LAMILUX

CI System glass architecture PR60

Living with light

Customized
Intelligence
Serving the customer is our first priority

LAMILUX CI-System glass architecture PR60

With our CI System Glass Architecture PR60 LAMILUX is the only daylight system manufacturer to provide an individually mullion and transom system that in the basic version already gives processors the option of meeting the strict energy requirements of the passive house classification.

Due to its **excellent insulation properties** this aesthetic glass roof construction ensures a completely tight building envelope.

The **narrow profile lines** that allow maximum daylight incidence help to achieve huge savings on electric lighting.

Buildings can be aerated and ventilated in an energy efficient and effective manner through integrated, **intelligent automated flap systems**.

Living with light - in the highest efficiency class

» Far more than a trend, and instead following its own ambitious goals and international sustainability criteria, architects and planners seek to fulfil the highest energy efficiency standards in new developments and refurbishment projects.

As integral parts of the building envelope, LAMILUX daylight systems offer versatile potential for reaching the high energy standards required by tenders worldwide. «

Dipl. Ing. Joachim Hessemer,
Technical Director
LAMILUX daylight elements

The LAMILUX CI Philosophy

Customer value is the reason for our existence and is the focus of our activities. This requires harmony, identity and a balance between customer value and company strategy.

These guiding ideas for our company's actions and our day-to-day relationship with our customers are described in LAMILUX's company philosophy:

'Customised intelligence – Serving customers is our first priority.'
This requires outstanding performance and leadership in all areas relevant to customers, particularly in the role of:

- **Leader in quality – for the highest customer benefit**
- **Leader in innovation – for always being ahead in technology**
- **Leader in service – for fast, straightforward, reliable and friendly communication**
- **Leader in expertise – for the best technical and commercial advice on the market**
- **Leader in problem solving – for custom made solutions**

Building: BMW 4-CYLINDER BUILDING MUNICH (GERMANY)| CI SYSTEM GLASS ARCHITECTURE

LAMILUX CI System Glass Architecture PR60

LAMILUX CI System Glass Architecture PR60$_{energysave}$

NEW: LAMILUX CI System Glass Architecture PR60$_{energ}$

Cover strips with splashwater channelling
(with optional cover profile)

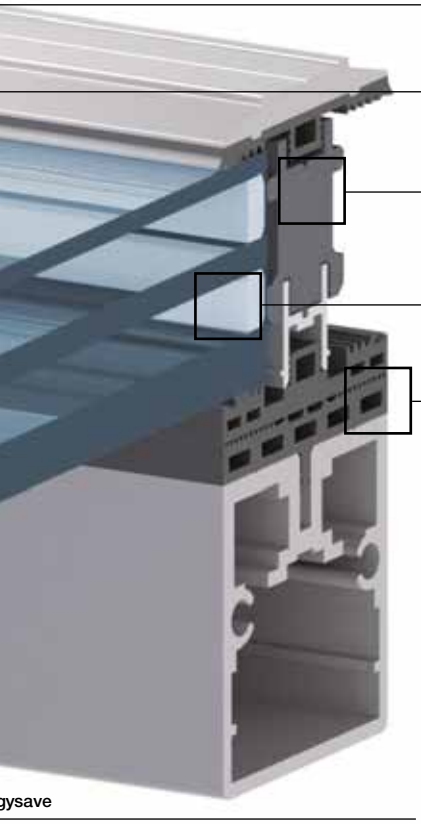
NEW: **Attractive flat round-headed screw joints with EPDM sealing washer**

Continuous EPDM seal

NEW: **Optimised insulation core**

3x insulating glazing with “warm edge” as standard

NEW: **Optimised sealing system**



gysave

LAMILUX CI System Glass Architecture PR60 –
Basic design with double insulation glazing

Customized Intelligence
Serving the customer is our first priority

The profile system – Energy efficiency and safety with freedom of design

In developing the system profile for the customisable LAMILUX CI System Glass Architecture PR60 glass roof construction, the main focus was on the geometry of the main profiles. They can be used as jambs, transoms, rafters or purlins. The results: a very versatile mullion and transom building system that supports a great degree of freedom in design. The supporting structure is made of high-grade aluminium with integrated screw channels to ensure optimum shape stability and strength.

The LAMILUX CI System Glass Architecture PR60 uses specially interlinked slot connectors to ensure excellent dimensional stability and strength in the joints. The structurally rigid profile sections allow for even the most complex profile joints.

