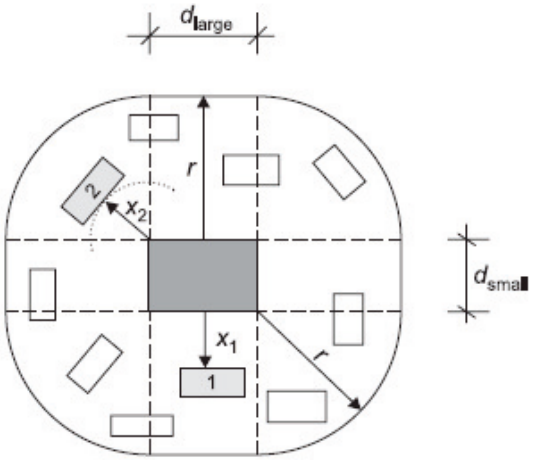
Designing a smoke ventilation system is therefore a rather complex matter, which must be addressed by skilled and authorized fire engineers in order to obtain an adequate level of performance and safety.

The design covers all relevant parameters such as the location of the building, height and shape of the roof, position of ventilators on the roof, relative position to each other, facades and doors providing air intake, mechanical ventilation, evacuation plan and escape routes, and the natural and artificial wind obstacles in the surroundings of the building.

The VELUX Group provides the essential performance characteristics of each individual CE-marked VELUX modular skylight in accordance with EN 12101-2, but cannot validate the functionality and safety of the complete system.

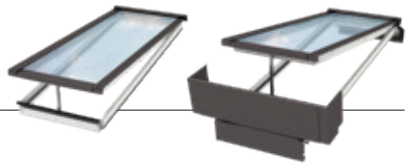






Source of images: DE 611XB549 Rapport, page 2, figure 1, and page 11

Skylight Module



VELUX wind deflector for smoke ventilation modules
Whenever it is required to obtain an Aerodynamic free area (Aa) which is accountable in any wind condition, i.e. considering the possible side wind effect, a possible solution is to install smoke ventilators with prefabricated VELUX wind deflector KCD. The wind deflector KCD is specifically designed to change the wind profile in any wind direction and to ensure that negative pressure i.e. wind suction occurs in the direct surroundings of the opening of the modular skylight. This enables smoke exhaust even in adverse wind conditions, provided that the entire building and smoke ventilation system is designed appropriately by authorized fire engineers.

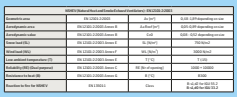
The wind deflector comes in two variants: KCD W00H00 0040 that covers one smoke ventilation module and KCD 0080 that covers three skylight modules, one smoke ventilating module in the middle of two fixed modules of the same width. A skylight configuration with six modules can thus contain two smoke ventilation modules with KCD 0080 and four fixed modules. Please contact VELUX for detailed design advice.

The aerodynamic performance of the modular skylights with and without deflectors in accordance with EN 12101-2 is expressed on page 80.

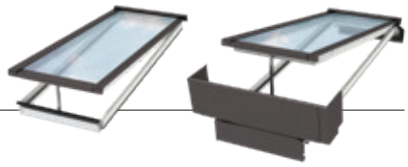
VELUX smoke ventilation modular skylights can be used without wind deflector in roof mounted applications, when local regulations and design conditions are allowing to do so.

VELUX smoke ventilation modular skylights installed in roof mounted applications i.e. up to 60° inclination are wind sensitive, which means that negative discharge i.e. air intake may occur in unfavourable wind conditions. This must be regarded and addressed by the building owner when designing the building and planning with wind sensitive smoke ventilators. To prevent negative discharge, the building owner must take steps to incorporate the product as a part of the total solution that can be approved by the local authorities. The solution could, for instance, be a VELUX KCD wind deflector, or a wind direction sensor in connection with multi-direction placement of smoke ventilators, or another device/roof integrated solution that ensures a sufficient aerodynamic free area.

VELUX wind deflector KCD is not applicable above 60° installation pitch, on so-called wall-mounted smoke ventilators. Smoke ventilators installed in this range are to be considered wind sensitive by default in accordance with EN 12101-2. When a smoke ventilator is used in wall-mounted applications i.e. above 60° installation inclination the aerodynamic area must be by default expressed without influence of side wind, therefore the use of a smoke deflector is meaningless in such applications. Wind deflector KCD is furthermore not compatible with narrow bottom flashing, Northlight flashings and Step solution flashings.



Skylight Module



Wind deflector KCD W00H00 0040	
Material	Aluminium
Material thickness	3 mm
Surface treatment	Powder coated (60 - 120µ)
Colour	NCS S7500-N, gloss 30

Wind deflector KCD 0080	
Material	Aluminium
Material thickness	3 mm
Surface treatment	Anodized
Colour	Nature anodized Optional – coloured powder coating

Skylight Module

Definitions

In accordance with EN 12101-2:

C_v [-] Coefficient of discharge that states the ratio between A_a and A_v ($C_v = A_a/A_v$). For roof-mounted smoke and heat exhaust ventilators the value of C_v is the lower of C_{v0} and C_{vw}.
For wall-mounted smoke and heat exhaust ventilators, C_v is not to be tested with wind influence i.e. $C_v = C_{v0}$.

C_{v0} [-] Coefficient of discharge calculated based on pressure testing without side wind influence.

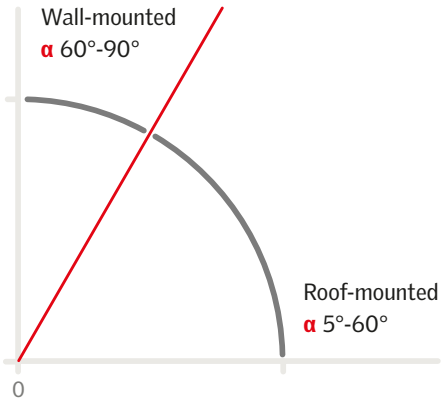
C_{vw} [-] Coefficient of discharge calculated based on pressure testing with side wind influence.

A_a [m²] A_a [m^2] Aerodynamic free area ($A_a = A_v \times C_v$).
May be described as the effective area of the ventilator taking into account reductions in air flow along edges and around the openable panel as well as motors etc.

A_v [m²] Geometric area, corresponds to frame aperture area.

Roof-mounted:
Smoke ventilators installed from 0° up to and including 60°. VELUX modular skylights installed from 5° to 60° are proven wind sensitive. This must be considered when planning the smoke ventilation of the building.

Wall-mounted:
Smoke ventilators installed above 60° up to 90°. Wall-mounted smoke ventilators are, as per definition, wind sensitive regardless of the design.



In accordance with EN 13141-1

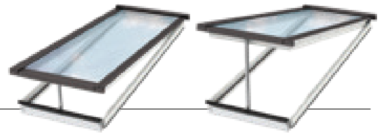
A_c [m²] Geometric free area corresponds to the minimum unobstructed opening of the openable modular skylights in natural comfort ventilation position.

The area is calculated using the total opening area of the ventilator, in case of modular skylight top-hung ventilators from the front opening and the side triangles. Not identical to **A_g [m²], which is calculated in smoke ventilation opening position.**

Used to define natural ventilation performance of comfort ventilation modular skylights and dual purpose smoke ventilation modular skylights in comfort ventilation use.

NSHEV (Natural Heat and Smoke Exhaust Ventilators) - EN 12101-2:2003			
Geometric area	EN 12101-2:2003	Av [m²]	0,48 -1,89 depending on size
Aerodynamic area	EN 12101-2:2003 Annex B	Aa Roof [m²]	0,05-0,89 depending on size
Aerodynamic value	EN 12101-2:2003 Annex B	Cv0	0,08 - 0,52 depending on size
Snow load (SL)	EN 12101-2:2003 Annex E	SL [N/m²]	750 N/m2
Wind load (WL)	EN 12101-2:2003 Annex F	WL [N/m²]	3000 N/m2
Low ambient temperature (T)	EN 12101-2:2003 Annex E	T [°C]	T (-15)
Reliability (RE) (Dual purpose)	EN 12101-2:2003 Annex C	RE [Nr of opening]	1000 + 10000
Resistance to heat (B)	EN 12101-2:2003 Annex G	B [°C]	B300
Reaction to fire for NSHEV	EN 13501-1	Class	B-s1,d2 for IGU 55.2 **B-s1,d0 for IGU 33.2**

Skylight Module



Geometric free area: A_c [m²]

In accordance with EN 13141-1

Comfort ventilation

Geometric area: A_v [m²]
Aerodynamic free area: $A_a = A_v \times C_v$

In accordance with EN 12101-2

Smoke ventilation

Skylight Module

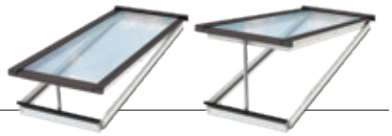


Table for European values

Ventilation Charateristics for HVC (European values)

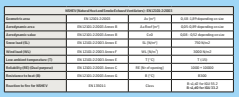
Size of Skylights	Smoke ventilation characteristics **HVC------ ----AB**														Comfort ventilation (EN13141-1)		
	Actuator chain stroke [mm]	Opening angle	Geometric area: Av [m²]	Discharge coefficient (C_v) (EN 12101-2)						Aerodynamic free area (A_a) [m²] (EN 12101-2)					HVC------ ----B and HVC------ ----AB in comfort function		
				Without deflector		With deflector type KCD 0080		With deflector type KCD 0040		Without deflector			With deflector type KCD 0080	With deflector type KCD 0040			
				without side wind	with side wind	without side wind	with side wind	without side wind	with side wind	5° ≤ installation inclination ≤ 60°		installation inclination > 60°	5° ≤ installation inclination ≤ 60°	5° ≤ installation inclination ≤ 60°	Actuator chain stroke [mm]	Opening angle	Geometric free area: A_v [m²]
				C_{v0}	C_{vw}	C_{v0}	C_{vw}	C_{v0}	C_{vw}	$A_{a\ Roof}$ [1] without side wind [2]	$A_{a\ Roof}$ with side wind	$A_{a\ Wall}$ [3]	$A_{a\ Roof}$ [4]	$A_{a\ Roof}$ [4]			
675 x 800	353	25.0°	0.48	0.42	0.00	0.49	0.59	0.40	0.26	0.20	0.00	0.20	0.24	0.13	353	25.0°	0.28
675 x 1000	410	23.0°	0.61	0.44	0.00	0.46	0.60	0.40	0.24	0.27	0.00	0.27	0.28	0.15	410	23.0°	0.40
675 x 1200	410	19.5°	0.74	0.40	0.00	0.43	0.57	0.38	0.22	0.30	0.00	0.30	0.32	0.16	410	19.5°	0.44
675 x 1400	410	16.5°	0.87	0.36	0.00	0.40	0.54	0.35	0.20	0.31	0.00	0.31	0.35	0.17	410	16.5°	0.48
675 x 1600	410	14.5°	1.00	0.33	0.00	0.38	0.52	0.33	0.19	0.33	0.00	0.33	0.38	0.19	410	14.5°	0.52
675 x 1800	410	13.0°	1.12	0.34	0.00	0.36	0.49	0.34	0.19	0.38	0.00	0.38	0.40	0.21	410	13.0°	0.56
675 x 2000	410	11.5°	1.25	0.32	0.00	0.33	0.45	0.33	0.16	0.40	0.00	0.40	0.41	0.20	410	11.5°	0.60
675 x 2200	410	10.5°	1.38	0.31	0.00	0.32	0.43	0.32	0.17	0.43	0.00	0.43	0.44	0.23	410	10.5°	0.64
675 x 2400	410	9.5°	1.51	0.29	0.00	0.30	0.41	0.30	0.16	0.44	0.00	0.44	0.45	0.24	410	9.5°	0.69
675 x 2600	410	9.0°	1.64	0.31	0.00	–	–	0.32	0.17	0.50	0.00	0.50	–	0.28	410	9.0°	0.73
675 x 2800	410	8.0°	1.76	0.28	0.00	–	–	0.31	0.18	0.49	0.00	0.49	–	0.32	410	8.0°	0.77
750 x 800	353	25.0°	0.54	0.41	0.00	0.47	0.56	0.38	0.26	0.22	0.00	0.22	0.25	0.14	353	25.0°	0.30
750 x 1000	439	25.0°	0.68	0.46	0.00	0.49	0.61	0.40	0.24	0.31	0.00	0.31	0.33	0.16	410	23.0°	0.42
750 x 1200	460	21.5°	0.83	0.44	0.00	0.44	0.57	0.41	0.23	0.36	0.00	0.36	0.36	0.19	410	19.5°	0.47
750 x 1400	460	18.5°	0.97	0.39	0.00	0.41	0.54	0.38	0.22	0.38	0.00	0.38	0.40	0.21	410	16.5°	0.51
750 x 1600	460	16.0°	1.11	0.37	0.00	0.39	0.51	0.36	0.21	0.41	0.00	0.41	0.43	0.23	410	14.5°	0.55
750 x 1800	460	14.5°	1.25	0.36	0.00	0.37	0.50	0.35	0.19	0.45	0.00	0.45	0.46	0.24	410	13.0°	0.59
750 x 2000	460	13.0°	1.40	0.37	0.00	0.36	0.48	0.35	0.19	0.52	0.00	0.52	0.50	0.27	410	11.5°	0.63
750 x 2200	460	12.0°	1.54	0.37	0.00	0.34	0.46	0.36	0.19	0.57	0.00	0.57	0,52	0.29	410	10.5°	0.67
750 x 2400	460	11.0°	1.68	0.35	0.00	0.33	0.44	0.35	0.15	0.59	0.00	0.59	0.56	0.25	410	9.5°	0.71
750 x 2600	460	10.0°	1.83	0.33	0.00	–	–	0.33	0.16	0.60	0.00	0.60	–	0.29	410	9.0°	0.75

[1] External building surfaces with inclination of 60° or less relative to the horizontal; shed roofs and continuous roof-lights, independent of inclination angle, are considered to be part of the roofs.

[2] The aerodynamic area has been declared in accordance with EN 12101-2, which means the products have been tested with and without side wind. The aerodynamic area expressed without deflector is wind sensitive which therefore, in connection with the design of the smoke ventilation system, means that steps must be taken to incorporate the products as part of a total solution that can be approved by the local fire authorities. This solution could consist of, for instance, a wind direction sensor, a wind deflector or another device that ensures a sufficient aerodynamic area at all times.
It is the responsibility of the building owner – together with the local fire authorities, if necessary – to ensure the system is specified, installed and operated in accordance with current national legislation and requirements.

[3] External building surfaces with an inclination of more than 60° relative to the horizontal.

[4] Aerodynamic tests as outlined in EN 12101-2:2003 were conducted both with wind (C_{vw}) and without influence of wind (C_{v0}). In any case, the lower of C_{v0} and C_{vw} is used.



Skylight Module

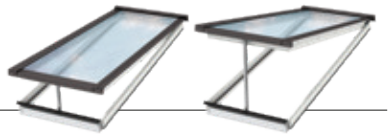


Table for European values

Ventilation Charateristics for HVC (European values)

Size of Skylights	Smoke ventilation characteristics HVC------ ----AB														Comfort ventilation (EN13141-1)		
				Discharge coefficient (C_v) (EN 12101-2)						Aerodynamic free area (A_a) [m²] (EN 12101-2)					HVC------ ----B and HVC------ ----AB in comfort function		
				Without deflector		With deflector type KCD 0080		With deflector type KCD 0040		Without deflector			With deflector type KCD 0080	With deflector type KCD 0040			
	Actuator chain stroke [mm]	Opening angle	Geometric area: Av [m²]	without side wind	with side wind	without side wind	with side wind	without side wind	with side wind	5° ≤ installation inclination ≤ 60°		installation inclination > 60°	5° ≤ installation inclination ≤ 60°	5° ≤ installation inclination ≤ 60°	Actuator chain stroke [mm]	Opening angle	Geometric free area: Ac [m²]
				C_{v0}	C_{vw}	C_{v0}	C_{vw}	C_{v0}	C_{vw}	$A_{a\ Roof}$ [1] without side wind [2]	$A_{a\ Roof}$ with side wind	$A_{a\ Wall}$ [3]	$A_{a\ Roof}$ [4]	$A_{a\ Roof}$ [4]			
800 x 800	353	25.0°	0.58	0.40	0.00	0.46	0.54	0.37	0.25	0.23	0.00	0.23	0.27	0.14	353	25.0°	0.32
800 x 1000	439	25.0°	0.73	0.45	0.00	0.48	0.59	0.41	0.24	0.33	0.00	0.33	0.35	0.18	410	23.0°	0.44
800 x 1200	526	25.0°	0.88	0.48	0.00	0.49	0.63	0.44	0.22	0.42	0.00	0.42	0.43	0.19	410	19.5°	0.48
800 x 1400	530	21.5°	1.04	0.45	0.00	0.45	0.59	0.41	0.22	0.47	0.00	0.47	0.47	0.23	410	16.5°	0.52
800 x 1600	530	19.0°	1.19	0.42	0.00	0.43	0.57	0.39	0.22	0.50	0.00	0.50	0.51	0.26	410	14.5°	0.56
800 x 1800	530	16.5°	1.34	0.39	0.00	0.40	0.54	0.38	0.21	0.52	0.00	0.52	0.54	0.28	410	13.0°	0.60
800 x 2000	530	15.0°	1.50	0.40	0.00	0.39	0.52	0.39	0.19	0.60	0.00	0.60	0.58	0.28	410	11.5°	0.64
800 x 2200	530	13.5°	1.65	0.38	0.00	0.37	0.50	0.37	0.18	0.63	0.00	0.63	0.61	0.30	410	10.5°	0.68
800 x 2400	530	12.5°	1.80	0.37	0.00	0.35	0.47	0.36	0.14	0.67	0.00	0.67	0.63	0.25	410	9.5°	0.72
900 x 800	353	25.0°	0.65	0.39	0.00	0.43	0.50	0.35	0.25	0.25	0.00	0.25	0.28	0.16	353	25.0°	0.34
900 x 1000	439	25.0°	0.83	0.44	0.00	0.45	0.57	0.39	0.23	0.36	0.00	0.36	0.37	0.19	410	23.0°	0.47
900 x 1200	526	25.0°	1.00	0.46	0.00	0.47	0.60	0.42	0.20	0.46	0.00	0.46	0.47	0.20	410	19.5°	0.51
900 x 1400	610	24.5°	1.17	0.47	0.00	0.47	0.62	0.42	0.18	0.55	0.00	0.55	0.55	0.21	410	16.5°	0.55
900 x 1600	610	21.5°	1.35	0.45	0.00	0.44	0.58	0.41	0.21	0.61	0.00	0.61	0.59	0.28	410	14.5°	0.59
900 x 1800	610	19.0°	1.52	0.43	0.00	0.42	0.55	0.41	0.20	0.65	0.00	0.65	0.64	0.30	410	13.0°	0.63
900 x 2000	610	17.0°	1.69	0.41	0.00	0.40	0.53	0.40	0.18	0.69	0.00	0.69	0.68	0.30	410	11.5°	0.67
900 x 2200	610	16.0°	1.86	0.40	0.00	0.40	0.52	0.40	0.16	0.75	0.00	0.75	0.75	0.30	410	10.5°	0.72
900 x 2400	610	14.5°	2.04	0.38	0.00	0.38	0.49	0.38	0.14	0.77	0.00	0.77	0.77	0.29	410	9.5°	0.76
1000 x 800	353	25.0°	0.73	0.37	0.00	0.40	0.47	0.33	0.25	0,27	0.00	0.27	0.29	0.18	353	25.0°	0.37
1000 x 1000	439	25.0°	0.92	0.41	0.00	0.43	0.54	0.37	0.21	0,38	0.00	0.38	0.40	0.19	410	23.0°	0.50
1000 x 1200	526	25.0°	1.11	0.44	0.00	0.45	0.58	0.40	0.18	0,49	0.00	0.49	0.50	0.20	410	19.5°	0.54
1000 x 1400	610	25.0°	1.31	0.46	0.00	0.46	0.61	0.42	0.16	0,60	0.00	0.60	0.60	0.21	410	16.5°	0.58
1000 x 1600	700	24.0°	1.50	0.47	0.00	0.46	0.60	0.44	0.17	0,71	0.00	0.71	0.69	0.26	410	14.5°	0.62
1000 x 1800	700	22.0°	1.69	0.47	0.00	0.44	0.58	0.42	0.17	0,80	0.00	0.80	0.75	0.29	410	13.0°	0.67
1000 x 2000	700	20.0°	1.89	0.44	0.00	0.43	0.55	0.42	0.16	0,83	0.00	0.83	0.81	0.30	410	11.5°	0.71
1000 x 2200	700	18.0°	2.08	0.42	0.00	0.42	0.52	0.41	0.15	0,87	0.00	0.87	0.87	0.31	410	10.5°	0.75
1000 x 2400	700	16.5°	2.27	0.39	0.00	0.40	0.51	0.39	0.13	0,89	0.00	0.89	0.91	0.30	410	9.5°	0.79

