Technical File

Chapter 2 – Façades

2.3 – Panel without varnish or paint

(Fixing with screws)

Cement-bonded particleboards

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2025.1

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Credits

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This Technical File supersedes all previous technical documents.

Edition: May 20, 2025

2. VENTILATED FAÇADES

Due to their mechanical characteristics and resistance to degradation caused by hygrothermal variations, Viroc panels are suitable for use in ventilated façade systems.

The panels have a unique finish, characterized by their heterogeneous texture and tonal variation, which can appear both on a single face and between different faces of the same panel, or between panels from different production batches. This variation in tone is an intrinsic characteristic of the product and is related to the materials and manufacturing process.

As a result of the production process, the surfaces of the panels may present minor irregularities, such as small inclusions or finish differences, which do not affect the product's functionality but contribute to its rustic and natural appearance. These characteristics give the panels a distinct aesthetic, making them suitable for projects that demand materials with a more organic and unique look.

Over time, exposure to sunlight may cause a slight change in the panels' original tone, typically resulting in gradual lightning. This color alteration process varies depending on the initial color of the panel, with darker tones showing more noticeable changes. This is a typical phenomenon in materials exposed to weather conditions and does not affect the mechanical properties of the panels.

The ventilated façade system is generally composed of the following elements:

- Viroc panels;
- Supporting structure and corresponding fixing elements;
- Screws or rivets for fixing the panels to the structure;
- Thermal insulation;
- Ventilated air cavity;
- Complementary profiles for finishing at singular points.

2.3 VIROC PANEL ON FAÇADES WITHOUT VARNISHING OR PAINTING

In this construction system, Viroc panels are used in their raw state, without any surface finish, and are fixed to the supporting structure using screws or rivets.

The absence of coating makes the panels more sensitive to hygrothermal variations, so the maximum recommended size for installation under these conditions is **1500 x 1250 mm**.

To allow free expansion and contraction of the panels without generating stress or forces that could cause damage, the fastening system must be designed with suitable clearances:

- **Peripheral fixings**: the holes made in the panels for screw installation should have a diameter of 11 mm, which is larger than the screw shaft diameter (4.8 mm or 5.5 mm), allowing the panel to move freely.
- **Central fixings**: the holes should match the screw diameter, ensuring a rigid connection and correct panel positioning.

The fixing sequence should start with the fixed points to ensure the correct alignment of the panels. Only after this should the clearance holes be secured, to prevent stress from possible displacements or settlements.

Note:

The supporting structure may be made of wood or galvanised steel.

The use of aluminum profiles is not allowed in this application due to their high thermal expansion coefficient, which could compromise the system's stability.

It is important to note that, since the panels are uncoated, the action of rain combined with cycles of wetting and drying may lead to the migration of salts present in the cement to the surface, causing efflorescence. This can result in visible streaks and stains caused by water runoff.

Additionally, panel deformations may occur, both within their plane and out of plane.

Claims related to efflorescence, streaks, or deformations resulting from these conditions will not be accepted.

2.3.01 Wood Supporting Structure

The wood supporting structure is composed of pine timber battens, properly fixed to the building's load-bearing wall using galvanised steel or stainless-steel brackets, with either metal mechanical anchors or fastening systems made up of metal screws and plastic plugs.

The timber used in the vertical studs must have a minimum strength class of C18, in accordance with EN 338, and a durability class of 2, 3 or higher, in accordance with EN 335.

For wood with durability class 2, the use of a protective moisture barrier tape is mandatory.

At the time of installation, the moisture content of the timber must not exceed 18%, and the moisture difference between adjacent studs must not exceed 4%.

Moisture must be measured using the method described in EN 13183-2, with a probe-type moisture meter.

The section of the studs should preferably be rectangular, with a minimum size of 40x50 mm (see Figure 2.3.1).

The design of the wood supporting structure must account for the loads and stresses to which it will be exposed, including temperature and humidity variations, and wind pressure and suction, ensuring that the functional performance of the ventilated façade system is not compromised.

The maximum allowable deflection of the studs, due to wind loads, must not exceed L/200, where L is the distance between fixing points.

The width of the studs must be sufficient to allow proper installation of the panel fasteners, including tolerance for any alignment deviations.

The distance between the screw axis and the edge of the stud must not be less than 15 mm (see Figure 2.3.21).

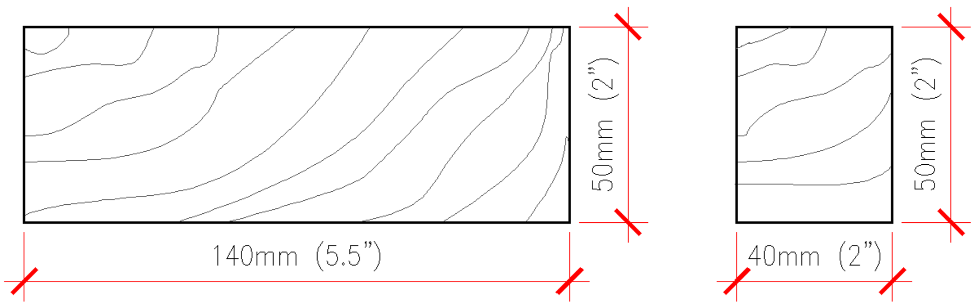


Figure 2.3.1 – Wood supporting structure

Minimum Class Resistance C18 (EN 338) and Class Durability 2 or 3 (EN335)

2.3.02 Galvanised Steel Supporting Structure

The galvanised steel supporting structure is composed of metal profiles, securely fixed to the building's load-bearing wall using galvanised steel or stainless-steel brackets, with metal mechanical anchors or fastening systems consisting of metal screws and plastic plugs.

The vertical profiles must be manufactured from steel with a minimum strength class of S220GD+Z, in compliance with EN 10346. The hot-dip zinc coating must be at least 275 g/m² in coastal areas and 140 g/m² in other areas.

The profile sections should preferably be in Omega (Ω), U or L shapes, with a minimum thickness of 1.5 mm (see Figures 2.3.2 and 2.3.3). Other shapes may be allowed, provided they offer equivalent structural performance and durability.

Note:

Metal profiles designed for plasterboard partitions must not be used, as their thickness is below the required minimum of 1.5 mm.

The design of the galvanised steel supporting structure must consider the loads and stresses it will be exposed to, including temperature and humidity variations, and wind pressure and suction, ensuring that the functional performance of the ventilated façade system is not compromised.

The maximum allowable deflection of the profiles due to wind loads must not exceed L/200, where L is the span between fixing points.

The width of the profiles must be sufficient to allow proper installation of the panel fasteners, including tolerance for any alignment deviations.

The distance between the screw axis and the profile edge must not be less than 10 mm (see Figure 2.3.22).

The distance between profiles must comply with the maximum fixing distance of the panels.

The alignment between adjacent profiles must not show deviations greater than 2 mm.

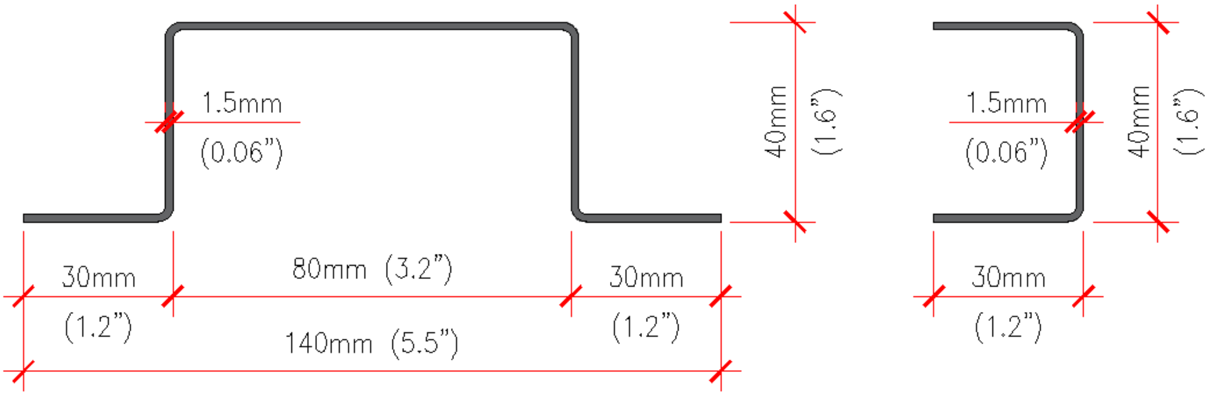


Figure 2.3.2 - Galvanised steel profiles

Minimum Class Resistance S220GD (EN 10346)

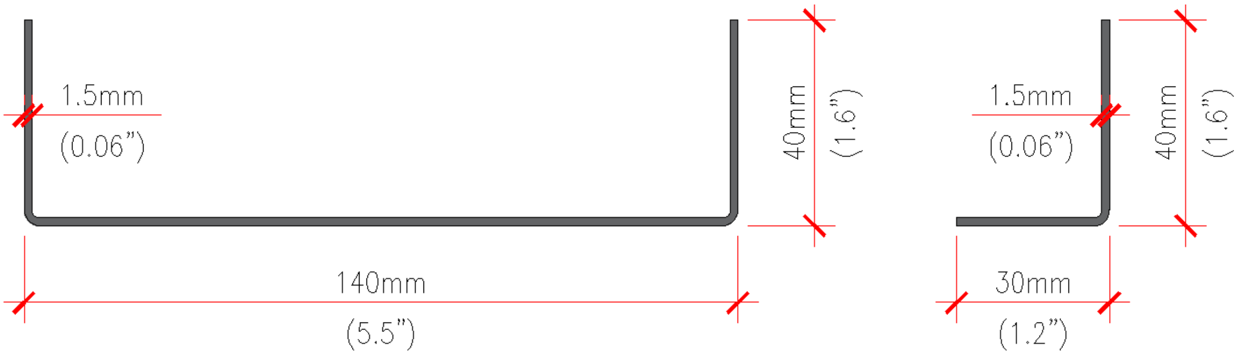


Figure 2.3.3 - Galvanised steel profiles (Alternative)

Minimum Class Resistance S220GD (EN 10346)

2.3.03 Support Brackets

The brackets used to fix the structure, whether wood or galvanised steel, must be made from a durable metal alloy, typically galvanised steel. The material must have a minimum strength class of S220GD, in accordance with EN 10147.