The profile system at a glance

- Extremely stable supporting structure made of rigid aluminium
- Practically no design constraints between 0 ° to 90 °
- Efficient ventilation of glass rebates
- Controlled water and condensate draining due to overlapping EPDM secondary draining
- Defined glazing clamping system based on insulating spacer webs
- Elastic bedding of glass panes

Safety on the roof due to CE-approved quality in line with EN 13830 (also under 2° installation pitch)

- Water tightness against driving rain EN 12154 / EN 12155 / RE 1950
- Airtightness (EN 12152 / EN 12153 / AE 1950 Pa)
- Resistance to wind load (EN 13116 / EN 12179/ 2000 Pa permissible load and 3000 Pa increased load)

Energy efficiency demonstrated

- Heat transfer coefficient of the jambs and transoms ($U_{m/t}$) of 1.3 to 0.72 W/(m²K) (depending on glazing thickness)
- Surface temperature factor f_{RSi} of 0.66 to 0.83 (depending on glazing thickness)

Comprehensive soundproofing

- Soundproofing demonstrated in system test in as-installed state as per EN 10140-2 up to 46 dB

Building: FORUM MITTELRHEIN, COBLENZ (GERMANY)

Overlapping transom seal
permanently elastic, cold-vulcanised connection with the rafter seal

End-to-end, shock-free rafter seal (ideal for barrel roofs)
with secondary drainage and rebate ventilation

With optimized sealing and drainage system to prevent condensation

LAMILUX CI System Glass Architecture PR60 ensures highly efficient ventilation of glass rebates and controlled drainage of water and condensate. This is accomplished by a special sealing system. The overlapping multistage sealing system, which is designed without direct joints, has secondary drainage in the inner sealing layer. A joint-free, continuous drainage plane is thus guaranteed for the jambs/rafters even for joints to the supporting structure (for example, polygonal bends in barrel roofs).

Water ingress is therefore not possible. In addition to this, the seal system aids thermal separation and ensures glazing rebate ventilation around each pane. In total, the profile system ensures optimised isothermal characteristics, reducing the risk of condensate forming on the inner sides of glass roof constructions.

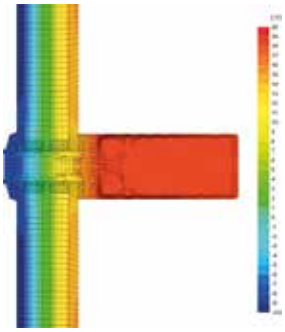
LAMILUX CI System Glass Architecture PR60$_{energysave}$

» With its **CI System Glass Architecture PR60$_{energysave}$** LAMILUX was the first manufacturer to launch a certified mullion and transom system in the sloped glazing category. For the first time, this gives energy- and cost-conscious architects and designers a glazed roof system solution that is not only suitable for passive houses, but also meets the highest Passive House efficiency class, phA. «

Dr.-Ing. Benjamin Krick
Passivhaus Institut Darmstadt

Energy efficiency:

- First inclined glazing certified to passive house standards
- Highest passive house efficiency class – **phA** advanced component
- Heat transfer coefficient **(U_{cwi}) of 0.81 W/(m²K)** well below the value required by Passivhaus Institut, Darmstadt of 1.0 W/(m²K)
- High solar gain
- Thermal characteristics computed on basis on DIN EN ISO 10077-1 and 10077-2



12.6° C isothermal characteristic completely in the construction

Comfort and technology:

Intelligent use of efficient materials limits the minimum temperature on the inside surface of the glass roof construction. This avoids condensation and mould growth.

Starting at a relative humidity of 80 percent, mould can form on surfaces. At a room temperature of 20° C and 50 percent humidity (standard conditions), this corresponds to a surface temperature of 12.6° C.

These figures are considered when computing the f_{Rsi} value. They tell you how likely it is for mould to form. If the value is less than 0.7, there is a risk of mould.

