

Technical
guide for
external
façades
04.2021 - EN

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1 | This is Laminam



Shaping the world of tomorrow

The art of ceramics expressed on large sized architectural surfaces and elevated to excellence by means of a continuous research and innovation process.

This is Laminam.

For years our company has committed itself to an innovation-centred approach towards this ancient material. We have led it into the future, reinventing and perfecting production processes that enhance its performance. In this way we have brought to life surfaces that have no application limits thanks to our selection of sizes and thicknesses.

The aesthetic dimension of all our creations expresses a multitude of different styles, all characterised by a single common denominator: elegance and beauty.

This is further enriched by qualitative perfection, stemming from Laminam's tireless research into raw materials and state-of-the-art technologies.

The result is a wide range of versatile surfaces that can be successfully utilized in different settings, for a new redefinition of spaces, redesigned in the name of beauty, modernity and sustainable processes.

One of the cornerstones of our company is attention towards the environment and the people. We dedicate the utmost attention to the selection of raw materials, which are all natural and with the highest standards, to guarantee the utmost quality and hygiene.

At Laminam every single staff member plays a determining part towards the achievement of objectives. This is why Laminam pays particular attention to the well-being of its employees and invests in continuous learning. The high technological level of production processes is upheld by highly qualified staff.

All this, combined with a safe and stimulating work environment, culminates in the creation of perfect surfaces that inspire architects and designers at a global level.



2 | Introduction



2.1 The Purpose of this Manual

The objective of this manual is to provide clear design guidelines that can lead the reader through the process of installing Laminam slabs on façades using different application systems. Laminam acts as the supplier of the finishing slab, and allows clients, designers and contractors to decide how to mount the material to fit the project that they are building with systems that are suitable, recognised and regulated by the country of reference.

Just like natural stone and glass, Laminam slabs can be applied with different types of sub-structures made by different suppliers. The designer can choose which one is best depending on performance, availability on the market, availability of qualified installers and the cost of all these aspects. Laminam slabs can be processed to obtain the sizes required for the project on site or at a marble or glass processing facility.



2.2 Project Engineering

Having a truly innovative product, like the large Laminam ceramic slab, creates the need to supply the designer with qualified professional support that is extremely informed and competent. Laminam has developed an internal division that can assist clients from the design phase through the construction phase, thanks to the studies completed on the material and the many years of experience matured through several completed projects all over the world.

Solutions and Services

The Project Engineering Division is a team of engineers that offers consulting services to the different actors involved in building the façade. It focuses primarily on:

- working with the client and the designer to verify which system can be built in the country where the work is being done, and the availability of the necessary materials and installers;

- suggesting the best solution for applying the slabs based on a preliminary analysis of the project (type of substrate, type of building, desired layout, etc.);
- providing designers with support during the architectural layout definition phase, developing installation diagrams for identifying the size that guarantees the least amount of waste and thereby optimising costs;
- providing the resistance values of the slab subjected to wind and shock depending on the various installation systems, which will allow designers to correctly dimension the sub-structure to fit the performance requirements of each individual project;
- developing modelling of finished elements to verify the static behaviour of the slab for each type of particular application, including the development of mock-ups to submit for testing at certified laboratories;
- providing assistance to the installer for the installation of the system identified;
- providing collaboration for suppliers of application systems present in the various countries in order to identify products that are suitable for use with Laminam slabs;
- helping designers and clients obtain local certifications for installing the material on façades.

BIM Design

All finishes and thicknesses of Laminam slabs in the catalogue and the indications of the main application systems for façades can be downloaded free of charge at the following links:

- Laminam website: <https://www.laminam.com/it/servizi-bim/>
- BimObject: www.bimobject.com/it/product?brand=laminam
- Archiproducts: www.archiproducts.com/it/laminam

Laminam provides assistance for BIM design in order to use content from online libraries, including the development of new dedicated models in collaboration with the designer.

2.3 Standards of Reference

Through the years, Laminam has tested its slabs under different reference standards adopted for the application of materials on façades (see chapter “Certifications”). The indications provided below are the result of this research.

There are many sector-specific standards, even inside one single nation, and given the requirements to fulfil, the designer and the company responsible for the construction works must verify feasibility of the application envisaged, prior to construction, based on the particular country’s current reference standards.

3 | The Product



Laminam slabs are made with advanced technologies that combine reduced thicknesses and large dimensions with high resistance to mechanical stress, chemicals, wear, scratches and deep abrasions. By nature, the material is hygienic and resistant to frost, mildew and the effects of UV rays. All characteristics and chromatic properties of our slabs are unalterable. They do not change over time or under any weather conditions. These revolutionary slabs are also environmentally friendly: natural raw materials, sustainable technology, and entirely recyclable products are the foundation of Laminam's green philosophy.

3.1 Size and thicknesses

Laminam 3



Features:

Laminam 3 is our basic slab and starting point for other versions. Untrimmed end product.

Processing surface: 1000x3000mm (39.4"x118.1") *

Nominal thickness: 3mm (1/8")

Laminam 3+



Features:

Laminam 3+ is the basic slab reinforced structurally with a fiberglass mesh bonded on the back with a specific adhesive.

Processing surface: 1000x3000mm (39.4"x118.1") *

Nominal thickness: 3,5mm (1/8")

Laminam 5



Features:

Laminam 5 is the basic slab.

Processing surface: 1000x3000mm (39.4"x118.1") / 1620x3240mm (63.7"x 127.5") *

Nominal thickness: 5,6mm (1/4")

To install Laminam 5 1000x3000mm on ventilated façades on request, when the order is placed, the slab can be structurally reinforced with a fiberglass mesh applied to the back with a special adhesive.

Laminam 5+

Features:

Laminam 5+ is the basic slab reinforced structurally with a fiberglass mesh bonded on the back with a specific adhesive.

Processing surface: 1200x3000mm (47.2"x 118.1") / 1620x3240mm (63.7"x 127.5")

Nominal thickness: 6mm (1/4")

Laminam 12+

Features:

Laminam 12+ is the basic slab reinforced structurally with a fiberglass mesh bonded on the back with a specific adhesive.

Processing surface: 1620x3240mm (63.7"x 127.5") *

Nominal thickness: 12,5mm (1/2")

Laminam 20+

Features:

Laminam 20+ is the basic slab reinforced structurally with a fiberglass mesh bonded on the back with a specific adhesive.

Processing surface: 1620x3240mm (63.7"x 127.5") *

Nominal thickness: 20,5mm (3/4")

The material can be also supplied cut to size. The minimum order quantity is 100 m² per item.

AMBIENCE bioactive Technology available with a minimum order of 100m² per item.

*Full size (untrimmed slab)

3.2 One surface, a multitude of technical features*



Easy to clean and maintain

Laminam is simple, fast and easy to clean. Laminam has no special maintenance requirements as time goes by; generally speaking, all you need to clean the surface is warm water and a neutral detergent.



Hygienic surface

Laminam surfaces are ideal for application in places where maximum hygiene is needed.



Suitable for contact with foodstuffs

Laboratory tests have proven that Laminam is totally compatible with foodstuffs.



Resistant to mould and fungi

Laminam does not allow mould, bacteria or fungi to grow.



Impervious surface

Laminam surface porosity is average 0,1%.



Resistant to freeze-thaw

Laminam is frost resistant and suitable for any weather condition, thanks to its low average water absorption (0,1%).



Dimensional stability

Laminam is not subject to dimensional variations of any significance, as it has a low coefficient of thermal expansion.



Suitable for indoor and outdoor applications

Laminam can be used both for interior and exterior décor. Weathering exposure does not damage or alter surfaces.



Resistant to heat and high temperatures

The ceramic surface does not contain any organic materials and so its surface is not altered in case of direct contact with very hot items in the kitchen, like pots and pans, and high temperatures, without any alterations.



Resistant to staining**

Laminam is not affected by prolonged contact with products commonly found in the kitchen that can cause staining, such as wine, coffee, olive oil or lemon juice, and its colour or shine will not be affected permanently.



Resistant to detergents and cleaning products***

Laminam resiste al contatto prolungato con i detersivi reperibili in commercio per la pulizia della casa, inclusi sgrassatori e anticalcare. Si pulisce con estrema facilità mantenendo inalterate le caratteristiche della superficie.



Resistant to chemicals, acids, alkalis and solvents***

Laminam is not affected by organic and inorganic solvents, chemical and disinfectants. The only chemical that can damage ceramics is hydrofluoric acid.



Resistant to thermal shock

Laminam slabs are resistant to thermal shock in both indoor and outdoor environments.



Resistant to humidity

The ceramic surface of Laminam is not affected by long-term humidity exposure.



Resistant to UV rays, no alteration to colours

Laminam surface is not affected by exposure to UV light and will preserve its original good looks throughout its lifetime.



Resistant to deflection

Laminam has a high modulus of rupture.



Resistant to scratches and abrasions****

Laminam is resistant to scratching and deep abrasion. Its properties do not change even if it is subjected to intensive use and frequent cleaning.



Eco-friendly and recyclable

Laminam is a product made of 100% natural materials. It does not release any elements into the environment and can be easily milled and recycled in other manufacturing processes.



IN-SIDE plus

The IN-SIDE technology combines advanced technical performance in terms of resistance and durability of Laminam surfaces with aesthetic qualities that further respond to the requirements of the furnishing and architectural industries. Body and surface continuity even after cutting, drilling, edging *****

* For the surface properties of the individual finishes, see technical data sheets at the end of the catalogue

** On Lucidato surfaces, stubborn stains must be removed quickly

*** On Lucidato surfaces, very aggressive detergents (such as bleach) must be removed quickly

**** Laminam slabs with Lucidato finishes, are resistant to deep abrasion, but less resistant to superficial scratches. However, Lucidato surfaces still offer a similar or a better performance than other natural and artificial materials used to make horizontal furnishing surfaces.

***** Valid for IN-SIDE technology

3.3 Adhesion properties of the fibre reinforcement

Applying a mesh to reinforce the back of the Laminam slab produces a composite product. This reinforcement is applied by Laminam S.p.A. with an automated industrial process, developed and perfected through years of research. The application guarantees high quality standards, verified by internal inspections on single production batches, and also ensures repeatability and constant product performance (process compliant according to ISO 9001).

The material obtained with this method can be installed with adhesive systems applied directly onto the fiber reinforcement without requiring abrasion and guaranteeing safe support of the slab in case of accidental breakage.

Since no specific regulations exist, Laminam created its own protocol to test the material under the most severe conditions that could occur during its life cycle. This protocol was certified by an authorized institute for the purpose of verifying the stability and constancy of the adhesion characteristics after cycles of conditioning and ageing.

This reserved information has become part of the industrial know-how of Laminam S.p.A., and other information will be supplied upon request in the context of a specific project submitted for approval to the Project Engineering office.



4 | AMBIENCE bioactive Technology, beauty and purity



In addition to the superior quality of its surfaces, Laminam provides AMBIENCE bio-active treatments for exterior and interior applications, developed in partnership with national and international researchers and leading companies in the field of innovative technologies.



AMBIENCE

AMBIENCE treatments for exterior applications can be applied onto most products from our range*. Thanks to a natural photocatalysis process, they enrich Laminam surfaces with important properties.

AMBIENCE is a technology based on the hot application of Titanium Dioxide and guarantees perfect adhesion to Laminam surfaces, for long-lasting effectiveness.

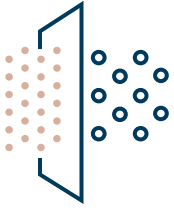
Titanium Dioxide triggers photocatalysis without being consumed by it over time. Accelerated aging studies simulating natural environmental degradation confirm that the treatment remains effective for up to 50 years of outdoor exposure.

A façade using Laminam slabs treated in this way enables particularly interesting designs, such as the use of thermal/sound insulation, alternative energy sources and eco-friendly materials, which give the building a green edge through a new generation of materials capable of interacting with the environment, and increases the building's commercial interest and value.

Laminam slabs used for exterior building cladding are enriched with different bio-active properties by specific AMBIENCE treatments for exterior use:

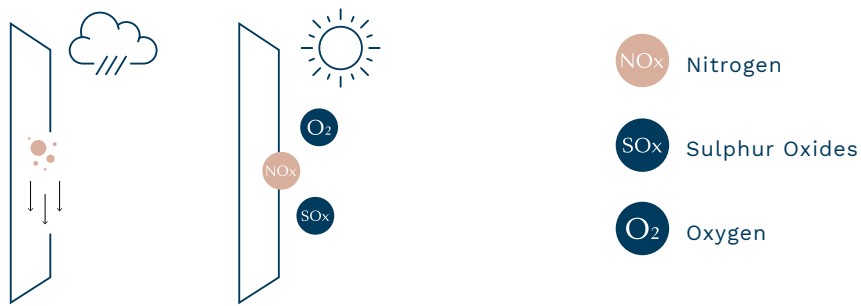
* The treatment cannot remove inorganic residues such as silicones, inert deposits, graffiti, etc. Please ask at info@laminam.com the list of materials on which the treatment can be applied.

4.1 Exterior surfaces

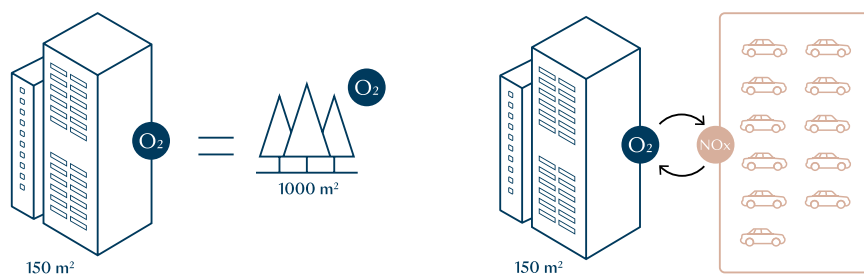


Air purification

Thanks to the natural action of the photocatalyst (TiO_2) present in the treatment, a reaction occurs on Laminam surfaces when they are exposed to the sun's rays, whereby the active oxygen species (O_2^- and OH^-) oxidize polluting materials and break them down, making them harmless for the environment (e.g. NO_x gases are converted into water, carbon dioxide and soluble salts such as nitrates). Through this break down of polluting materials, Laminam's AMBIANCE treatment causes a significant improvement in air quality and cleanliness.



A home with an exterior cladding surface area of approximately 150 sq. m onto which AMBIANCE treatments for exteriors have been applied purifies the same quantity of air generated by a forest of around 1000 sq. m and reduces the same quantity of NO_x produced by 11 cars traveling 30 km per day.



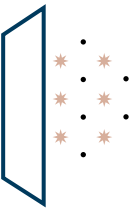


Self-cleaning

Active oxygen, generated by means of the combined action of the sun's rays and Titanium Dioxide applied onto Laminam surfaces, decomposes a vast series of organic substances due to accumulations of dirt and smog*.

The natural removal of dirt combined with an increase in surface hydrophilicity, a property also conferred by the AMBIENCE treatment, causes rainwater to carry out a self-cleaning action on external vertical surfaces.

The surface's wettability due to its hydrophilicity (i.e. a small water contact angle) makes dirt particles glide off the smooth surface and therefore easy to remove. The Ambience treatment, therefore, preserves the aesthetics of the Laminam slabs while also facilitating ordinary cleaning operations (resulting in lower maintenance costs and quicker extraordinary cleaning operations).



Antibacterial

Thanks to natural photocatalysis, a powerful oxidation process is generated, capable of preventing the formation and proliferation of bacteria, molds and fungi on surfaces treated with AMBIENCE.

The active oxygen species attack pathogens and transform them into molecules that are not harmful to health (e.g. water, carbon dioxide and salts).

The Ambience treatments for exterior applications, tested on several bacterial strains, show a reduction of the microbial load of up to 99.9%. This ensures greater hygiene in between cleaning.

* The AMBIENCE treatments for exterior applications can be applied on natural, bush-hammered and soft touch surfaces.

5 | Design



When designing a façade with Laminam slabs, we recommend laying patterns that optimize the standard sizes in the price list. The less waste required to obtain the layout, the lower the impact of the material on the façade cost. Generally, it is advisable to avoid "L" cuts, which are more affected by the settling of the substrate, regardless of the application system, and which could cause the slab to crack. If this occurs it cannot be considered a defect. Laminam slabs can be supplied in Full Size and processed by the customer directly or by a person appointed by the customer according to the façade requirements. Alternatively, the slabs can be supplied according to the different design methods listed below.

5.1 Modular façade design

The layout of a modular façade is taken from the architectural design. This makes it possible to define the main sizes and quantities of slabs required to carry out the project, without waiting for measurements or a detailed design to be carried out and speed up the work. The material can be supplied in different regular sizes in minimum quantities of 100m² per item and finish. Smaller and non-standard sizes to obtain compensating elements, such as end elements, near openings, and cornices will be made on site or in the workshop from a standard size element. For on-site processing, please refer to the "Processing" chapter in the Technical guide for cladding & flooring. This type of design guarantees a high degree of flexibility, on-site adaptations, and plan the material order in advance. This is usually the least expensive and limits the fabrication and cutting required to obtain a made-to-measure product. This type of design is generally used for application systems using Laminam 3+, 5, 5+, excluding the rivet system.