- **Requirements for Coastal Areas**:
  In coastal zones (within 3 km of the sea), the brackets must have additional corrosion protection.
  The zinc coating must be ≥ 275 g/m². Alternatively, stainless steel may be used to ensure greater corrosion resistance.

- **Brackets:**
  Generally, the brackets are L-shaped, available in various lengths and with multiple perforations to allow efficient fixing.
  The minimum thickness of the brackets must be 2.5 mm (see Figure 2.3.4).

- **Structural Design:**
  The bracket design must consider the self-weight of the façade, applying a partial safety factor of 1,5.
  The vertical deformation of the bracket under maximum vertical load must not exceed 3 mm.

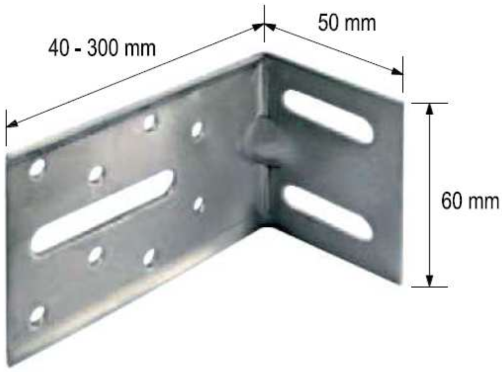


Figure 2.3.4 - Galvanised steel support brackets
Minimum Class Resistance S220GD. Minimum thickness: 2.5 mm

2.3.04 Anchors for Brackets Fixing

The support brackets must be fixed to the load-bearing wall using mechanical anchors. These can be metal anchors with a diameter of 8 mm, or plastic anchors with a diameter of 10 mm, used with metal screws of 7 mm in diameter (see Figures 2.3.5 and 2.3.6).

In terms of mechanical strength and stability, the anchors must be designed and installed so that the loads acting on them during the service life of the structure do not result in any of the following:

- Complete or partial failure of the structure;
- Deformations that are considered unacceptable;
- Damage to other parts of the structure, equipment, or installations due to excessive deformation of the support structure;
- Disproportionate damage in relation to the original cause.

The anchors must be designed to resist shear, tension, and combined loading, ensuring:

- Adequate strength resistance under Ultimate Limit States;
- Adequate resistance deformation under Serviceability Limit States.

The anchors must have a European Technical Assessment (ETA) certification with CE marking, or alternatively, a DH (Document of Homologation), indicating characteristic resistance values and respective safety factors.

If no ETA or DH certification is available, resistance values must be validated through technical documentation or load testing.

Metal anchors are generally recommended for concrete substrates, while plastic anchors with metal screws are suitable for both concrete substrates and solid or hollow masonry.

Figure 2.3.5 - Ø10 mm Plastic anchor
Stainless Steel or Galvanised Steel Screw Ø7mm, minimum length 75 mm

Figure 2.3.6 - M8 Metal anchor
Stainless Steel or Galvanised Steel, minimum length 80 mm

2.3.05 Anchors for Thermal Insulation Fixing

The dimensioning of the thermal insulation should be carried out in accordance with the national regulations established for the Thermal Behavior of Buildings.

The fixation of the thermal insulation to the supporting structure is done using plastic dowels or equivalent materials, which generally feature a wide head and a length suitable for the thickness of the insulation, ensuring proper adhesion and stability of the system (see Figure 2.3.7).

Figure 2.3.7 – Anchor fixing the thermal insulation to the supporting structure

2.3.06 Protection Strips for Timber Studs

When the structure is made up of timber studs classified as durability class 2, according to standard EN 335, it is mandatory to use a protection strip along their entire height, to safeguard the wood against rainwater infiltration.

The protection strip must have the following characteristics:

- Be waterproof;
- Be 10 mm wider than the timber studs on each side, ensuring adequate coverage.

The protection strips may be made of flexible PVC or EPDM (see Figures 2.3.8).

Additionally, the application of protection strips over the galvanised steel profiles of the structure is also permitted, on an optional basis.

Figure 2.3.8 - Flexible PVC or EPDM protection strip
Mandatory on timber studs with durability class 2

2.3.07 Screws for Fixing Panels Supported on a Wooden Substructure

The screws used to fix the panels onto the timber substructure must be made at least of stainless-steel class A2, with the following minimum specifications:

- Screw body diameter: 4.8 mm;
- Screw head diameter: 16 mm.

A neoprene washer may be used to control the tightening force (see Figure 2.3.9).

If screws with a smaller head diameter are used, a 16 mm diameter metal washer with neoprene must be added to ensure correct load distribution.

The screw pull-out resistance (Pk) must be greater than 2.0 kN (± 200 Kgf), considering a penetration depth into the timber of 22 mm.

Manufacturers such as SFS Intec, ETANCO, and EJOT supply screws specifically designed for façades, and may also offer them with a lacquered finish in the desired colour. However, screws from other manufacturers may be used, provided they offer equivalent performance.

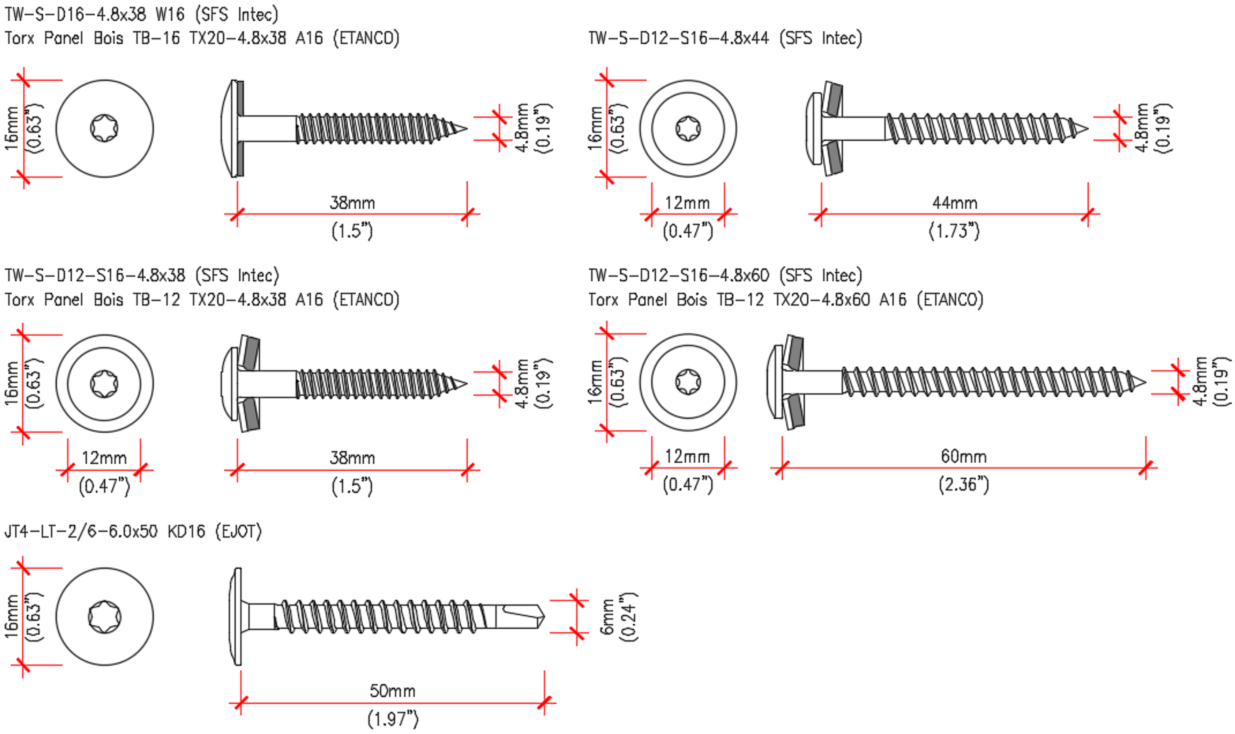


Figure 2.3.9 - Screws for wooden structures

2.3.08 Screws for Fixing Panels Supported on a Galvanised Steel Substructure

The screws used to fix Viroc panels to the galvanised steel substructure must be bimetallic, with a stainless-steel body and a carbon steel drilling tip. The minimum specifications are:

- Head diameter: 16 mm;
- Body diameter: 5.5 mm.

Screws with smaller head diameters may be used, provided that 16 mm metal washers with neoprene are applied.

The length of the screw must be compatible with the thickness of the panel and the metal profile (see Figure 2.3.10).

The screw pull-out resistance (Pk) must exceed 2.0 kN (approximately 200 kg) for any type of substructure.

Manufacturers such as SFS Intec, ETANCO, and EJOT supply façade-specific screws, which may also be offered with custom-painted finishes to match the desired colour. Screws from other manufacturers may also be used, provided they deliver equivalent performance.