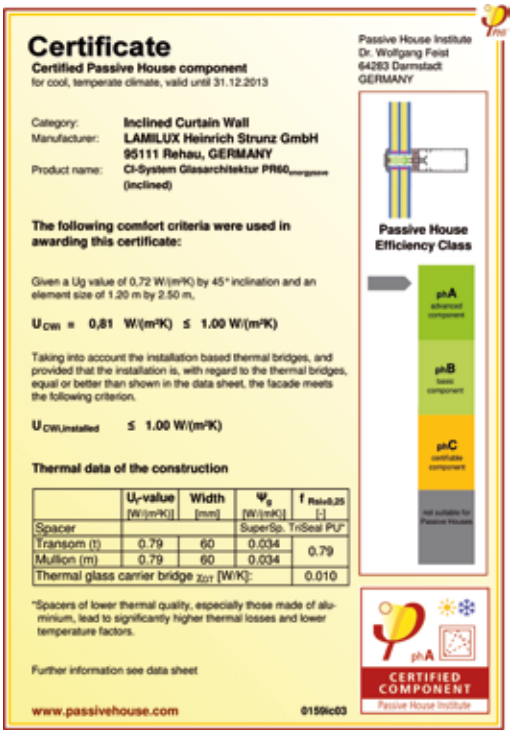
With the **CI System Glass Architecture PR60$_{energysave}$** system, this value is a stable **0.79**. This corresponds to a minimum surface temperature of **14.8° C** – **which in turn ensures secure comfort and saves energy!**

Building: KÖNIGSGALERIE DUISBURG (GERMANY)

Tested and approved with recognised certification

In addition to thermal insulation properties, evaluation in line with the passive house standard takes the heat loss and heat gain balance into consideration.

Since solar gains are difficult to detect, the approved method is to consider the losses. This means: areas where no solar gains are possible are quantified. This is expressed as Ψ_{opaque} The smaller this value is, the higher the efficiency class.



Certificate

Certified Passive House component

for cool, temperate climate, valid until 31.12.2013

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Category: Inclined Curtain Wall
Manufacturer: LAMILUX Heinrich Strunz GmbH
95111 Rehau, GERMANY
Product name: CI-System Glasarchitektur PR60 (inclined)

The following comfort criteria were used in awarding this certificate:

Given a Ug value of 0.72 W/(m²K) by 45° inclination and an element size of 1.20 m by 2.50 m,

U_{CW} = 0,81 W/(m²K) ≤ 1.00 W/(m²K)

Taking into account the installation based thermal bridges, and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the facade meets the following criterion.

$U_{CW,installed}$ ≤ 1.00 W/(m²K)

Thermal data of the construction

	U_f-value [W/(m²K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi0,25}$ [-]
Spacer			SuperSp. TriSeal PU*	
Transom (t)	0.79	60	0.034	0.79
Mullion (m)	0.79	60	0.034	
Thermal glass carrier bridge z_{GT} [W/K]:				0.010

*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

Further information see data sheet

www.passivehouse.com 0159ic03

Passive House Efficiency Class

phA advanced component
phB basic component
phC certifiable component
not suitable for Passive Houses