[1] External building surfaces with inclination of 60° or less relative to the horizontal; shed roofs and continuous roof-lights, independent of inclination angle, are considered to be part of the roofs.

[2] The aerodynamic area has been declared in accordance with EN 12101-2, which means the products have been tested with and without side wind. The aerodynamic area expressed without deflector is wind sensitive which therefore, in connection with the design of the smoke ventilation system, means that steps must be taken to incorporate the products as part of a total solution that can be approved by the local fire authorities. This solution could consist of, for instance, a wind direction sensor, a wind deflector or another device that ensures a sufficient aerodynamic area at all times.
It is the responsibility of the building owner – together with the local fire authorities, if necessary – to ensure the system is specified, installed and operated in accordance with current national legislation and requirements.

[3] External building surfaces with an inclination of more than 60° relative to the horizontal.

[4] Aerodynamic tests as outlined in EN 12101-2:2003 were conducted both with wind (C_{vw}) and without influence of wind (C_{v0}). In any case, the lower of C_{v0} and C_{vw} is used.

Skylight Module

Other relevant aerodynamic areas

The aerodynamic areas below are outside of the scope of EN 12101-2.

They are however used nationally and referred to in national regulations and/or practical guides.

1) A_g [m²] Geometric free area, corresponds to the minimum unobstructed opening area of the smoke ventilators.

The typical use of this parameter is to define the ventilation area of smoke ventilators when they are used as so called cold smoke exhaust ventilators, assuming that the outtake pressure is generated by mechanical extract fans or generated by a chimney stack effect. A typical use of this area is when smoke ventilators are used over staircases. National and local regulations may differ and wherever they exist, they must be followed.

Definition of the geometric free area:

Figure 1.a:
Germany: In accordance with DIN 18232

The area is calculated in relation to the use of the total unobstructed opening area of the ventilator. In case of modular skylight top-hung ventilators it equals to the front opening (A) and the side triangles (B + C).
Not identical to A_c [m²], which is calculated in comfort opening position.

Figure 1.b:
Austria: In accordance with the Guideline TRVB S 111 + addendum 3.3.2018 to point 5.4

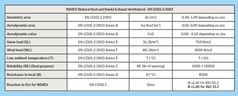
The area is calculated in relation to the use of the total unobstructed opening area of the ventilator with some limitations depending on the size and installation inclination and the relation of the opening angle to the installation inclination.
In case of modular skylight top-hung ventilators the value is equal to

- The front opening (A) when the $A_v \leq 1m^2$
- The front opening (A) when the $A_v > 1m^2$ and the sash remains below or raises maximum up to horizontal open position
- The front opening (A) plus one of the two side triangles (B)

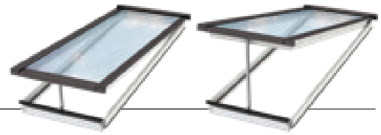
Figure 2:
Great Britain: Free area of smoke ventilators

- Great Britain: In accordance with Approved Document B, Volume 2, Appendix C, Section 5.b, Diagram C7, figure a

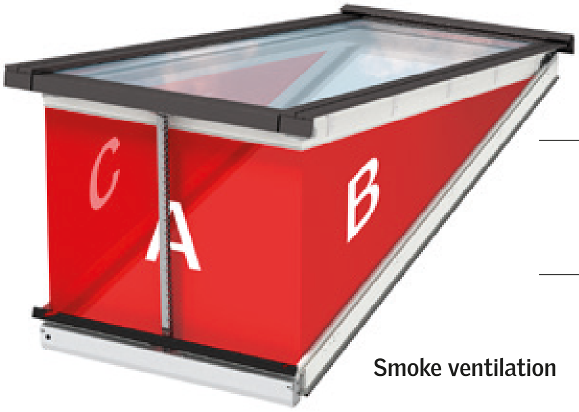
The area is usable as an alternative to the first place cited Aerodynamic Free (Aa) in accordance with BS EN 12101-2 under Section 5.a. whenever it is specified in the requirements.



Skylight Module



1.a:



Geometric free area: A_g [m²] in Germany

In accordance with DIN 18232

Geometric free area: A_g [m²] in Denmark

In accordance with DBI 027

Smoke ventilation

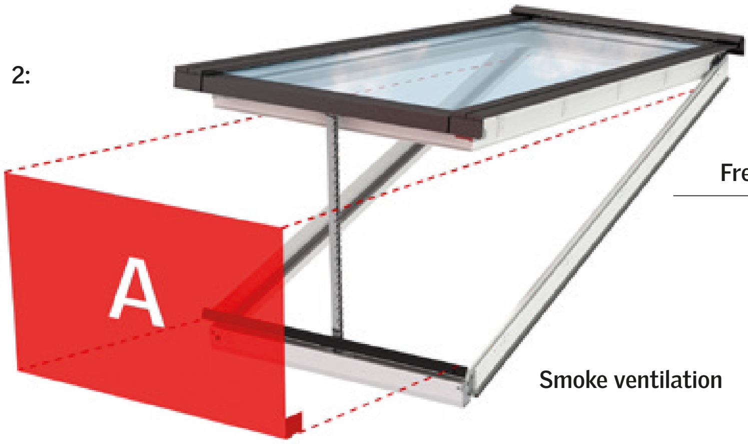
1.b:

Geometric area: A_g [m²] in Austria

In accordance with Guideline TRVB S 111
+ addendum 3.3.2018 to point 5.4.

Smoke ventilation

2:



Free area of smoke ventilators: A in Great Britain

In accordance with Approved Document B,
Volume 2, Appendix C, Section 5.b,
Diagram C7, figure a

Smoke ventilation

Skylight Module

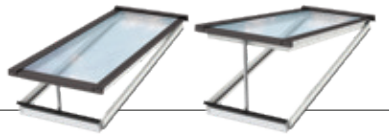
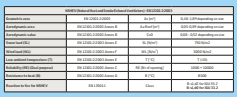


Table for country specific values

Additional Ventilation Charateristics HVC

Basic geometry data				Additional national smoke ventilation characteristics HVC------ ----AB				
				Germany	Denmark	Austria		Great Britain
				DIN 18232	DBI 027	Guideline TRVB S 111 + addendum 3.3.2018 to point 5.4.		
Size of Skylights	Actuator chain stroke [mm]	Opening angle	Geometric area: Av [m²] (EN 12101-2)	Geometric free area: A_g [m²]	Cold smoke exhaust area: A_g [m²]	The installation inclination of the module is smaller than the opening angle of the sash relative to horizontal, i.e the sash raises above horizontal in fully opened position.	The installation inclination of the module is larger than the opening angle of the sash relative to horizontal, i.e the sash remains below or raises maximum up to horizontal in fully opened position	The Free Area Smoke Ventilator in accordance with Approved Document B, Volume 2, Appendix C, Section 5.b, Diagram C7, figure a.
						Geometric area: A_g [m²]		Area (A) [m²] *
675 x 800	353	25.0°	0.48	0.28	0.28	0.16	0.16	0.14
675 x 1000	410	23.0°	0.61	0.39	0.39	0.20	0.20	0.18
675 x 1200	410	19.5°	0.74	0.44	0.44	0.20	0.20	0.17
675 x 1400	410	16.5°	0.87	0.48	0.48	0.20	0.20	0.17
675 x 1600	410	14.5°	1.00	0.52	0.52	0.20	0.20	0.17
675 x 1800	410	13.0°	1.12	0.56	0.56	0.38	0.20	0.17
675 x 2000	410	11.5°	1.25	0.60	0.60	0.40	0.20	0.16
675 x 2200	410	10.5°	1.38	0.64	0.64	0.42	0.20	0.16
675 x 2400	410	9.5°	1.51	0.68	0.68	0.44	0.20	0.16
675 x 2600	410	9.0°	1.64	0.72	0.72	0.46	0.20	0.16
675 x 2800	410	8.0°	1.76	0.76	0.76	0.48	0.20	0.16
750 x 800	353	25.0°	0.54	0.30	0.30	0.18	0.18	0.16
750 x 1000	439	25.0°	0.68	0.46	0.46	0.24	0.24	0.22
750 x 1200	460	21.5°	0.83	0.55	0.55	0.26	0.26	0.23
750 x 1400	460	18.5°	0.97	0.60	0.60	0.26	0.26	0.23
750 x 1600	460	16.0°	1.11	0.65	0.65	0.45	0.26	0.22
750 x 1800	460	14.5°	1.25	0.70	0.70	0.48	0.26	0.22
750 x 2000	460	13.0°	1.40	0.75	0.75	0.50	0.26	0.22
750 x 2200	460	12.0°	1.54	0.80	0.80	0.53	0.26	0.22
750 x 2400	460	11.0°	1.68	0.85	0.85	0.55	0.26	0.22
750 x 2600	460	10.0°	1.83	0.90	0.90	0.58	0.26	0.22
800 x 800	353	25.0°	0.58	0.31	0.31	0.20	0.20	0.17
800 x 1000	439	25.0°	0.73	0.48	0.48	0.26	0.26	0.24
800 x 1200	526	25.0°	0.88	0.69	0.69	0.33	0.33	0.31
800 x 1400	530	21.5°	1.04	0.76	0.76	0.54	0.33	0.30
800 x 1600	530	19.0°	1.19	0.82	0.82	0.58	0.33	0.30
800 x 1800	530	16.5°	1.34	0.89	0.89	0.61	0.33	0.29
800 x 2000	530	15.0°	1.50	0.95	0.95	0.64	0.33	0.29
800 x 2200	530	13.5°	1.65	1.01	1.01	0.67	0.33	0.29
800 x 2400	530	12.5°	1.80	1.08	1.08	0.70	0.33	0.29

* Note that this particular calculation of the The Free Area Smoke Ventilator in accordance with Approved Document B, Volume 2, Appendix C, Section 5.b, Diagram C7, figure a. is only a secondary alternative to the in the first place cited Aerodynamic Free (Aa) in accordance with BS EN 12101-2 under Section 5.a. Furthermore, the calculation in accordnace to 5.d diagram C7, figure a. cannot take into consideration individual lining depths used in specific interior design cases, which may give further limitations to the values presented above.



Skylight Module

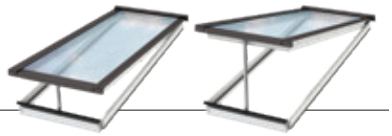


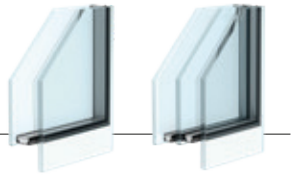
Table for country specific values

Additional Ventilation Charateristics HVC

Basic geometry data				Additional national smoke ventilation characteristics HVC------ ----AB				
				Germany	Denmark	Austria		Great Britain
				DIN 18232	DBI 027	Guideline TRVB S 111 + addendum 3.3.2018 to point 5.4.		
Size of Skylights	Actuator chain stroke [mm]	Opening angle	Geometric area: Av [m²] (EN 12101-2)	Geometric free area: A_g [m²]	Cold smoke exhaust area: A_g [m²]	The installation inclination of the module is smaller than the opening angle of the sash relative to horizontal, i.e the sash raises above horizontal in fully opened position.	The installation inclination of the module is larger than the opening angle of the sash relative to horizontal, i.e the sash remains below or raises maximum up to horizontal in fully opened position	The Free Area Smoke Ventilator in accordance with Approved Document B, Volume 2, Appendix C, Section 5.b, Diagram C7, figure a.
						Geometric area: A_g [m²]		Area (A) [m²] *
900 x 800	353	25.0°	0.65	0.34	0.34	0.22	0.22	0.20
900 x 1000	439	25.0°	0.83	0.52	0.52	0.30	0.30	0.27
900 x 1200	526	25.0°	1.00	0.73	0.73	0.37	0.37	0.35
900 x 1400	610	24.5°	1.17	0.98	0.98	0.71	0.44	0.42
900 x 1600	610	21.5°	1.35	1.05	1.05	0.75	0.44	0.41
900 x 1800	610	19.0°	1.52	1.13	1.13	0.79	0.44	0.41
900 x 2000	610	17.0°	1.69	1.21	1.21	0.83	0.44	0.40
900 x 2200	610	16.0°	1.86	1.29	1.29	0.87	0.44	0.40
900 x 2400	610	14.5°	2.04	1.37	1.37	0.91	0.44	0.40
1000 x 800	353	25.0°	0.73	0.36	0.36	0.25	0.25	0.22
1000 x 1000	439	25.0°	0.92	0.55	0.55	0.33	0.33	0.30
1000 x 1200	526	25.0°	1.11	0.77	0.77	0.59	0.41	0.39
1000 x 1400	610	25.0°	1.31	1.02	1.02	0.76	0.49	0.47
1000 x 1600	700	24.0°	1.50	1.32	1.32	0.95	0.58	0.56
1000 x 1800	700	22.0°	1.69	1.42	1.42	1.00	0.58	0.55
1000 x 2000	700	20.0°	1.89	1.51	1.51	1.05	0.58	0.55
1000 x 2200	700	18.0°	2.08	1.61	1.61	1.10	0.58	0.54
1000 x 2400	700	16.5°	2.27	1.71	1.71	1.14	0.58	0.54

* Note that this particular calculation of the The Free Area Smoke Ventilator in accordance with Approved Document B, Volume 2, Appendix C, Section 5.b, Diagram C7, figure a. is only a secondary alternative to the in the first place cited Aerodynamic Free (Aa) in accordance with BS EN 12101-2 under Section 5.a. Furthermore, the calculation in accordnace to 5.d diagram C7, figure a. cannot take into consideration individual lining depths used in specific interior design cases, which may give further limitations to the values presented above.