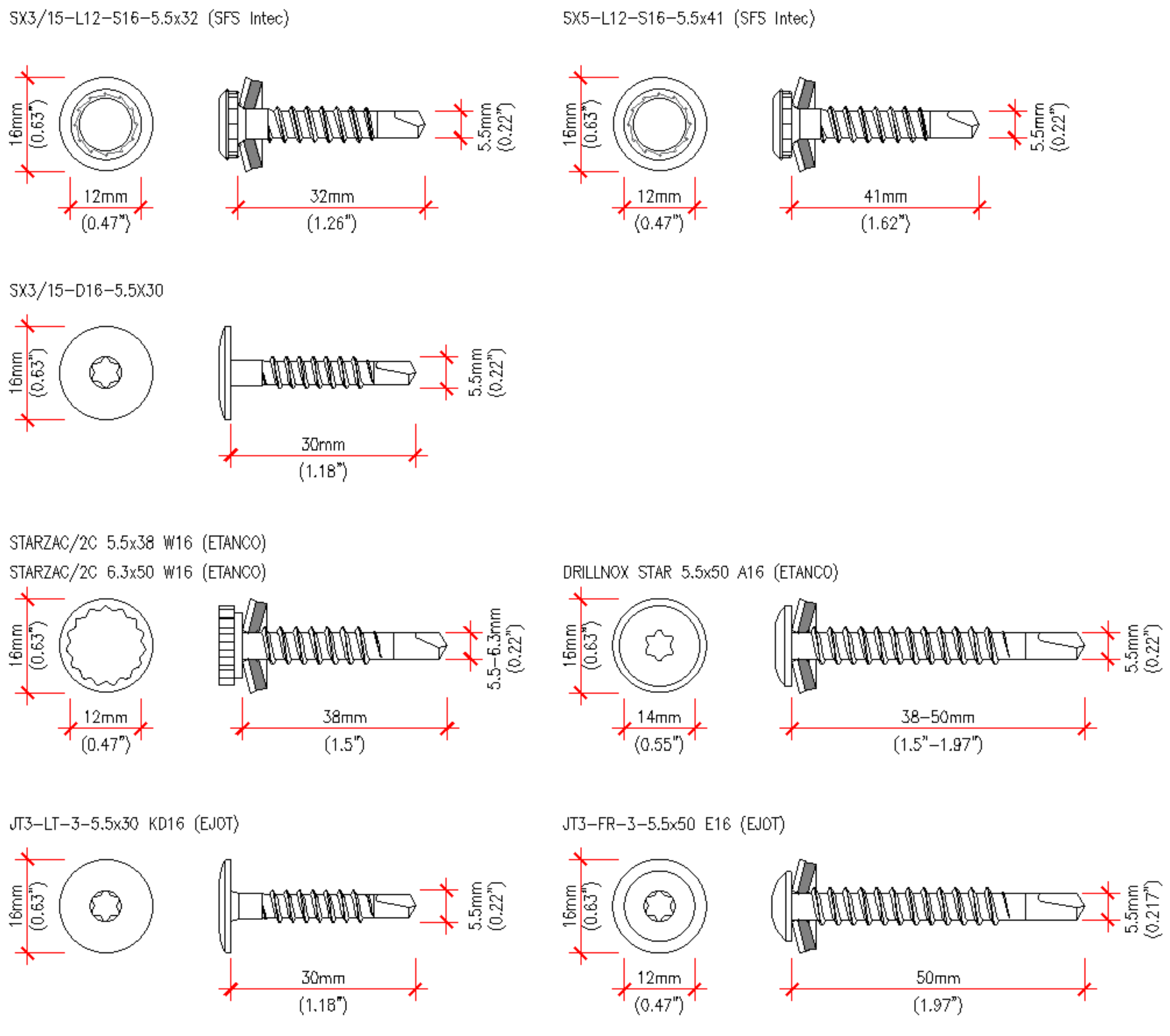


Figure 2.3.10 - Screws for metal structures

2.3.09 Rivets for Fixing the Panels Supported on a Frame made of Galvanised Steel

When the supporting structure is made of galvanised steel, Viroc panels can be fixed using rivets.

The rivets must have the following characteristics:

- Rivet body: Aluminium;
- Pulling mandrel: Stainless steel;
- Minimum diameter: 4.8 mm;
- Length: Must be suitable to ensure secure fastening of the panel to the substructure (see Figure 2.3.11).

The rivet pull-out resistance (Pk) must exceed 2.0 kN for any type of substructure.

When panels are fixed with rivets, a clamping limiter must be used on the tip of the rivet gun. This prevents over-tightening and allows for the natural expansion and contraction of the panel (see Figure 2.3.12).

Manufacturers such as SFS Intec, ETANCO, and EJOT supply façade-specific rivets, which can be provided in the desired colour. Rivets from other manufacturers may also be used, provided they offer equivalent performance.

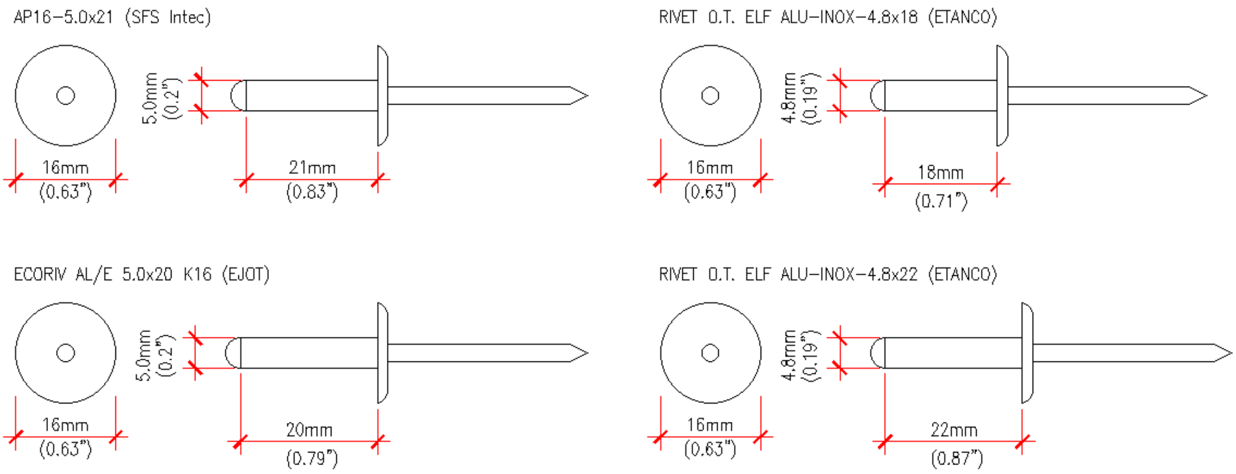


Figure 2.3.11 - Rivets for fixing Viroc panels to a metal structure

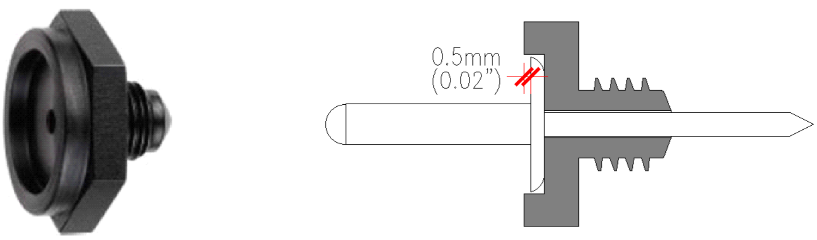


Figure 2.3.12 - Clamping limiter

Mandatory use

2.3.10 Recommended Thicknesses of Viroc Panels for Façades and Tolerances

Thickness: 12 mm ± 1.0 mm; 16 mm ± 1.2 mm

For the full range of available thicknesses and colours, please refer to the Viroc panel technical datasheet.

2.3.11 Panel Weight

12 mm: 16.2 ± 1.2 kg/m^2;

16 mm: 21.6 ± 1.6 kg/m^2.

2.3.12 Manufacturing Dimensions of Viroc Panels and Cutting Tolerances

- Dimensions: 2600x1250 mm and 3000x1250 mm
- Tolerances:
  - Length and width: ± 3 mm
  - Squareness: ≤ 2 mm/m
  - Edge straightness: ≤ 1.5 mm/m

The Viroc panel technical datasheet also provides the available sizes and colours.

Any intermediate dimension can be obtained by cutting the panels.

2.3.13 Maximum Panel Size for Unvarnished Façade Applications

The maximum size of panels to be used in ventilated façades without coating is 1500 x 1250 mm.

2.3.14 Minimum Panel Size for Façade Applications

The minimum size of panels to be used in ventilated façades is 300 mm. Viroc Portugal does not recommend a length-to-width ratio greater than 3 (L/W ≤ 3). Very long and narrow panels tend to be more fragile and may break more easily.

2.3.15 Facade Assembly Operations

The installation of a facade is carried out following the steps below:

- Marking and identification of facade elements;
- Assembly of the support brackets;
- Installation of thermal insulation;
- Assembly of support profiles;
- Fixing the panels;
- Treatment of singular points.

2.3.16 Marking and Identification of Façade Elements

There is no preferred orientation for the assembly of the panels. The system allows the installation of panels of all sizes and shapes, including intermediate dimensions. Viroc panels can be placed horizontally or vertically. The main objective is to follow the stereotomy defined by the architectural design.

2.3.17 Assembly of Support Brackets

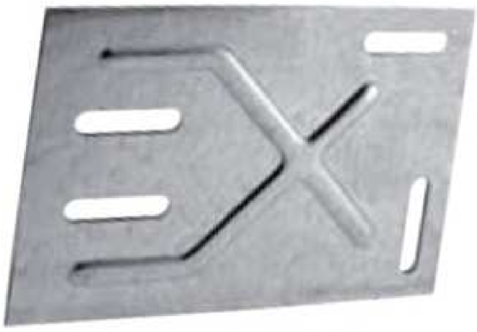
The location of the support brackets determines the final position of the profiles, so their placement must be carried out with precision.

2.3.18 Fixing the Brackets to the Supporting Wall

The brackets are fixed to the support wall using anchors. The anchors can be metal sleeves with a diameter of 8 mm or plastic sleeves with a diameter of 10 mm, with a metal screw of 7 mm in diameter.

2.3.19 Angle Plates

Angle plates are available to facilitate the creation of corner angles. The use of these plates is optional (see figure 2.3.13).