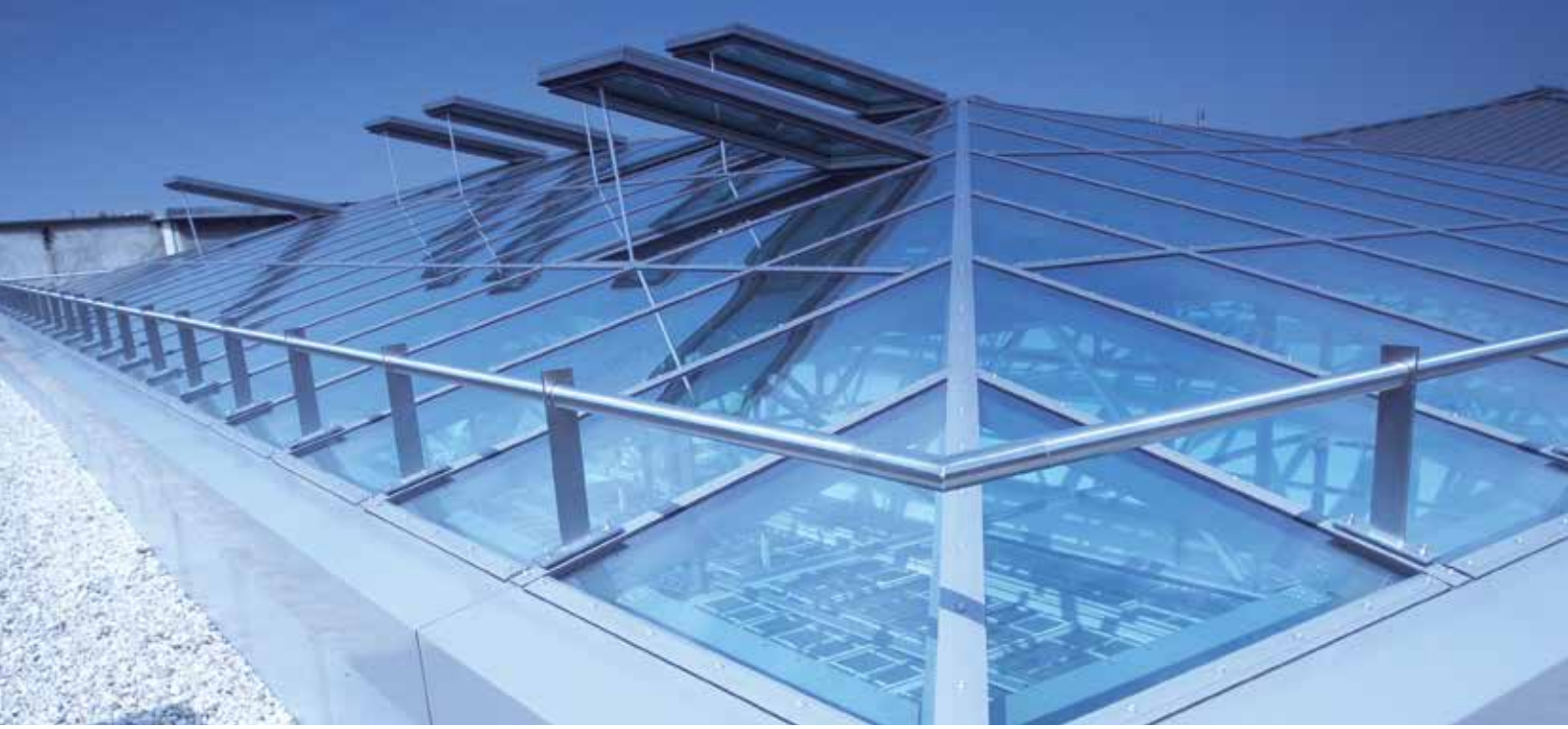
phA CERTIFIED COMPONENT Passive House Institute

Passive House efficiency classes

Ψ_{opak}	Passive House efficiency class	Designation
≤ 0.220 W/(mK)	ph**C**	Certifiable component
≤ 0.155 W/(mK)	ph**B**	Basic component
≤ 0.110 W/(mK)	ph**A**	Advanced component

System and method

- Vertical or inclined aluminium mullion and transom system with internal screw channel and PE insulation in the glass rebate
- Calculation of thermal bridges with a heat flow program BISCO
- Determination of thermal losses through the glass carriers and screws using three-dimensional heat flow analysis with the Solido program



The flap system Glass Architecture M

Controllable flap systems save energy

Regulating integrated flap systems in glass roof and façade structures to provide natural ventilation plays a considerable role in optimising building air conditioning systems and reduces the amount of energy used for cooling in air conditioning units. Around 30 percent of energy used to heat and cool buildings can be saved as a result of efficiency optimisation functions in room automation systems.

CI System Ventilation Flap M in ventilation position

Building: MUSIC ACADEMY MUNICH (GERMANY)

CE marking – approved according to DIN EN 14351-1

2009 saw the introduction of mandatory approval of window flaps sold on the European market in accordance with the DIN EN 14351-1 product standard, along with mandatory CE marking. Our flap systems have completed all tests successfully and hold the required certifications:

- Resistant against wind load (Class C4/B5 EN 12210)
- Watertightness (Class E 1200 EN 12208)
- Sound insulation (EN ISO 140-3 up to 45 dB)
- Heat protection (Ug values of 1.1 to 0.6 W/(m²K) EN 673)
- Total energy permeability (g between18 and 78 percent)
- Light transmission (Lt of 19 to 82 percent)
- Permeability to air (Class 4 EN 12207),
- Uf values of 1.5 to 1.3 W/(m²K) as per EN 12412-2, EN ISO 12567-2 and prEN 1873

Assembly situation of flap systems

(showing a smoke lift as an example)

Single flap on flat roof

Single flap on ridged roof

Double flap on ridged roof

Double flap (full flap) on ridged roof

Double flap on flat roof

Single flap on shed roof

The flap systems for Smoke and Heat Extraction

CI System Smoke Lift M – Flexible safety

The *CI System Smoke Lift M* is the ideal flap system for smoke and heat extraction in the glass roof. The smoke and heat extraction system can be installed at angles of 0° to 90° in the CI System Glass Architecture PR60.