Glazing Unit

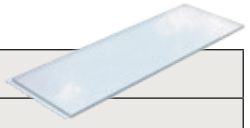


Coating options	Colour code	Explanation
LowE		Low-emissivity coating
Sun1		Light sun protection coating
Sun2		Enhanced sun protection coating

Glazing description	Colour code	Explanation	Characteristic bending strength
F		Float	45.0 N/mm²
H		Toughened	120.0 N/mm²
HS		Heat Strengthened	70.0 N/mm²
Int		Fire protection gel	–

Gas description	Colour code
Argon	
Krypton	

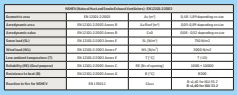
Foil	Colour code	Explanation
Polyvinyl butyral (PVB)		Lamination foil between the sheets of the laminated glass



Example of glazing unit construction	
	Description, from outside - inside
Glazing variant	IGU 16
Construction	8H LowE-12 Argon-8HS-12 Argon-33.2F LowE

	Description	Visual colour description
8H	8 mm pane with toughened glass	
LowE	Low-emissivity coating	
12 Argon	12 mm Argon filled cavity	
8HS	8 mm pane with heat strengthened glass	
12 Argon	12 mm Argon filled cavity	
33.2F	Laminated float glass pane, 3 + 3 mm, 2 x 0.38 mm PVB	
LowE	Low-emissivity coating	

	Description, from outside - inside	Visual colour description, from outside - inside
Construction colour code	8H LowE-12 Argon-8HS-12 Argon-33.2F LowE	



Glazing Unit

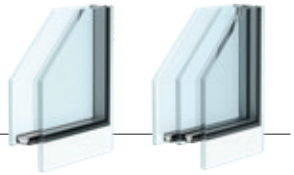
Double Glazing = **DG** Triple Glazing = **TG**

TG/ DG	Coating	IGU code	Construction Insulating Glass Unit (IGU) (outside - inside)	Visual colour description Insulating Glass Unit (IGU) (outside - inside)
DG	LowE	10	8H-20 Argon-33.2F LowE	
DG	LowE	10T	8H-16 Argon-55.2F LowE	
TG	LowE	16	8H LowE-12 Argon-8HS-12 Argon-33.2F LowE	
TG	LowE	16K	8H LowE-12 Krypton-4HS-12 Krypton-55.2HS LowE	
TG	LowE	16T	8H LowE-12 Argon-4HS-12 Argon-55.2HS LowE	
DG	Sun1	11	8H Sun1-20 Argon-33.2F	
DG	Sun1	11T	8H Sun1-16 Argon-55.2F	
TG	Sun1	17	8H Sun1-12 Argon-8HS-12 Argon-33.2F LowE	
TG	Sun1	17K	8H Sun1-12 Krypton-4HS-12 Krypton-55.2HS LowE	
TG	Sun1	17T	8H Sun1-12 Argon-4HS-12 Argon-55.2HS LowE	
DG	Sun2	12	8H Sun2-20 Argon-33.2F	
DG	Sun2	12T	8H Sun2-16 Argon-55.2F	
TG	Sun2	18	8H Sun2-12 Argon-8HS-12 Argon-33.2F LowE	
TG	Sun2	18T	8H Sun2-12 Argon-4HS-12 Argon-55.2HS LowE	

Fire resistant glazing units used in fire resistant modules HFS

TG/ DG	Coating	IGU code	Construction Insulating Glass Unit (IGU) (outside - inside)	Visual colour description Insulating Glass Unit (IGU) (outside - inside)
DG	LowE	10U	6H LowE-9Krypton - 5H - Int.6 - 44.2F	
DG	Sun1	11U	6H Sun1-9Krypton - 5H - Int.6 - 44.2F	
DG	Sun2	12U	6H Sun2-9Krypton - 5H - Int.6- 44.2F	

Glazing Unit



Double glazing = DG / Triple glazing = TG	Coating	IGU	Thermal transmittance	Psi value	Thermal transmittance of the entire window in accordance with EN 14351-1		Light transmittance	Solar factor	UV transmittance	Colour rendering index	Direct airborn sound reduction IGU	Acoustic performance window [1),2)]	Rain noise	Total solar energy direct absorbtion	Resistance to pendulum body impact	Resistance to burglary
					area > 2.3 m²	area ≤ 2.3 m²										
		IGU	U_g	ψ	U_W	U_W	τ_v	g	τ_{uv}	R_a	R_w (C, C_{tr})	R_w (C, C_{tr})	Lia	a	Class	Class
		code	W/m²K	W/mK	W/m²K	W/m²K	%	%	%		dB	dB	dB	%	Outside/Inside	Inside
DG	LowE	10	1.1	0.066	1.4	1.5	79	59	1.6	96	37 (-2;-6)	36 (-1;-5)	49	27	1C1/1B1	P2A
DG	LowE	10T	1.0	0.066	1.3	1.4	73	50	0.4	95	41 (-1;-4)	38 (-1;-4)	49	24	1C1/1B1	P2A
TG	LowE	16	0.7	0.080	1.0	1.1	70	50	1.2	95	39 (-3;-8)	37 (-1;-6)	48	32	1C1/NPD/1B1	P2A
TG	LowE	16K	0.5	0.080	0.86/0.87 [3)]	0.96/0.99 [3)]	70	50	1.2	96	42 (-2;-6)	38 (-1;-4)	48	31	1C1/NPD/1B1	P2A
TG	LowE	16T	0.7	0.080	1.0	1.1	70	50	1.2	96	42 (-2;-6)	38 (-1;-4)	48	31	1C1/NPD/1B1	P2A
DG	Sun1	11	1.1	0.066	1.4	1.5	50	28	0.3	91	37 (-2;-6)	36 (-1;-5)	49	41	1C1/1B1	P2A
DG	Sun1	11T	1.0	0.066	1.3	1.4	49	28	0.3	90	41 (-1;-4)	38 (-1;-4)	49	42	1C1/1B1	P2A
TG	Sun1	17	0.7	0.080	1.0	1.1	45	25	0.6	89	39 (-3;-8)	37 (-1;-6)	48	44	1C1/NPD/1B1	P2A
TG	Sun1	17K	0.5	0.080	0.86/0.87 [3)]	0.96/0.99 [3)]	45	25	0.6	90	42 (-2;-6)	38 (-1;-4)	48	44	1C1/NPD/1B1	P2A
TG	Sun1	17T	0.7	0.080	1.0	1.1	45	25	0.6	90	42 (-2;-6)	38 (-1;-4)	48	44	1C1/NPD/1B1	P2A
DG	Sun2	12	1.1	0.066	1.4	1.5	18	17	0.5	87	37 (-2;-6)	36 (-1;-5)	49	59	1C1/1B1	P2A
DG	Sun2	12T	1.1	0.066	1.4	1.5	18	17	0.5	87	41 (-1;-4)	38 (-1;-4)	49	59	1C1/1B1	P2A
TG	Sun2	18	0.7	0.080	1.0	1.1	17	14	0.4	87	39 (-3;-8)	37 (-1;-6)	48	58	1C1/NPD/1B1	P2A
TG	Sun2	18T	0.7	0.080	1.0	1.1	17	14	0.4	88	42 (-2;-6)	38 (-1;-4)	48	58	1C1/NPD/1B1	P2A

Fire resistant glazing units used in fire resistant modules HFS

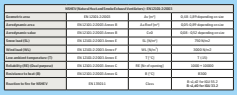
	Coating	IGU	U_g	ψ	U_W Area > 2.3m²	U_W Area ≤ 2.3m²	τ_v	g	τ_{uv}	R_a
		code	W/m²K	W/mK	W/m²K	W/m²K	%	%	%	
DG	LowE	10U	1.0	0.083	1.3	1.4	76	60	–	96
DG	Sun1	11U	1.0	0.083	1.3	1.4	65	40	–	92
DG	Sun2	12U	1.0	0.083	1.3	1.4	57	33	–	90

Notes:
[1)] For product sizes A </= 2.7 m². For product sizes of 2.7m² < A <3.6 m², the sound insulation values must be deducted by 1 dB
[2)] The R_w-value indicates the number of decibels by which a window will reduce apparent noise.
R_w+C is an adjustment factor to account for high frequency noise sources e.g. living activities (talking, music, radio, TV), railway traffic at medium to high speed, road traffic exceeding 80 km/h or a jet aircraft.
R_w+Ctr is an adjustment factor to account for low frequency noise sources e.g. urban road traffic or railway traffic at low speeds.

[3)] HFC/HVC

General notes:
- It is up to the customer to verify the chosen fire reststant glazing unit against the project specific conditions following the national requirement.
- Production height for calculation of climatic load is from 0 to 300 metre above sea level.
- Modules higher than 2400 mm will be delivered with a T-pane.

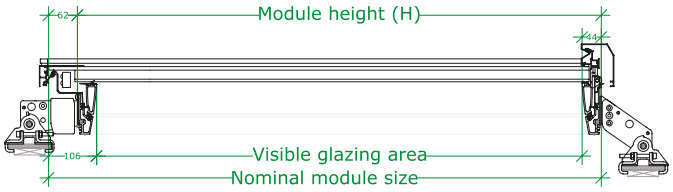
Under normal conditions the free vision trough the glass in a HFS module will not be adversely affected.
The term normal conditions implies that the gel layer may not be allowed to reach temperatures below -10°C or above + 45°C.

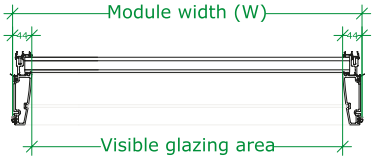


Glazing Area

Calculation of glazing area

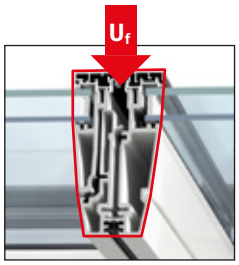
Nominal module size: W x (H + 62 mm) m^2
Visible glazing area: (W – (2 x 44 mm)) x (H – (2 x 44 mm)) m^2





Frame & Sash

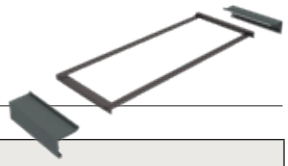
Frame and Sash	
Material	Pultruded composite (approx. 80% fibreglass and 20% polyurethane)
Material thickness	3-4 mm
Surface coating	Waterbased white coating
Colour	RAL 9010, gloss 30



Thermal transmittance of the frame profiles (U_f)	
U_f [1] [W/m^2K]	
Double-glazed	Triple-glazed
1.40	1.25

[1] Calculated in accordance to EN ISO 10077-2:2012 and refers to the joint profiles when modules are combined.

Cladding & Flashing



Cladding	
Material	Aluminium
Material thickness	1.5 mm
Surface	Scratch resistant powder lacquer (60-120 my)
Colour	"Noir 2100 Sable YW" Akzo Nobel

Flashing		
Flashing material	Aluminium	
Material thickness	1 mm	
Surface	Front: PVdf lacquer	Back: polyamid polyester lacquer
Colour	Front: NCS standard colour: S 7500-N (RAL 7043)	

Insulation material	EPS	
Material thickness	10 mm	

Wind and snow stop	Polyurethane foam	

Frame & Sash – Interior Colours

Standard colours

FRAME AND SASH
WHITE

Material: Pultruded composite (approx. 80% fibreglass and 20% polyurethane)
Surface: Waterbased white coating
Colour: RAL 9010, gloss 30

Semi-standard colours – (often used colours but not standard)

FRAME AND SASH
LIGHT GREY

Material: Pultruded composite (approx. 80% fibreglass and 20% polyurethane)
Surface: Waterbased light grey coating
Colour: RAL 7037, gloss 30

FRAME AND SASH
DARK GREY

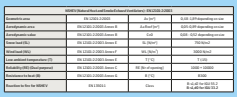
Material: Pultruded composite (approx. 80% fibreglass and 20% polyurethane)
Surface: Waterbased dark grey coating
Colour: RAL 7021, gloss 30

FRAME AND SASH
BLACK

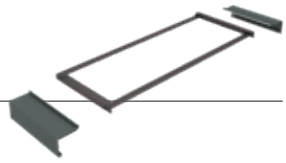
Material: Pultruded composite (approx. 80% fibreglass and 20% polyurethane)
Surface: Waterbased black coating
Colour: RAL 9005, gloss 30

Special colours

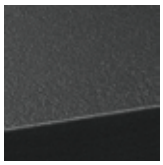
SPECIAL COLOURS
All other colours can be ordered at premium price.
Contact our sales team for more details.



Cladding and Flashing – Exterior Colours



Standard colours



CLADDING
DARK GREY

Material: Aluminium (1.5 mm)
Surface: Scratch resistant powder lacquer
Colour: "Noir 2100 Sable YW" Akzo Nobel (Granite 60)

FLASHING
GREY

Material: Aluminium (1 mm)
Surface: PVdf lacquer
Colour: NCS standard colour: S 7500-N (RAL 7043), gloss 30

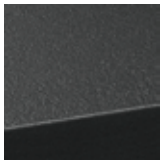
Semi-standard colours – (often used colours but not standard)

CLADDING
WHITE

Material: Aluminium (1.5 mm)
Surface: Scratch resistant powder lacquer
Colour: AA10F Sable (Granite 01)

FLASHING
WHITE

Material: Aluminium (1 mm)
Surface: PVdf lacquer
Colour: RAL 9010, gloss 30



CLADDING
DARK GREY

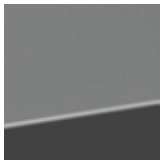
Not a semi-standard colour
Same as our standard colour cladding

FLASHING
DARK GREY

Material: Aluminium (1 mm)
Surface: PVdf lacquer
Colour: RAL 7021, gloss 30

CLADDING
LIGHT GREY

Material: Aluminium (1.5 mm)
Surface: Scratch resistant powder lacquer
Colour: Gris 400 Sable (Granite 20)



FLASHING
LIGHT GREY

Material: Aluminium (1 mm)
Surface: PVdf lacquer
Colour: RAL 7037, gloss 30

CLADDING
BLACK

Material: Aluminium (1.5 mm)
Surface: Scratch resistant powder lacquer
Colour: Noire 900 Sable (Granite 80)

FLASHING
BLACK

Material: Aluminium (1 mm)
Surface: PVdf lacquer
Colour: RAL 9005, gloss 30

Special colours

SPECIAL COLOURS
All other colours can be ordered at premium price.
Contact our sales team for more details.

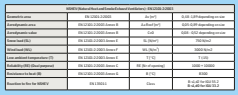
Vapour Barrier Connection Strip

BCX	
Membrane	Polyethylene (PE-LD) 150 µm
Gasket	Welded rubber EPDM seal gasket
Height	200 mm
Length	10,000 mm (10 m)
Classification	BCX is CE-marked in accordance with EN 13984
Permability	Water vapour permeability Sd = 80 m
Reaction to fire	Class E

Chain Actuator

VELUX INTEGRA®	
Material	Anodised aluminium housing with zinc cromate passivated steel chain
Weight	Max 5.5 kg
Control system	VELUX INTEGRA®
Supply cable*	0.3 m silicone cable, 4 cord, 0.75 mm² (white, brown, black, red)
Chain stroke	Up to 410 mm (depending on module size)
Opening speed	4 mm/s
Sound level	TBD
Holding force (tractive)	5000 N (burglary strength) min.
Pressure force	1000 Newton
Tractive force	500 Newton
Operation conditions	-15°C - +76°C, max. 90% relative humidity (not condensing)
Nominal voltage**	24 V DC
Power consumption	Max. 200 W (peak)
Service	It is recommended to carry out a function test of the actuator at least once a year and to make sure that the skylight opens correctly.
CE marking	The product is tested with the VELUX control unit KLC 400 and complies with the EMC directive's requirements for use in residential, commercial and light commercial buildings.
Reservation	The VELUX Group reserves the right to make to technical changes.

* The supply cable is only for connection with VELUX control unit KLC 400.
** Supplied by VELUX control unit KLC 400.



Chain Actuator

Open system	
Material	Anodised aluminium housing with zinc cromate passivated steel chain
Weight	Max 5.5 kg
Control system	MotorLink™ or ±24 V DC*
Supply cable	1.2 m grey silicone cable, 3 cord, 0.75 mm² (white brown green**)
Chain stroke	Up to 700 mm (depending on module size)
Opening speed	HVC ----CB (comfort) 7 mm/s
	HVC ----AB (smoke and comfort) 13 mm/s
Sound level	32 dB (min speed)***
Holding force (tractive)	5000 N (burglary strength) min
Pressure force	1000 Newton* (smoke ventilation: 1300 Newton)
Tractive force	300-1000 Newton
IP rating	IPX4
Operation conditions	-15°C - +76°C, max. 90% relative humidity (not condensing)
Nominal voltage	24 V DC (max 10% ripple)
Voltage	19-32 V DC
Max voltage	32 V DC
Switch-on-duration	ED max 20% (2 minutes per 10 minutes)
Current consumption	HVC ----CB (comfort) max. 2A
	HVC ----AB (smoke and comfort) 2.5 - 5.5A depending on module size, glazing variant and required snow load
Service	It is recommended to carry out a function test of the actuator at least once a year and to make sure that the skylight opens correctly.
CE marking	The product is tested with the original WindowMaster control units and complies with the EMC directive's requirements for use in residential, commercial and light commercial buildings.
Reservation	The VELUX Group reserves the right to make to technical changes.

*At standard ± 24 V DC connection maximum distances from venting skylight to power supply in accordance to calculation:

$$\text{Max cable length} = \frac{\text{(admissible voltage drop (UL) x conductivity of copper (56) x cable cross-section (a))}}{\text{(total max. actuator current (I) in amps x 2)}}$$

At MotorLinkTM (3 cord) connection maximum distances from roller blind to motor controller (power supply) is 50 m.
**Green = communication wire
*** The sound level can vary depending on the opening speed and building conditions

Preconditions for drive time for comfort ventilation

When using a smoke ventilation skylight module HVC AB for comfort ventilation, it must be ensured that the comfort opening is in accordance with the tables on pages 80-81 of the Technical Handbook.

The chain stroke for comfort opening function must be limited accordingly by the control system time to prolong the lifetime expectancy of the modules, and for example can be done by limiting the drive time in most simple control setup.

The provided drive times to the right are examples valid for the default strongest motor variant N1300.

When a lower power consumption motor variant is configured and used, the chain will travel at a lower speed depending in the size of the module. Therefore, in these situations the appropriate drive time to reach the comfort opening must be established by the installer of the control system and set accordingly.

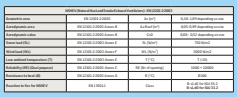
Maximum drive time for comfort ventilation (HVC ---AB)		
Module length	Chain stroke [mm]	Drive time [sec]
800	353	27
1000	410	32
1200	410	32
1400	410	32
1600	410	32
1800	410	32
2000	410	32
2200	410	32
2400	410	32
2600	410	32
2800	410	32

Control System

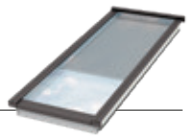
KLC 400	
Material and colour	Black fire resistant polycarbonate
Size and weight	Product including packaging: 587 mm x 80 mm x 166 mm (W x H x D) 2.0 kg Control unit: 380 mm x 36 mm x 87 mm (W x H x D) 1.5 kg
Installation	24 V DC SELV class III construction output. The control unit is for use in small/medium installations with VELUX modular skylights. The control unit is installed under the front flashing of VELUX modular skylights and functions at temperatures between -15°C and +50°C. ta = 40°C The control unit is equipped with a 7.5 m (EU) / 2.2 m (UK) 2-core cable (2 x 1.5 mm² H05VV-F) and plug for connection to the mains supply. Radio frequency range: 300 m range open field. Depending on the building construction, the indoor range is approximately 30 m.
IP rating	IPX4
Power supply characteristics	Primary side: 230/240 V AC - 50 Hz / 200W Secondary side: 24 V DC - 5 A class III construction output.
Connection	The control unit is only to be used with VELUX modular skylights and VELUX roller blinds RMM. The control unit can supply power to one venting skylight module and/or up to four roller blinds RMM. The connection wires are pre-fitted with wire-to-wire connectors. The connection wire to the chain actuator may not be extended.
Compatibility	KLC 400 is based on radio frequency (RF) technology and signals are transmitted in the 868 MHz range. It can be used with VELUX modular skylights chain actuator and roller blinds RMM. VELUX electrical products connected to KLC 400 can be operated by io-homecontrol® compatible activation controls.
CE marking	CE-marked to indicate that it is in accordance with the following EU directives: CPR, LVD, MD, RoHS, WEEE, R&TTE, Packaging waste directive and EMC for household, trade and light industry. Combinations of VELUX electrical products meet the requirements of above-mentioned directives.
Note	The VELUX Group reserves the right to make technical changes.