5.2 Cubed partitioned façade design

When planning the façade implementation timetable, the production and processing of the slabs need to start after the size list is received. This method, which involves the preparation of a detailed design, may require a longer overall implementation time than a modular design that allows the slabs order to be defined based on the architectural design.

A cubed partitioned façade requires slabs supplied in the sizes specified in the detailed design after the building is measured. The customer/designer must provide a complete list of sizes.

This type of design is used for Laminam 12+ and 20+ slabs and for rivet, cell, curtain wall and window wall systems which are based on each detailed design.

5.3 Shades

Laminam slabs are produced from natural raw materials and obtained through an industrial process. Even though they are not subjected to important aesthetic variations like natural stones, the type of raw material used to manufacture them ensures that there are minimal chromatic variations even inside the same finish.

The production process at Laminam S.p.A. involves an attentive selection phase to identify the production batches with the same shade, thus guaranteeing that the product always be within the company's predetermined tolerance margins. Slabs with the same finish but different dimensions and thicknesses will always have a different shade, which will always be in the company's preset range.

To guarantee that the designer can obtain a high-quality aesthetic result on the façade, supplies will be divided into the identified shades. We suggest completing each perspective or continuative portion in the same shade. If this is not possible, the presence of protrusions, alcoves, or other elements that create separations makes it possible to apply different shades without them being perceived as different. For continuative perspectives with large surfaces that cannot be done in a single shade, do not mix shades randomly. Create a clear horizontal or vertical separation, possibly in correspondence with an architectural element.

The Project Engineering of Laminam S.p.A. can provide assistance to distribute the shades supplied, together with the designer/buyer, based on the project requirements.

5.4 Directions

The uniformity of the shades described above is possible only if the slabs are applied on the walls with the grain running in the same horizontal or vertical direction. If there are non-standard sizes, even for uniform finishes, it is necessary that they be separated and mounted in the same direction as the main slabs.

If the same wall is clad in slabs mounted in different directions, there will be a perceived chromatic variation when exposed to the light even if they are exactly the same shade.

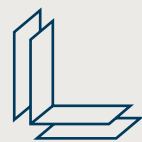
Any variations in direction inside the same perspective must therefore be assessed by the designer based on the final desired effect.

5.5 Vertical Installation of the Filo Series

The Argento, Ghisa, Oro, and Mercurio colours in the Filo series have an exclusive iridescent surface which is made through the relief application of special metal oxides. For the best aesthetic effect in applying the cladding, we recommend laying the slabs making the sides with the Made in Italy writing on the back align two by two, alternately rotating the slabs by 180°. This refined metallic finish feature may vary slightly in shade and brightness when exposed to the outside weather. The Filo series metal finish and structure may reflect light unevenly when applied outdoors. It is not possible to guarantee a uniform reflection even for the same shade. Weather-exposed Filo series finishes could have small uneven shades.



6 | Ventilated Façades



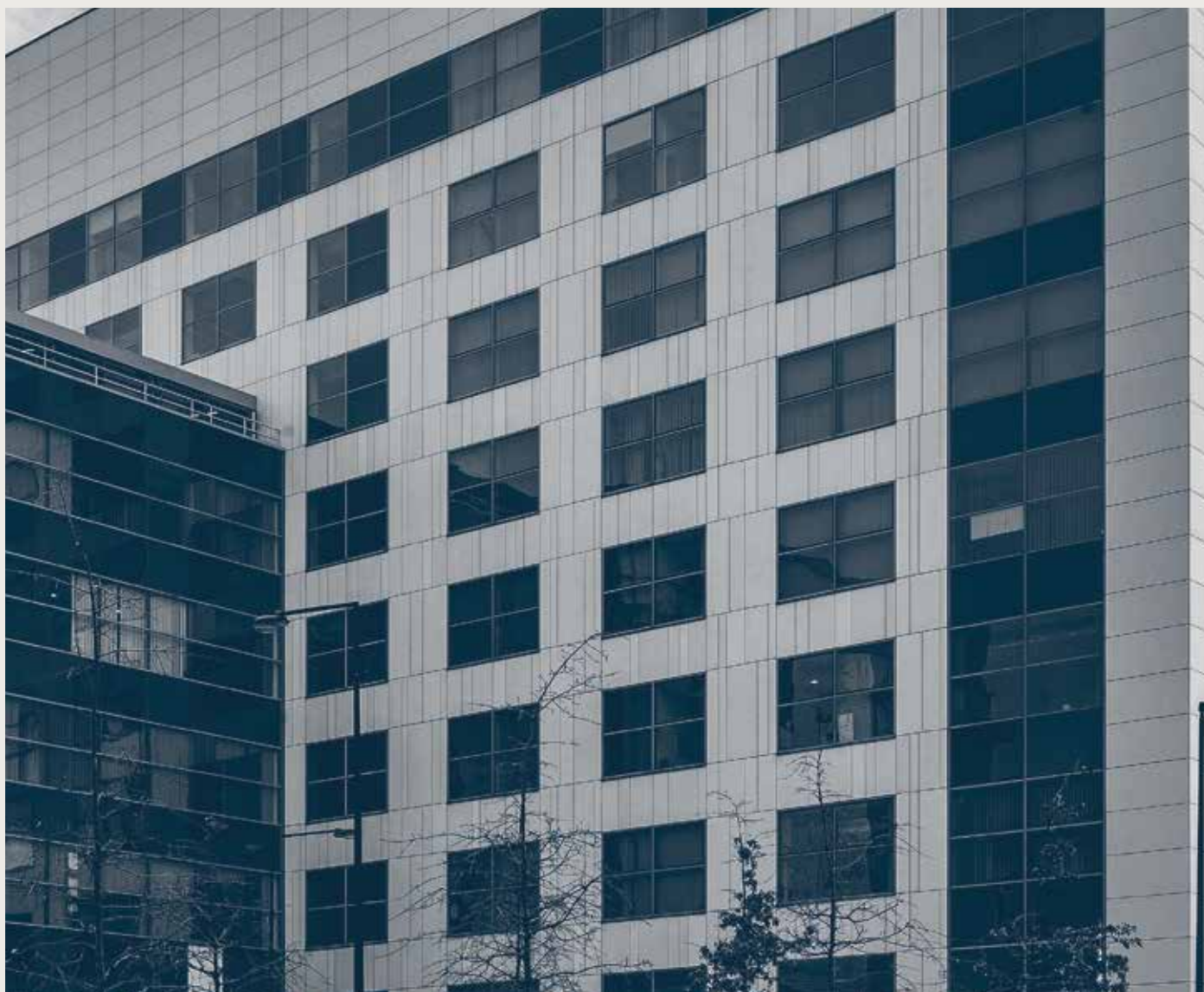
Ventilated façades are a technological solution in which the cladding is applied on profiles anchored to the building's external structure with a space in between the exterior and the slabs.

This space generates an air flow from the bottom to the top of the building, which creates a chimney effect that helps lower the temperature and eliminate any residual condensation.

This space can be built to accommodate thermal insulation of any thickness and type, acoustic insulation, and possibly firewall barriers.

This solution can be adopted for any type of structure to guarantee a high level of comfort in the interiors.

The main application systems are listed below.



6.1 Adhesive system

Slab installed by applying adhesive to the sub-structure profiles in situ. Adhesive bonding must withstand wind and mediate the different expansion ratios of the profiles and slab.

Laminam Slab Sizes

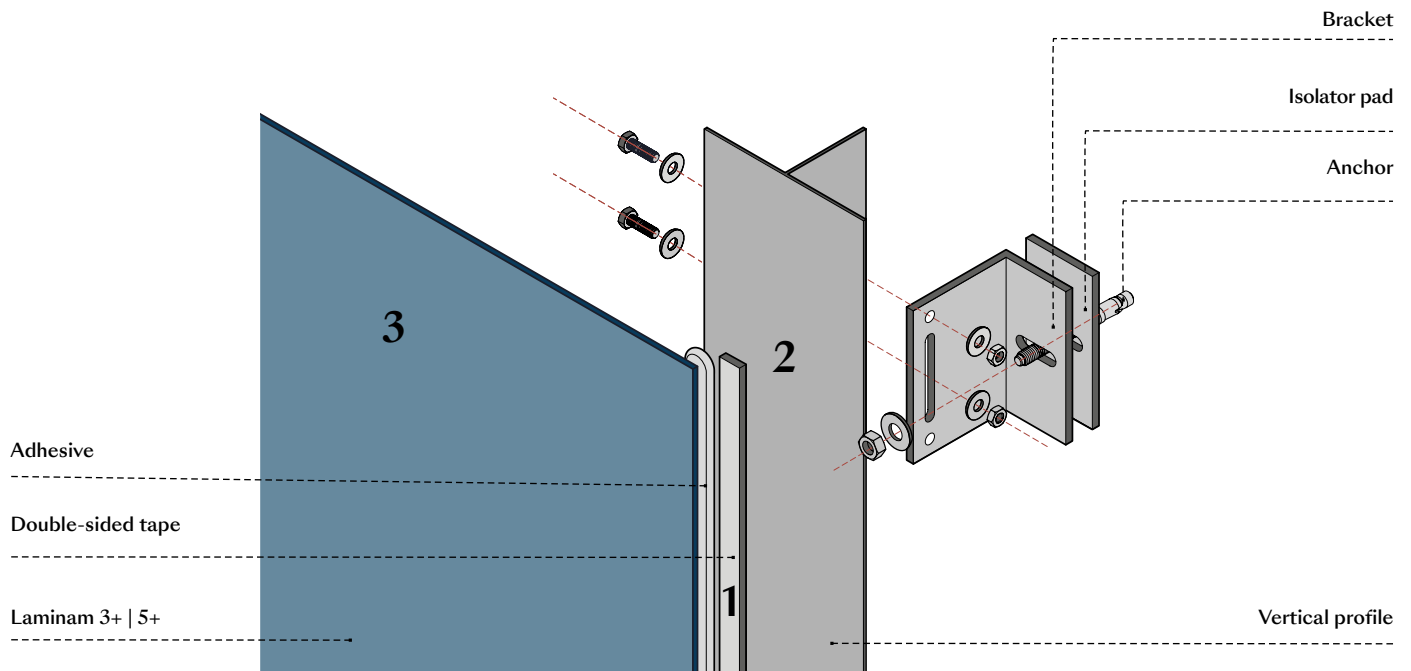
Laminam 3+ and Laminam5+ slabs can be applied in a maximum size of 1000x3000mm, 1200x3000mm and 1620x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

Using the adhesive system, it is possible to follow the modular design, described in chapter 5, and obtain the size list from the architectural design.

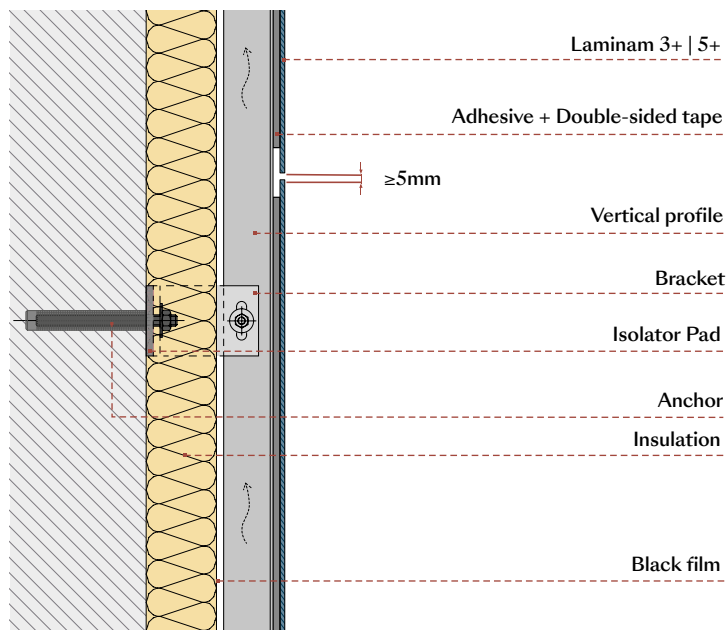
Non-standard sizes can be made on site by cutting the Laminam slab. This provides a great deal of flexibility and permits modifications/corrections as the works progress.



1) Adhesive

The slab is fixed on site by applying a single-component adhesive vertically, to the aluminum sub-structure. Bonding can be done horizontally, ensuring that water is avoided along the silicone bead. Silicones, polyurethanes, and MS polymers tested by the manufacturer and indicated as being suitable for Laminam slabs can be used.

The adhesive bead must be sized by the supplier which must provide the correct application instructions. Normally, the adhesive is combined with double-sided tape, which guarantees the correct thickness of the adhesive, and supports the slab when it is applied during the first phase of bonding. The distance between the adhesive beads must be based upon the wind pressure.



2) Sub-structure

Sub-structure profiles must be adequately sized, and have an L, T, Ω, or box section or generic profile, with a width and surface finish which guarantees bonding. The profiles must be cleaned using a cleaner, and, if necessary, treated using primer. The distance between the profiles must be based upon the wind pressure. Choosing and sizing brackets depends on the resistances required and the insulation thickness. The above instructions must be confirmed by the company that manufactures the adhesive.

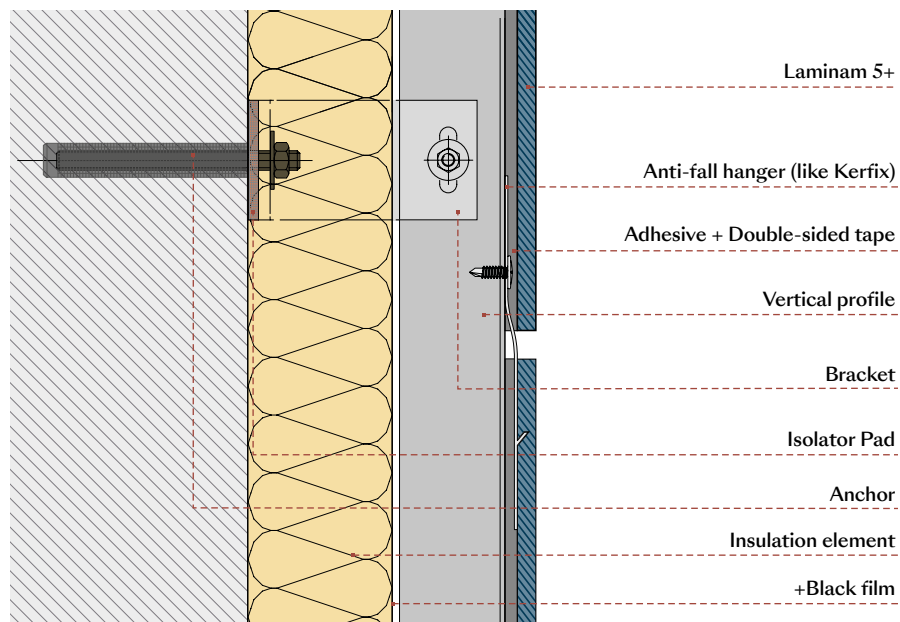
3) Slab Installation

Laminam slabs can be installed horizontally or vertically, and they require care during handling. We suggest keeping a gap of at least 5 mm between the slabs.

Fall Prevention Hanger

The adhesives guarantee perfect fixing of the slabs to the cladding. However, when the Project Management or Local Regulations require mechanical fixings to be used, a steel (Raifix type) fall-prevention hanger can be fitted.

Hangers for Laminam 5+ slabs are housed in a milled groove in the back of the slab, and then fixed to the sub-structure using a rivet or self-tapping screw. The hangers prevent the slab from falling if detachment occurs during an exceptional event and allow easy removal and reinstallation.





6.2 Clip System

Slabs can be installed with metal clips as mechanical fasteners. Slab support systems must contrast the action of the wind and allow thermal expansion of the profile.

Laminam Slab Sizes

Laminam 3+ slabs can be applied in a maximum size of 500x3000mm.

Laminam 5+ slabs can be applied in the maximum formats of 1000x3000mm, 1200x3000mm and 810x3240mm.