- Tailor-made flap width and height (flap widths and heights can each be up to 3.00m, featuring a maximum flap size of 3.00 m²
- Complies with European standard 12101-2 for smoke and heat evacuation systems
- Variety of available drive systems – pneumatic or 24-volt, electrical design
- Also eminently suitable for upgrading older glass roof structures, since it can be integrated into other systems

CI System Smoke Lift M with a single flap

Building: RHEIN GALLERY, LUDWIGSHAFEN (GERMANY)

Product features in compliance with EN 12101-2

- Re 50/Re 1000
- WL 1500
- SL 500 - SL 1000
- up to T (-15)
- B 300-E

CI System Smoke Lift M with a double flap

Control technology – LAMILUX as a system integrator

Glass roof structures provide an ideal structural platform for integrating flap systems for smoke and heat exhaust ventilation (SHEV). As a specialised manufacturer and installer of SHEV systems LAMILUX deploys sophisticated triggering and control technologies. As a system integrator, we use command centres to link all moving elements in the building envelope that are functionally related to SHEV and climate control concepts. We integrate these automated systems into the central building management system.

- Actuation of pneumatic and electric systems, and drives for ventilation and SHEV systems
- Design, installation and commissioning of the alarm sensors, actuating units and drives
- Installation of pneumatic pipes and electrical wiring
- System integrator for third-party systems
- Interface with building management system

Solutions for an optimum structural mount

CI System *Glass Architecture PR60* is every architect's dream come true with its unlimited design freedom. Almost any aesthetically appealing and technically challenging glass roof construction can be built with this system. The requirements: high stability and maximum safety also for the structural mount.

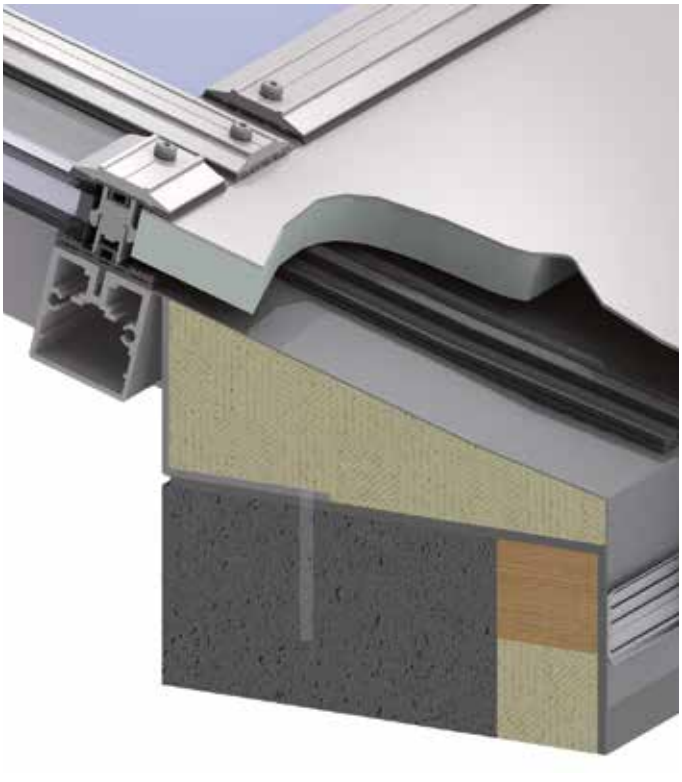
The high quality of our **CI System Glass Architecture PR60** is evidenced in the premium overhead glazing and profiled cover strips with stainless steel screw joints - and thus in the structural mount. Our system features heat insulated eaves with foil edging and continuous flashing.