KLR 200	
Material and colour	ABS, white (NCS S 1000-N), black (RAL 9005) and metallic grey
Size and weight	Product including packaging: 235 x 153 x 48 mm (W x H x D), 250 g Control pad: 95 x 95 x 23 mm (W x H x D), 180 g
Use	For indoor use, maximum ambient temperature 50°C Radio frequency range: 200 m range open field. Depending on the building construction, the indoor range is approximately 20 m Maximum number of products is 200*
Battery requirement	3 x Alkaline AA (1.5 V) batteries Expected battery lifetime: Approximately 1 year
Compatibility	Based on radio frequency (RF) technology, transmitted in 868 MHz range. Compatible with products with the io-homecontrol® logo. Can be used with all VELUX INTEGRA® and VELUX INTEGRA® Solar products.
CE marking	CE-marked to indicate that it is in accordance with the following EU directives: CPR, LVD, MD, RoHS, WEEE, R&TTE, Packaging waste directive and EMC for household, trade and light industry. Combinations of VELUX electrical products meet the requirements of above-mentioned directives.
Note	This product has been designed for use with genuine VELUX products. The connection to other products may cause damage or malfunction. The VELUX Group reserves the right to make technical changes.

* Maximum recommended number of products is 100 and for daily use it is 50.



Roller Blind



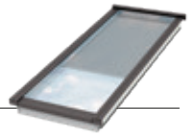
VELUX INTEGRA® and Open System		
Materials (visible parts)	Fabric	Polyester
	Wire	Stainless steel
	Bottom rail	Anodized aluminium
	Top pulley wheels	Stainless steel
Colours (cloth)	Grey, white and black (silver on the backside of the black)	
Weight	Max 3.4 kg	
Installation	Please see installation instructions	
Combability	All VELUX modular skylights with VELUX INTEGRA® control system and ±24 V DC control systems	
Control system	VELUX INTEGRA® or ±24 V DC	
Supply cable	0.2 m cable, 2-core, 0.75 mm² (white, brown)	
RMM cable on skylight module*	0.35 - 1.35 m cable, 3-core, 0.75 mm² (white, brown, green**)	
Running speed	70 mm/sec.	
IP rating	IPX0	
Sound level	< 70 dB	
Operating conditions	-5°C - +75°C, max. 90% relative humidity (not condensing)	
Nominal voltage	24 V DC (max 10% ripple)	
Voltage	19-24 V DC	
Switch-on-duration	ED max 20% (2 minutes per 10 minutes)	
Electric current requirement	Max 1A	
Service	It is recommended to carry out a function test of the roller blind at least once a year and to make sure that the roller blind runs correctly.	
CE marking	The product is tested with genuine VELUX control units and a ±24 V DC control system and complies with the EMC directive's requirements for use in residential, commercial and light commercial buildings.	
UL approval	VELUX roller blind RMM is approved in accordance to UL 325, Door, Drapery, Gate, Louver, and Window Operators and Systems.	
Reservation	The VELUX Group reserves the right to make to technical changes.	

* For Open system ± 24 V DC connection, the maximum distance from roller blind to power supply is in accordance to the following calculation:

$$\text{Max. cable length} = \frac{\text{admissible voltage drop (UL) x conductivity of copper (56) x cable cross-section (a)}}{\text{total max. actuator current (I) in amps x 2}}$$

** Green cable has no function

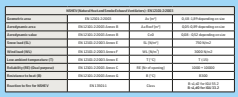
Roller Blind



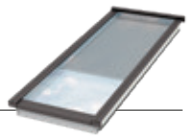
Roller blind cloth properties			
Colour	White (8806)	Grey (8805)	Black (8807)
Radiation properties without glazing unit (%)			
Light transmittance in visible light spectrum (tau, v)	36%	10%	1%
Light transmittance in full light spectrum (tau, e)	35%	22%	3%
Light reflectance in full light spectrum (rho, e)	59%	45%	53%
Light absorption in full light spectrum (alpha, e)	6%	33%	44%
Reaction to Fire			
Norm	Class		
EN 13501-1	B, s1-d0		
DIN 4202-1	B1		
NF P 92 503 -507	M1		

Roller blind effects on double-glazing unit (%)									
Glazing variant	10			11			12		
	g-value	t-value	Fc-value	g-value	t-value	Fc-value	g-value	t-value	Fc-value
Without RMM	59%	79%	100%	28%	50%	100%	16%	19%	100%
With RMM									
White (8806)	34%	30%	58%	17%	20%	61%	12%	8%	75%
Grey (8805)	41%	8%	69%	21%	5%	75%	14%	2%	88%
Black (8807)	35%	1%	59%	18%	1%	64%	12%	1%	75%

Roller blind effects on double-glazing unit (%)									
Glazing variant	10T			11T			12T		
	g-value	t-value	Fc-value	g-value	t-value	Fc-value	g-value	t-value	Fc-value
Without RMM	49%	67%	100%	28%	49%	100%	16%	19%	100%
With RMM									
White (8806)	31%	27%	63%	17%	20%	61%	12%	8%	75%
Grey (8805)	37%	7%	76%	21%	5%	75%	14%	2%	88%
Black (8807)	32%	1%	65%	18%	1%	64%	12%	1%	75%



Roller Blind



Roller blind effects on triple-glazing unit (%)									
Glazing variant	16			17			18		
	g-value	t-value	Fc-value	g-value	t-value	Fc-value	g-value	t-value	Fc-value
Without RMM	50%	70%	100%	25%	45%	100%	14%	17%	100%
With RMM									
White (8806)	31%	27%	62%	16%	18%	64%	10%	7%	71%
Grey (8805)	37%	7%	74%	20%	5%	80%	12%	2%	86%
Black (8807)	33%	1%	66%	17%	1%	68%	11%	1%	79%

Roller blind effects on triple-glazing unit (%)									
Glazing variant	16T / 16K			17T / 17K			18T		
	g-value	t-value	Fc-value	g-value	t-value	Fc-value	g-value	t-value	Fc-value
Without RMM	50%	70%	100%	25%	45%	100%	14%	17%	100%
With RMM									
White (8806)	32%	28%	64%	16%	19%	64%	11%	7%	79%
Grey (8805)	38%	7%	76%	20%	5%	80%	12%	2%	86%
Black (8807)	33%	1%	66%	17%	1%	68%	11%	1%	79%

g-value:
"The total transmitted fraction of the incident solar radiation consisting of direct transmitted solar radiation and the part of the absorbed solar radiation transferred by convection and thermal radiation to the internal environment."
(EN 13363-2)

"The fraction of the incident solar radiation that is totally transmitted by the glass." (EN 410)

The g-value (total solar energy transmittance) is a measure of how much solar energy is transmitted through the construction in the cooling period.

The g-value is defined as the ratio between the solar energy transmitted through the glazing and the incident solar factor on the glazing.

T-value:
"The transmitted fraction of the incident solar radiation in the visible part of the solar spectrum, see EN 410."
(EN 13363-2)

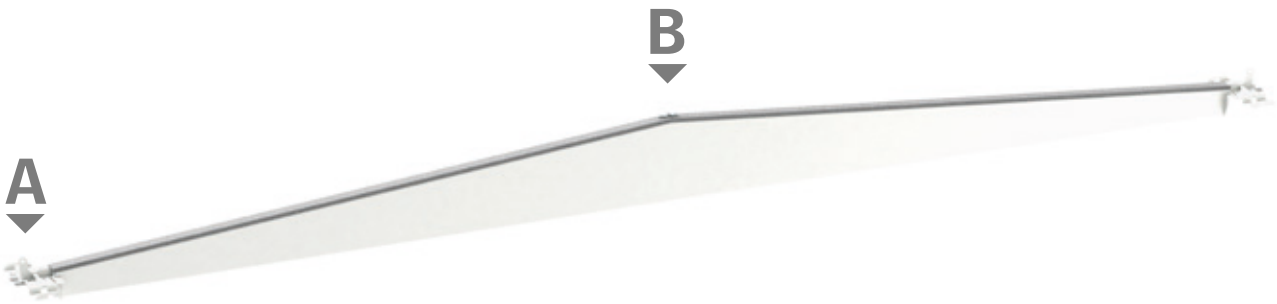
"The fraction of incident light that is transmitted by the glass."
(EN 410)

Fc-value:
"The shading factor, F_C-value, is the ratio of the solar factor of the combined glazing and solar protection device, g_{tot}, to that of the glazing alone, g. $F_C=g_{tot}/g$.

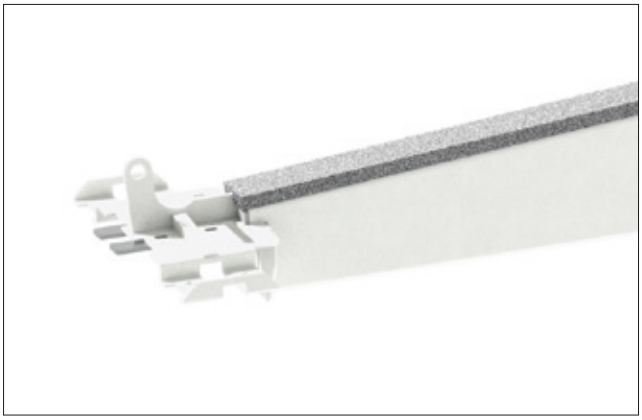
Note: in some countries, F_C is known as z." (EN 14501)

Beam for Ridgelight at 5°

Beam for Ridgelight at 5°	
Material	Steel
Material thickness	3 mm
Construction	Hollow beam
Surface	White RAL 9010
Foam gasket on beam	15 mm



A



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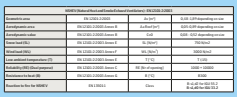
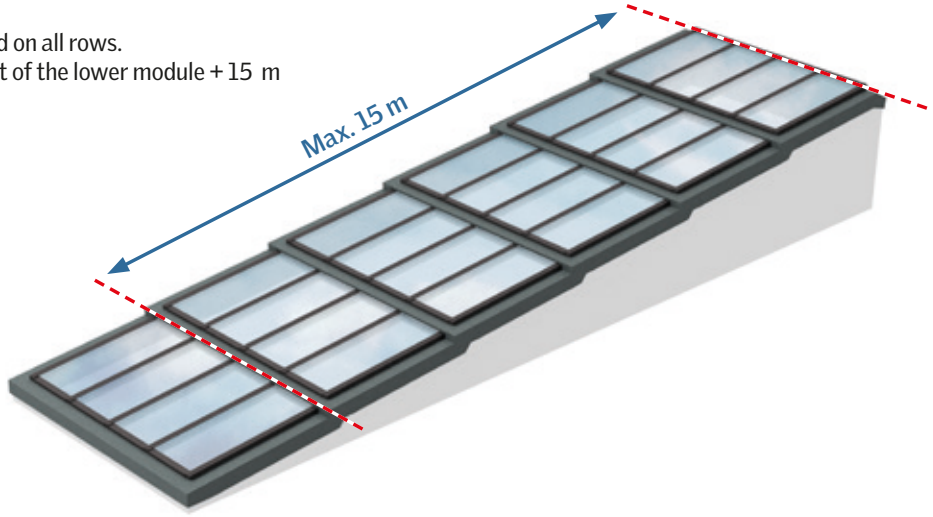
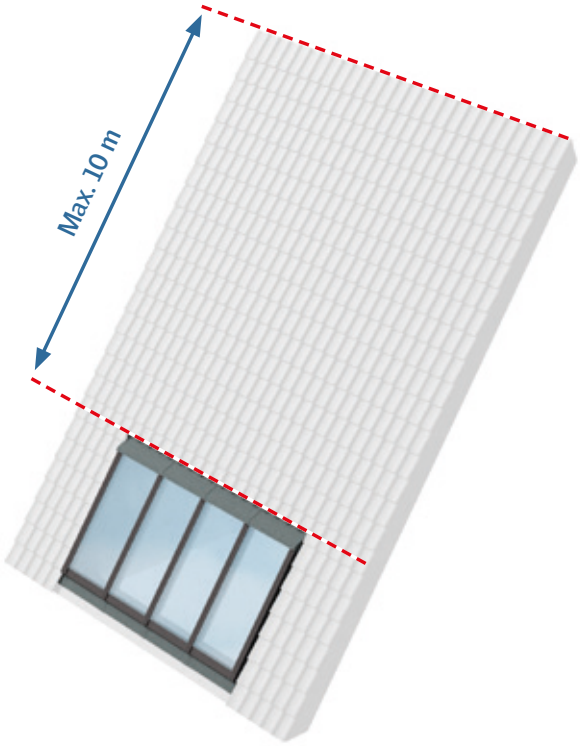


Water Pressure & Drainage

Additional information on water pressure and drainage on a Step solution
Please observe:
- Same installation pitch is required on all rows.
- Max. number of rows is the height of the lower module + 15 m



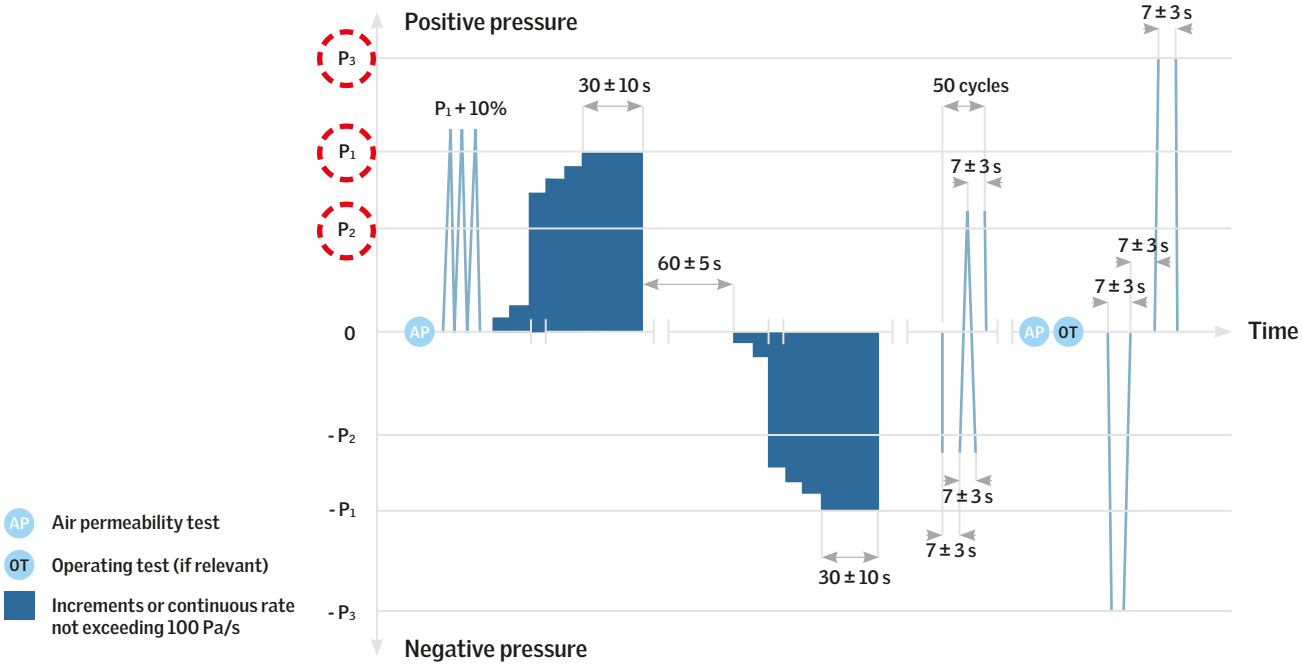
Additional information on water pressure and drainage on a Northlight
Please observe max. 10 m distance above the skylight module, when installed in a sloping roof.



Additional information on water pressure and drainage on a Wall-mounted Longlight
Please observe a max. 3 m wall height above skylight module.

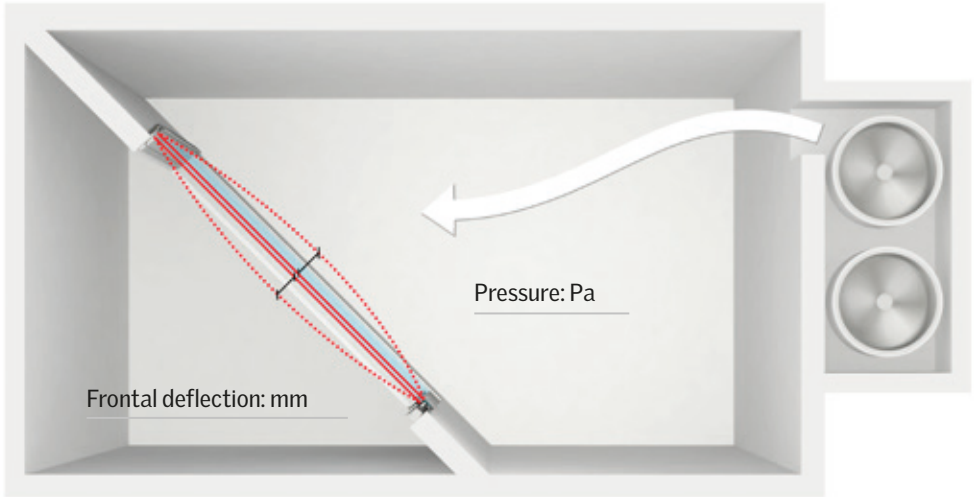
Resistance to Wind Load

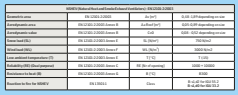
Test method: EN 12211



VELUX modular skylights: Class C5

P_1 : 2000 Pa
P_2 : 1000 Pa
P_3 : 3000 Pa





Resistance to Wind Load

Classification: EN 12210

Classification of wind load			
Class	**P1**	**P2[1)]**	**P3**
0		not tested	
1	400	200	600
2	800	400	1200
3	1200	600	1800
4	1600	800	2400
5	2000	1000	3000
Exxxx[2)]	xxxx		

[1)] Pressure repeated 50 times.
[2)] Specimen tested with wind load above class 5, classified Exxxx – where xxxx is the actual test pressure P1 (e.g. 2350 etc.)

Classification of relative frontal deflection	
Class	**Relative frontal deflection**
A	< l/150
B	< l/200
C	< l/300

[1)] Pressure repeated 50 times.
[2)] Specimen tested with wind load above class 5, classified Exxxx – where xxxx is the actual test pressure P1 (e.g. 2350 etc.)