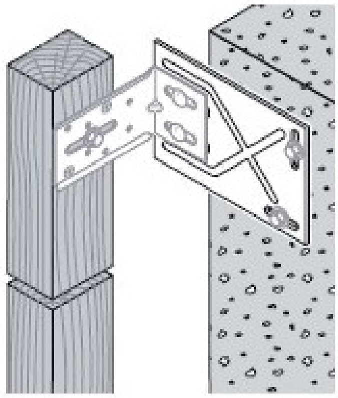


Figure 2.3.13 - Auxiliary angle plate, galvanised steel Z350. Thickness: 2.5 mm

2.3.20 Installation of Thermal Insulation

The thermal insulation must be dimensioned according to the standards established in the Regulations for the Thermal Performance of Buildings. The insulation is fixed to the support using plastic anchors or similar materials, typically with a wide head and length suitable for the thickness of the insulation.

2.3.21 Installation of Support Profiles

The support profiles must be arranged vertically, according to the specifications and technical drawings provided in this document, properly adjusted to the stereotomy defined in the architectural design. A horizontal arrangement of the profiles may be adopted, provided there is adequate ventilation, and the profiles do not accumulate water that could cause degradation.

The distance between the profiles must comply with the maximum distance between the panel fixations. The alignment of the profiles between adjacent elements must be verified, ensuring there are no differences greater than 2 mm.

2.3.22 Fixing the Profiles to the Support Brackets

Fixing the Wooden Structure

The connections of the wooden posts to the frames should be made with a screw of a diameter equal to or greater than 6.0 mm, placed in the oval hole, and a second screw of a diameter equal to or greater than 3.5 mm, placed in one of the circular holes, to block movement (see figures 2.3.14).

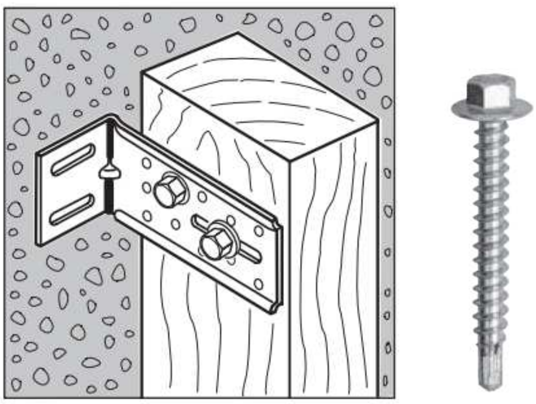


Figure 2.3.14 - Fixing the wooden profile to the brackets

Fixing the Galvanised Steel Profiles

The connections of the galvanized steel profiles to the frames are made using self-drilling screws or rivets, which should be placed in the oval hole, and another screw in the circular hole to prevent movement. The connection can be made with self-drilling screws with a diameter equal to or greater than 5.5 mm or rivets with a diameter equal to or greater than 4.8 mm (see figure 2.3.15).

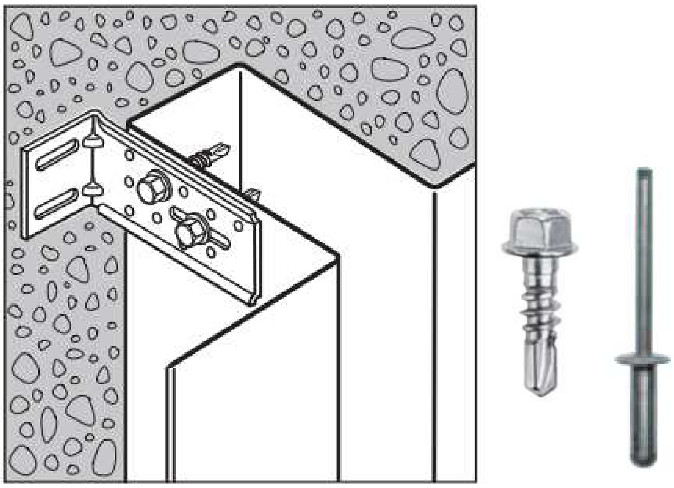


Figure 2.3.15 - Fixing the galvanised steel profiles to the brackets
(Ø≥5.5 screws or Ø≥4.8 rivets)

2.3.23 Protection Bands for Wooden Posts

When the support structure is made of class 2 durability wood, according to EN 335 standard, the posts must be protected from rainwater with a flexible PVC or EPDM band, which should cover their entire height. Protection bands can also be used over the metal profiles, optionally.

2.3.24 Cutting Viroc Panels

Cuts on Viroc panels should be made with a portable circular saw equipped with suitable cutting discs. The discs must be made of carbide, typically with tungsten carbide tips (see figure 2.3.16).

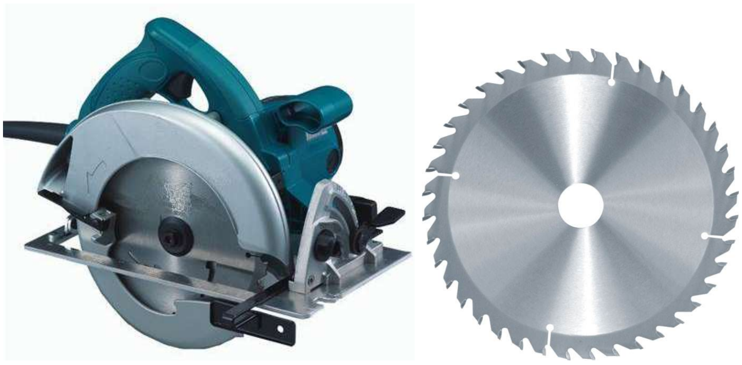


Figure 2.3.16 – Circular saw with tungsten cutting disc

2.3.25 Drilling Viroc Panels

Whenever it is necessary to drill Viroc panels, the holes should be made with HSS drill bits for metal. The drill should be set to drilling mode, without impact (see figure 2.3.17).

Note: FREZITE offers drill bits suitable for drilling Viroc with great durability.

Figure 2.3.17 - Drill and HSS drill bits (for drilling metal)

2.3.26 Surface Preparation of Viroc Panels

Viroc panels are supplied raw, without any surface finish. Their surfaces may show some irregularities and imperfections, including small incrustations, stains, scratches, wood shavings, and salts resulting from the chemical reactions that occur during the manufacturing process.

Before installation, the visible surfaces of the panels must be properly cleaned/polished to remove dirt, oils, scratches, dust, or surface salts. This process should be performed on the faces that will be exposed, using a medium-density Scotch-Brite cleaning pad. Alternatively, fine sandpaper with a grain of 120 or higher can be used.

It is important to note that this cleaning/polishing process does not alter the natural appearance of the panel, maintaining its inherent characteristics, such as stains, heterogeneities, and some salts or incrustations embedded in the surface.

Video: Demonstration of the Viroc panel polishing process.

https://www.youtube.com/watch?v=HeQZNVN0ZYI

2.3.27 Varnishing or Painting of Viroc Panels

This chapter deals with the application of Viroc panels in facades that do not use varnish.

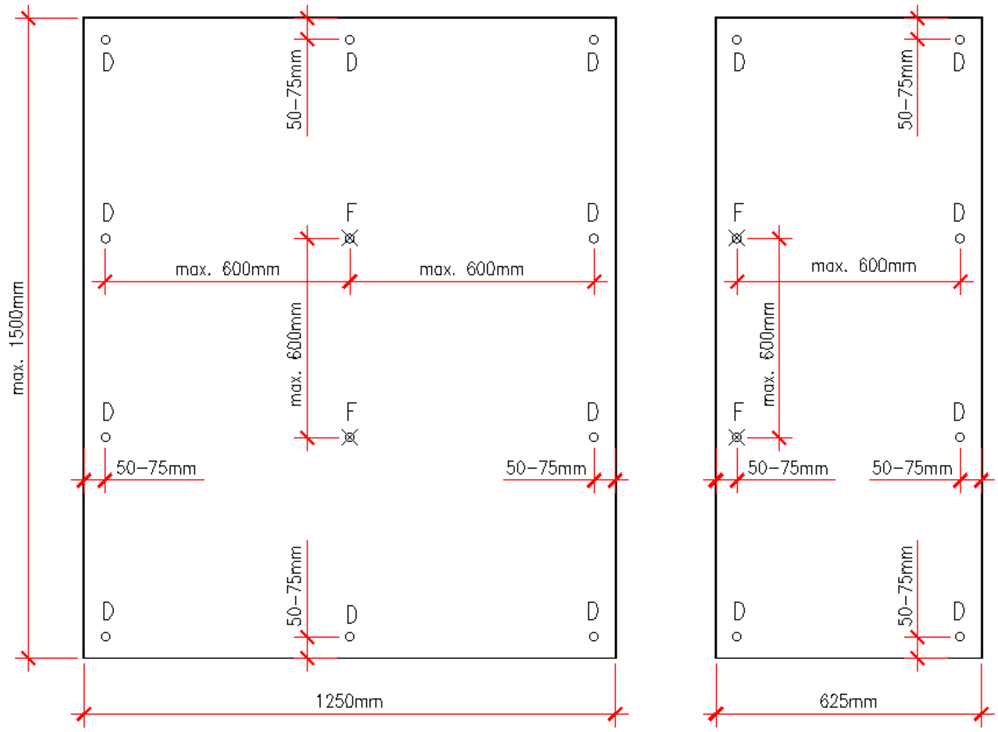
To reduce the formation of efflorescence and streaks, a protective finish may be applied to the panels.

2.3.28 Fixing Viroc Panels

Viroc panels for facades are fixed to the structure with screws. When exposed to the exterior, the panels may undergo dimensional variations, which can increase up to 1.5 mm or decrease up to 5 mm per linear meter, if not sealed. To allow for these dimensional variations without causing damage, the fixing system must be designed to accommodate such movements.