Customised design

CI System Glass Architecture PR60 stands out due to its wide range of roof fitting and roof attachment variants and can be custom-built to accommodate all types of building architecture:

Roof mount variants (examples):

- Mount on steel sheet frame
- Mounted on insulated wood upstand with internal metal sheeting
- Mounted on an insulated concrete upstand
- Mounted on a support with a wooden plank upstand



Mounted on a concrete upstand

Building: ELISABETH FOUNDATION, DARMSTADT (GERMANY)

Mounted on a wooden upstand

Mounted vertically on wooden plank frame

Mounted on a steel sheet upstand

NOTE: The mounting systems shown in the diagrams are concept drawings for guidance purposes only. The roofing specialist must comply with technical standards for waterproofed roofs, such as flat roof guidelines, when planning and carrying out waterproofing work.

Multifunctionality and active energy management

LAMILUX shed roof structures are an expression of multi-functional versatility and efficient energy management**. This daylight system can both save and generate energy.**

Only the north-facing side is glazed. The south side of the daylight structure faces the sun and usually features opaque filling materials. As a result, direct sunlight and glare are minimised inside the building.

The north side – Multi-functional versatility

Light

- Insulated glazing (U_g value 1.1 to 0.6 W(m²/K) with laminated safety glass
- Glazing which channels or diffuses light
- Solar protection glass
- Glazing with integrated solar protection blinds
- Soundproof glass

Air

- Integration of CI System Ventilation Flap M: system certified (CE conformity) according to DIN EN 14351-1 (waterproof against driving rain, permeability to air, resistance to wind load, soundproofing, heat protection, total energy transmission, light transmission)

Smoke and heat ventilation

- Integration of the CI System Smoke Lift M: tested smoke and heat extraction system in accordance with EN 12101-2

Building: HAWE, FREISING (GERMANY)

Modern, energy-efficient building skins:

The south-facing side of the structure becomes an energy supplier, as it is equipped with photovoltaic systems and solar panels. Compact, insulating sandwich panels ensure optimum energy efficiency due to excellent heat insulation properties.

The south side – Efficient energy management

- Installation of highly insulated sandwich panels with a filling of polyurethane foam for superior insulation
- Attachment of solar collectors for thermal solar systems
- Attachment of solar panels for photovoltaic systems
- Integration of typically semi-transparent glazing with glazing-integrated photovoltaic systems

Fire protection and soundproofing

- Installation of sandwich panels (trapezoid profiles) with a mineral core insulation layer. The roof-wall panel complies with Building Material Class A2 (non-flammable) and also features excellent soundproofing properties (up to 32 dB)

Rugged mullion and transom construction

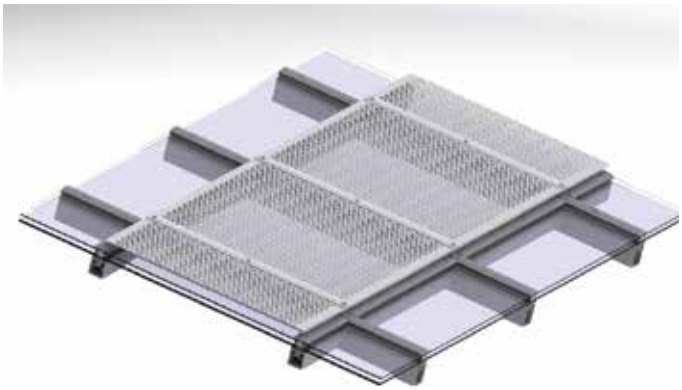
- Based on LAMILUX CI System Glass Architecture PR60
- Eminently suitable for refurbishment and changes of use in industrial buildings
- Visible elements in the load bearing structure (aluminium) and roof panels can be supplied with RAL coatings

Transparent versatility for high levels of light incidence, heat and solar protection

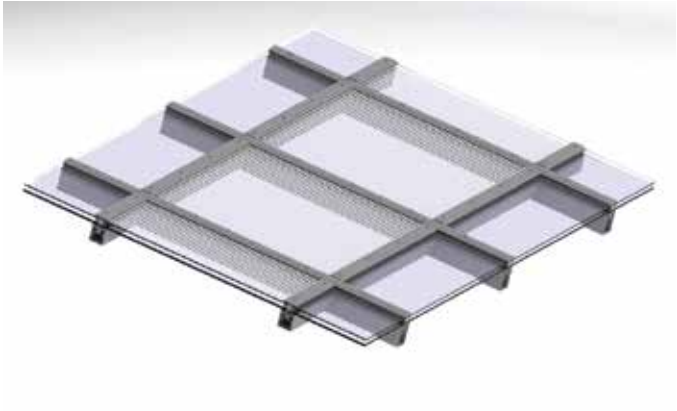
How much daylight is required for natural, energy-saving illumination, when solar heat input needs to be restricted, how glare can be eliminated – this is all decided by glazing and shading systems geared to match the building's use and comfort requirements.