Classification of resistance to wind load			
Wind load class	**A**	**B**	**C**
1	A1	B1	C1
2	A2	B2	C2
3	A3	B3	C3
4	A4	B4	C4
5	A5	B5	C5
Exxxx	Aexxxx	Bexxxx	Cexxxx

Note: In resistance to wind load classification, the number refers to the wind load class, see table 1 and the letter to the relative frontal deflection, see table 2

VELUX modular skylights: Class C5

- Frontal deflection measured at P1: 2000 Pa is less than L/300.
- 50 cycle pressure test P2: 1000 Pa
- After that repeated air permeability test passed

Safety test done at P3: 3000 Pa passed with no released part

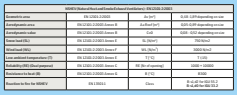
Reaction to Fire

Test method: EN ISO 11925-2, EN 13823

Reaction to fire classes for building products (excl. floorings)							
Main class	Smoke class	Burning droplets class	Requirements according to			FIGRA	
			Non comb	SBI	Small flame	W/s	
A1	-	-	x	-	-	-	Non combustible
A2	s1 - s3	d0 - d2	x	x	-	≤ 120	
B	s1 - s3	d0 - d2	-	x	x	≤ 120	
C	s1 - s3	d0 - d2	-	x	x	≤ 250	
D	s1 - s3	d0 - d2	-	x	x	≤ 750	
E	-	- or d2	-	-	x	-	
F	-	-	-	-	-	-	No performance determined

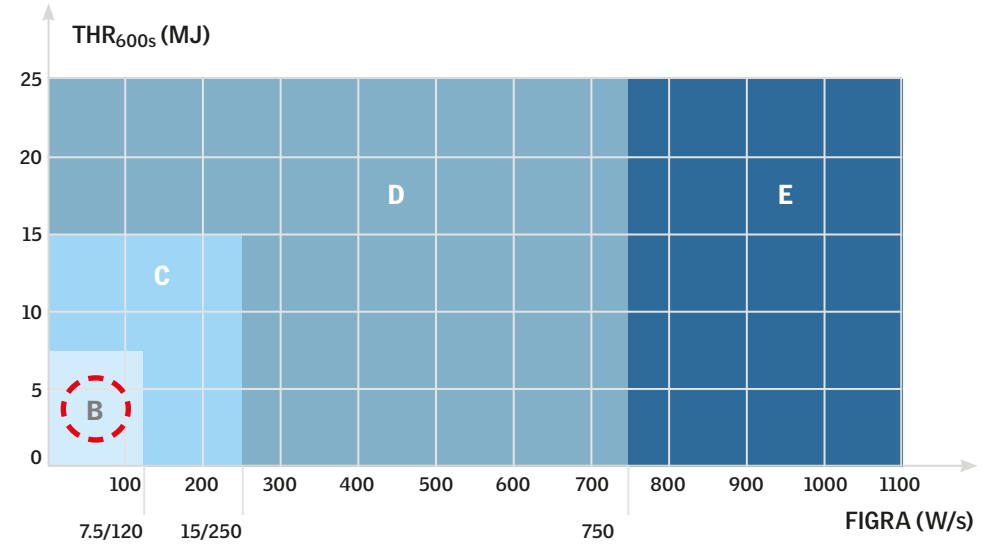
[1] The test is a corner basket test, which shows how much the product contributes to the development of fire.

Internal fire spread and smoke contribution.

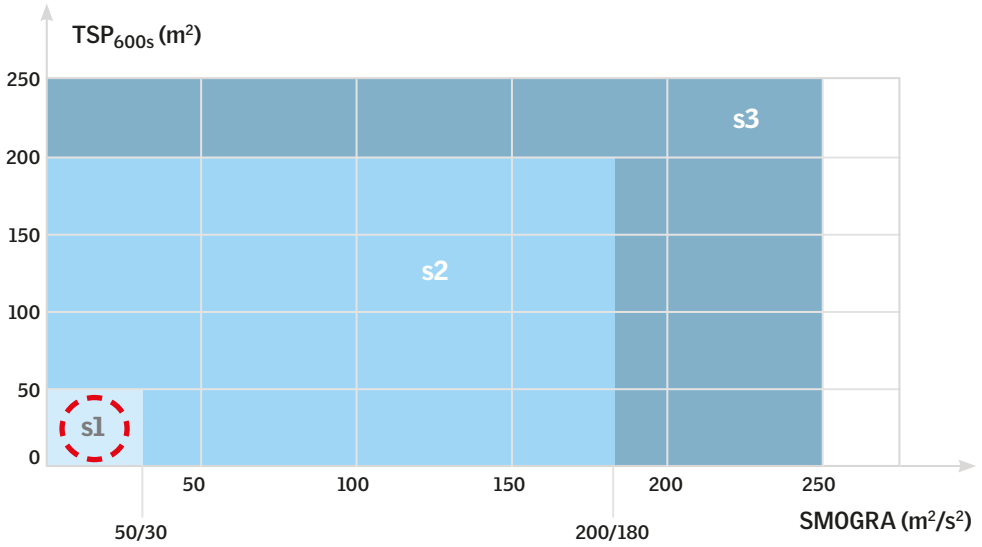


Reaction to Fire

Classification: EN 13501-1



Smoke sub-class



CLASSIFICATION
A1, A2, B: Non-combustable and not very combustable product. Over 20 minutes to flashover.
C: Moderate combustable products. Between 10 and 20 minutes to flashover.
D: Moderate combustable products. Between 2 and 10 minutes to flashover.
E: Moderate combustable products.
F: Highly combustable products (or products whose reaction to fire has not been assessed).

SUB-CLASS
s1: Low smoke production.
s2: Medium smoke production.
s3: High smoke production.

FLAMING DROBLETS SUB-CLASSIFICATION
d0: No flaming droplets.
d1. Flaming droplets that persist for less than 10 s.
d2: Flaming droplets.

VELUX modular skylights:

Class B, s1-d0 or d2

B: Very low combustibility
(A: Incumbustable eg steel and concrete)

s1: Lowest smoke volume
d0: No droplets in T-pane variants
d2: Droplets in standard pane variant

Resistance to Fire

Test method: EN 1365-2

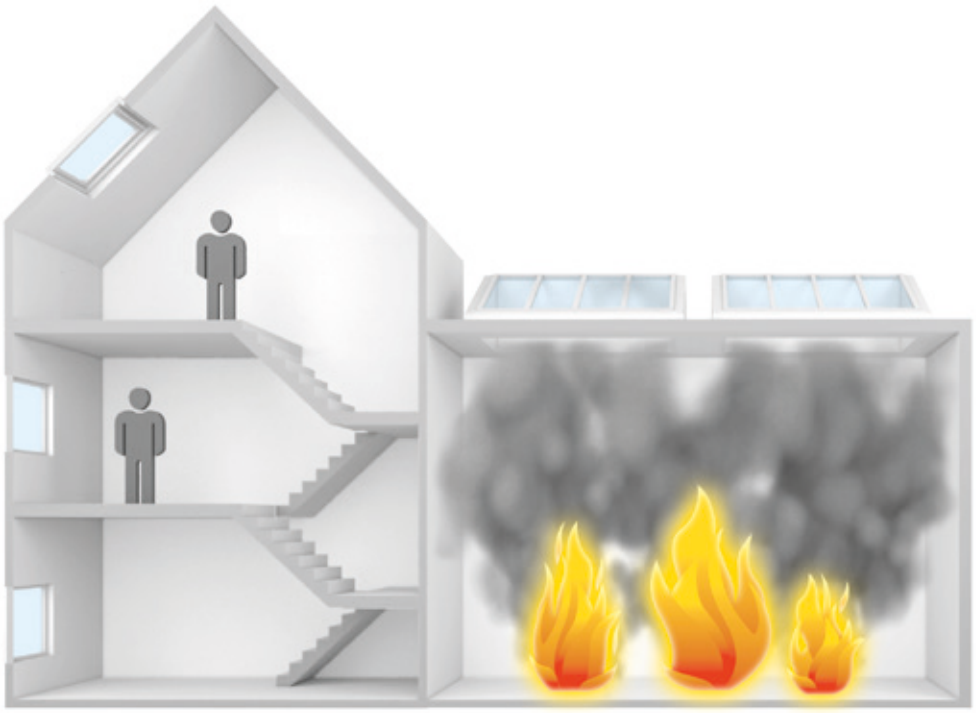
Fixed modules: EN 1365-2 Fire resistance tests for loadbearing elements - Part 2: Floors and roofs*

* In accordance with EN 1365-2, 1, which is the relevant standard for fixed modular skylights, roofs can be roof constructions incorporating glazed elements.

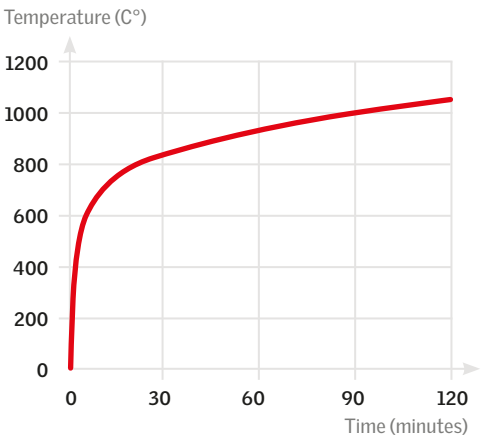
Under fire conditions, certain elements and windows can be required to remain satisfactory fire barriers depending on national and local requirements.

The tests assess how satisfactory fire barriers the modules are in the defined test conditions.

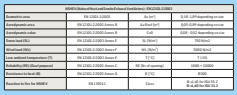
More simply, the tests assess the length of time the modules can effectively keep the fire inside the burning compartment.



Temperature in the furnace



Modules on the furnace



Resistance to Fire

Classification: EN 13501-2

Presentation of classification
Performance Characteristics – Designatory letters and pass criteria
The classification shall be presented according to the following template

Presentation of classification		
Load bearing capacity	Integrity	Insulation
R	E	I

R- Load bearing capacity (not applicable on venting modules, only on fixed)
Withstanding fire exposure without loss of mechanical stability

E- Integrity
No cracks or openings in excess of given dimension
No ignition of a cotton pad on the unexposed side
No flames sustained on the unexposed side

I- Insulation
Maximum temperature rise on unexposed side not exceeding 180°
Mean temperature rise on unexposed side not exceeding 140°C

Please note that there are further characteristics that are defined in the standard, however these are not relevant for VELUX modular skylights.

Classification periods
All classification periods against any of the characteristics must be declared in minutes, using one of the periods: 10, 15, 20, 30, 45, 60, 90, 120, 180, 240 or 360. Note that not all the periods apply to all elements.

Declaration of performance
Combination of the designatory letters as appropriate shall be used as a part of the classification of performance. They shall be supplemented by time in the elapsed completed minutes of the nearest lowest class during which the functional requirements are satisfied.

VELUX modular skylights:

Fixed module (HFS): REI30

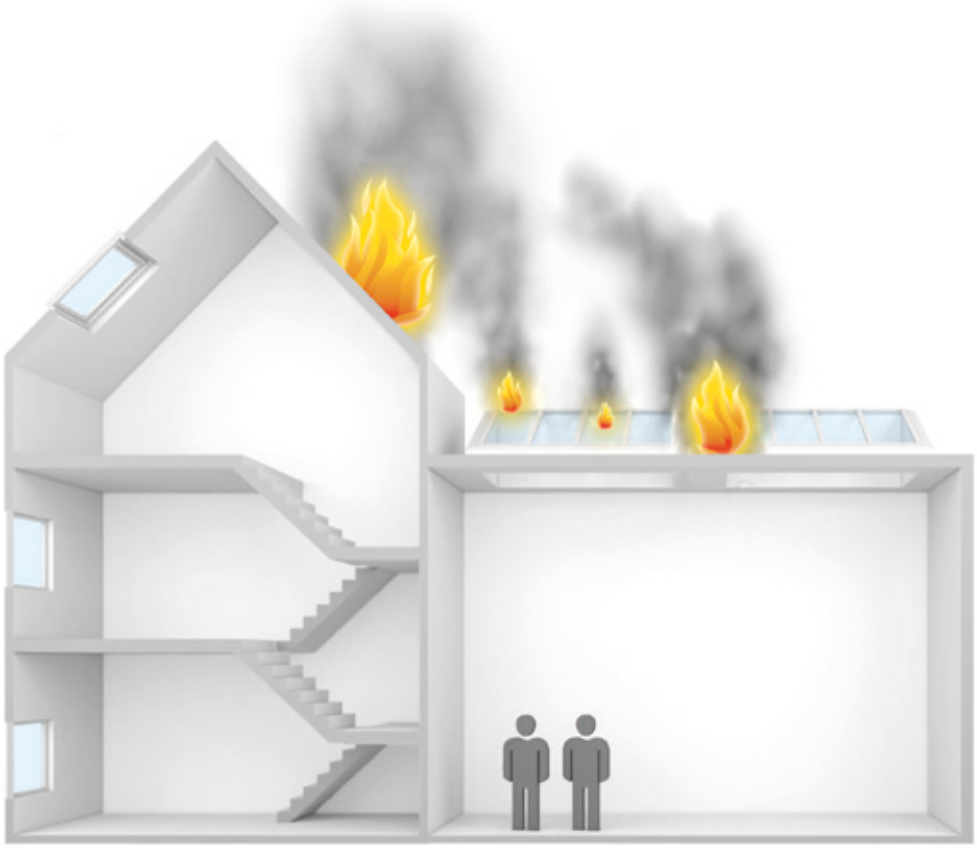
For more information on fire resistant skylight module HFS, see pages 70 and 88.

External Fire Performance

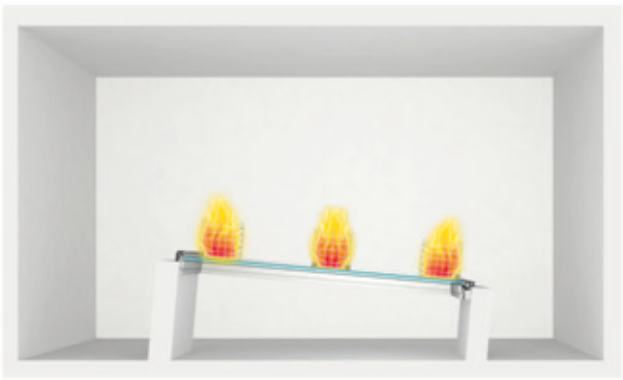
Test method: TS 1187 - External fire exposure to roofs*

* In accordance with EN 14351-1, TS1187 test methods T1 and T4 must be used to determine the external fire performance of roof windows.

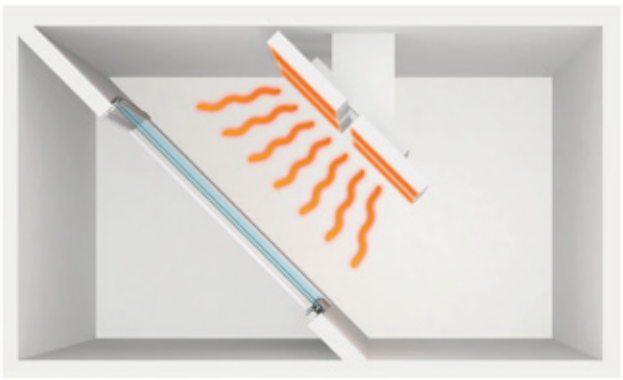
The tests assess the fire spread across the external surface of the roof*, the fire spread within the roof*, the fire penetration and the production of falling droplets or debris falling from the underside of the roof*.

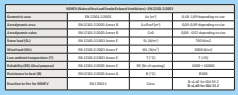


Test 1 – with burning brands



Test 4 - two stages incorporating burning brands, wind and supplementary radiant heat





External Fire Performance

Classification: EN 13501-5 + A1

Test 1

Class	Classification criteria
B_{ROOF} (t1)	All of the following conditions must be satisfied for all tests: – external and internal fire spread upwards < 0.700 m – external and internal fire spread downwards < 0.600 m – maximum burned length external and internal < 0.800 m – no burning material (droplets or debris) falling from exposed side – no burning/glowing particles penetrate the roof construction – no single through opening > 25 mm^2 – sum of all spreed opening < 4500 mm^2 – lateral fire spread does not reach the edges of the meassuring zone – no internal glowing combustion – maximum radius of fire spread on flat roofs, external and internal < 0.200 m
F_{ROOF} (t1)	No performance determined.