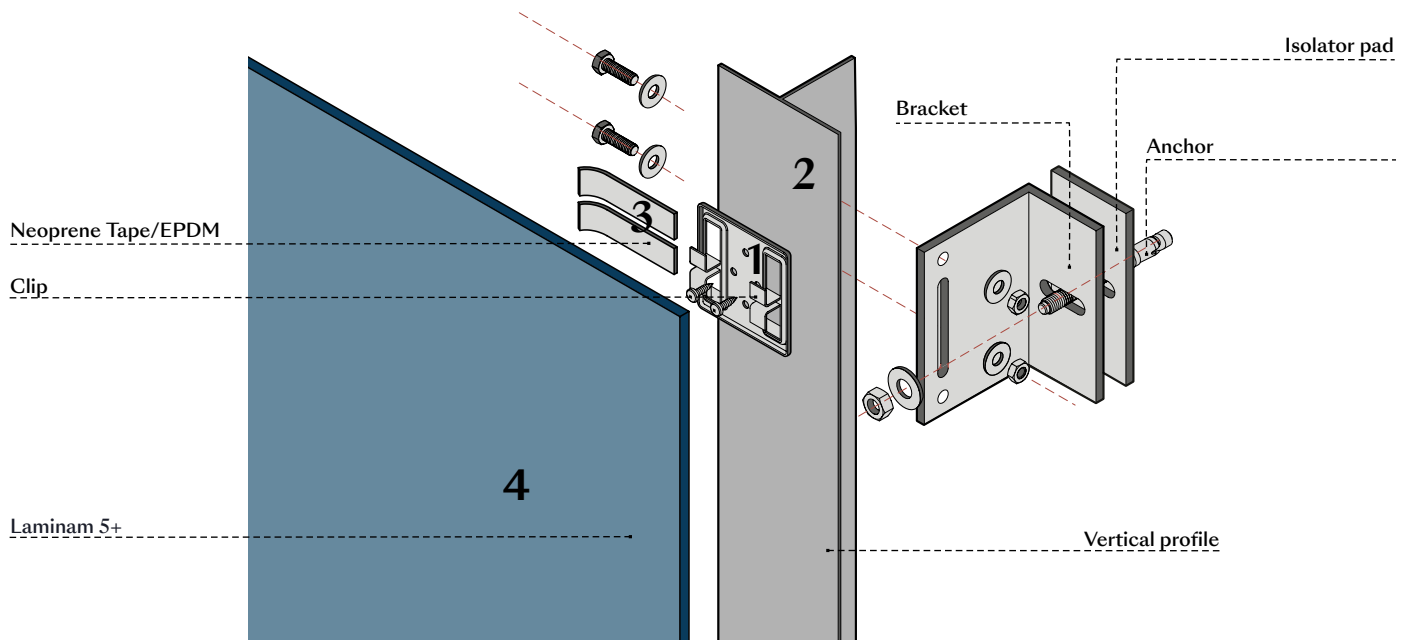
Any local regulation limits must be evaluated individually by the appointed designer.



Design

Using the clip system, it is possible to follow the modular design, described in chapter 5, and obtain the size list from the architectural design.

Non-standard sizes can be made on site by cutting the Laminam slab. This provides a great deal of flexibility and permits modifications/corrections as the works progress.



1) Clips

Stainless steel clips can be in one piece or in two pieces.

Clips in other metal alloys can be used after being verified by a technician approved by the supplier company. Clips can be fastened to the sub-structure with rivets, cap screws or special fixing systems. Clips fastened with rivets, screws or interlocks must be guaranteed by the company that supplies the system, which must also provide the instructions for the correct installation of the clips.

The visible part of the clip can be painted in different RAL colors based on the finish of the desired Laminam slab. The distance between the clips must be based on the wind pressure.

2) Sub-structure

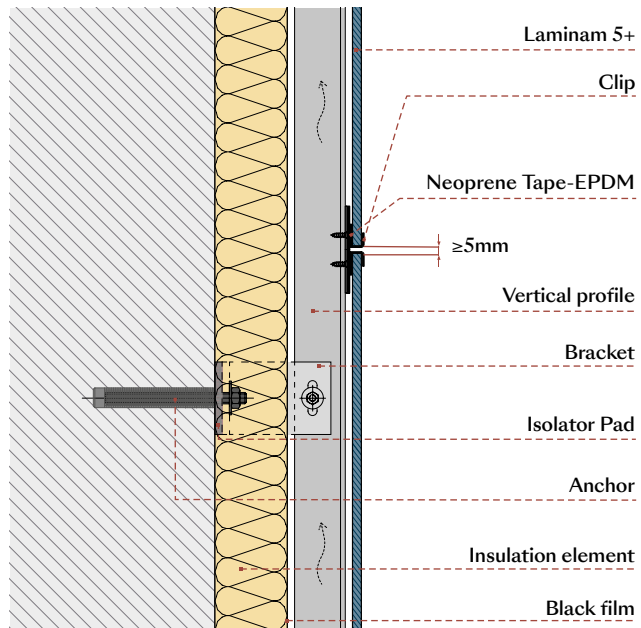
Sub-structure profiles must be adequately sized, and have an L, T, Ω , or box section or generic profile, with a width and surface finish which guarantees the correct installation of the clip, or dedicated profiles that were designed for this type of fixing system. The distance between the profiles must be based upon the wind pressure. Choosing and sizing brackets depends on the resistances required and the insulation thickness.

3) Anti-vibration Element

It is necessary to position the neoprene, EPDM or other equivalent material between the back of the slab and the clip or profile to give the system solidity, prevent lateral slipping and eliminate vibrations. This material can be in the form of adhesive tape to place on the profiles or an element that is directly included or assembled on the clip. As an alternative, silicone can be applied at points along the profiles.

4) Slab Installation

Laminam slabs can be installed horizontally or vertically and they require care during handling. Installation must be carried out without applying particular pressure on the slab and avoiding any type of forcing. The vertical or horizontal gap between the slabs must be the equal to or greater than 5 mm.





6.3 Rivet System

Installation of the slab with rivets in aluminum, copper or stainless steel. .

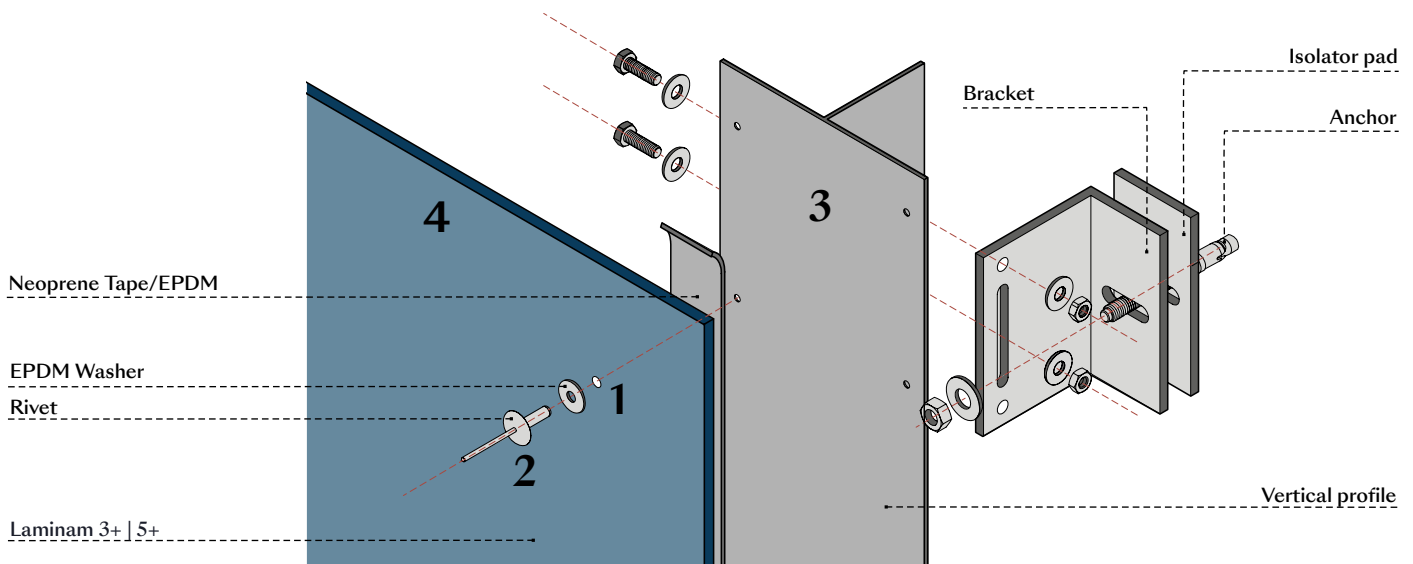
Laminam Slab Sizes

Laminam 3+ and Laminam5+ slabs can be applied in a maximum size of 1000x3000mm, 1200x3000mm and 1620x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

A survey of the building and detailed working drawing of the façade must be carried out to obtain a list of the necessary sizes and the positions of the rivets. The material can be processed directly at the building site or at a manufacturer with a water-jet machine for cutting and drilling holes in the slab.



1) Drilling

Laminam slabs must be drilled with a water-jet machine or with diamond-tipped drill bits suitable for processing thin porcelain stoneware. All rivet holes must have a diameter of at least 5 mm (or the diameter required by the rivet manufacturer) and a distance from the edge equal or greater than 50 mm, measured from the hole barycenter. The dimension of the hole in the slab must be calculated to allow for thermal expansion of the structure without creating stress in the slab, keeping at least two 5 mm holes in the central area as fixed points. Holes in the sub-structure must also have a diameter of 5 mm (or the diameter required by the rivet manufacturer).

2) Rivets

Rivets can be easily obtained from different companies present on the market. Generally, they are made in stainless steel, copper, aluminum or aluminum with the body in stainless steel and round dome heads. They must be compression rivets, instead of expanding or peel-style rivets. The rivet body must be made of stainless steel or aluminum to prevent corrosion at the pullout point. The rivet used to install Laminam slabs generally presents a body diameter of 4.8 mm and a head that at least 14 mm wide. The body length and locking thickness must accommodate the sum of the thicknesses of the materials fastened together. The suitability of the rivet for this type of application must be approved by the rivet manufacturer. The visible part of the rivet can be painted in different RAL colors based on the finish of the desired Laminam slab. A rivet gun of the brand and model suggested by the rivet manufacturer must be used to install the rivets. A washer in EPDM rubber 1 mm thick and D-1 mm in diameter must be placed between the slab and the rivet head, for

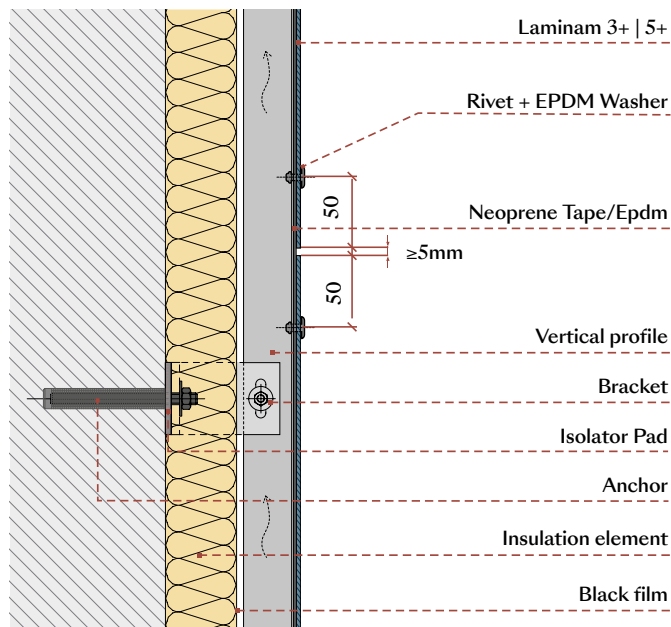
the purpose of eliminating possible stress that would damage the connection between the slab and the rivet. Collapsible black adhesive tape in neoprene (or an equivalent material) must be inserted on the vertical sub-structure, in correspondence with the holes in the slab, to eliminate vibrations.

3) Sub-structure

Sub-structure profiles must be adequately sized, and have an L, T, Ω, or box section or generic profile, with a width and surface finish which guarantees correct installation of the rivets. The distance between the profiles must be based upon the wind pressure. Choosing and sizing brackets depends on the resistances required and the insulation thickness.

4) Slab Installation

Laminam slabs can be installed vertically and horizontally, taking care while handling them. To correctly move the slab, we advise using suction pads or frames with suction pads to make the procedure easier. The rivet installation process must take place without applying particular pressure on the slab, avoiding shocks and unsuitable tensions near the hole. To correctly mount the slab, we advise fastening it with at least three rivets, which are not vertically or horizontally aligned, to secure the slab to the façade immediately and then proceed to install the remaining fasteners. The vertical or horizontal gap between the slabs must be the equal or greater than 5 mm.





6.4 Cell System

The system involves designing the façade with a an “abacus” of frames, usually in aluminum, and then installing the slabs in the workshop with suitable adhesives. This format creates a system of “cells” that is mounted on a sub-structure used generally also installing aluminum composites. The cell system offers the quality of a product installed in a workshop and guarantees high precision during the work and continuity of process with respect to systems installed entirely on site. These frames can be mounted quickly and precisely.

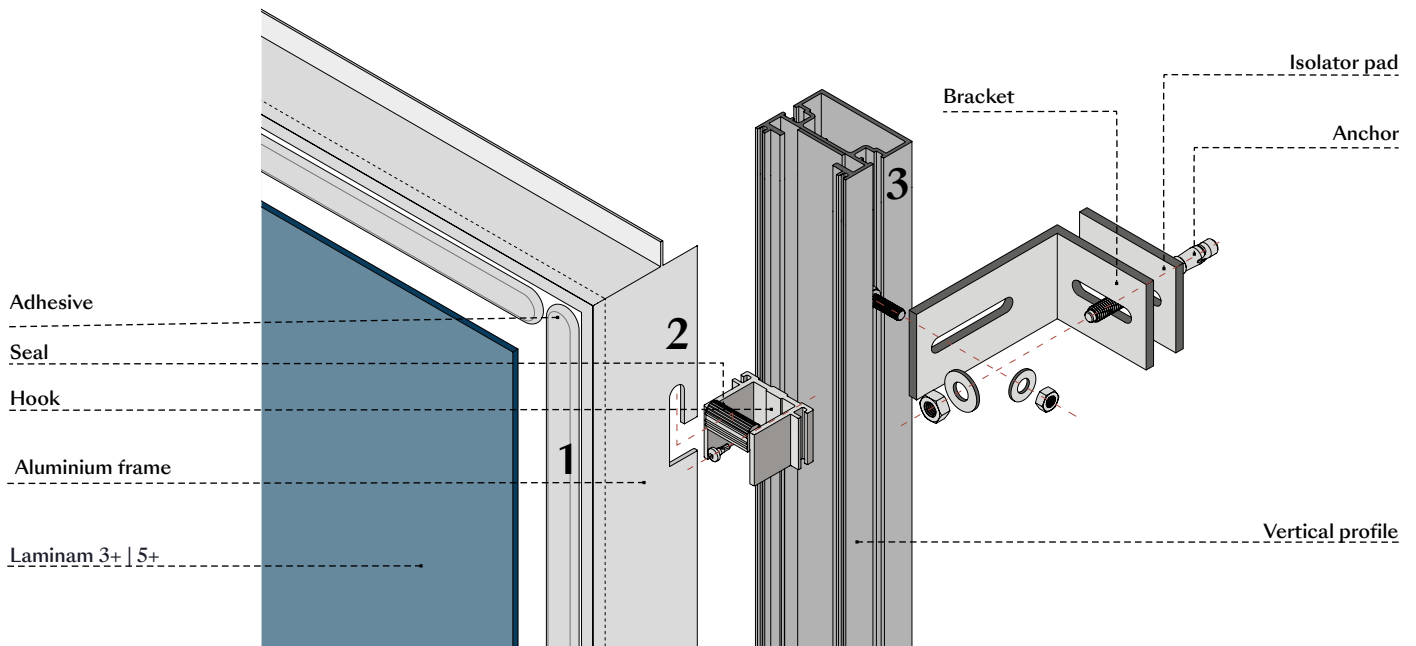
Laminam Slab Sizes

Laminam 3+ and Laminam5+ slabs can be applied in a maximum size of 1000x3000mm, 1200x3000mm and 1620x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

Using the cell system it is possible to follow the modular design, described in chapter 5, and obtain the size list from the architectural design. Non-standard sizes can be made in the workshop by cutting the Laminam slab. In some cases, the construction of a cell façade may be based on a detailed design. This implies a cubed partitioned design as described in Chapter 5 .



1) Adhesive for façades

The slab is adhered with silicone, polyurethane adhesive or MS polymer on the aluminum frame. The adhesive and the dimensions of the adhesive bead must be indicated by the supplier, which must also provide the correct application instructions.

2) The Frame

The frame is made from boxed or generic profiles in aluminum, assembled with brackets, corner brackets or dedicated systems. The frame must be designed to fit the center distance on the sub-structure to guarantee adequate resistance to the slab and satisfy wind load requirements specified in the project.