Intensive and widespread incidence of light is determined by glazing that perfectly matches the property – in addition to the width of the profiles in the supporting structure. In addition, the glazing must meet stringent requirements for thermal insulation and soundproofing.

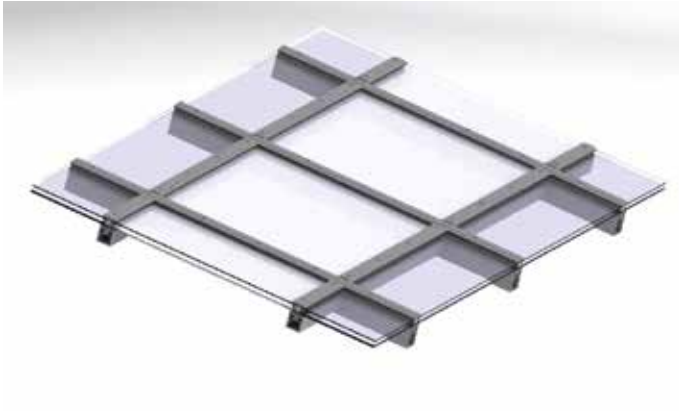
Daylight incidence and solar heat input create great potential for channelling energy into buildings and making savings on costs for heating and artificial light. This should not be achieved in an uncontrolled way, but regulated and guided by permanent or controllable shade systems.



Solar protection with deciduous tree effect

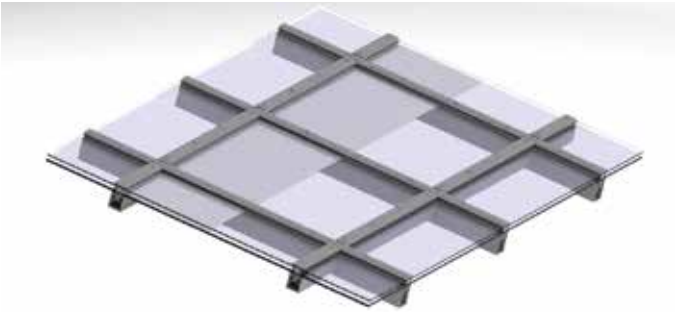


Solar protection with screen printed glazing



Solar protection with light matt foil

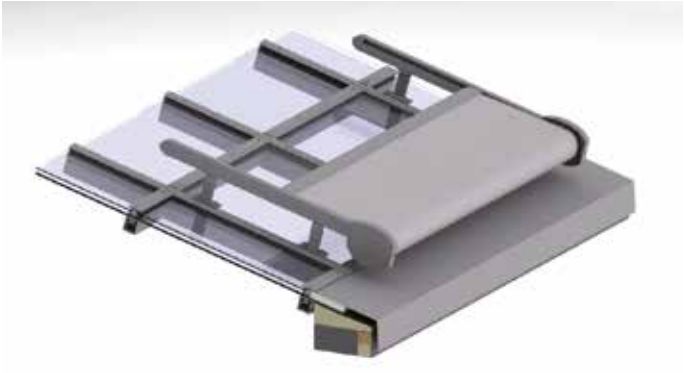
Buidling: NEUE GALERIE (NEW GALLERY), KASSEL (GERMANY)



Controllable solar protection with glazing-integrated blind

Solar protection with slats

Controllable solar protection with interior blind



Controllable solar protection with exterior blind

REFERENCES

Forum Mittelrhein Coblenz

At the heart of Coblenz city centre, a new world of shopping, the Forum Mittelrhein, invites passers-by to come in. More than 80 shops, cafes and restaurants are gathered under one roof and offer a unique diversity of products and brands. LAMILUX designed and manufactured five skylights for the tube-shaped openings in the roofs for developer ECE who built the shopping mall. The individually designed mullion and transom structures are designed as warm facades with thermally insulated system profiles and a roof inclination of 10°. ECE is known for strict sustainability requirements in the numerous shopping mall projects it has developed in Germany and Europe.

The five skylights, which provide widespread and bright natural light, have a freely-formed basic shape. The supporting structure in each case is a supporting grid of rectangular hollow aluminium profiles that rests at regular intervals on the supporting traverses. This grid has the axial dimensions of 3 metres by 1 metre.