Test 4

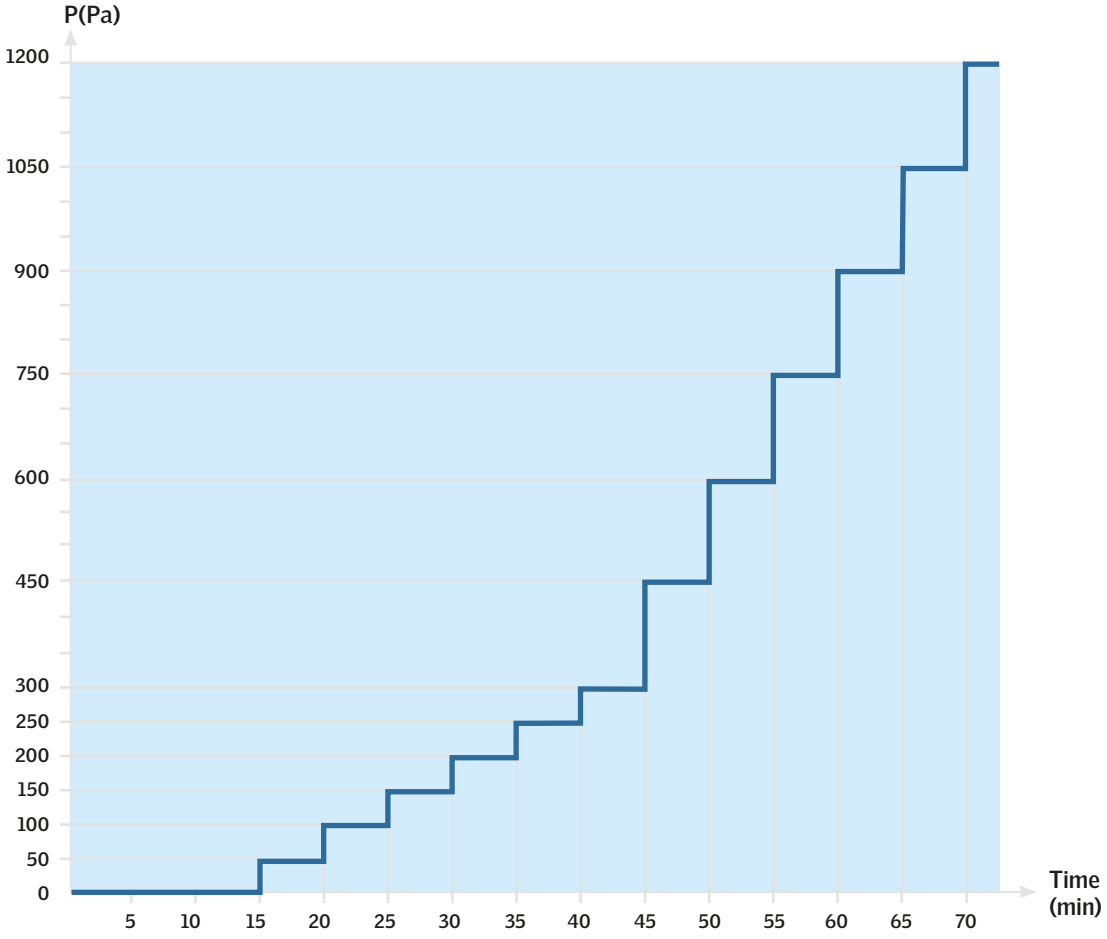
Class	Classification criteria
B_{ROOF} (t4)	– No penetration of roof system within 1 h. – In preliminary test, after withdrawal of the test flame, specimens burn for < 5 min. – In preliminary test, flame spread < 0.38 m across region of burning.
C_{ROOF} (t4)	– No penetration of roof system within 30 min. – In preliminary test, after withdrawal of the test flame, specimens burn for < 5 min. – In preliminary test, flame spread < 0.38 m across region of burning.
D_{ROOF} (t4)	– Roof system is penetrated within 30 min but is not penetrated in the preliminary test. – In preliminary test, after withdrawal of the test flame, specimens burn for < 5 min. – In preliminary test, flame spread < 0.38 m across region of burning.
E_{ROOF} (t4)	– Roof system is penetrated within 30 min but is not penetrated in the preliminary test. – Flame spread is not controlled.
F_{ROOF} (t1)	No performance determined.

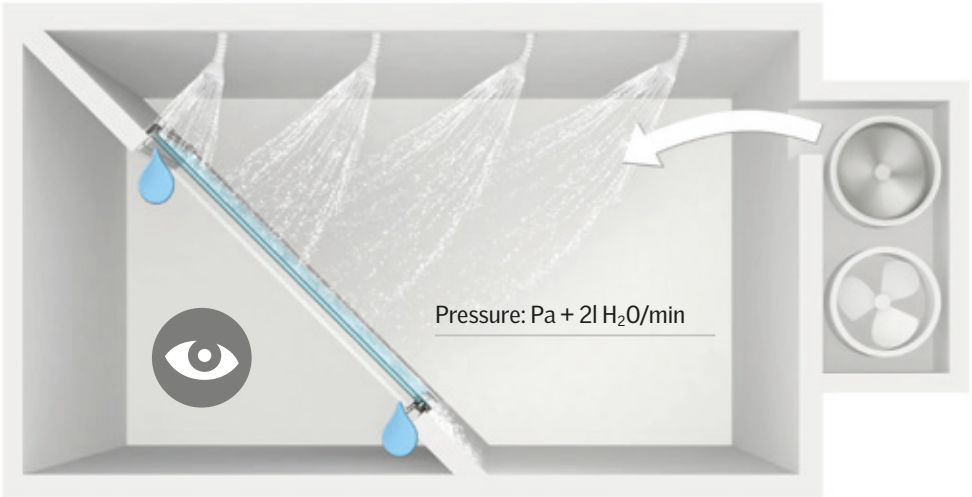
VELUX modular skylights

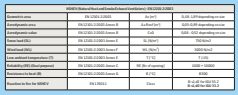
B_{ROOF} (t1)
B_{ROOF} (t4)

Watertightness

Test method: EN 1027







Watertightness

Classification: EN 12208

Watertightness		
Classification	**Presure (Pa)**	**Wind (Km/h)**
1 A	0	0
2 A	50	32
3 A	100	45
4 A	150	55*
5 A	200	63
6 A	250	71
7 A	300	78
8 A	450	95
9 A	600	110
E750	750	123**
E900	900	134
E1050	1050	145
E1200	**1200**	**155**

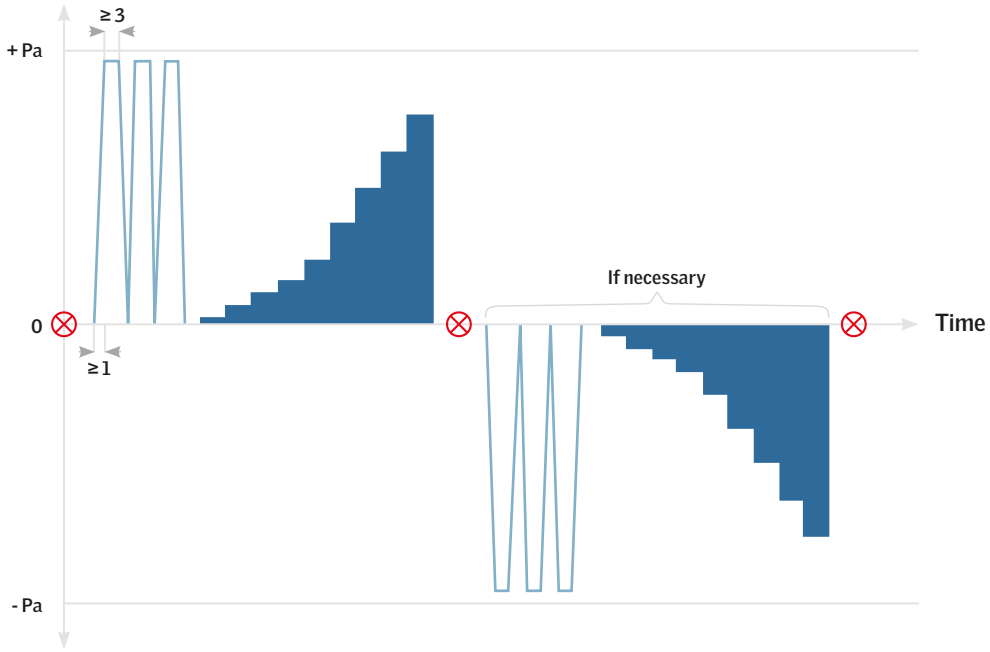
* Equal to depression
** Equal to tropical storm

VELUX modular skylights: E1200

No water penetration up to 1200 Pa.
1200 Pa equals 155 Km/h.