The holes for fixing the screws on the edges of the panels should have a diameter of 11 mm, larger than the screw body, which may be 4.8 mm or 5.5 mm, allowing for shrinkage and expansion of the panels without introducing forces. For the central areas of the panel, the holes should have the same diameter as the screw body, ensuring a rigid fixing of the panel and its proper positioning, either 5 or 6 mm.

The fixing begins at the fixed points to correctly position the panel. The expandable points are done afterward to avoid stress during installation. The screws should be placed between 50 mm and 75 mm from the edges of the panels. The maximum distance between screws is 600 mm, both horizontally and vertically, as illustrated in figure 2.3.18.



D – Expandable Support - Ø 11 mm

F - Fixed Support - Ø 5 or 6 mm

Figure 2.3.18 - Location of fixings and hole diameter

The screws should be positioned perpendicular to the plane of the panel, with a maximum deviation of 2.5°, and with the appropriate tightening to avoid crushing the neoprene washer (see figures 2.3.19 and 2.3.20).

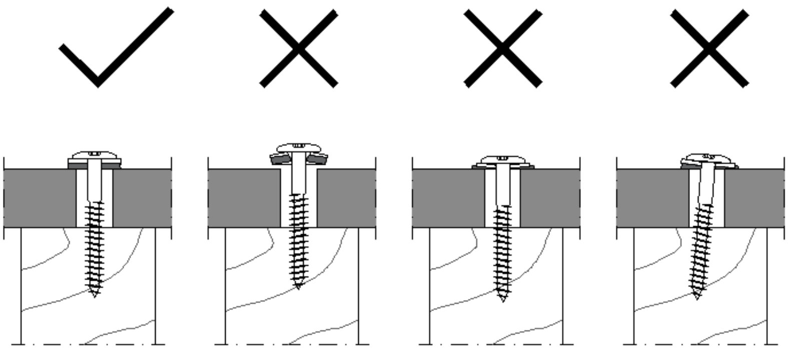


Figure 2.3.19 - Correct tightening and positioning of the screws

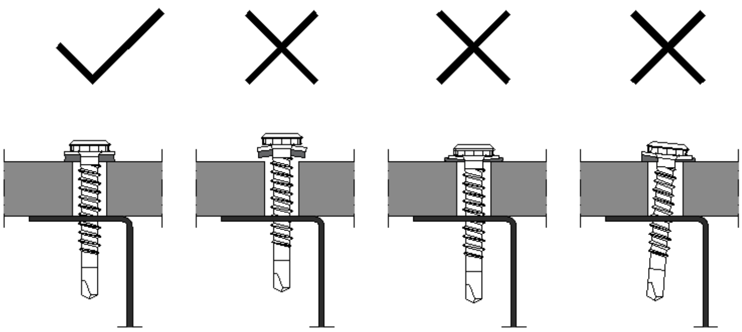


Figure 2.3.20 - Correct tightening and positioning of the screws

When the panels are fixed to a wooden structure, the screws must not be placed less than 15 mm from the edge of the timber joist (see figure 2.3.21).

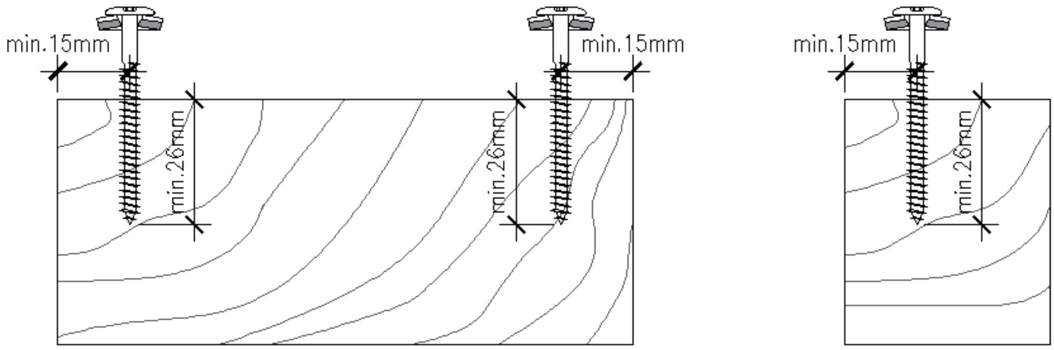


Figure 2.3.21 - Minimum distance of screws from the edge of the timber joist

When the structure is made of galvanized steel, the minimum distance from the edge is 10 mm (see figure 2.3.22).

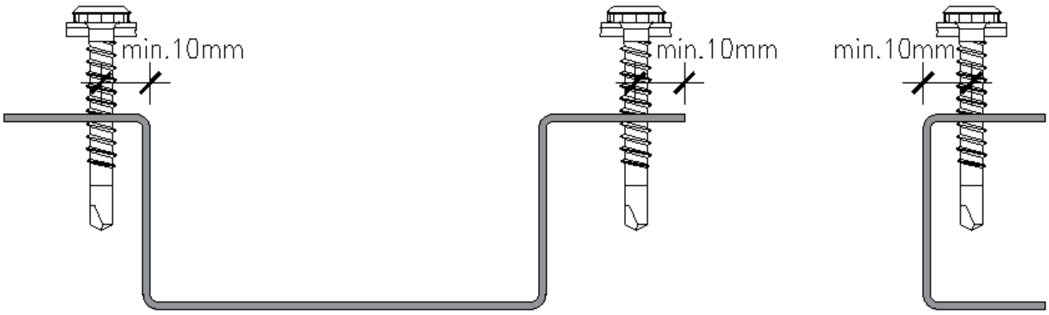


Figure 2.3.22 - Correct positioning of screws or rivets

2.3.29 Auxiliary Assembly Tools

There are various auxiliary tools that can facilitate the assembly, such as keys for centering holes and screws (see figures 2.3.23, 2.3.24, and 2.3.25).

Figure 2.3.23 – Key for centering screws

Figure 2.3.24 – Key for centering Holes

Figure 2.3.25 – Tool for centering hole

2.3.30 Joint Treatment

Viroc panels should be installed with a gap between 5 mm and 8 mm in the vertical and horizontal joints. The joints can be kept open or closed with a profile, depending on the desired aesthetic.

2.3.31 Air Gap Ventilation

The ventilated facade, as described in this Technical Dossier, creates a continuous air gap between the back of the panel and the thermal insulation. The minimum thickness for ventilation of the air gap must be 20 mm, and this distance must be maintained even in areas where obstructions may occur.

At the base of the facade, this opening should be protected by a grille or perforated sheet to prevent the entry of birds or rodents (see figure 2.3.26).

Figure 2.3.26 – Perforated profile to prevent rodents

2.3.32 Ruffle at the Top of the Façade

At the top of the façade, the opening must be protected with a flashing to prevent water from entering directly into the air cavity and to avoid water runoff over the panels. The installation of flashings is essential to prevent staining or streaking from developing over time (see Figures 2.3.41 and 2.3.56).

2.3.33 Air Cavity Compartmentalisation

The air cavity must be compartmentalised both vertically and horizontally, without obstructing free air circulation. The purpose of this compartmentalisation is to prevent fire from spreading between different floors or façades in the event of a fire. This compartmentalisation can be carried out using galvanised steel or aluminium sheets (see Figures 2.3.36, 2.3.37, 2.3.44, 2.3.51, 2.3.52, 2.3.53 and 2.3.60).

2.3.34 Angle Profiles

Some manufacturers of facade accessories offer auxiliary profiles for the finishing of facade corners. The use of these profiles is optional (see figures 2.3.27 and 2.3.28).

Figure 2.3.27 - Corner angle profiles

Figure 2.3.28 - Corner angle profiles

2.3.35 Panel Cleaning after Application

The cleaning of the panels can be carried out during the construction process using a water jet with neutral detergent.

2.3.36 Panel Replacement

To replace a facade panel, the existing panel must be removed. Before installing the new panel, it should be verified that the support structure is in proper condition to receive the panel. The structure must be correctly aligned and in good condition. If the area where the new screws are to be placed is damaged, it must be repaired before starting the installation of the new panel.

2.3.37 Impact Resistance

Hard Body Impact Energy EN 1128

12 mm, E = 12.9 Joules, Break Energy

16 mm, E = 12.8 Joules, Break Energy

Impact Test According to ETAG 034

12mm thick panel

Impact Type	Energy	Results
Hard Body	1 J	No damage (Pass)
	3 J	No damage (Pass)
Soft Body	20 J	No damage (Pass)
	60 J	No damage (Pass)
	100 J	No damage (Pass)
	130 J	No damage (Pass)
	300 J	Breakage (Fail)

2.3.38 Wind Action

The exposure of the panel to wind action, in the direction perpendicular to its plane, generates a pressure or depression (measured in kN/m²).

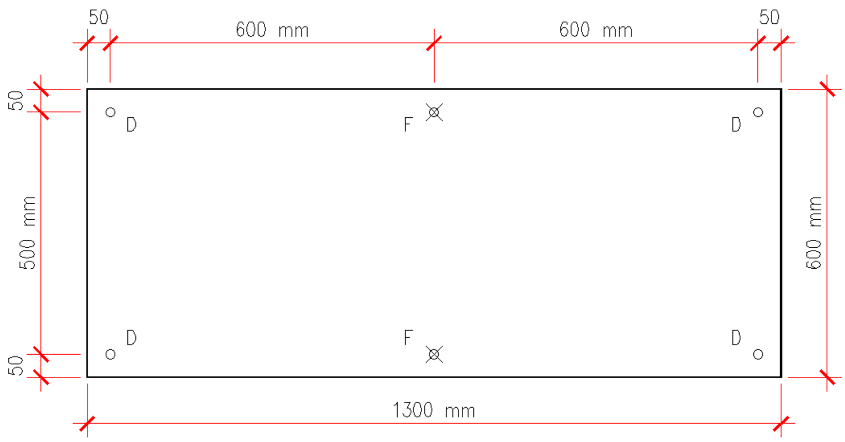
The design resistance value to these forces is specified in Tables 1, 2, 3, and 4.