The glazing consists of double panes of ceramic-printed heat insulation glazing with a U value of 1.1 W/(m²K). In order to reduce solar heat intake, the panes have a uniform dot matrix with a flat printing scope of 20 percent, so that the light transmission is 61 percent. The total energy permeability is 47 percent.

In total there are 238 panes (65 of them sashes) measuring 3 metres by 1 metre and 103 special panes with a freely designed shape in the five supporting structures, as well as 70 fixed panes which were used in the outline contours. For smoke and heat extraction and energy-efficient natural ventilation of the shopping mall, a total of 60 LAMILUX CI System Smoke Lift M type lift systems are integrated in the five glass roofs. They are each driven by two pneumatic cylinders.

Music Academy Munich

The Munich Academy of Music clearly shows the energy-savings that LAMILUX glass roof structures offer, when it comes to energy-saving refurbishment of existing buildings: To achieve a significant reduction in the primary energy requirements for the representative, public building, two hipped roofs, each 22 metres long and 14 metres wide, were fitted with a 20° inclination on the support structure which was revitalised with strengthening measures and visual refinements.

The new systems replace two old glass roof structures with wired glass. Additionally, 24 lift systems for ventilation and SHEV were integrated (CI system Ventilation Flap M type). The results: Two highly-insulated daylight systems for high level of daylight incidence. They achieve significant savings in terms of heating energy and artificial lighting. Additionally, the integration of ventilation flaps ensures a controllable indoor climate.

Thier Gallery Dortmund

Shops, restaurants and services on a floor space of 33,000 square metres: The Thier Gallery has emerged at the heart of Dortmund's inner city – a shopping mall of an impressive size which welcomes its visitors to brightly lit malls. The most impressive architectural feature in the building, which cost 300 million euros to construct, is a large-scale, triangular glass roof by LAMILUX which spans the central public area with a glazed area of 2,300 square metres.

Due to the high levels of incident daylight combined with variably controllable and conveniently actuated lift systems for natural ventilation, the central roof contributes significantly to building management that is characterised by energy efficiency and sustainability. LAMILUX planned and implemented all of the SHEV systems and control engineering in the mall and the stairwells.

Neue Galerie (New Gallery) Kassel

The “Neue Galerie“ in Kassel is one of the chosen venues of the world‘s largest art exhibition, “documenta“, which is held every five years. To maintain its status as a temporary backdrop for a variety of exhibits, the gallery was completely renovated. Architect Volker Staab from Berlin designed a “daylight museum“ with generous natural lighting. The decisive features include a 75 metre long and 10 metre wide glass roof with mezzanine glazed ceilings.

320 prism systems for optimum light distribution are built into the interstices of the 320 heat protection panes. Additionally, five horizontal glass ceilings each installed above the individual skylight halls (total area of 450 square metres) and visible panes of frosted plastic suspended as another mezzanine ceiling plane. Insulated glazing in the mezzanine ceilings thermally decouple the roof space below the skylight structure and act as a buffer space.

BMW 4-Cylinder Building Munich

An architectural masterpiece – the BMW "Four Cylinders" in Munich – is starting to show its age. The group has responded and is in the process of completely refurbishing its prestigious headquarters, which opened in 1973. LAMILUX had the task of replacing old wire glass elements which encircle the inner stairwell of the administrative building in the shape of the BMW logo. Glass roof structures including ventilation flaps were also integrated in four other areas of the building.

In addition to this, it proved necessary to upgrade the technical equipment of the building in terms of heating, ventilation and fire safety to modern standards. In the course of this work, LAMILUX handled the complete design, installation and implementation of the SHEV systems including the control technology in the foyer of the building and the halls and courtyards of the connected low-rise.

LAMILUX CI-SYSTEME

ROOFLIGHT DOME F100

CONTINUOUS ROOFLIGHT B

LIGHT WALL

GLASS ARCHITECTURE PR60

BUILDING CONTROL SYSTEMS

FRESH AIR SUPPLY DEVICES

GLASS ELEMENT F

CONTINUOUS ROOFLIGHT S

BUILDING UPGRADES

SMOKE AND HEAT EXHAUST SYSTEMS

PHOTOVOLTAICS

FIBRE-REINFORCED COMPOSITES

LAMILUX

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