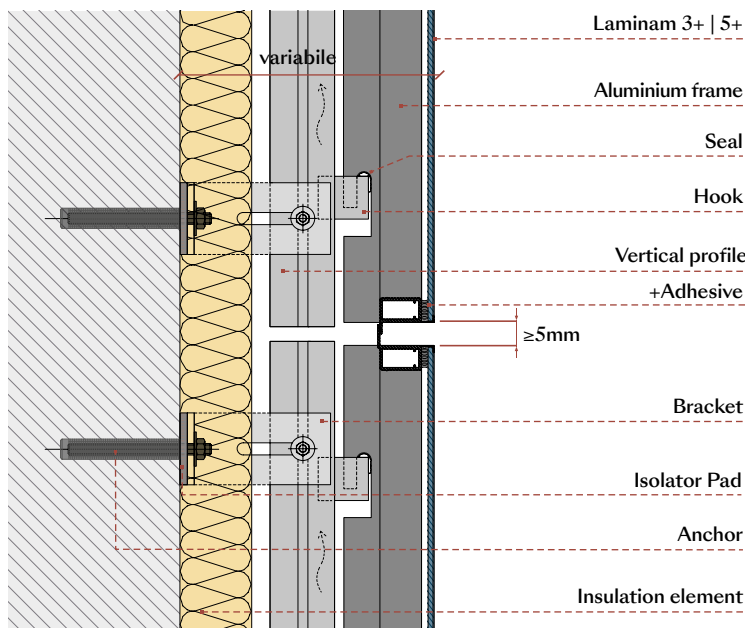
Mechanical fixing of the cell to the sub-structure can be done with fasteners that are already prepared on the frame or with screws. These systems generally allow the removal of each individual panel and guarantee that the underlying part of the wall can be inspected.

3) Installation of Panels and Sub-structure

The system allows the installation of slabs in horizontal or vertical positions.

Sub-structures available on the market can be used, which have panel fastening systems built in workshops, or with T, L or Ω profiles in aluminum or steel to which the prepared frame is mechanically fastened with screws. It is possible to use this system also with wooden sub-structures.

The center distance of the sub-structure must be determined in relation to wind pressure and the type of building. Choosing and sizing brackets depends on the resistances required and the insulation thickness.





6.5 Undercut Anchoring System

Slab installation using undercut anchors inserted in the back of the slab and anchored to the sub-structure.

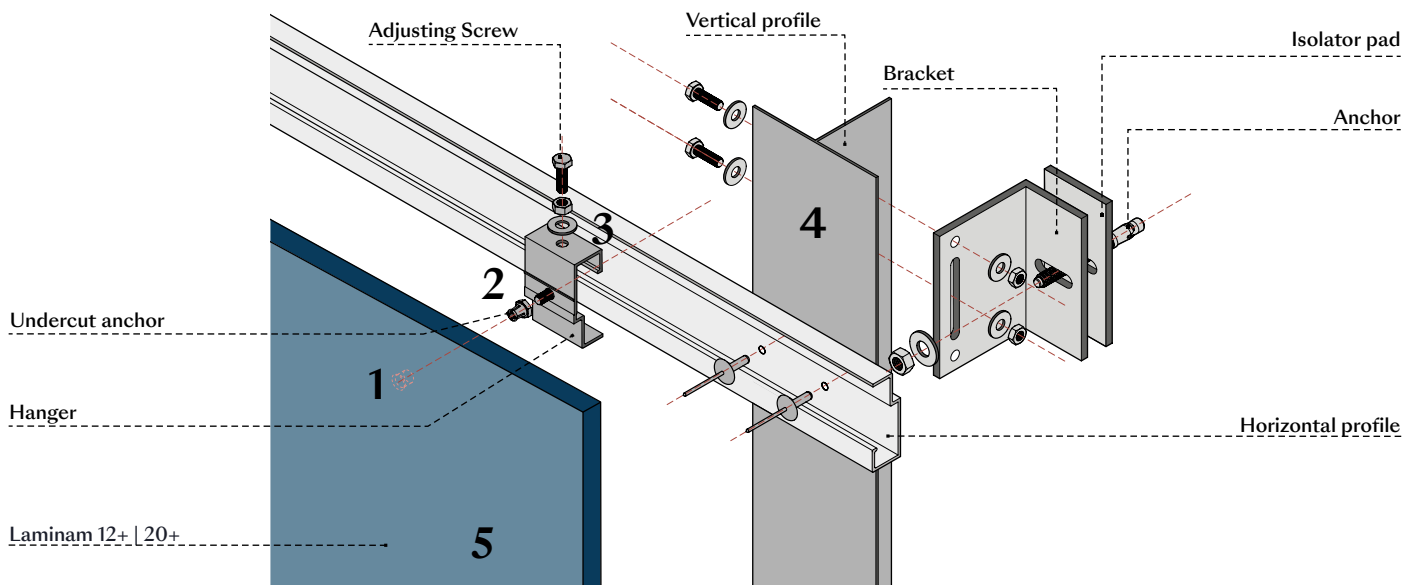
Laminam Slab Sizes

Laminam 12+ and Laminam 20+ slabs can be applied in a maximum size of 1620x3240mm mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

A survey of the building and working drawing of the façade must be carried out to obtain a list of the sizes and the positioning of the holes. The material is prepared by a manufacturer with the necessary equipment for cutting, drilling, and inserting the anchor.



1) Drilling

The Laminam slab must be drilled using suitable diamond-tipped drill bits and the procedures indicated by the anchoring system supplier, while taking the material's thickness tolerances into account. The hole must be tested under the conditions indicated by the anchor manufacturer.

2) Anchoring Devices

There are various companies on the market that supply anchoring devices also used for natural stone. Manufacturers must indicate the suitable anchor and provide data on its strength in relation to the thickness of the slab to be used, and the design's strength requirements. The number and spacing of the undercut anchoring devices must be based upon the wind pressure.

3) Fixing System

The fixing system, to which the slab is anchored, can be in the form of fixing points or a continuous profile.

4) Sub-structure

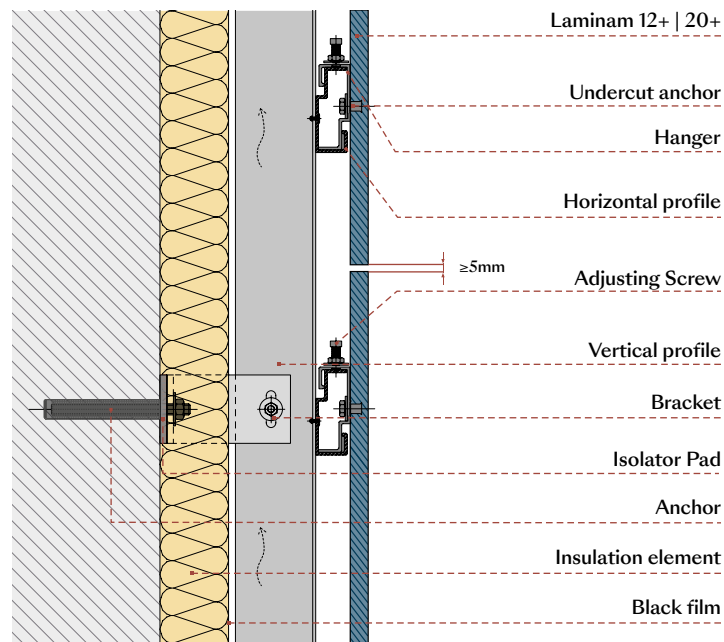
The sub-structure is a double layered system. The vertical profiles may be L, T, Ω, boxed, or a generic profile, while horizontal profiles have a cross section which can accommodate the fixing system. The center distance between the profiles is based on the building's structure, cladding weight and wind pressure. Choosing and sizing brackets depends on the resistances required and the insulation thickness.

5) Slab Installation

Laminam 12+/20+ slabs can be vertically or horizontally installed.

The smaller sizes can be installed manually using scaffolding where necessary. Due to the larger slab's weight, these must be equipped with a system for lifting them on site, similar to those used for glass. This is necessary to allow safe handling of the slabs to their installation positions, while allowing the operators to secure the necessary anchoring.

The horizontal and vertical gaps between the slabs must be equal to or greater than 5 mm, while minor alignment adjustments can be made in situ, by adjusting the fixings.



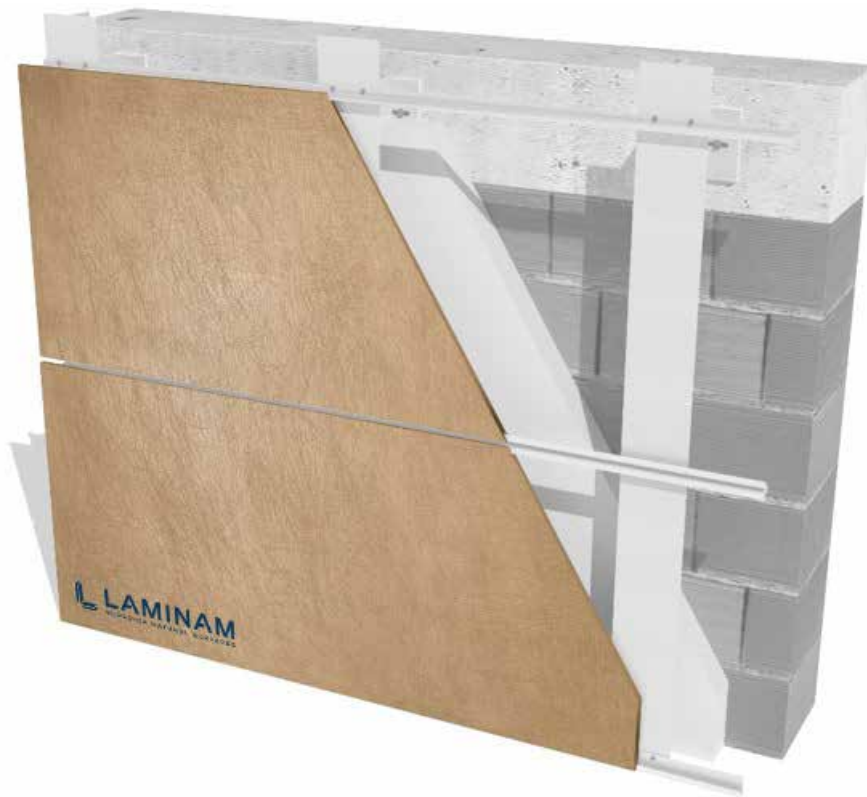


6.6 Kerf System

Slab installation with hidden fasteners (metal clips or continuous profiles) inserted in a groove (kerf) made for that purpose on the lower and upper edges.

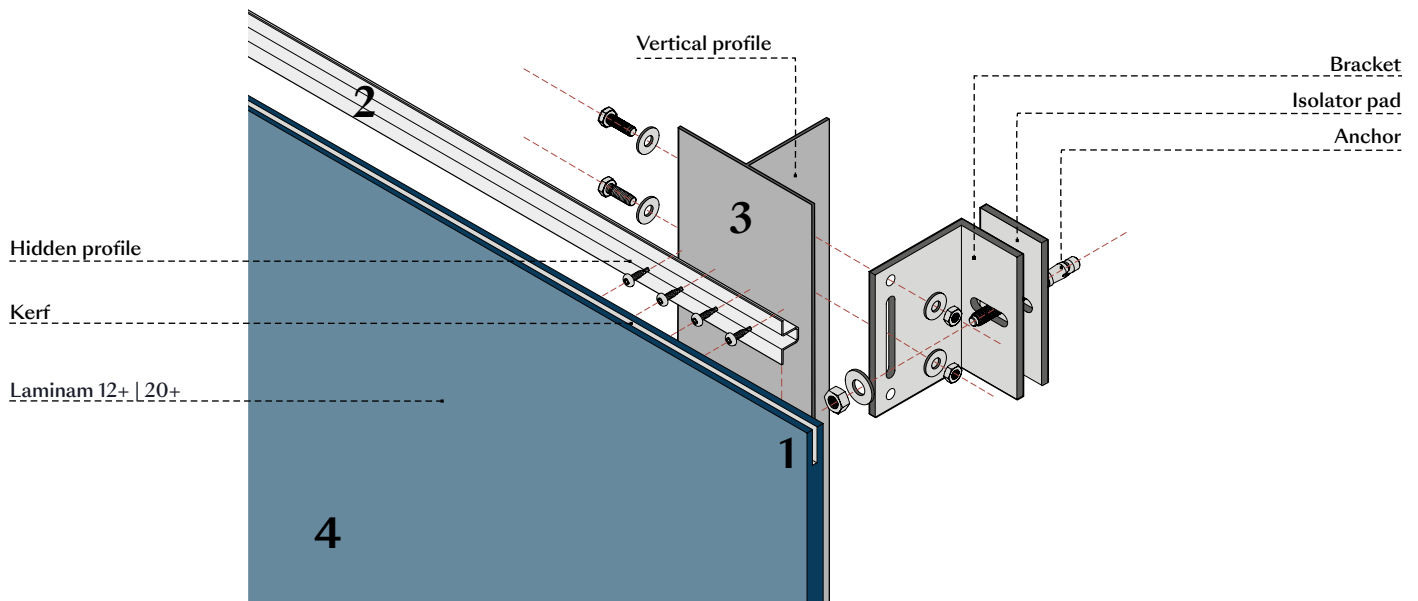
Laminam Slab Sizes

Laminam 12+ and Laminam 20+ slabs with this fixing system can be mounted in the maximum sizes of 810x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

A survey of the building and a drawing of the façade must be carried out to obtain a list of the main sizes. Non-standard sizes to finish spaces next to the corners, openings, etc. can be prepared in situ with waterjet cutting techniques, or they can be requested from the manufacturer after having completed a detailed working drawing which lists the sizes that need to be supplied.



1) Kerf System

The kerf system for Laminam 12+/20+ slabs must be done with a waterjet cutting disc. This process can be done along the entire length of the slab or it can be interrupted before the end of the slab to hide the cut after it is mounted. If fixing points are used, the kerfs will be made only in the fixing points.

2) Fixing System

Slabs are mechanically fixed with clips at certain points or continuous profiles. The clips and profiles in stainless steel must be sized to withstand the weight of the material and the resistances required by the project. The kerfs must be cut at the center of the slab edge.

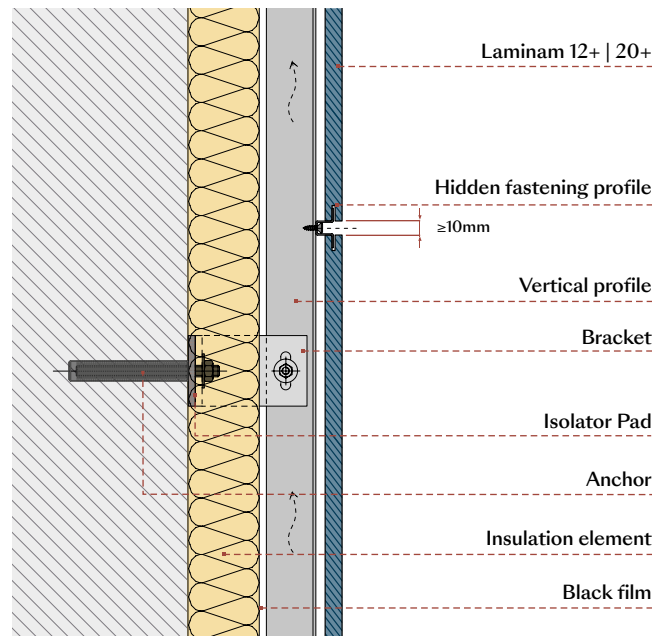
3) Sub-structure

Sub-structure profiles must be adequately sized, and have an L, T, Ω , or box section or generic profile. The center distance between the profiles is based on the building's structure, cladding weight and wind pressure. Choosing and sizing brackets depends on the resistances required and the insulation thickness.

4) Slab Installation

In this specific application Laminam slabs can only be installed horizontally, in order to maintain adequate distance between the supports. Smaller sizes, such as slats, can be installed manually using scaffolding where necessary. Due to the larger slab's weight, these must be equipped with a system to lift them on site, similar to those used for glass.

This is necessary to allow safe handling of the slabs to their installation positions, while allowing the operators to secure the necessary anchoring. At the time of installation, we suggest inserting neoprene foam tape or silicone-based products between the vertical profiles and the slab, to prevent vibrations or sliding. The vertical or horizontal gap between the slabs must be the equal or greater than 5 mm.





6.7 Composite Panel System

These systems involve creating sandwich panels which have Laminam slabs as the external surface and a support element, to which the fixing system will be attached.