Air Permeability

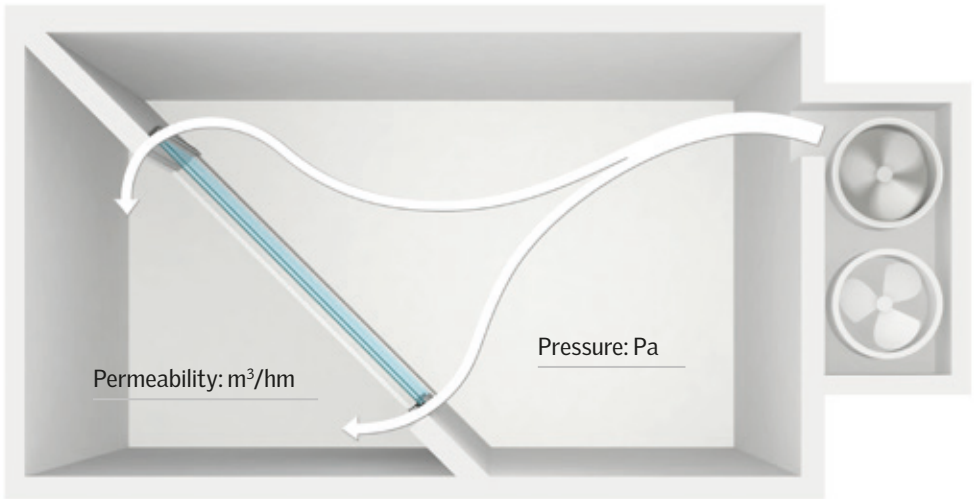
Test method: EN 1026

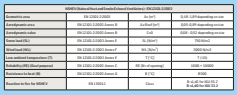


⊗ Opening and closing

Test Pressure

150 Pa - Class 1
300 Pa - Class 2
600 Pa - Class 3, 4





Air Permeability

Classification: EN 12207

Class 1

- Lowest tightness
- Highest heat loss

Class 2

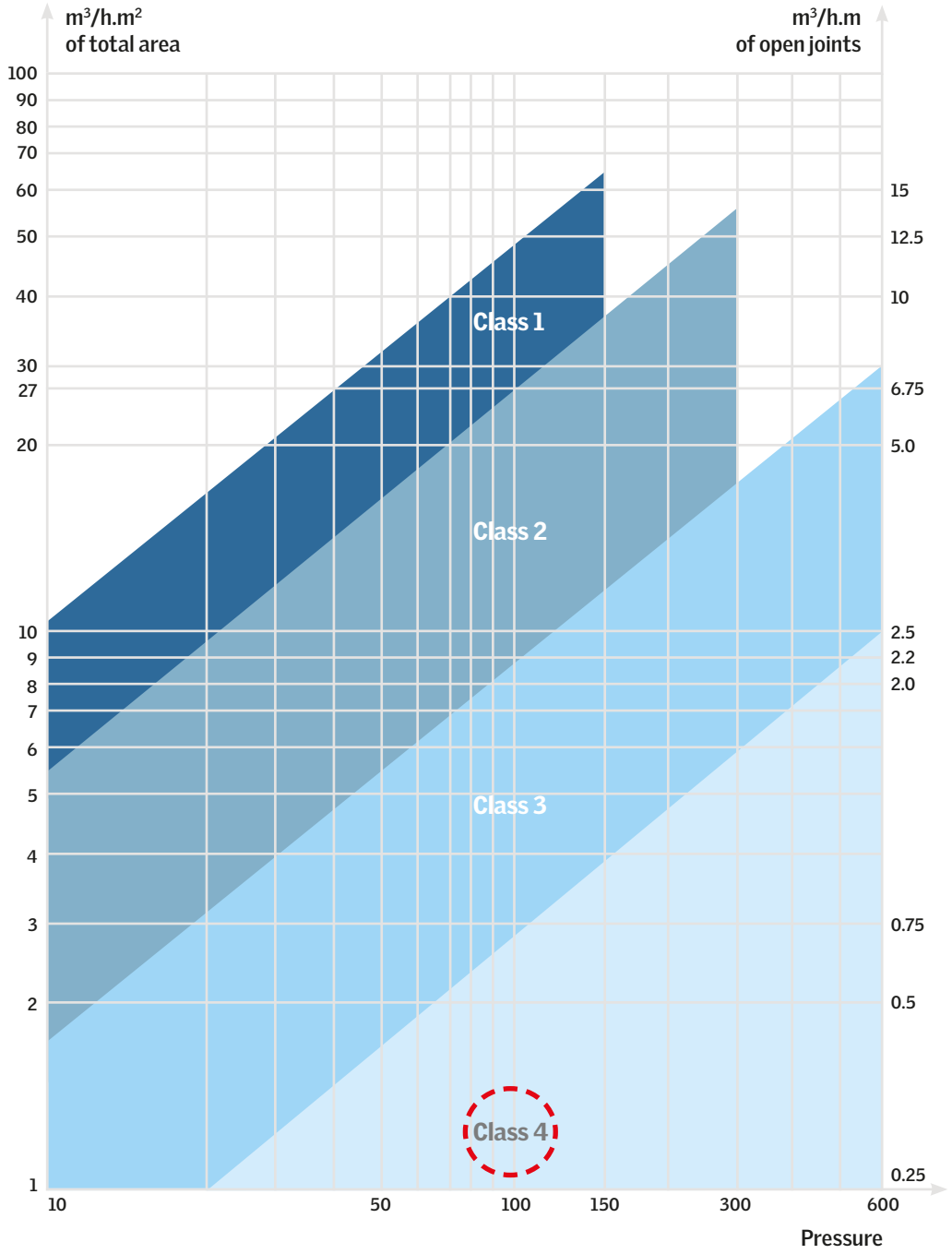
- Moderate tightness
- High heat loss

Class 3

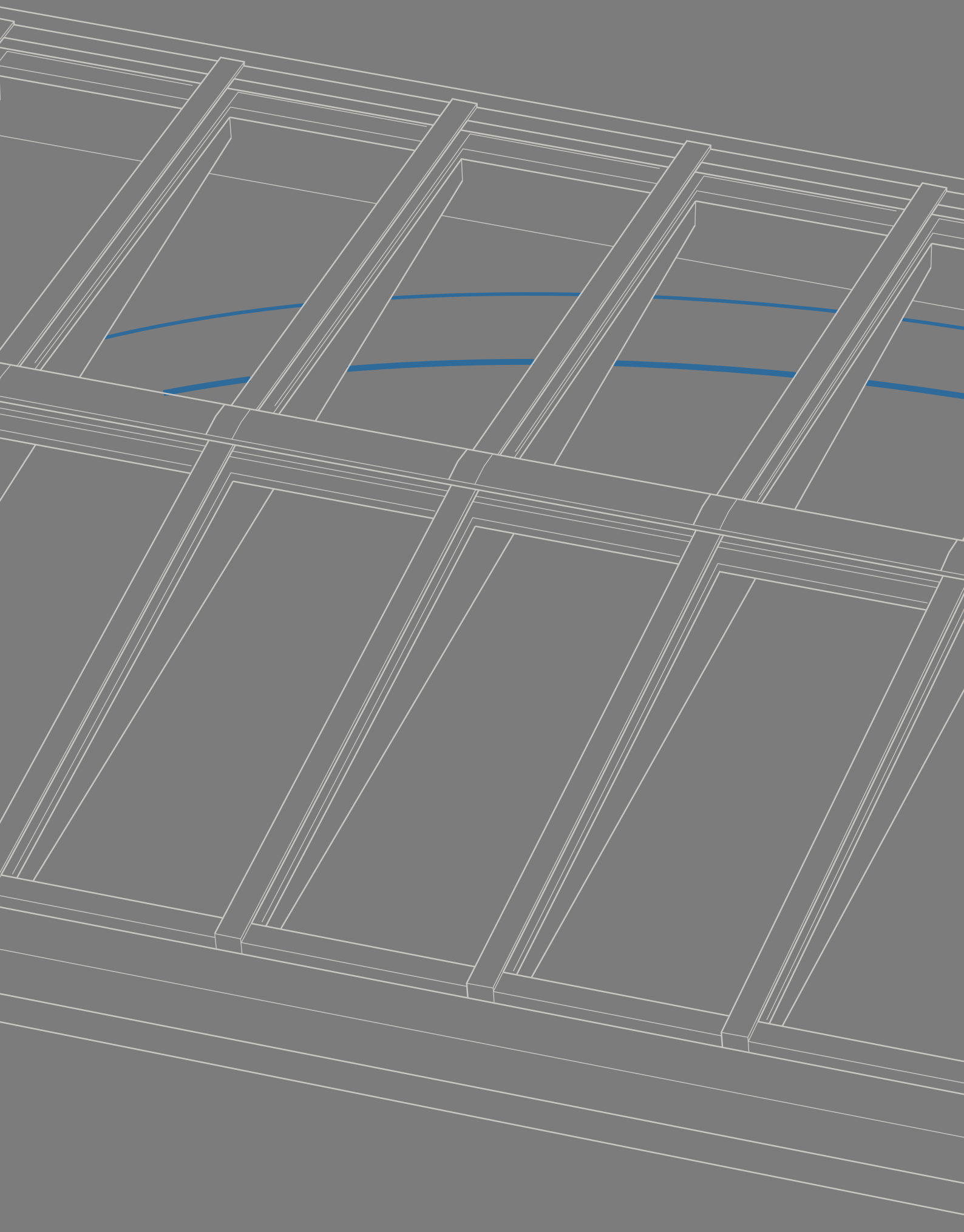
- Advanced tightness
- Low heat loss

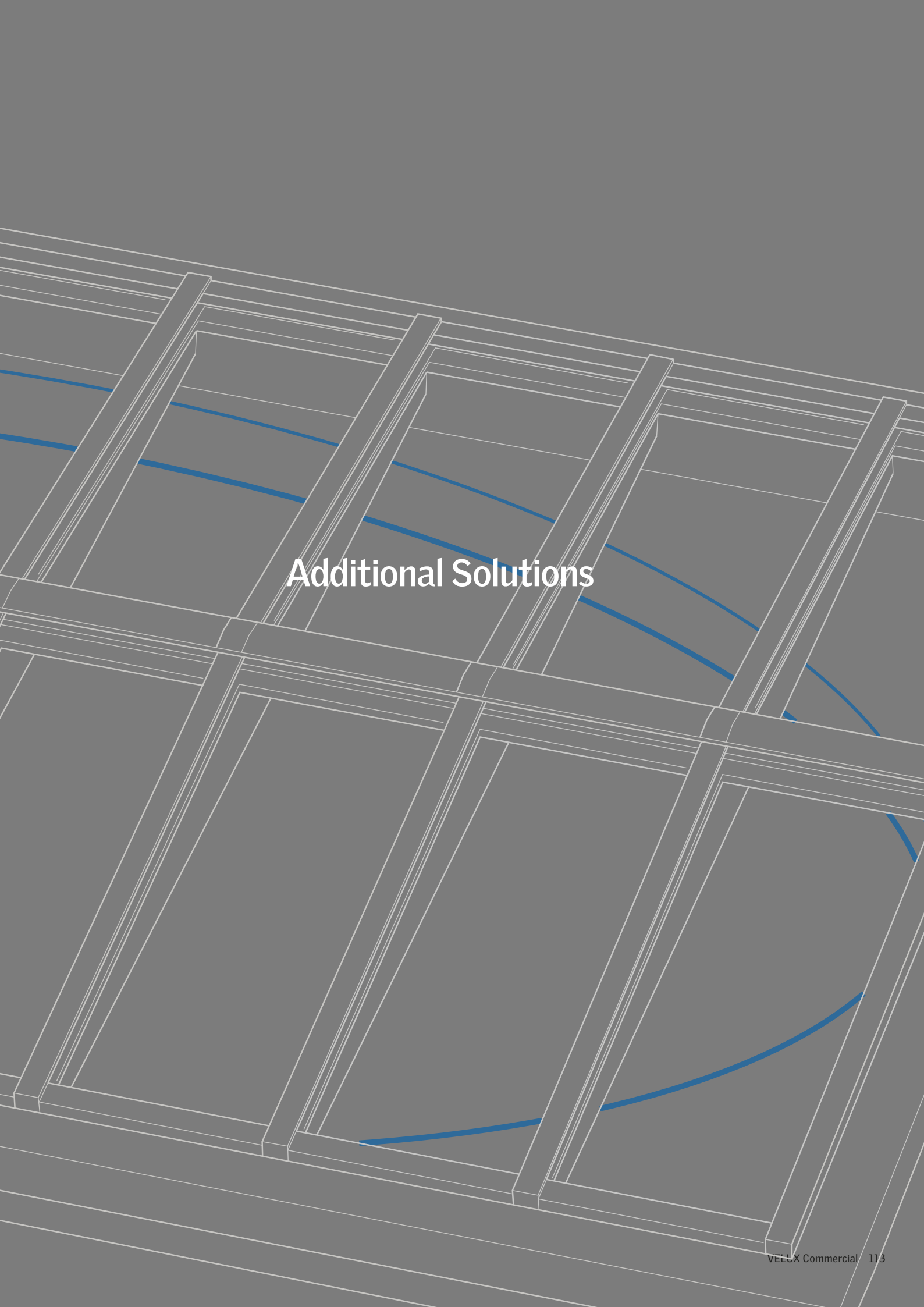
Class 4

- Highest tightness
- Lowest heat loss



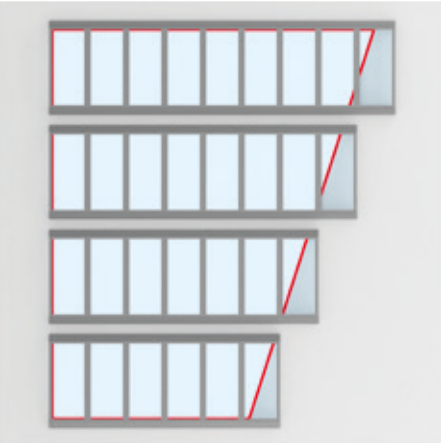
VELUX modular skylights: Class 4





Additional Solutions

Shaped Solution with Adaption of Lining



Atrium Longlight
Internal lining
Roof

Atrium Longlight
Internal lining
Roof

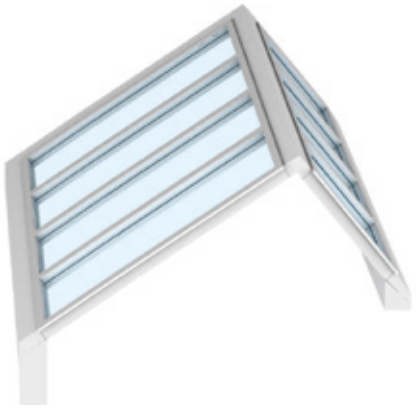
Feature	Advantage	Benefit
By adapting the internal lining, it is possible to build a shaped skylight with standard skylight modules.	By using standard skylight modules on non-square roof designs, the architects will not have to compromise the wishes for the interior design. The solution can be combined with venting modules and internal roller blinds.	Using standard products with standard installation principles gives high security in the design and building process. Installing venting modules and roller blinds gives a better indoor climate.

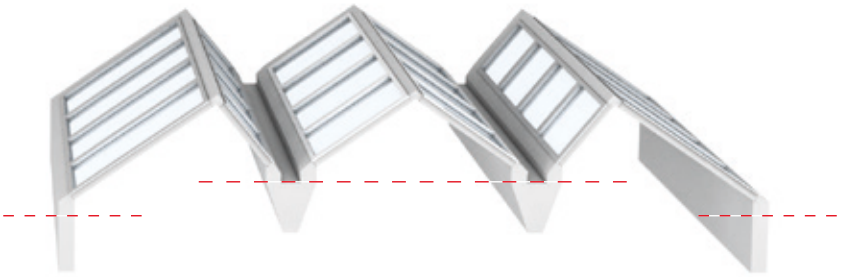
Shaped Solution with Oval Lining

Ridgelight
Internal lining
Roof

Feature	Advantage	Benefit
By adapting the internal lining, it is possible to build a shaped skylight with standard skylight modules.	By using standard skylight modules on non-square roof designs, the architects will not have to compromise the wishes for the interior design.	Using standard products with standard installation principles gives high security in the design and building process. The solution can be combined with internal roller blinds.

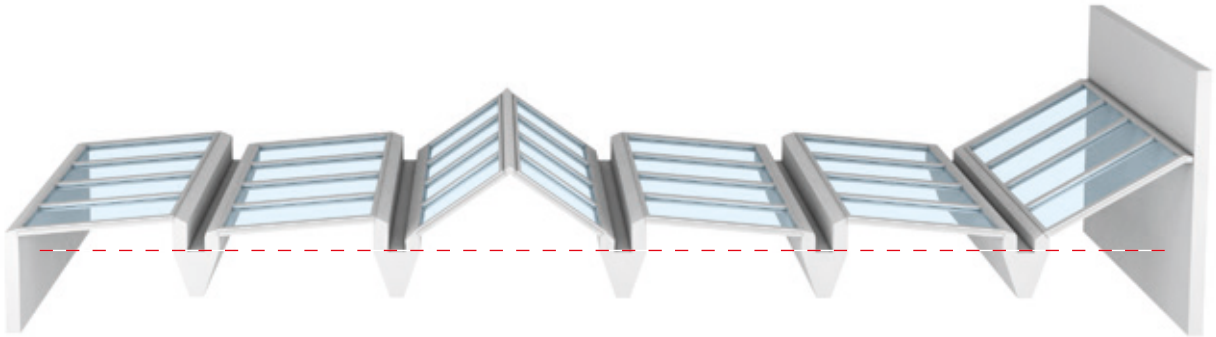
Asymmetric Ridgelight





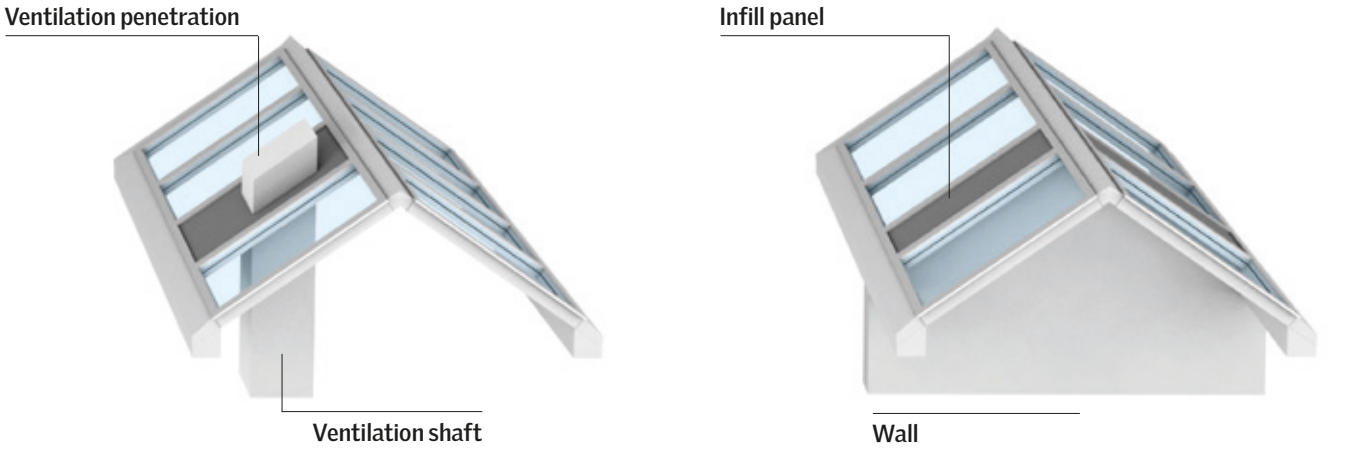
Feature	Advantage	Benefit
By constructing an asymmetric Ridgelight, it is possible to combine modules of different lengths in an installation.	The solution allows for installation between two roofs of different heights or of modules in different slopes. By combining panes with different characteristics on each side of the Ridgelight, it is possible to maximize daylight and minimize heat gain.	The asymmetric Ridgelight offers more flexibility in installations between buidlings or sections of buildings.

Atrium of Combined Solutions



Feature	Advantage	Benefit
An Atrium built of a combination of different solutions.	Combining different solutions in an installation exploits the advantages of each solution in one atrium and offers the possibility to optimize comfort and smoke ventilation areas.	Flexibility in designing an Atrium.

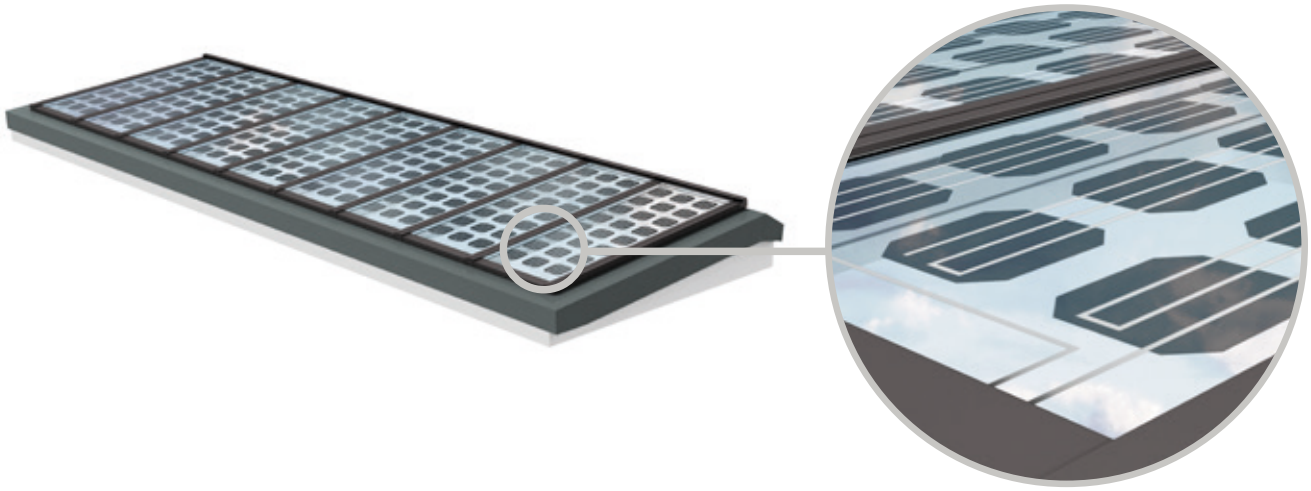
Infill Panel



Feature	Advantage	Benefit
Ventilation shaft: Use an infill panel when penetrating the skylight with e.g. ventilation. Wall: Use infill panels when covering a wall in the building.	Continuous modular skylight installations instead of disrupted installations.	Cheaper product solution and better design.

Note:
Products with a fixed, opaque insulating infill panel are out of the scope of the harmonised product standard EN 14351-1 used for CE marking of windows.
No harmonised product standard is available/applicable for these products; they are not and cannot be CE-marked.
The VELUX Group can deliver the above-mentioned products and provide product specifications on the relevant general performance characteristics for thermal transmittance, air permeability, watertightness, resistance to wind load and reaction to fire on request. The VELUX Group is not responsible for the specific application of the product with fixed, opaque insulating infill panel. It is the responsibility of the customer to verify the fitness of the product for specific use with the relevant authorities.

Skylight Modules with Photovoltaic Glazing Units

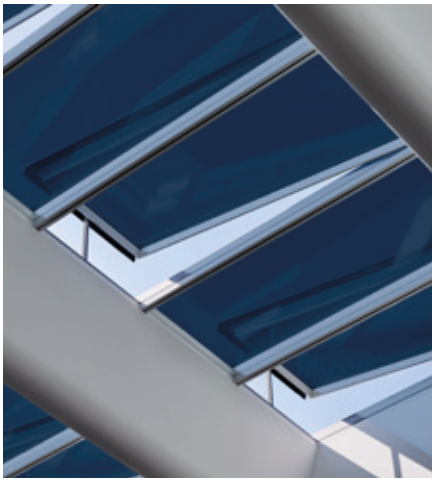


Feature	Advantage	Benefit
VELUX modular skylights can be delivered with photovoltaic glazing units in both a fully covered or partly covered variant (illustration shows partly covered variant).	The solution offers a built-in solution where photovoltaic panels are combined with skylight installations.	The solution will optimize the utilization of space on the roof. Furthermore, the photovoltaic panels create a shadow effect in the building that reduces heat gain and glare.

Sun Screening – Electrochrome Glass

Glazing with no coating.
Visible light transmission 79%

Glazing with electrochrome glass.
Visible light transmission 50%



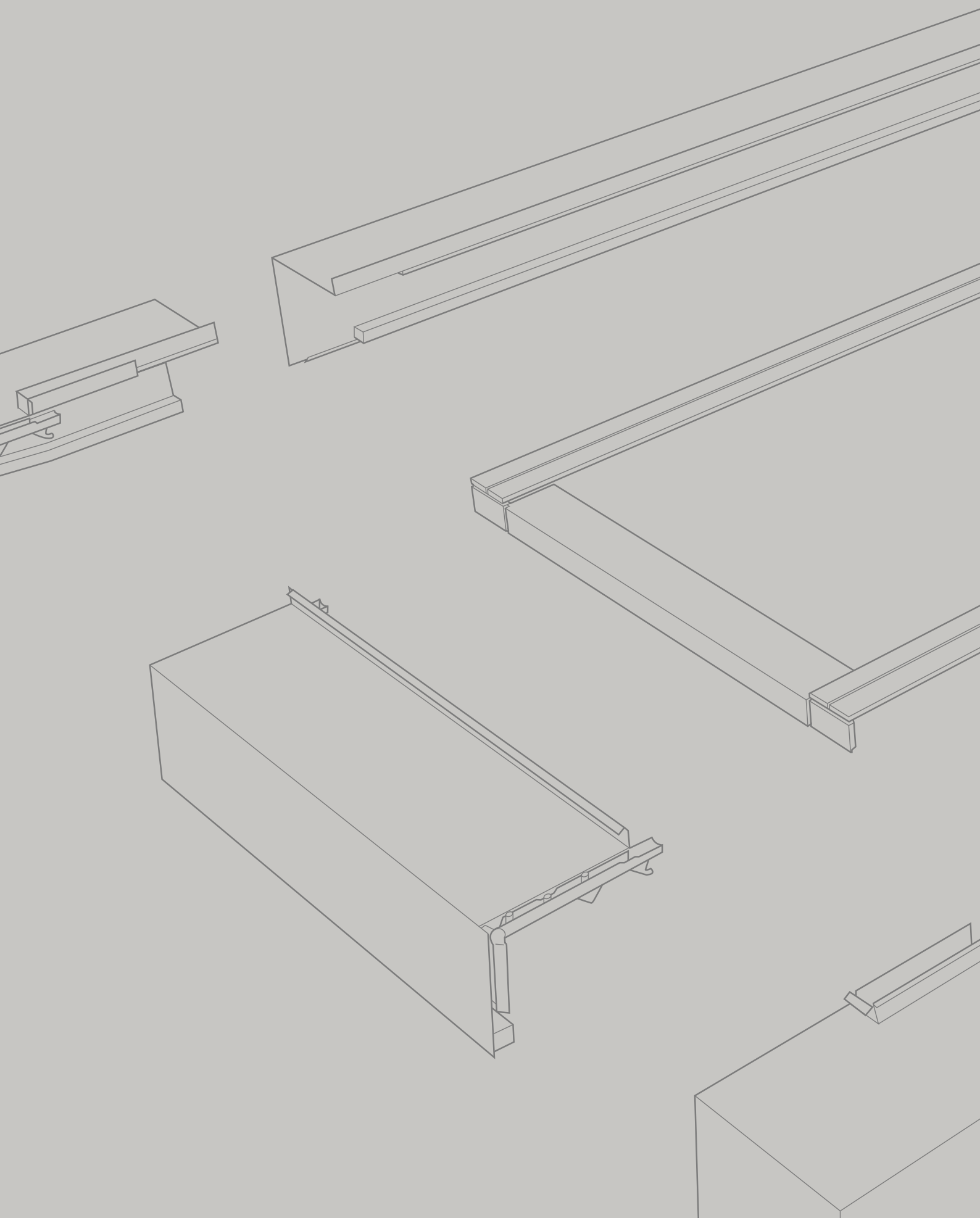
Glazing with electrochrome glass.
Visible light transmission 1%

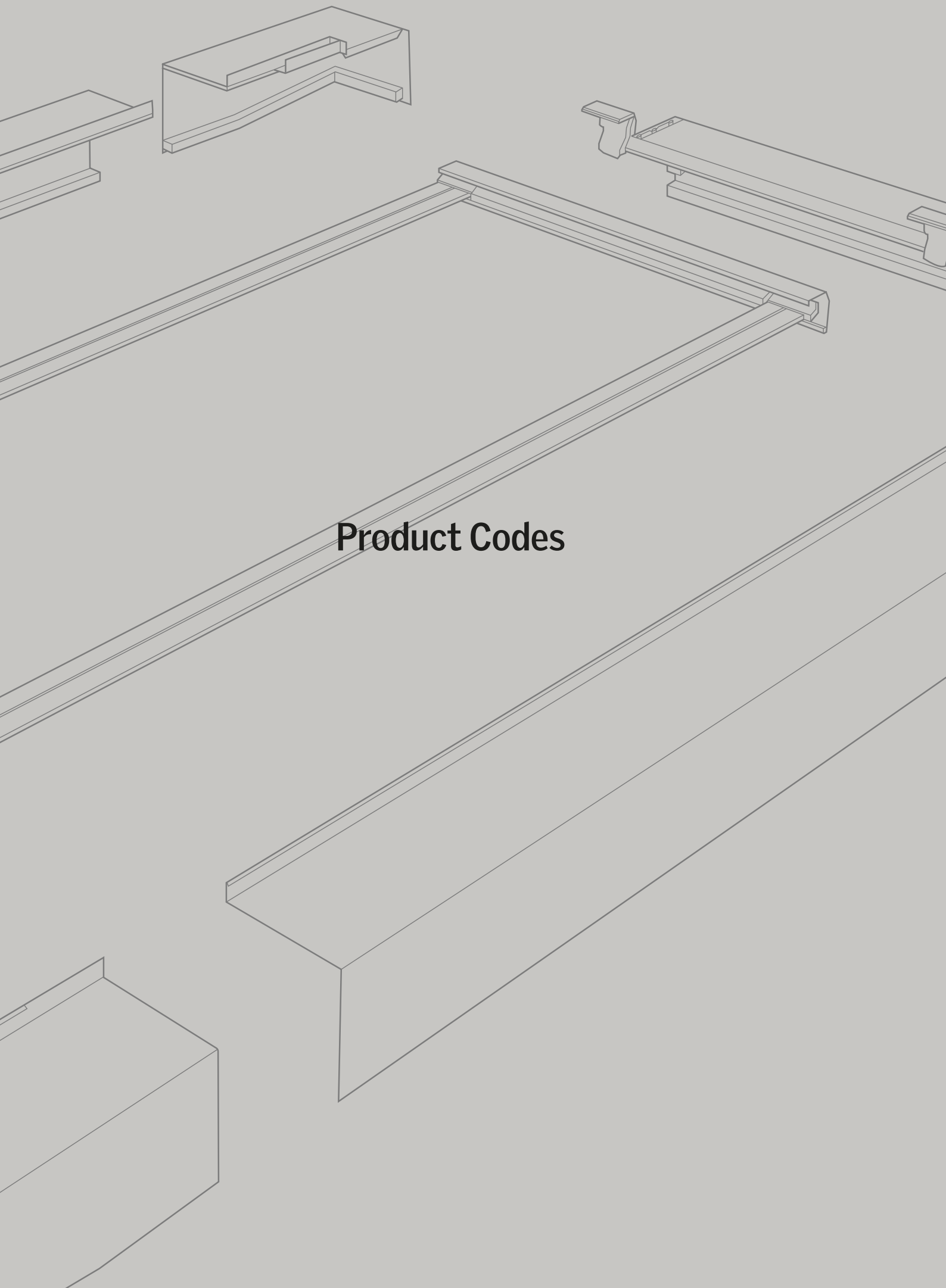
Electrochrome glass gives you the ability to control natural light. We do it without blocking the view to the outdoors, without disruptive glare or drastic temperature extremes. With just a push on a button.