2.3.39 Verification of Safety Against Wind Actions

The quantification of wind actions is carried out in accordance with the National Annex of Eurocode 1, which defines the standards for evaluating wind forces on buildings and other structures. The wind resistance tables were developed based on experimental tests performed for the most critical situation of panel resistance to wind forces, considering suction action.

2.3.40 Example of Verification of Safety of a Viroc Panel to Wind Loads

Considering a 12 mm thick Viroc panel with the configuration specified below, what is the maximum wind load that the panel can withstand without compromising its structural safety?



Number of screws horizontally: 3, Number of vertical screws: 2

Configuration: 3x2, using Table 3x2

Distance between screws horizontally: 600 mm => See Table 4

Distance between screws vertically: 500 mm

Horizontal distance between screws 600 mm (24")									
Thickness Of Panel	(H x V)	Vertical distance between screws							
		300mm	12"	400mm	16"	500mm	20"	600mm	24"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	1,4	29	1,4	29	1,4	29	1,2	25
	2 x 3	1,4	29	1,4	29	1,2	24	1,0	20
	2 x N	1,4	29	1,4	29	1,2	24	1,0	20
	3 x 2	1,7	36	1,4	28	1,1	24	1,0	20
	N x 2	1,7	36	1,4	28	1,1	24	1,0	20
	3 x 3	1,5	32	1,2	24	0,9	19	0,8	16
	3 x N	1,5	32	1,2	24	0,9	19	0,8	16
	N x 3	1,5	32	1,2	24	0,9	19	0,8	16
16 mm 5/8"	2 x 2	3,3	69	3,3	69	3,0	62	2,5	53
	2 x 3	3,3	69	3,1	64	2,5	52	2,1	43
	2 x N	3,3	69	3,1	64	2,5	52	2,1	43
	3 x 2	3,6	75	2,9	60	2,4	50	2,1	43
	N x 2	3,6	75	2,9	60	2,4	50	2,1	43
	3 x 3	1,7	35	1,3	27	1,0	21	0,8	18
	3 x N	1,7	35	1,3	27	1,0	21	0,8	18
	N x 3	1,7	35	1,3	27	1,0	21	0,8	18

Table 4 – Maximum pressure, 600 mm spacing between screws horizontally

The design resistance value of the Viroc panel to wind pressure (w_{Rd}) is 1.1 KN/m2 (24 psf)

Note: The wind action exerts pressure or depression on the panel. This action is particularly critical when it acts as depression, as the panel is only fixed by the head of the screws, which may result in panel rupture due to shear or punching in the fixation areas.

2.3.41 Efflorescence and water streaks

During the cycles of moisture and drying of the panels, caused by rain action, migration of salts present in the cement to the surface may occur, resulting in efflorescence. These efflorescence's may, in turn, lead to streaking—visible marks or lines caused by water dripping, laden with salts, onto the panels.

The formation of these streaks can be reduced through the following preventive measures:

- Avoid storing the panels outdoors;
- Polish the panels before application;
- If efflorescence appears, perform another polishing of the surface;
- Plan for the installation of drip edges to prevent direct rainwater runoff onto the facade panels.

Note:

Factory-polished panels do not need to be polished on site, as long as they are stored correctly.

2.3.42 Panel Warping

As the panel is not sealed, it may undergo more significant dimensional variations, both in-plane and out-of-plane of the facade. These deformations may worsen if the panels are fixed with only two lines of screws, either vertically or horizontally (see figure 2.3.29 on the right).

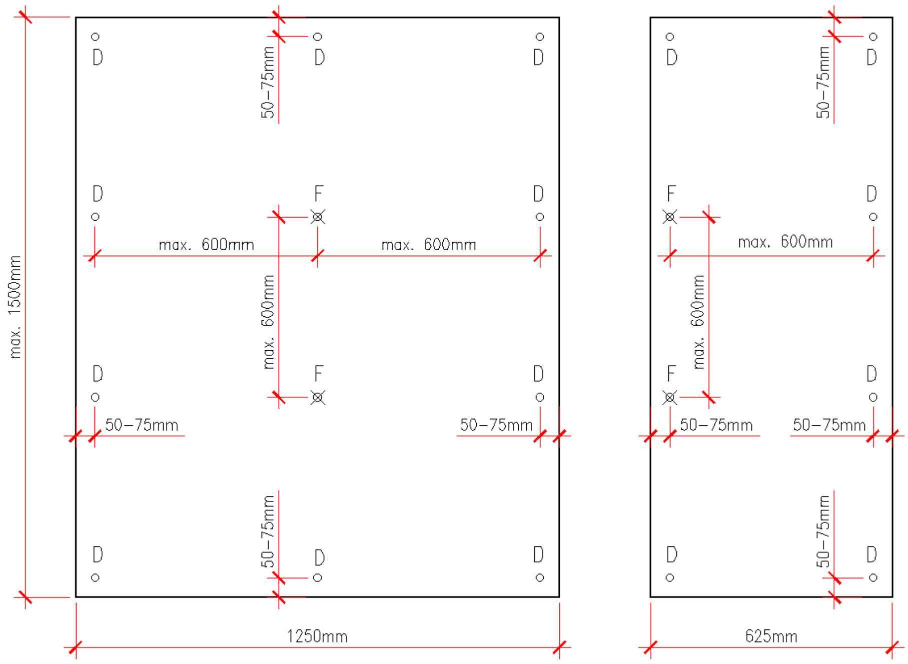


Figure 2.3.29 – Panel fixation with 3 and 2 Lines of Screws

2.3.43 Color Change of the Panels

Over time, exposure to solar radiation can cause a slight change in the original color of the panels, resulting in a gradual lightening. This phenomenon is natural, and its intensity varies depending on the initial color of the panel, being more noticeable in darker shades. In the case of Viroc panels, as they are not varnished, this color change tends to be more pronounced. It is a typical process in materials exposed to weather conditions, which does not affect the mechanical properties of the panels.

2.3.44 Storage

Viroc panels must always be stored in a covered, dry location, protected from direct exposure to sunlight and rain, including on-site. Pallets must be placed on a flat, horizontal base, supported on battens with a minimum height of 8 cm, to allow handling by forklift or other lifting equipment.

Note:

Outdoor storage of panels is strictly prohibited. Exposure to sunlight and rain leads to the formation of efflorescence and surface stains, which may not be immediately visible, but will appear after some time, compromising the final appearance of the façade.

2.3.45 Acclimatisation

To ensure proper installation conditions, Viroc panels must be acclimatised to the environment in which they will be installed, taking into account the local temperature and relative humidity.

The acclimatisation process should follow these steps:

- Remove the straps around the pallets;
- Remove the protective plastic film;
- Leave the panels exposed to the construction environment for at least 72 hours before installation.

During this period, it is normal for the panels located at the top of the pallet, already unstrapped, to show signs of warping, usually forming a concave shape facing upwards. This phenomenon occurs due to a differential loss of moisture between the two faces of the panel.

This type of deformation is temporary and reversible. To restore the panel to its flat shape, it is recommended to:

- Turn the back side of the panel upwards, allowing both faces to reach a moisture balance.

This procedure enables the panels to recover their original shape and be in ideal condition for installation.

2.3.46 Details, Wood Structure

Figures 2.3.30 to 2.3.44 show examples of various details and singular areas of the façade.