This method of application is normally used if certain requirements are necessary:

- High wind load resistance
- Rigidity, lightness, resistance to shocks
- Easy installation
- Creation of monolithic elements

Laminam Slab Sizes

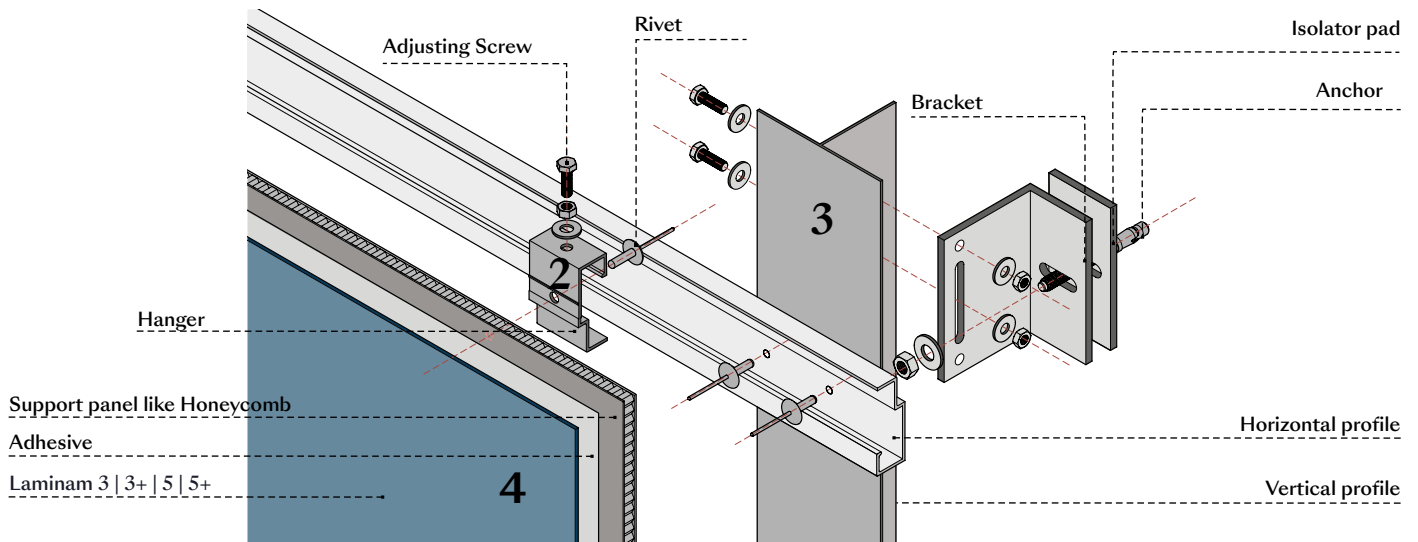
Laminam 3/3+ and Laminam 5/5+ slabs can be applied in a maximum size of 1000x3000mm, 1200x3000mm and 1620x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

A survey of the building and a detailed working drawing of the façade must be carried out to obtain a list of the sizes required. The material is bonded and cut to measure at the workshop.

Full size slabs are supplied for these systems



1) Sandwich Panels

Normally, sandwich panels are made by bonding Laminam slabs to honeycomb panels, commonly used as backing for thin stone veneer. A honeycomb panel is constituted by a central core, which has a honeycomb cell pattern, and two external surfaces called skins. The skins are usually made from a material with high mechanical resistance that can be a composite in fiberglass, carbon fiber or Kevlar, or even thin aluminum or steel sheet. As an alternative, other types of panels can be used which have been designed and certified by specialized companies in the sector. Using defined layering and industrial processes, these panels can be bonded to Laminam slabs with processes similar to those described below. The Laminam slab, supplied with or without fiber depending on requirements of the panel producer, is glued to these panels in the workshop, generally with polyurethane or epoxy adhesives, as specified by the manufacturer of the panel. The sizes required for the project can be obtained before or after the bonding process.

The manufacturer and the assembler of the panel must guarantee:

- sizing/thickness of the panel in compliance with specified resistance requirements;
- expansion compatibility between the Laminam slab and the selected panel;
- the type of glue used to guarantee adhesion and prevent separation of the layers over time;

In some cases, it may be necessary to seal the edges of the panel to prevent waterlogging;

In this specific application, the Laminam is exclusively used as a surface finish;

2) Fixing System

The panel fixing system is built with aluminum profiles and attached with fixing points or continuous profiles to the internal skin of the panel, generally with rivets. The number of fasteners must be determined based on the resistances required by the project, the thickness of the panel and the type of material that the skin is made from.

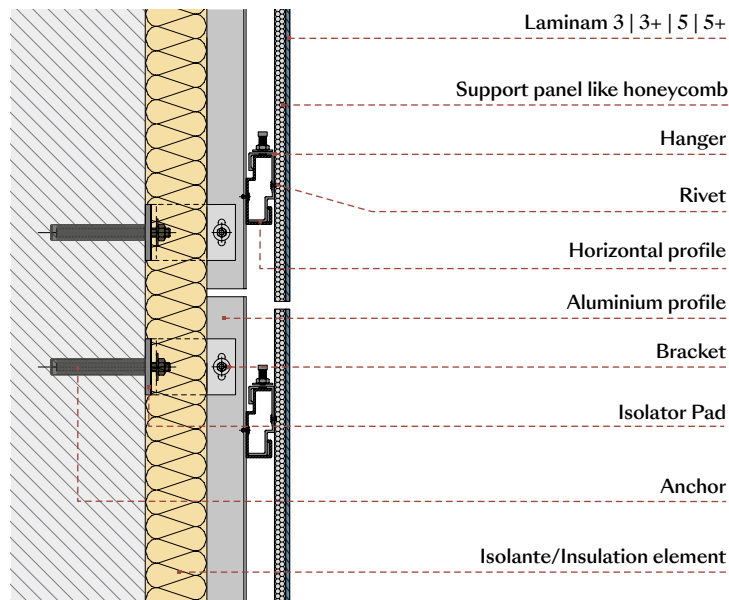
3) Sub-structure

The sub-structure is generally a double layered system.

The vertical profiles may be L, T, Ω , boxed, or a generic profile, while horizontal profiles have a cross section which can accommodate the fixing system. The center distance between the profiles is based on the building's structure, cladding weight and wind pressure. Choosing and sizing brackets depends on the resistances required and the insulation thickness.

4) Panel Installation

Panels can be installed both horizontally and vertically. Suitable lifting systems must be used, depending on the panel thickness.



7 | Curtain Wall



The curtain wall is a technological solution in which the exterior cladding is the building's envelope main element, which performs the main functions of an external wall, such as ensuring waterproofing, weather barrier etc.

Continuous vertical elements are anchored to the building's horizontal load-bearing elements. This type of façade must be designed and installed by specialized companies. Curtain walls are used mainly on buildings destined to commercial use.

Laminam slabs can be used to make cells to build curtain walls. The structures used are the same used to mount glass panels. The cell is inserted in a structural aluminum grid formed from vertical profiles that are anchored at points between floors and on cross beams.



Laminam Slab Sizes

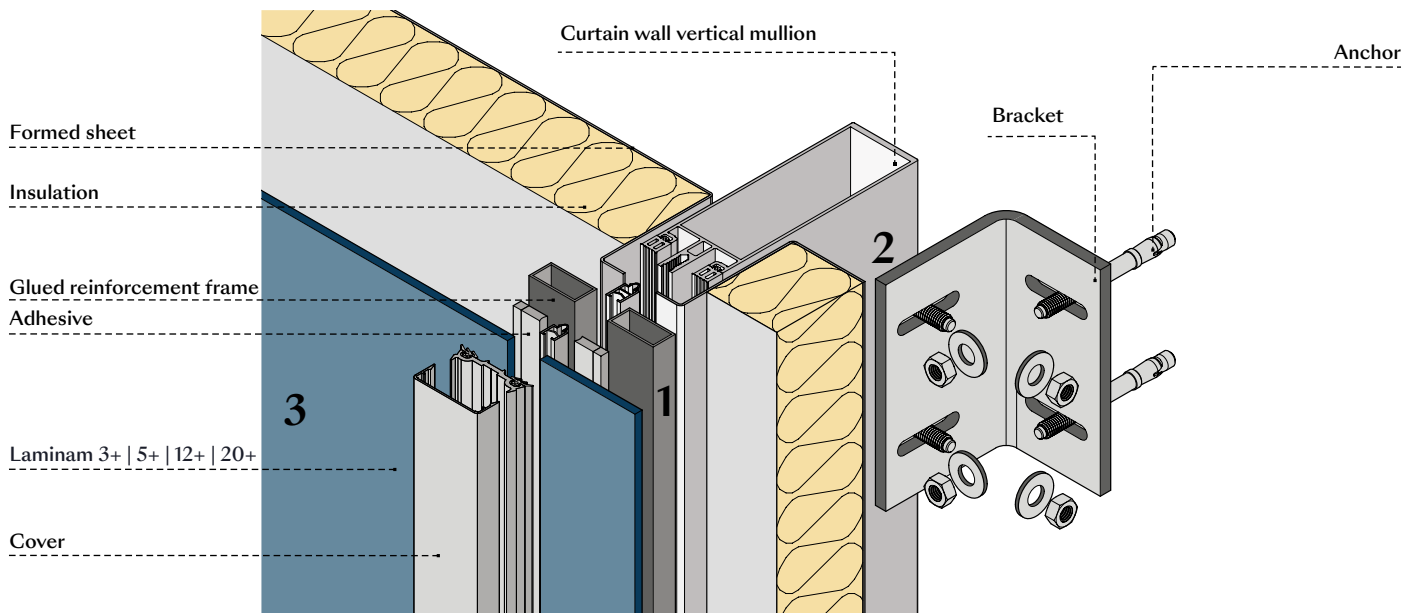
Laminam 3+, Laminam5+ Laminam 12+ and Laminam 20+ slabs can be applied in a maximum size of 1000x3000mm, 1200x3000mm and 1620x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

The design of the curtain wall must satisfy structural and architectural requirements. The design defines the frequency and dimensions of the vertical profiles, which will be the load-bearing part, and the cells anchored to them, which will be the architectural part.

Standard curtain wall systems exist on the market which can be adapted to various projects, but sometimes dedicated structures are built for specific projects.

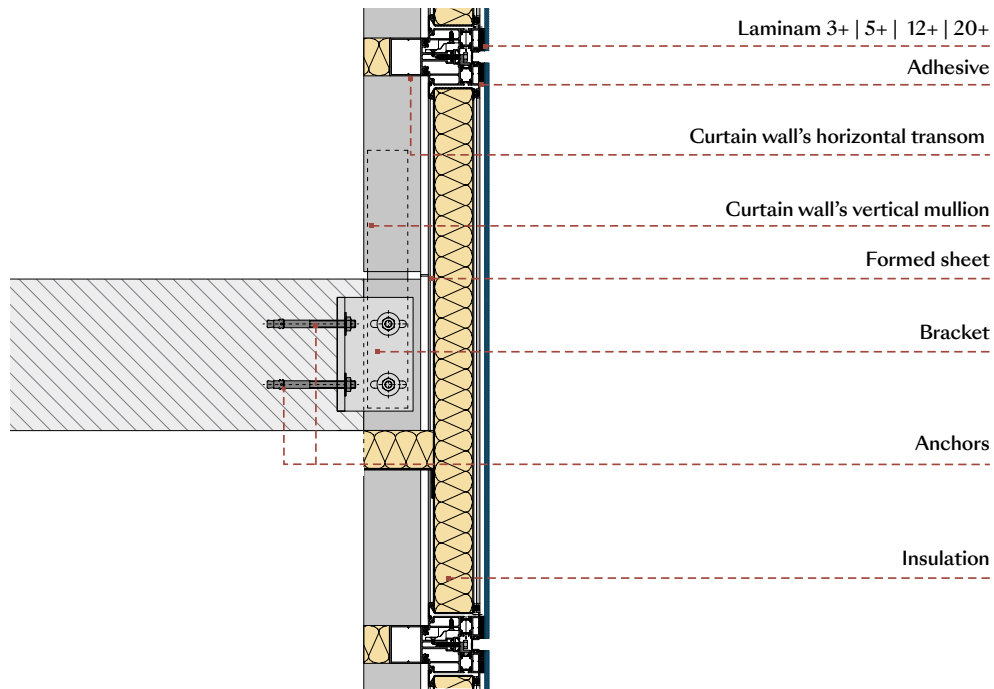


1) Cell Assembly

The cell is formed from a frame in aluminum upon which the Laminam slab is anchored with structural silicone or polyurethane or polymer adhesive. The adhesive and its dimensioning must be indicated by the supplier, which must also provide the correct application instructions.

The cells must be built in compliance with the list of sizes envisaged by the working documents and can be supplied at the building site already furnished with insulation and the internal closing sheet made of metal sheet.

The slab thickness must be decided based on wind and shock resistance required for the project, and also based on the cleaning and maintenance system that will be used for the façade. In addition to the perimeter frame, intermediate reinforcements can be inserted in the cell or a honeycomb panel can be added to give the slab adequate resistance against the wind load.



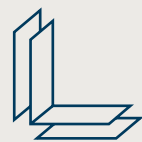
2) Load-bearing Structure

The structure comprises continuous vertical elements, anchored with brackets projecting from the horizontal between-floor structures. The horizontal crossbeams and preassembled cells are anchored to these vertical profiles. Depending on the type of project and the installation system, the cells can hold more than one slab, or a combination of slabs and portions in glass. The cells can have hidden or visible mechanical fixing systems.

3) Cell Installation

Cells built with Laminam slabs can be installed horizontally or vertically, as established by the architectural plan. Installation phases and lifting systems are the same used for traditional curtain walls in glass. Since it also functions as the only wall, the between-floor areas must be sealed internally and internal counterparts must be built for the blind parts of the façade.

8 | Window Wall

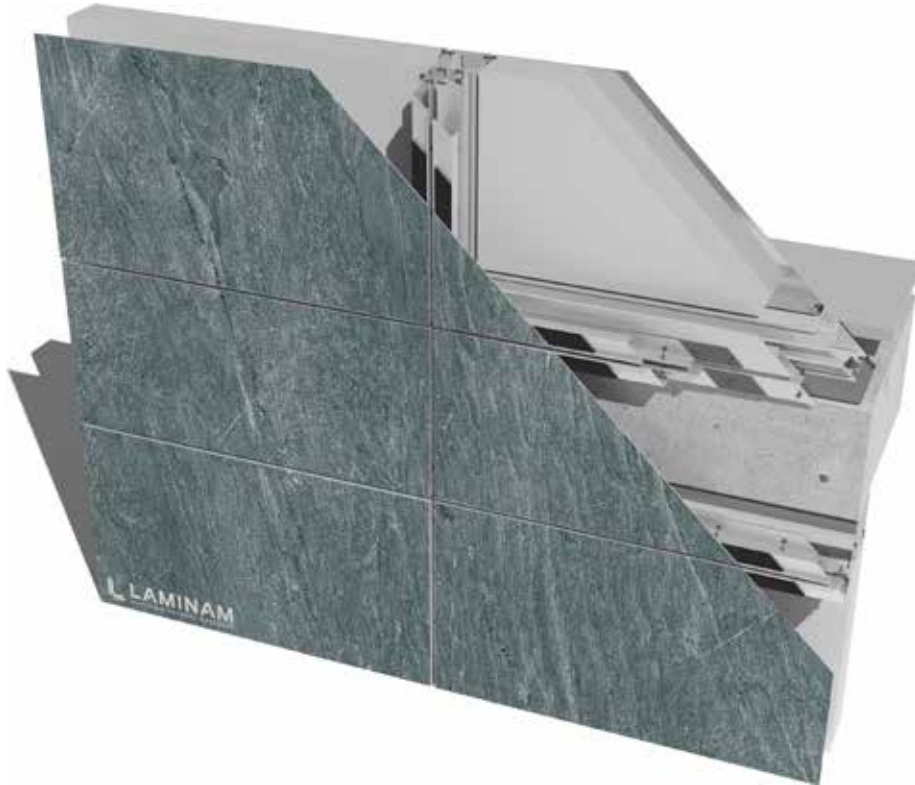


The window wall is a technological solution in which the exterior cladding is the building's infill element, which performs the main functions of an external wall, such as ensuring waterproofing. Unlike a curtain wall, the frames of a window wall are anchored to the between-floor slabs, internally flush with the building wall. For this reason, the profiles require lower sections, which generally offer a cheaper solution than the curtain wall. This type of façade must be designed and installed by specialized companies. Laminam slabs can be used as infill combined with glass, installed on specific frames.