Sun Screening – External Awning Blinds

Maintain a pleasant thermal indoor environment
The Topfix® VMS external awning blind by Renson protects the interior from excessive solar heating. The product is optimized for VELUX modular skylights and is applicable to both fixed and venting modules. Topfix® VMS operates on mounting feet that fits perfectly onto the external surface of the modular profiles.
The blinds features a VELUX compatible operation system and can endure wind loads up to 120 km/h.

RENSON® inside



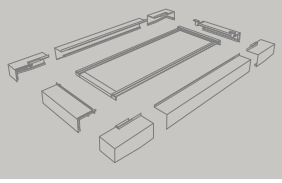


Product Codes

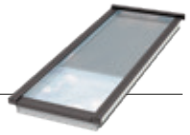
Modular Skylights – Code Structure

Example

HVC	067	160	0	0	10	T	C	B
Type	**Module width**	**Module height**	**Interior colour**	**Exterior colour**	**Pane type**	**Pane variant**	**Electric variant**	**Genera-tion**
H = VMS	067 = 675 mm	120 = 1200 mm	0 = std.	0 = std.	10 = DGU/LowE	No letter = 3+3 mm inner glass	No letter = VELUX INTEGRA®	
	075 = 750 mm	140 = 1400 mm	**RAL colour 9010, gloss 30**	**"Noir 2100 Sable YW" Akzo Nobel**	11 = DGU/Sun1			
F = Fixed	080 = 800 mm	160 = 1600 mm			12 = DGU/Sun2	T = 5+5 mm inner glass	A = Open-system/ Smoke	
V = Venting	090 = 900 mm	180 = 1800 mm			16 = TGU/LowE			
	100 = 1000 mm	200 = 2000 mm				K = Krypton gas instead of the stand-ard Argon gas, 5 + 5 mm inner glass.		
C = Commercial market		220 = 2200 mm	8 = special		17 = TGU/Sun1		C = Open-system/ Comfort	
		240 = 2400 mm						
S = Fire-resistant variant. With fire resistant glazing unit and intumescent strip		260 = 2600 mm						
		280 = 2800 mm						
		300 = 3000 mm			18 = TGU/Sun2	U = Fire resist-ant		



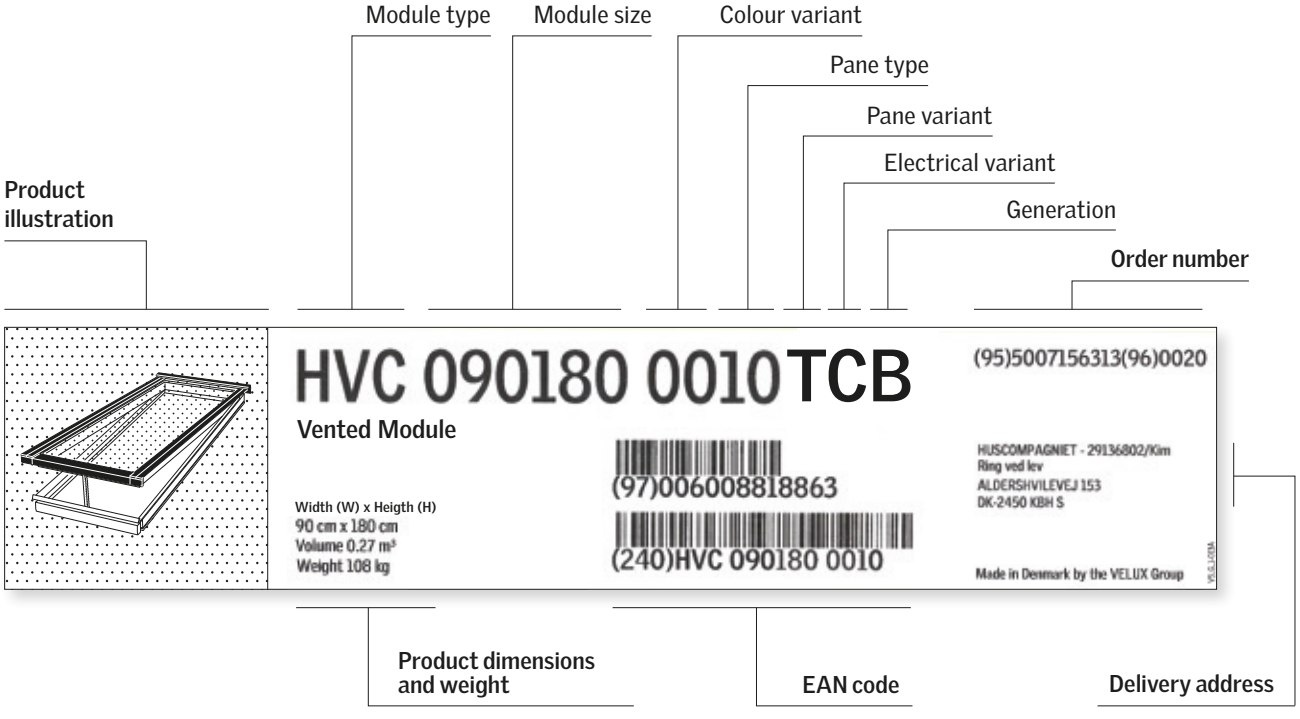
Roller Blinds – Code Structure



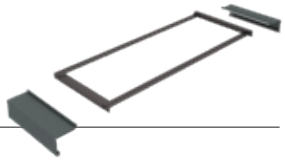
Example

RMM	067	160	8805
Type	**Module width**	**Module height**	**Fabric variant**
R = Roller blind	067 = 675 mm	120 = 1200 mm	8805 = Grey, fire retardant
	075 = 750 mm	140 = 1400 mm	8806 = White, fire retardant
M = Electrical	080 = 800 mm	160 = 1600 mm	8807 = Black, fire retardant
	090 = 900 mm	180 = 1800 mm	
M = For VELUX Modular Skylights	100 = 1000 mm	200 = 2000 mm	
		220 = 2200 mm	
		240 = 2400 mm	
		260 = 2600 mm	
		280 = 2800 mm	
		300 = 3000 mm	

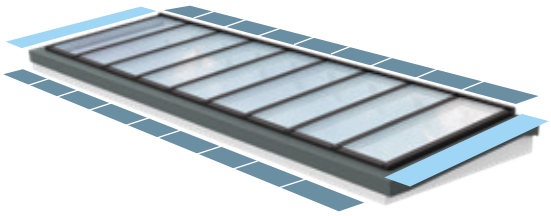
Product Label – Code Structure



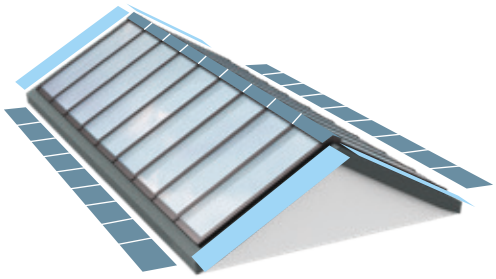
Flashings – Code Structure



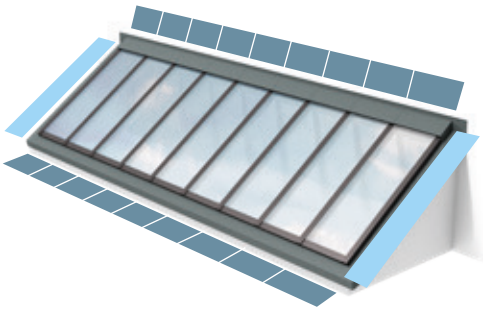
Longlight 5-30°



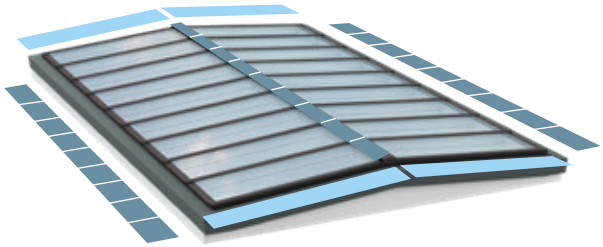
Ridgelight 25-40°



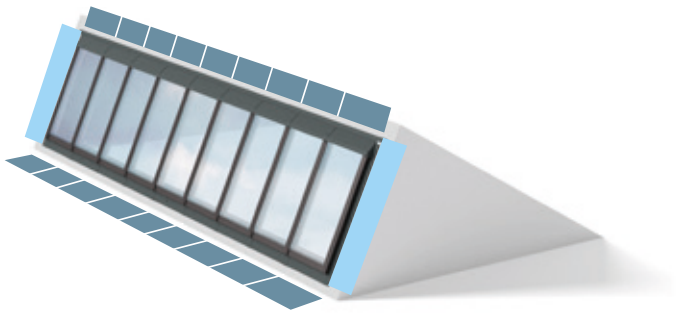
Wall-mounted Longlight 5-45°



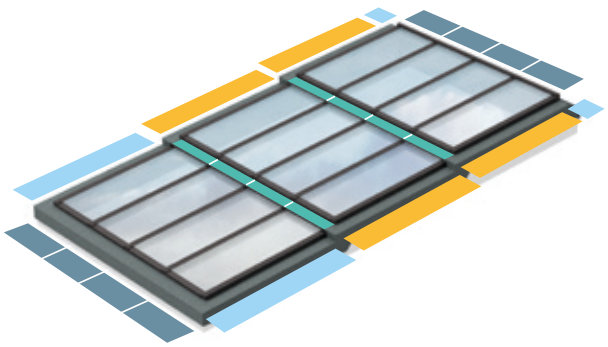
Ridgelight at 5° with Beams



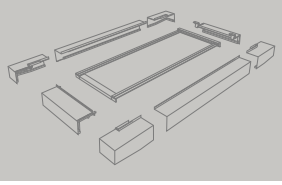
Northlight 25-90°



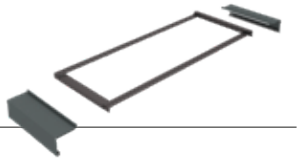
Step Longlight 5-25°



Code Structure	
Opening flashing package	Step Solution extension package – module height
Module flashing package	Step Solution extension package – module width



Opening Flashing Package – Code Structure



Example

ERC	XXX	160	0	0	0	25	D	B

Type	Module width	Module height	Interior	Exterior flashing	Exterior cladding	Installation pitch	VMS Cover	Gene-ration
E = Flashing	XXX = Not relevant on height package	120 = 1200 mm	0 = std.	0 = std.	0 = std.	05 = 5°, 10 = 10° etc.	D = Extra cover	
		140 = 1400 mm	Only relevant on ERC: Beams	NCS standard colour: S 7500-N (RAL 7043)	"Noir 2100 Sable YW" Akzo Nobel	Standard pitches:	Extra Cover When HVC ≥ HFC	
L = Longlight		160 = 1600 mm				ELC: 05, 10, 15, 20, 25 / ERC: 05, 25, 30, 35, 40 / EWC: 05, 10, 15, 20, 25, 30, 35, 40 / ENC: 25, 55		
R = Ridgelight		180 = 1800 mm					1 pcs for ELC/ EWC/ ENC	
N = Northlight		200 = 2000 mm						
W = Wall-mounted Longlight		220 = 2200 mm						
		240 = 2400 mm						
C = Commercial Market		260 = 2600 mm	RAL colour 9010, gloss 30				2 pcs for ERC	
		280 = 2800 mm						
		300 = 3000 mm						

Module Flashing Package – Code Structure

Example

ERC	080	XXX	0	0	0	25	B

Type	Module width	Module height	Interior	Exterior flashing	Exterior cladding	Installation pitch	Genera-tion
E = Flashing	067 = 675 mm	XXX = Not relevant on width package	0 = std.	0 = std.	0 = std.	05 = 5°, 10 = 10° etc.	
	075 = 750 mm		Only relevant on ERC: Inner ridge covering	NCS standard colour: S 7500-N (RAL 7043)	"Noir 2100 Sable YW" Akzo Nobel	Standard pitches:	
L = Longlight	080 = 800 mm					ELC: 05, 10, 15, 20, 25 / ERC: 05, 25, 30, 35, 40 / EWC: 05, 10, 15, 20, 25, 30, 35, 40 / ENC: 25, 55	
R = Ridgelight	090 = 900 mm						
N = Northlight	100 = 1000 mm						
W = Wall-mounted Longlight			RAL colour 9010				
C = Commercial Market							

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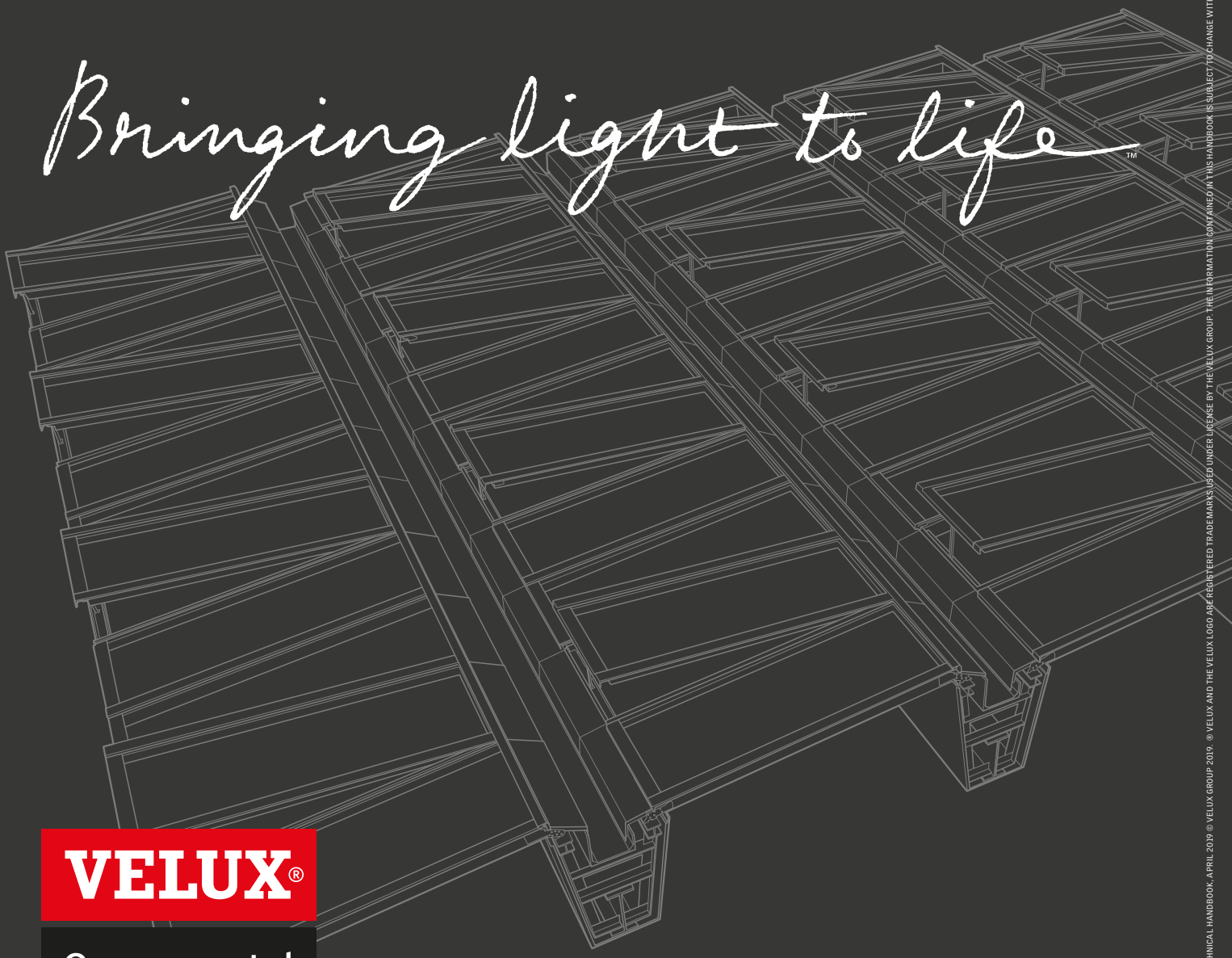

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