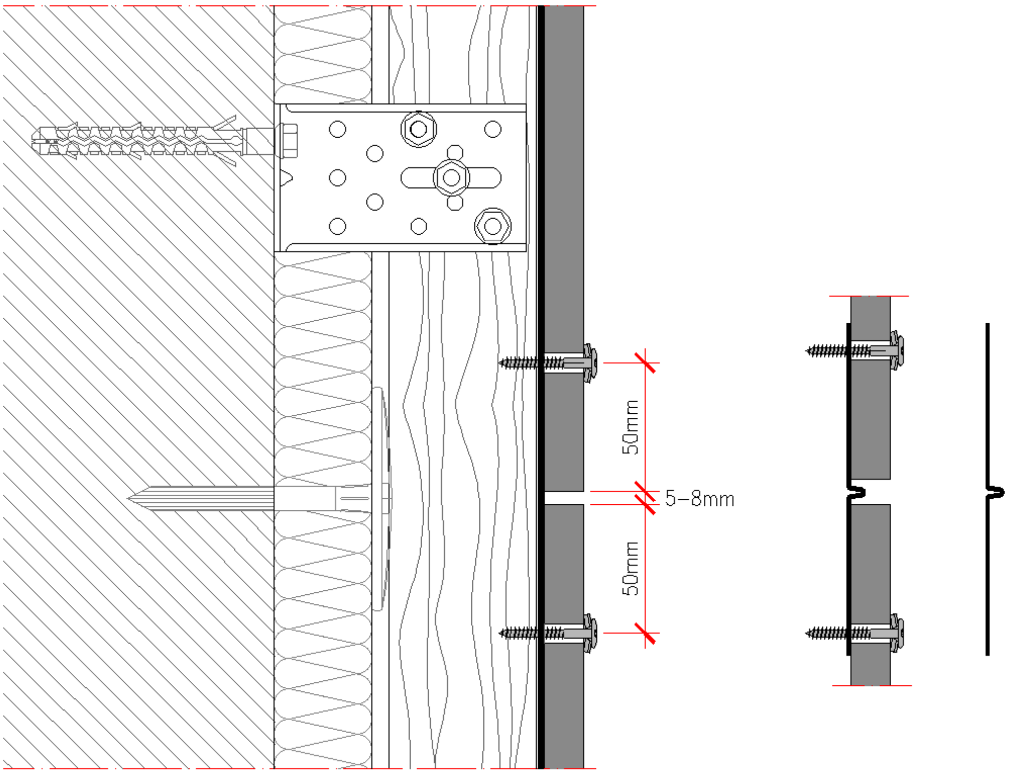


Figure 2.3.30 - Vertical section, joint between panels

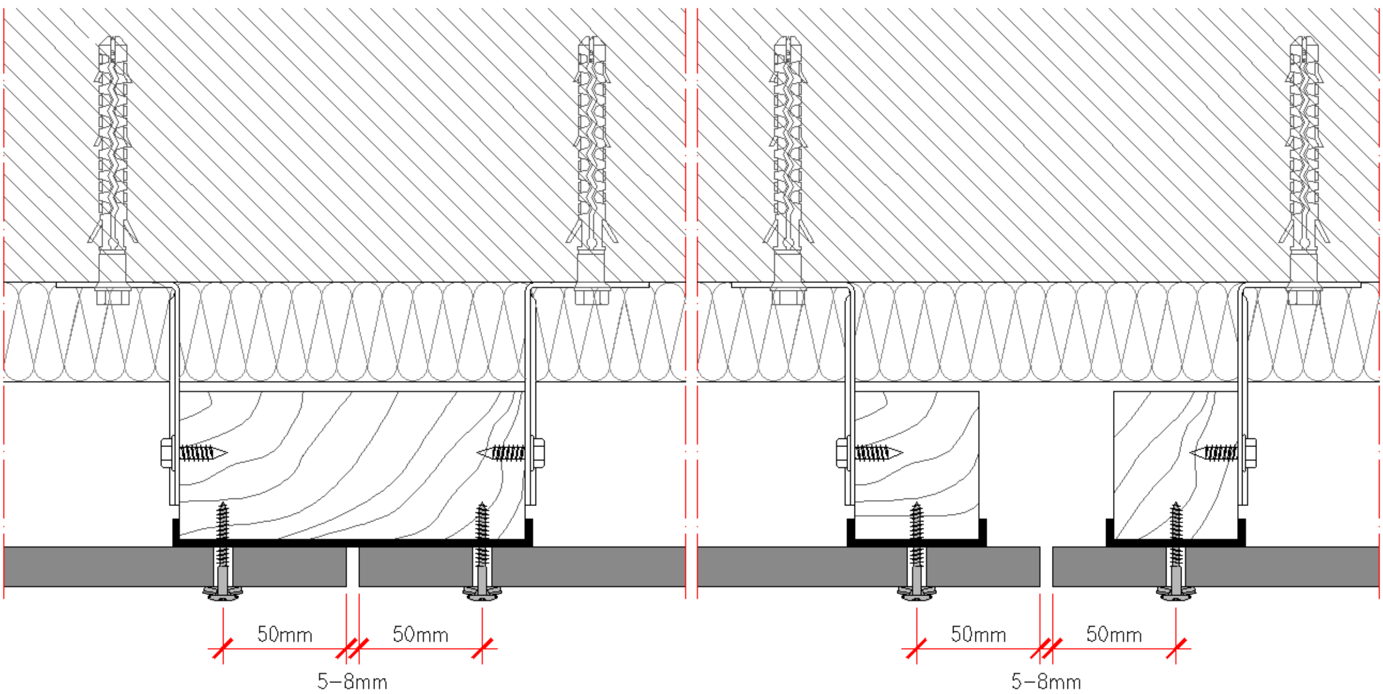


Figure 2.3.31 - Horizontal section, joint between panels

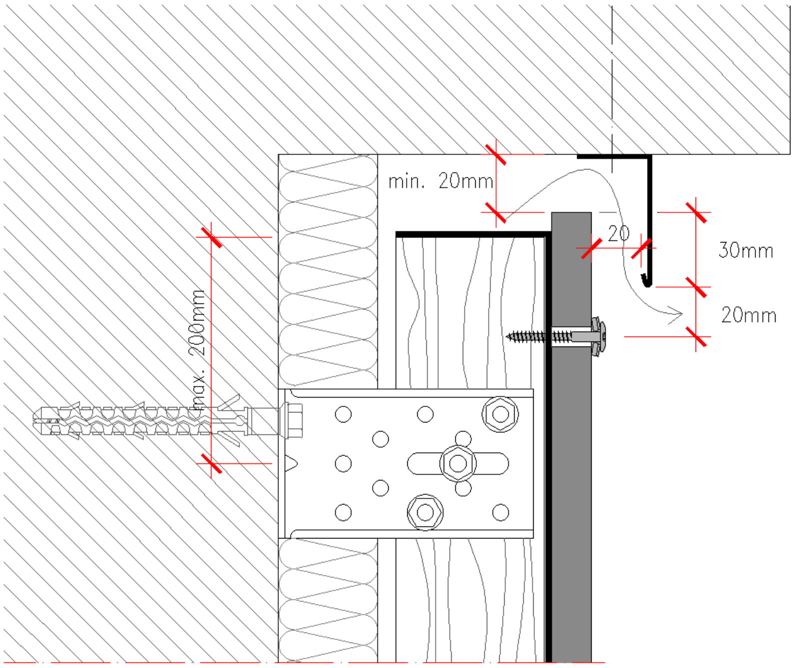


Figure 2.3.32 – Edge under balcony

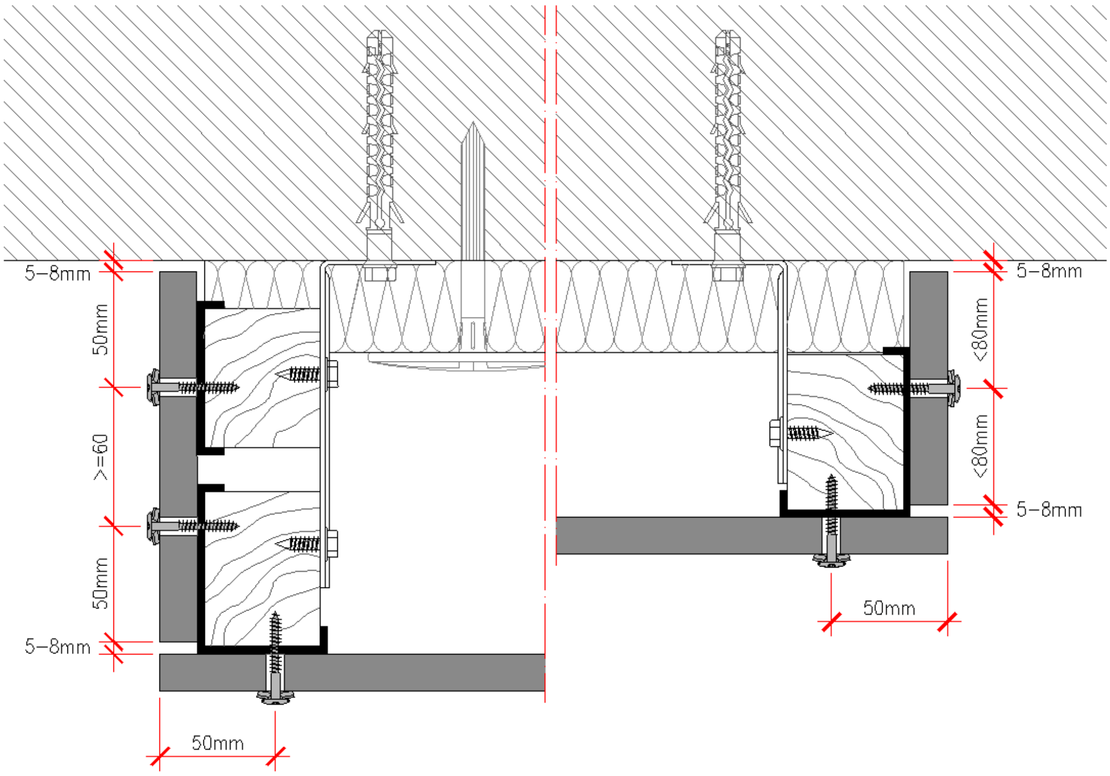


Figure 2.3.33 – Lateral edge

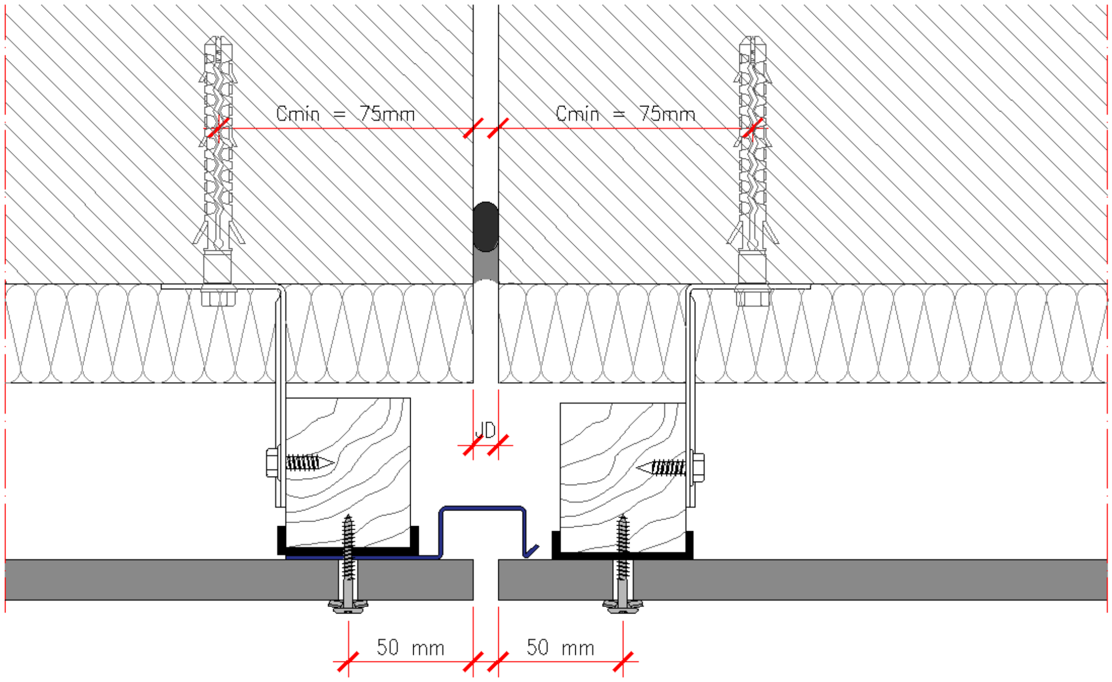