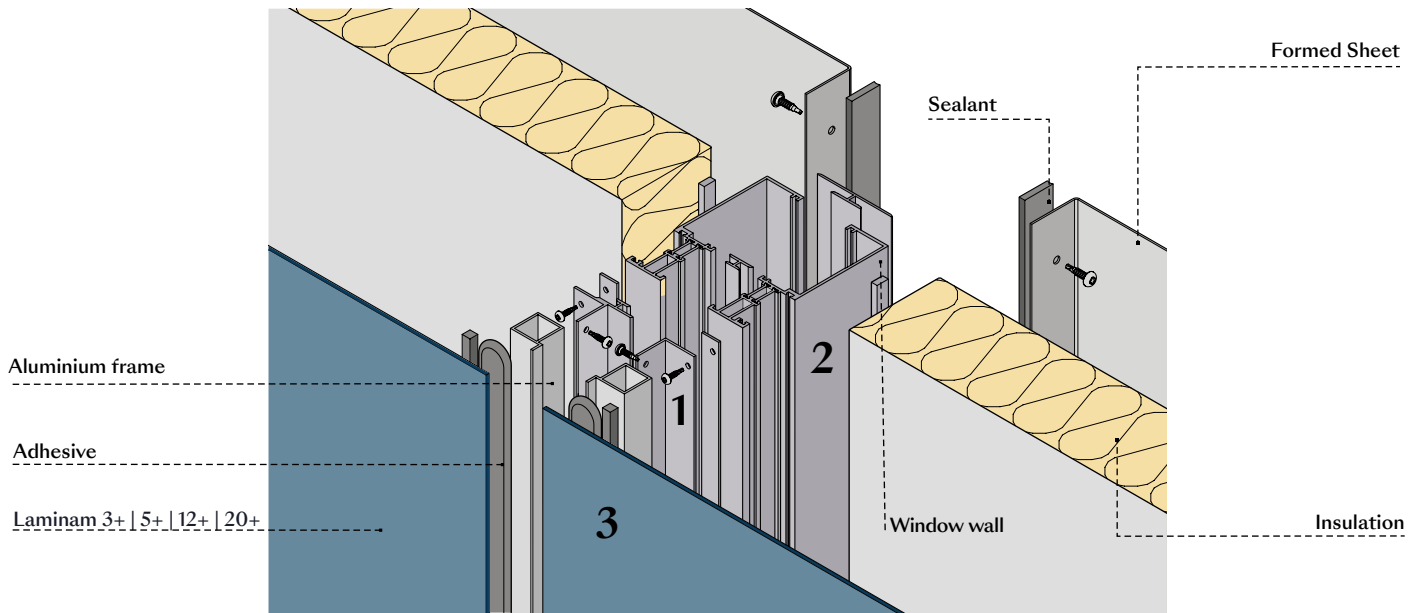
Laminam Slab Sizes

Laminam 3+, Laminam5+ Laminam 12+ and Laminam 20+ slabs can be applied in a maximum size of 1000x3000mm, 1200x3000mm and 1620x3240mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

Window walls are usually designed using structures available on the market to install windows, already supplied with different sections to satisfy the mechanical resistance requirements for the place of installation. They can be in aluminum, PVC or wood, and are usually installed on shorter buildings.

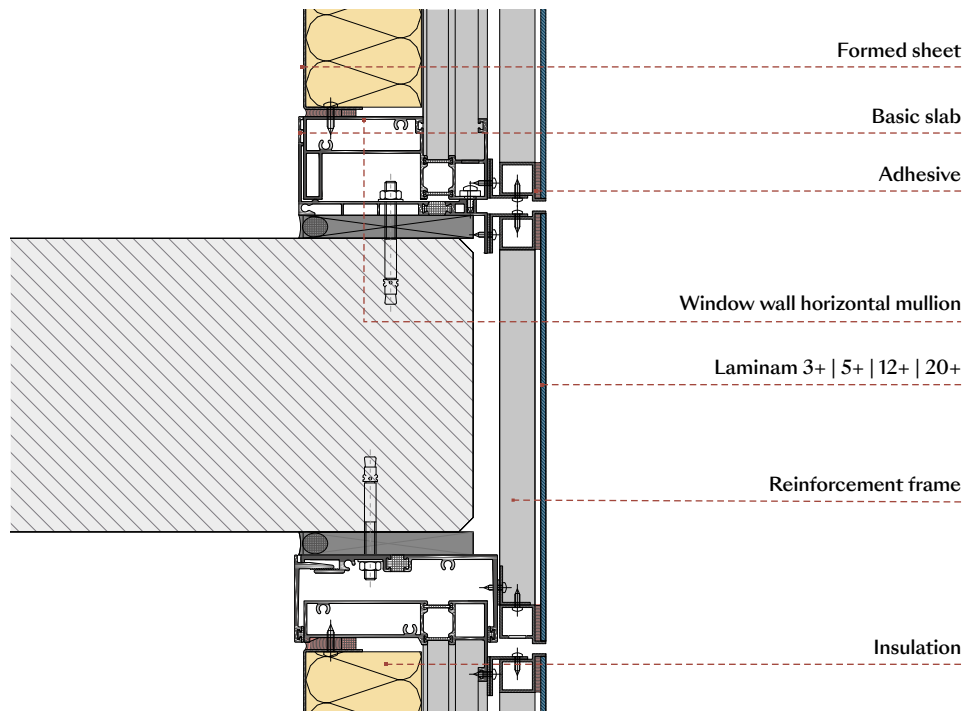


1) Cell Assembly

The frame is built in the dimensions envisaged for the project, and the Laminam slab is installed in one of two ways:

- mechanically: the slab is inserted inside the thickness of the perimeter profile and sealed with specific gaskets to guarantee waterproofing;
- structurally hidden: the slab is installed flush with the exterior of the frame with specific adhesives.

The cells must be built in compliance with the list of sizes envisaged by the working documents and can be supplied at the building site already furnished with insulation and the internal closing sheet made of metal sheet. The slab thickness must be decided based on wind and shock resistance required for the project, and also based on the cleaning and maintenance system that will be used for the façade. In addition to the perimeter frame, intermediate reinforcements can be inserted in the cell or a honeycomb panel can be added to give the slab adequate resistance against the wind load.



Example of a slab anchored with a structural system flush with the exterior.

2) Load-bearing Structure

The frame from which the window wall is formed constitutes the load-bearing structure of the system. The top and bottom of the frame are anchored to concrete floor slabs with suitable profiles raised from the slabs through the use of specific spacers. Depending on the type of project and the installation system, the cells can hold more than one slab, or a combination of slabs and portions in glass. They can be done with the floor slabs visible or covering elements made in the same way as the cells described above, if the architectural project includes this layout.

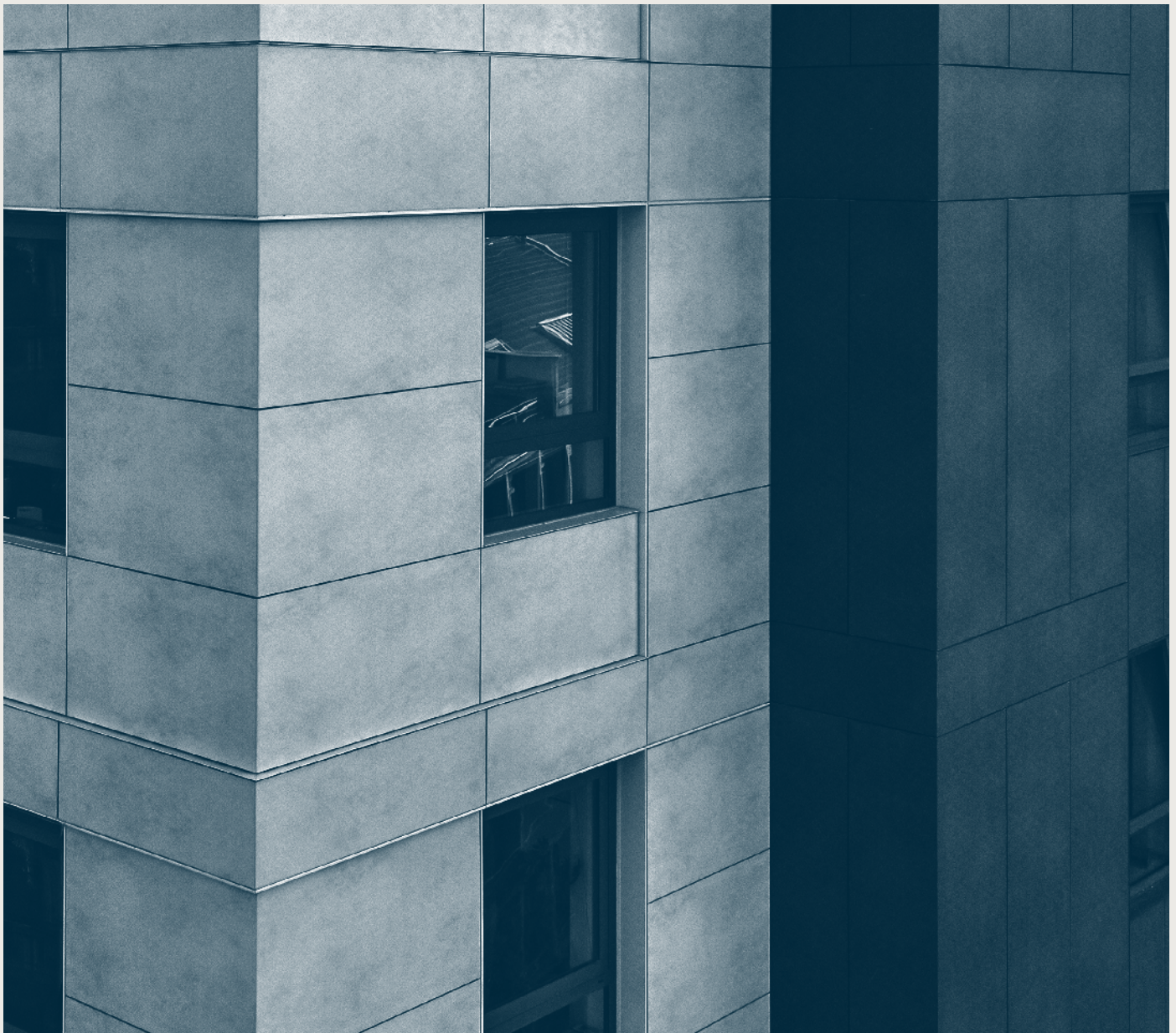
3) Cell Installation

Cells built with Laminam slabs can be installed horizontally or vertically, as established by the architectural plan. Installation phases and lifting systems are the same used for traditional curtain walls in glass. Since it also functions as an infill wall, the between-floor areas must be sealed internally, moreover, internal counterparts must be built for the blind parts of the façade.

9 | Solutions with Cementitious Adhesives



These solutions involve gluing the Laminam slabs directly onto a continuous substrate with a full spread of modified cementitious adhesive distributed to cover the surface completely. One option is to adhere the slabs directly to the infill wall, on insulating systems or on supporting walls in cement board slabs. Adopting this type of cladding, the designer must pay attention to the thermal and hygrometric aspects of the building because if the cladding is in waterproof ceramic, it will not allow the wall to breathe.



9.1 Installation on Plaster

Laminam slabs can be glued directly onto a suitable layer of external plaster or render. This application is generally carried out on masonry walls built during the works and not on prefabricated elements. If mounting slabs on prefabricated elements, it is mandatory to match the expansion joints in the various materials compose the wall.

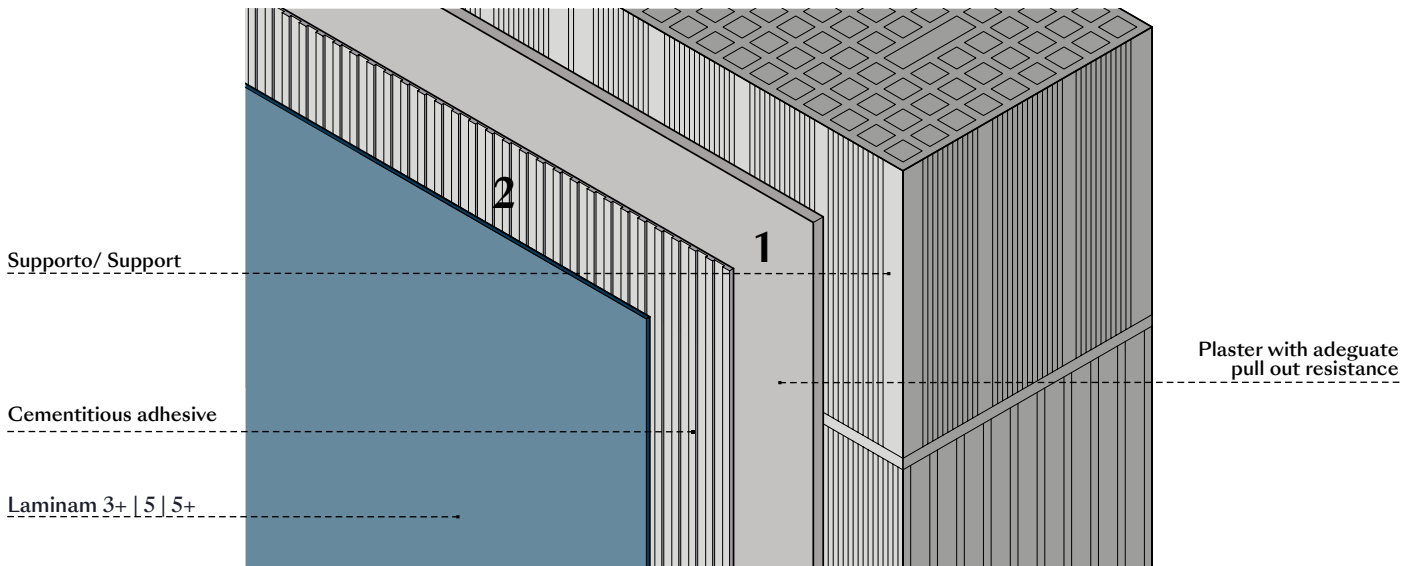
Laminam Slab Sizes

For exterior claddings, it is possible to install Laminam 3+ and Laminam 5/5+ slabs in all standard and non-standard sizes required for this type of application. Any local regulation limits must be evaluated individually by the appointed designer.



Design

This type of cladding adheres directly to the wall, without a space and insulation in between. If there is insulation, it is provided directly by the masonry block, by two blocks with insulation interposed, or by a sheet of insulation positioned on the internal part of the wall. The wall must be designed to prevent formation of condensation. Mechanical systems for circulation of humid air can be used. The dimension of the slab size must be designed based on the color of the finish, exposure of the wall and the average temperatures in that geographic area. We suggest reducing the size for dark colors and high working temperatures. The possibility of installing a large sized slab at a height must be evaluated, since it is necessary to guarantee correct installation (handling, applying a double coat of adhesive, gluing and smoothing to attach the adhesive effectively). For exterior claddings, it is therefore advisable to use the largest sized slabs available to limited heights and when building site conditions allow installers to guarantee excellent results. Size limitations can also be required by local regulations or the manufacturer of the adhesive used for the installation. Closing elements, flashings, sills, and other elements that prevent water infiltrations between the slab and the substrate must be equipped with an anti-condensation system.

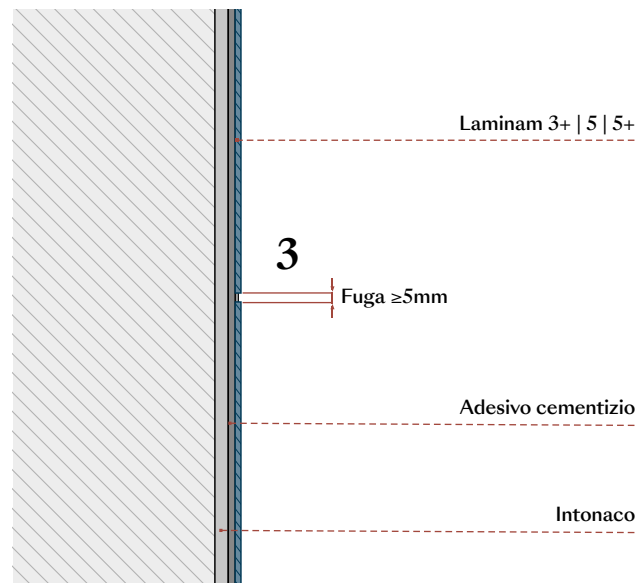


1) Plaster

Plaster or render for exteriors must have a cement base and can be made during the construction process or with the use of a premixed material. It must ensure high mechanical resistance and be suitable to hold large sized ceramic cladding. It must be applied on reinforcement mesh if the infill is made up of more than one material or with portions of insulation. Some local regulations establish a minimum pullout resistance that the plaster must guarantee (for example, 1 N/mm²).

2) Cementitious Adhesive

The installation must be done after the plaster is fully cured, using modified cementitious adhesives certified by their manufacturers for the specific application of the slab size and in the desired color. They must be applied with full spread of adhesive, with the back buttering technique, to prevent empty spots from forming between the slab and the substrate. It is important to follow all instructions provided by the adhesive manufacturer.



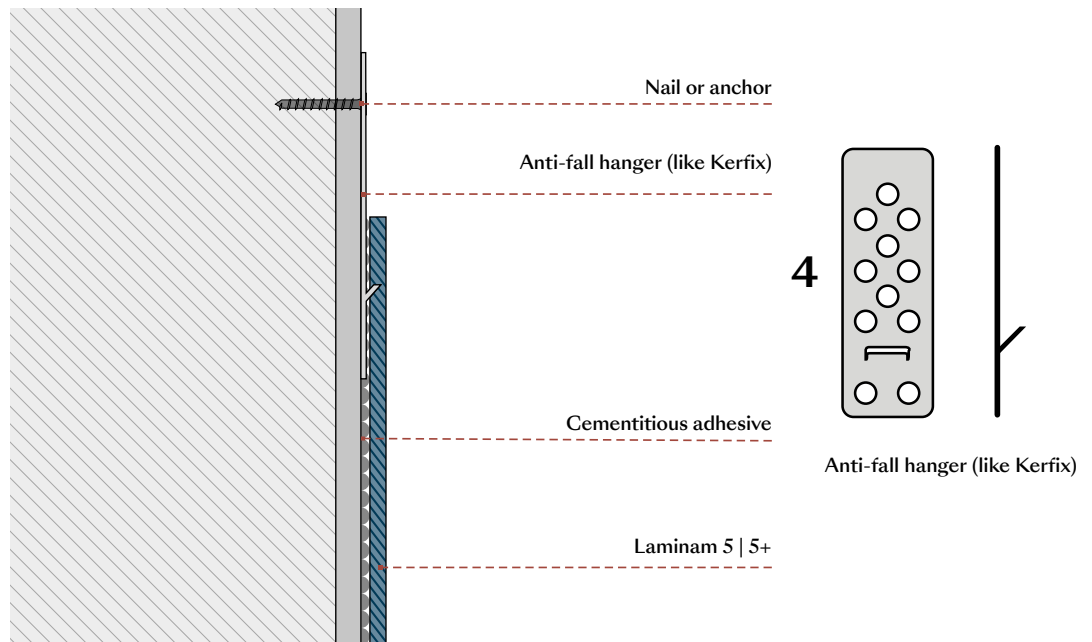
3) Gaps and Joints

A minimum gap of 5 mm is advisable, filled with cementitious filler. Match the structural joints in the building and the infill, if made of prefabricated blocks. Expansion joints must be made in the ceramic cladding every 9 m², with the longest side not over 4 m. The expansion joints must be sealed with a silicone-based material. If installing the largest size of slab or using dark colors, the gaps can be filled with this material to guarantee a uniform look.

4) Anti-tilting Hanger

If local regulations require the use of a mechanical system, on the Laminam 5 or 5+ slabs it is possible to use a mechanical safety holder hidden in a kerf cut into the back of the slab (Raifix type). The kerf can be made directly at the building site with the use of suitable adaptors for the cutting tool.

This system can also be required by the Project Management, generally for cases of important heights.



9.2 Installation on Cement Board

Laminam slabs can be applied as cladding on prefabricated panels in cement board or another material certified by the manufacturer as suitable for this use. These panels can make up either the exterior layer of a dry infill wall or supporting wall, if installed on profiles.

Laminam Slab Sizes

For exterior claddings, it is possible to install Laminam 3+ and Laminam 5/5+ slabs in all standard and non-standard sizes required for this type of application. Limitations can possibly be indicated by the panel manufacturer or required by local regulations. These limits must be assessed individually by the designer in charge.



Example of a cement board panel installed as a supporting wall.

Design

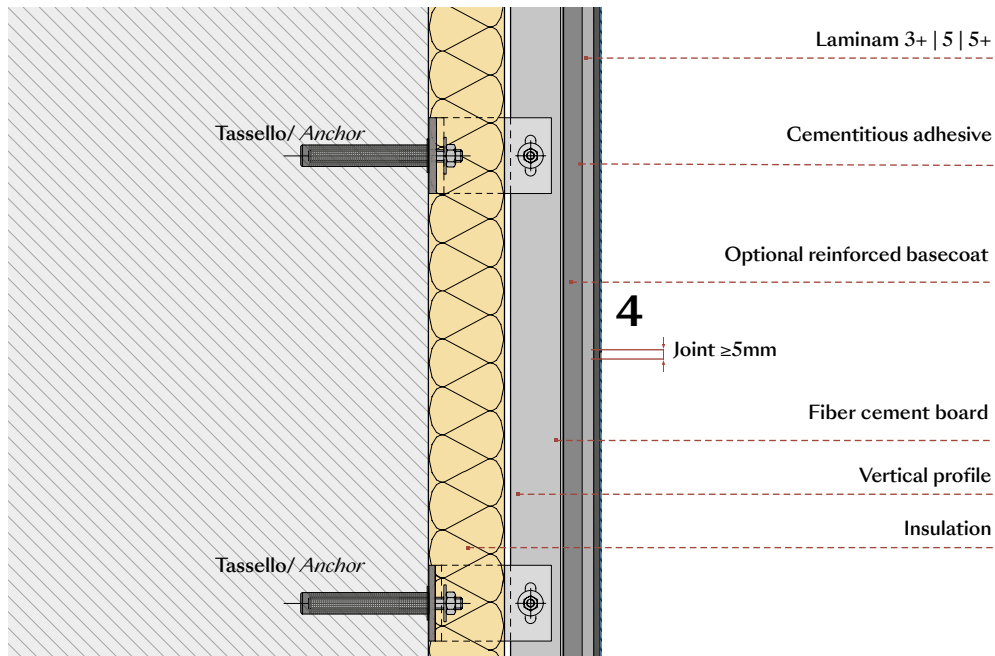
If the prefabricated panel constitutes the exterior layer of a dry infill wall, the same indications required during the design phase must be complied with (see Plaster). If a supporting wall is designed, and this wall is vented, it allows the same advantages as a ventilated façade (housing of insulation, outflow of hot or humid air) and guarantees the level of finishing of a traditional cladding with closed gaps.

The dimension of the slab size must be designed based on the color of the finish, exposure of the wall and the average temperatures in that geographic area. We suggest reducing the size for dark colors and high working temperatures. The possibility of installing a large sized slab at a height must be evaluated, since it is necessary to guarantee correct installation (handling, applying a double coat of adhesive, gluing and smoothing to attach the adhesive effectively). For exterior claddings, it is therefore advisable to use the largest sized slabs available to limit heights and when building site conditions allow installers to guarantee excellent results.

Size limitations can also be required by local regulations or the manufacturers of the panel and adhesive used for the installation. Closing elements, flashings, sills, and other elements that prevent water infiltrations between the slab and the substrate must be equipped with an anti-condensation system.

4) Gaps and Joints

A minimum gap of 5 mm is advisable, filled with cementitious filler. Always comply with structural joints in the building and those present on the supporting wall. Expansion joints must be made in the ceramic cladding every 9 m², with the longest side not over 4 m. The expansion joints must be sealed with a silicone-based material. If installing the largest size of slab or using dark colors, the gaps can be filled with this material to guarantee a uniform look.





9.3 Installation on Insulation System

The external insulation system arises from the need to combine a thermal benefit with an aesthetic benefit. First, the building is covered with a layer of insulation, and then the insulated surface is cladded with Laminam slabs, which also ensure reduced maintenance over time. These systems were specifically studied to hold large size slabs of cladding. Their levels of mechanical resistance are greater than those guaranteed by traditional insulation systems which are not suitable for the installation of cladding.

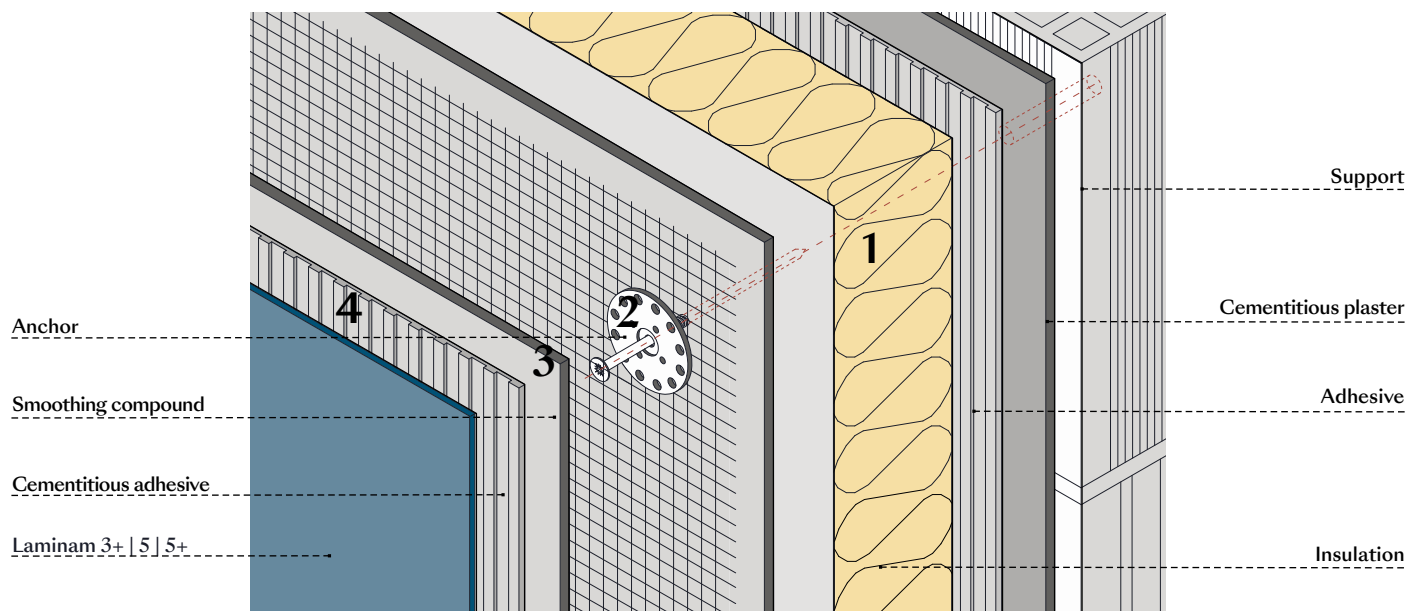
Laminam Slab Size

To install the cladding on the insulation system, it is possible to use the Laminam 3+ and Laminam 5/5+ slabs. The size normally used for these systems is about 500x1000mm, 500x1500mm or 1000x1000mm. Any local regulation limits must be evaluated individually by the appointed designer.



Design

This type of system adheres directly to the infill wall, without a space in between. The wall must be designed to prevent formation of condensation. In addition to the indication of the maximum slab size, the system manufacturer must indicate the solar reflectance index of the applicable finish depending on the insulation used. Any limitations due to local regulations must be assessed individually, also considering any height limitations set by the system manufacturer. If a complete system supplied by one manufacturer is adopted, it is necessary to follow the instructions with regard to materials to use and their installation. If they are not available on the market, or if the designer decides to not use a complete package, it is possible to build an insulation system by applying reinforced plaster on the insulation. Closing elements, flashings, sills, and other elements that prevent water infiltrations between the slab and the substrate must be equipped with an anti-condensation system.



1) Insulation

These systems can be built by applying different types of insulation. The insulation must be chosen and dimensioned by the designer in light of the desired performance levels and the availability of that insulation in the system used. The insulation must be fixed to the wall substrate with a cementitious adhesive to apply in compliance with the manufacturer's instructions on the package.

2) Anchors

The anchors for this type of insulation are generally mechanical expansion bolts. The type of anchor, its frequency and position must be indicated by the manufacturer of the insulation system

3) Plaster

If using a complete system made by one company, apply on top of the insulation a structural plaster reinforced with fiberglass or galvanized steel mesh of the type indicated by the manufacturer. If using materials that do not belong to a complete system, a galvanized mesh for plaster mechanically anchored to the substrate wall is normally fastened to the insulation and covered in a layer at least 15/20mm thick of structural plaster. This type of application must be approved by the plaster supplier and the installer, on the basis of his experience in the sector.

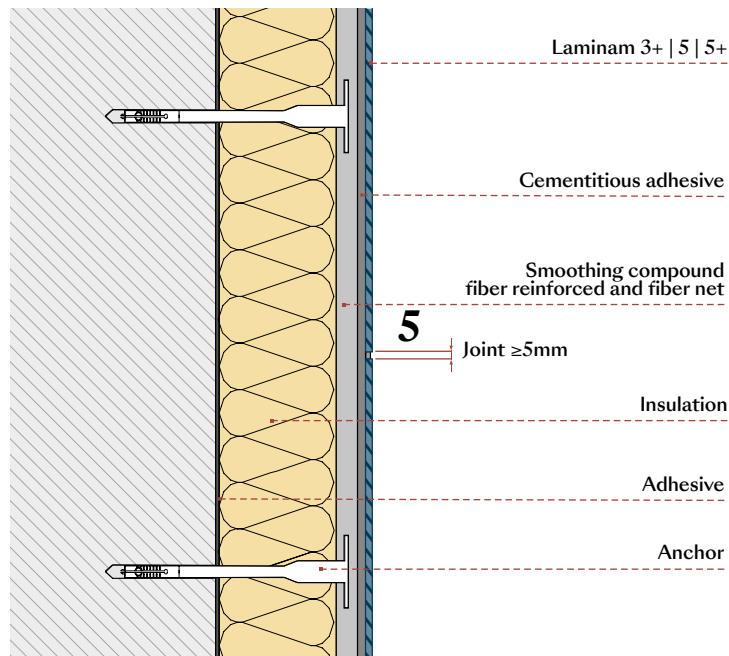
4) Cementitious Adhesive

The slabs must be installed after the plaster is fully cured, using a modified cementitious adhesive certified by their manufacturers for the specific application of the slab size and the in desired color.

They must be applied with full spread of adhesive, with the double coating technique, to prevent empty spots from forming between the slab and the substrate. It is important to follow all instructions provided by the adhesive manufacturer.

5) Gaps and Joints

A minimum gap of 5 mm is advisable, filled with cementitious filler. Always comply with structural joints of the building and possibly those set by the system manufacturer. Expansion joints must be made in the ceramic cladding every 9 m², with the longest side not over 4 m. The expansion joints must be sealed with a silicone-based material.



10 | Cleaning and maintenance



The slabs are extremely easy to clean and do not require particular maintenance work.

The production process (involving very high-quality raw materials and high firing temperatures) makes the finishes of Laminam slabs non-absorbent and their surfaces almost completely non-porous, which means that cleaning operations are simple and efficient.

In fact, the ceramic structure does not allow dirt to penetrate inside the slab.

Post-installation Cleaning

After installation, it is very important to clean the slabs correctly to completely remove any residues of the products used for their installation. Since lifting systems are necessary to clean the façade, we suggest planning the cleaning phase right after the installation works have ended, when the lifting systems are still present at the building site and performing the cleaning process from the top down.

Particular care must be taken to remove residue of silicone adhesives and MS polymer or polyurethane for ventilated façade systems and curtain and window walls, and also residues of cementitious and silicone-based adhesives for traditional systems. In addition to these, all residue of building site dust must be removed. The cleaning process must be carried out uniformly on the entire surface area of the installed façade in order to prevent chromatic differences caused by different levels of cleaning or concentrations of dirt deposited on the slabs.

Ordinary Cleaning

Cleaning the façade is done at the client's discretion and can depend on the selected Laminam finish, the characteristics of the building, the climate conditions and the level of local pollution. In general, it is possible to use hot water and neutral detergents to clean Laminam slabs.

Extraordinary Cleaning

Extraordinary cleaning operations may become necessary to remove spots of particularly resistant dirt. The aforementioned cleaning processes can be carried out using different types of detergents, depending on the residue to remove. In general, avoid using lightly abrasive detergents or sponges on products with polished finishes and on the Filo series.

Type of stain	Product
Cementitious fillers Rust / Metallic marks Limescale residues	Acid
Epoxy fillers Graffiti	Alkaline
Silicones Ink / Marker ink	Solvent-based detergents
Pollution and dirt	Hot water and neutral detergents

Generally speaking for all materials used to create façade systems, the supplier should indicate the most suitable cleaning product and method, and also the time required for effective cleaning. Failing to comply with these instructions could result in a failure to completely remove the residue from the surface.

The use of cementitious materials to glue or seal gaps could require cleaning operations to remove efflorescence of salts that form due to the evaporation of humidity absorbed in some types of materials. These phenomena are not defects, but could appear after installation. They are categorized as ordinary cleaning operations for the façade.

11 | References









Ventilated Façades | Adhesive system

Year: 2019
Private House
Treviso, Italy
Design: B+ B associati architetto
Bonariol Marco
Fokos, Sale





Ventilated Façades | Adhesive system

Year: 2019
Private House
Brugherio /Italy
Design: GE Homes
Fokos, Piombo
Legno Venezia, Sabbia





Ventilated Façades | Adhesive system

Year: 2018
Thermalresort Köck
Bad Füssing / Germany
Design Studio: arCH-de.GmbH
Fokos, Terra
I Naturali, Pietra di Savoia Avorio
I Naturali, Pietra di Savoia Perla
Collection, Fumo





Ventilated Façades | Adhesive system

Year: 2015
Chamber of Deputies
Santiago De Querétaro / Mexico
Design: Arch. Augusto Álvarez /
Arch. Martín Gutiérrez +
Arch. Gerardo Gutiérrez
Collection, Bianco, Grigio





Ventilated Façades | Adhesive system

Year:2017
4Expo Headquarters
Suchy Las / Poznan / Poland
Design: Mroczkowski Architekci
Collection Bianco





Ventilated Façades | Clip System

Year: 2017
OEB Headquarters
Camposanto / Modena / Italy
Design: ESTERNI Architettura Design Pae-
saggio, RS2 Architetti
Collection, Nero
Filo, Argento





Ventilated Façades | Clip System

Year: 2014

OBI

Livorno /Italy

Design: èthostudio s.r.l.

Arch. Marco Brazzini

Ing. Antonino Valenti

Oxide, Bianco, Grigio





Ventilated Façades | Clip System

Year: 2015
Tarnowskie Termy
Tarnowo Podgórne / Poland
Oxide, Bianco





Ventilated Façades | Rivet System

Year: 2015
Politechnika Wroclawska
Wroclaw / Poland
Design:
Arch. Ewa Frankiewicz
I Naturali,
Crema Marfil





Ventilated Façades | Rivet System

Year: 2013
Office Building
La Spezia / Italy
Blend, Nero





Ventilated Façade | Cell System

Year: 2014
1 York Menkes
Toronto / Canada
Design: Sweeny&Co Architects
Oxide, Nero





Ventilated Façade | Cell System

Year: 2014
House Complex
Taichung /Taiwan
Oxide, Moro





Ventilated Façade | Cell System

Year: 2015

Office Building

Milano/Italy

Design: Studio Guidarini & Salvadeo

Tredi Carbonio, Oxide Perla





Ventilated Façade | Cell System

Year: 2018
Gongpyong Office Plaza
Seoul / South Korea
Design: SMDP Studio
Calce, Nero





Ventilated Façade | Cell System

Year: 2014
Fluxmans Building
Johannesburg / South Africa
Design: Paragon Architects
Collection, Bianco Lucidato





Ventilated Façade | Cell System

Year: 2016
Commercial Building
Johannesburg/South Africa
Design: MDS Architecture
Filo - Brina





Ventilated Façade | Composite Panel System

Torre Bhojwani
Miami Beach / Florida
Design: Kobi-Karp





Ventilated Façade | Composite Panel System

Year: 2012
The Ruby
Mumbai /India
Design: Access Architects
Oxide, Moro





Curtain Wall

Year: 2012
I-Tower
Seoul/South Korea
Collection, Fumo





Curtain Wall

Year: 2010
Commercial Building
Seoul /South Korea
Collection, Moro, Neve,
Corallo, Arancio, Notte





Curtain Wall

Year: 2009
Pan Pacific
Commercial Building
Seoul/South Korea
Collection, Nero





Solutions with Cementitious Adhesives | Installation on Plaster

Year: 2019
Private House
Forte dei Marmi, Italy
Kanka, Brown





Solutions with Cementitious Adhesives | Installation on Plaster + Cement Board

Year: 2018
Residential and Commercial Building
Cagliari / Italy
Design: Studio Fadda
Construction Company: Ing. Raffaello Pellegrini Srl
Collection, Bianco Assoluto





Solutions with Cementitious Adhesives | Installation on Plaster

Year: 2014
Private House
Terni/Italy
Collection Fumo, Tortora





Solutions with Cementitious Adhesives | Installation on Plaster

Year: 2018
Vort Ebisu Maxim
Tokyo, Japan
Design Studio:
Seiwa Design & Construction
Oxide, Bianco





Solutions with Cementitious Adhesives | Installation on Cement Board

Year: 2019
Private House
Firenze, Italy
Project: Studio VBAA
Oxide, Moro





Solutions with Cementitious Adhesives | Installation on Cement Board

Year: 2016
Residenza Privata
Forte dei Marmi (Lucca)/Italia
Design: FABBRICANOVE
Fokos Roccia





Solutions with Cementitious Adhesives | Installation on Insulation System

Year: 2016
Residential Building
Torino / Italy
Design: GOODFOR
(Arch. M. Luciano Arch. G. Alladio)
I Naturali, Pietra di Savoia Grigia





Solutions with Cementitious Adhesives | Installation on Plaster

Year: 2015
Private Residence
Tauranga/New Zealand
Design: Creative Space
Ventilated Façades
Oxide Perla
Blend Grigio

12 | Technical specifications





Technical specifications



<i>physical and chemical properties</i>	norm / test method	1000x3000 Full Size Laminam 3 CE*
Full Size: "length and width" nominal size: 1000x3000mm size / (39.4"x118.1")	Laminam	minimum size: ≥ 1015x3030 mm full size untrimmed
full size: difference between diagonals	Laminam	not applicable
weight	Laminam	average value 7,8 kg/m ²
surface quality % pieces with no visible flaws	ISO 10545-2	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1%
breaking strength in N	ISO 10545-4 **	-
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 (sample dimensions 200x300 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value
resistance to thermal shock	ISO 10545-9	resistant
chemical resistance	ISO 10545-13	class: from A to B
stain resistance	ISO 10545-14	class: from 4 to 5
resistant to freeze-thaw	ISO 10545-12	resistant
fire reaction	EN 13501 (rev. 2005)	A1 - (decision 96/603/CE as amended)

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



physical and chemical properties	norm / test method	1000x3000 Laminam 3+
1000x3000mm "length and width" nominal size/manufacturing: rectified 1000x3000mm size / (39.4"x118.1")	ISO 10545-2	max. deviation on the side +/- 0.5 mm
1000x3000mm difference between diagonals rectified 1000x3000mm size / (39.4"x118.1")	Laminam	max +/- 1,5 mm
weight	Laminam	average value 8,2 kg/m ²
surface quality / % pieces with no visible flaws	ISO 10545-2	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1% ***
breaking strength in N	ISO 10545-4 **	average value 700 (sample dimensions 200x300 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 *** (sample dimensions 200x300 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value ***
resistance to thermal shock	ISO 10545-9	resistant ***
chemical resistance	ISO 10545-13	class: from A to B
stain resistance	ISO 10545-14	class: from 4 to 5
resistant to freeze-thaw	ISO 10545-12	resistant ***
fire reaction	EN 13501 (rev. 2005)	A2 - s1, d0

* For wall application only

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*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



physical and chemical properties	norm / test method	1000x3000 Laminam 5 C€	1000x3000 Laminam 5 Lucidato C€
1000x3000mm "length and width" nominal size/manufacturing: rectified 1000x3000mm size / (39.4"x118.1")	ISO 10545-2	max. deviation on the side +/- 0,5 mm	max. deviation on the side +/- 0,5 mm
1000x3000mm difference between diagonals rectified 1000x3000mm size / (39.4"x118.1")	Laminam	max +/- 1,5 mm	max +/- 1,5 mm
weight	Laminam	average value 14,5 kg/m ²	average value 14,5 kg/m ²
surface quality % pieces with no visible flaws	ISO 10545-2	> 95%	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1%	average value ≤ 0,1%
breaking strength in N	ISO 10545-4	average value 1100 (sample dimensions 1000x1000 mm)	average value 1100 (sample dimensions 1000x1000 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 (sample dimensions 1000x1000 mm)	average value 50 (sample dimensions 1000x1000 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value	6,6 average value
resistance to thermal shock	ISO 10545-9	resistant	resistant
chemical resistance	ISO 10545-13	class: from A to B	class: from A to C
stain resistance	ISO 10545-14	class: from 4 to 5	class: from 2 to 5
resistenza al gelo resistant to freeze-thaw	ISO 10545-12	resistant	resistant
fire reaction	EN 13501 (rev. 2005)	A1 - (decision 96/603/CE as amended)	A1 - (decision 96/603/CE as amended)

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



physical and chemical properties	norm / test method	1200x3000 Full Size Laminam 5 CE
Full Size: "length and width" nominal size: 1200x3000mm size / (47.2"x118.1")	Laminam	minimum size: ≥ 1210x3050 mm full size untrimmed
weight	Laminam	average value 14,5 kg/m ²
surface quality / % pieces with no visible flaws	ISO 10545-2	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1%
breaking strength in N	ISO 10545-4	average value 1100 (sample dimensions 1000x1000 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 (sample dimensions 1000x1000 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value
resistance to thermal shock	ISO 10545-9	resistant
chemical resistance	ISO 10545-13	class: from A to B
stain resistance	ISO 10545-14	class: from 4 to 5
resistant to freeze-thaw	ISO 10545-12	resistant
fire reaction	EN 13501 (rev. 2005)	A1 - (decision 96/603/CE as amended)

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



physical and chemical properties	norm / test method	1200x3000 Laminam 5+
1200x3000mm "length and width" nominal size/manufacturing: rectified 1200x3000mm size / (47.2"x118.1")	ISO 10545-2	max. deviation on the side +/- 0,5 mm
1200x3000mm difference between diagonals rectified 1200x3000mm size / (39.4"x118.1")	Laminam	max +/- 1,5 mm
weight	Laminam	average value 14,9 kg/m ²
surface quality / % of tiles with no visible flaws	ISO 10545-2	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1% ***
breaking strength in N	ISO 10545-4	average value 1100 *** (sample dimensions 1000x1000 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 *** (sample dimensions 1000x1000 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ / °C	ISO 10545-8	6,6 average value ***
resistance to thermal shock	ISO 10545-9	resistant ***
chemical resistance	ISO 10545-13	class: from A to B
stain resistance	ISO 10545-14	class: from 4 to 5
resistant to freeze-thaw	ISO 10545-12	resistant ***
fire reaction	EN 13501 (rev. 2005)	A2 - s1, d0

* For wall application only

** Requirement UNI EN 14411 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



physical and chemical properties	norm / test method	1620x3240 Full Size Laminam 5 CE	1620x3240 Full Size Laminam 5 Lucidato CE
Full Size: "length and width" nominal size: 1620x3240mm size / (63.7"x 127.5")	Laminam	minimum size: ≥ 1630x3250mm full size untrimmed	minimum size: ≥ 1630x3250mm full size untrimmed
weight	Laminam	average value 14,5 kg/m ²	average value 14,5 kg/m ²
surface quality / % pieces with no visible flaws	ISO 10545-2	> 95%	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1%	average value ≤ 0,1%
breaking strength in N	ISO 10545-4	average value 1100 (sample dimensions 1000x1000 mm)	average value 1100 (sample dimensions 1000x1000 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 (sample dimensions 1000x1000 mm)	average value 50 (sample dimensions 1000x1000 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value	6,6 average value
resistance to thermal shock	ISO 10545-9	resistant	resistant
chemical resistance	ISO 10545-13	class: from A to B	class: from A to C
stain resistance	ISO 10545-14	class: from 4 to 5	class: from 2 to 5
resistant to freeze-thaw	ISO 10545-12	resistant	resistant
fire reaction	EN 13501 (rev. 2005)	A1 (decision 96/603/CE as amended)	A1 (decision 96/603/CE as amended)

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



<i>physical and chemical properties</i>	<i>norm / test method</i>	1620x3240 Laminam 5+ C€	1620x3240 Laminam 5+ Lucidato C€
1620x3240mm "length and width" nominal size/ manufacturing: rectified 1620x3240mm size / (39.4"x118.1")	ISO 10545-2	max. deviation on the side +/- 0,5 mm	max. deviation on the side +/- 0,5 mm
1620x3240mm difference between diagonals rectified 1620x3240mm size / (39.4"x118.1")	Laminam	max +/- 1,5 mm	max +/- 1,5 mm
weight	Laminam	average value 14,9 kg/m ²	average value 14,9 kg/m ²
surface quality / % pieces with no visible flaws	ISO 10545-2	> 95%	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1% ***	average value ≤ 0,1% ***
breaking strength in N	ISO 10545-4	average value 1100 *** (sample dimensions 1000x1000 mm)	average value 1100 *** (sample dimensions 1000x1000 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 *** (sample dimensions 1000x1000 mm)	average value 50 *** (sample dimensions 1000x1000 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value ***	6,6 average value ***
resistance to thermal shock	ISO 10545-9	resistant ***	resistant ***
chemical resistance	ISO 10545-13	class: from A to B	class: from A to C
stain resistance	ISO 10545-14	class: from 4 to 5	class: from 2 to 5
resistant to freeze-thaw	ISO 10545-12	resistant ***	resistant ***
fire reaction	EN 13501 (rev. 2005)	A2 - s1, d0	A2 - s1, d0

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Technical specifications



physical and chemical properties	norm / test method	1620x3240 Full Size Laminam 12+	1620x3240 Full Size Laminam 12+ Lucidato
Full Size: "length and width" nominal size: 1620x3240mm size / (63.7"x 127.5")	Laminam	minimum size: ≥ 1630x3250mm full size untrimmed	minimum size: ≥ 1630x3250mm full size untrimmed
weight	Laminam	average value 30 kg/m ²	average value 30 kg/m ²
surface quality / % pieces with no visible flaws	ISO 10545-2	> 95%	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1% ***	average value ≤ 0,1% ***
breaking strength in N	ISO 10545-4	> 4000 *** (sample dimensions 400x800 mm)	> 4000 *** (sample dimensions 400x800 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 *** (sample dimensions 400x800 mm)	average value 50 *** (sample dimensions 400x800 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value ***	6,6 average value ***
resistance to thermal shock	ISO 10545-9	resistant ***	resistant ***
chemical resistance	ISO 10545-13	class: from A to B	class: from A to C
stain resistance	ISO 10545-14	class: from 4 to 5	class: from 2 to 5
resistant to freeze-thaw	ISO 10545-12	resistant ***	resistant ***
fire reaction	EN 13501 (rev. 2005)	A2 - s1,d0	A2 - s1,d0

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

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Technical specifications



physical and chemical properties	norm / test method	1620x3240 Full Size Laminam 20+	1620x3240 Full Size Laminam 20+ Lucidato
Full Size: "length and width" nominal size: 1620x3240mm size / (63.7"x 127.5")	Laminam	minimum size: ≥ 1630x3250mm full size untrimmed	minimum size: ≥ 1630x3250mm full size untrimmed
weight	Laminam	average value 50,4 kg/m ²	average value 50,4 kg/m ²
surface quality / % pieces with no visible flaws	ISO 10545-2	> 95%	> 95%
water absorption	ISO 10545-3 / ASTM C373	average value ≤ 0,1% ***	average value ≤ 0,1% ***
breaking strength in N	ISO 10545-4	> 10000 *** (sample dimensions 400x800 mm)	> 10000 *** (sample dimensions 400x800 mm)
modulus of rupture in N / mm ²	ISO 10545-4	average value 50 *** (sample dimensions 400x800 mm)	average value 50 *** (sample dimensions 400x800 mm)
resistance to deep abrasion	ISO 10545-6	≤ 175 mm ³	≤ 175 mm ³
coefficient of linear thermal expansion / 10 ⁻⁶ /°C	ISO 10545-8	6,6 average value ***	6,6 average value ***
resistance to thermal shock	ISO 10545-9	<i>resistant</i> ***	<i>resistant</i> ***
chemical resistance	ISO 10545-13	class: from A to B	class: from A to C
stain resistance	ISO 10545-14	class: from 4 to 5	class: from 2 to 5
resistant to freeze-thaw	ISO 10545-12	<i>resistant</i> ***	<i>resistant</i> ***
fire reaction	EN 13501 (rev. 2005)	A2 - s1,d0	A2 - s1,d0

* For wall application only

** Requirement UNI EN 144111 not applicable for Laminam3, Laminam3+./ The values indicated for 3+ are valid only for side length 3000 mm.

*** Value relative to the ceramic body only

The unique features of Laminam products do not allow for a perfect comparison with ceramic tiles. The test results are therefore only indicative and not binding.

Certification



Façade system certifications:

- **ETA 16/0317:**

European technical assessment for the application of Laminam 12 and Laminam 12+ slabs on ventilated façades, using Keil undercut anchoring devices

- **Atex-A 2515-A:**

Technical assessment for use in France of Laminam 5+ 1000x3000mm slabs arranged horizontally on a ventilated façade and fastened with clips

- **Zulassung n. Z-10.8-737**

German certification issued by DIBt for the installation of Laminam 5 slabs on ventilated façades, using Sika Tack Panel adhesive

Tests performed on Laminam slabs installed on façade systems illustrated in this catalogue:

Shock Test according to ETAG 034/2012 on:

- Adhesive system
- Clip System
- Rivet System
- Cell System
- Undercut anchoring system
- Kerf System

Wind Test according to ETAG 034/2012 on:

- Adhesive system
- Clip System
- Rivet System
- Cell System
- Undercut anchoring system
- Kerf System

Fire propagation test according to NFPA 285 on:

Installation with cementitious adhesive on plaster/ render
Ventilated façade system with clip + MS Polymer

Fire reaction test according to UNI EN 13501-1:2009 on:

Ventilated façade system with clip

Seismic resistance test according to Cahier du CSTB n° 3725 (janvier 2013):

Ventilated façade system with clip

Certification



Environmental certifications



GBC Green Building Council Italia:

Non-profit association that is part of the international GBC network. It promotes a culture of sustainable construction.

UNI EN ISO 14021:

Products containing at least 20% of pre-consumer re-cycled material in bulk (LEED 20) having an high solar reflectance index (SRI)

UNI EN ISO 14021:

Products containing at least 30% of pre-consumer recycled material in bulk (LEED 30) having an high solar reflectance index (SRI)

UNI EN ISO 14021:

Products containing at least 40% of pre-consumer re-cycled material in bulk (LEED 40) having an high solar reflectance index (SRI)



BREG EN EPD No. 000148 secondo EN 15804:2012+A1:2013:
Environmental Product Declaration issued for Laminam 3+ and 5

Certificazioni di prodotto e di qualità



UNI EN ISO 9001:

International Standard for Quality management systems



CCC: Chinese quality certification



ITB: Polish quality certification

Russian certification for use of Laminam 3+ in the construction sector
Russian certification of compliance with hygienic standards in the construction sector
Russian certification of fire prevention conformity



C-TPAT Customs-Trade Partnership Against Terrorism – USA



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