Figure 2.3.34 - Expansion joint

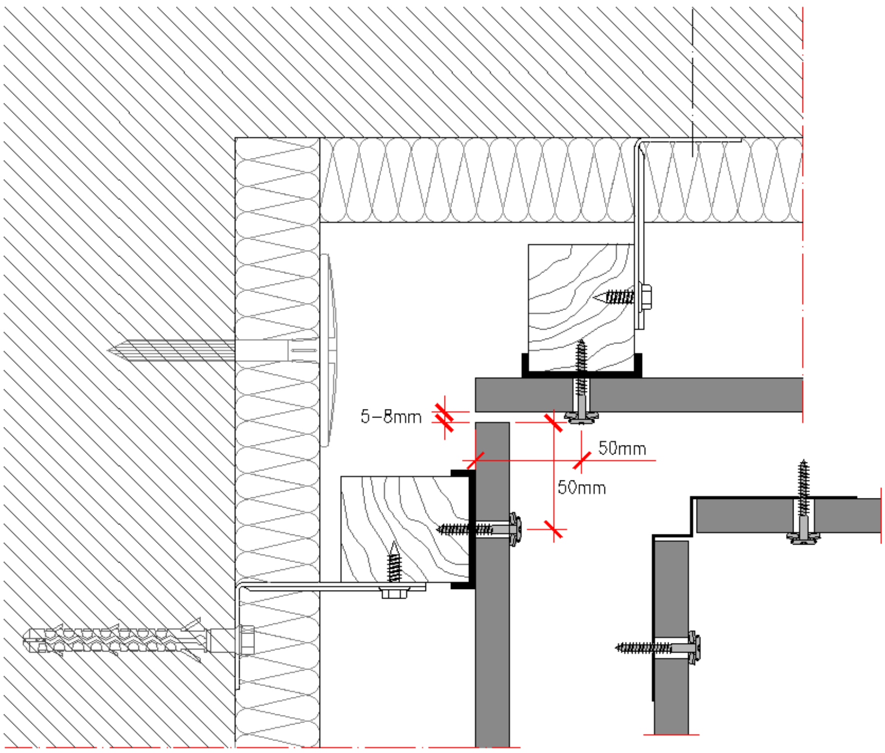
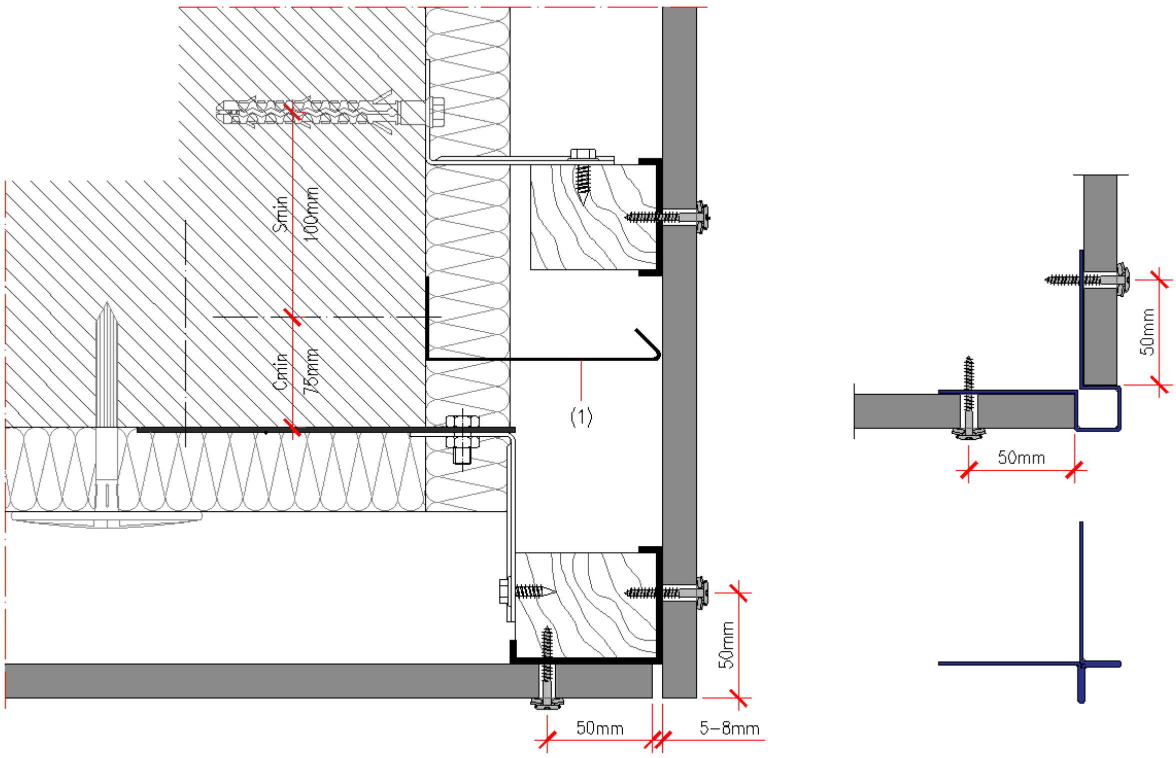


Figure 2.3.35 – Corner angle (90 º)



Air gap compartmentalization (1)

Figure 2.3.36 - Corner angle (270 º)

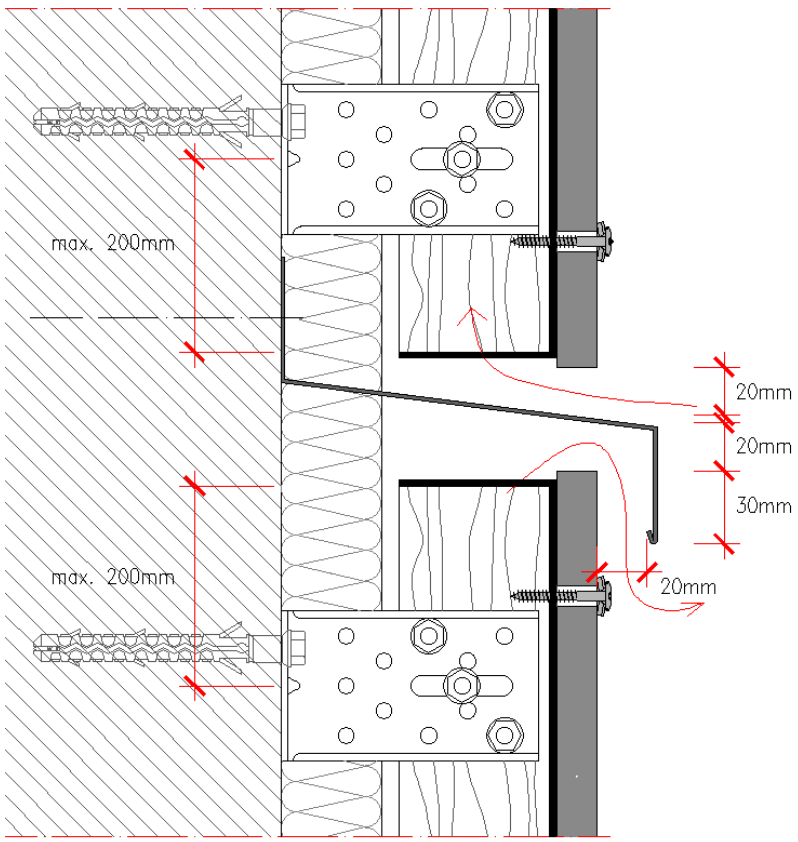


Figure 2.3.37 - Horizontal compartmentalization of the air gap

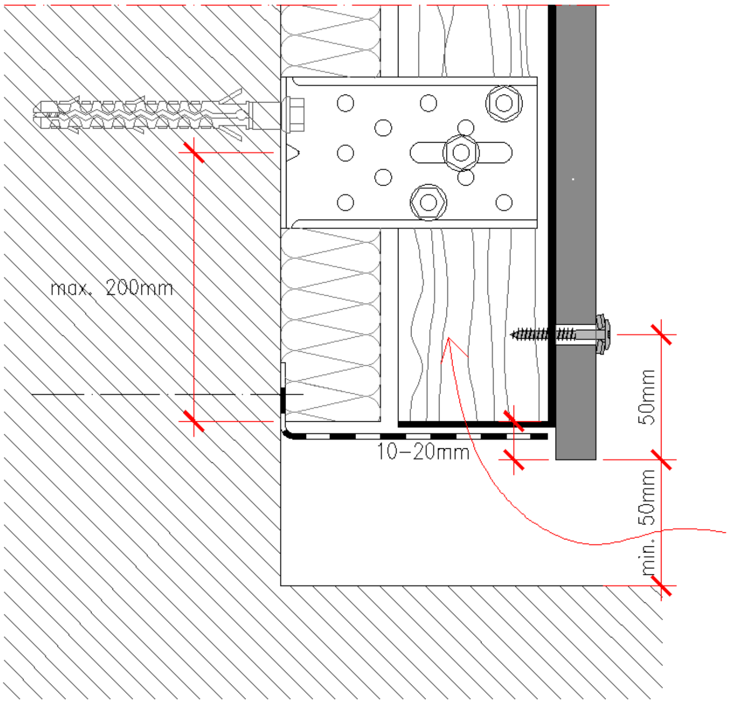


Figure 2.3.38 – Base detail, anti-rodent grille

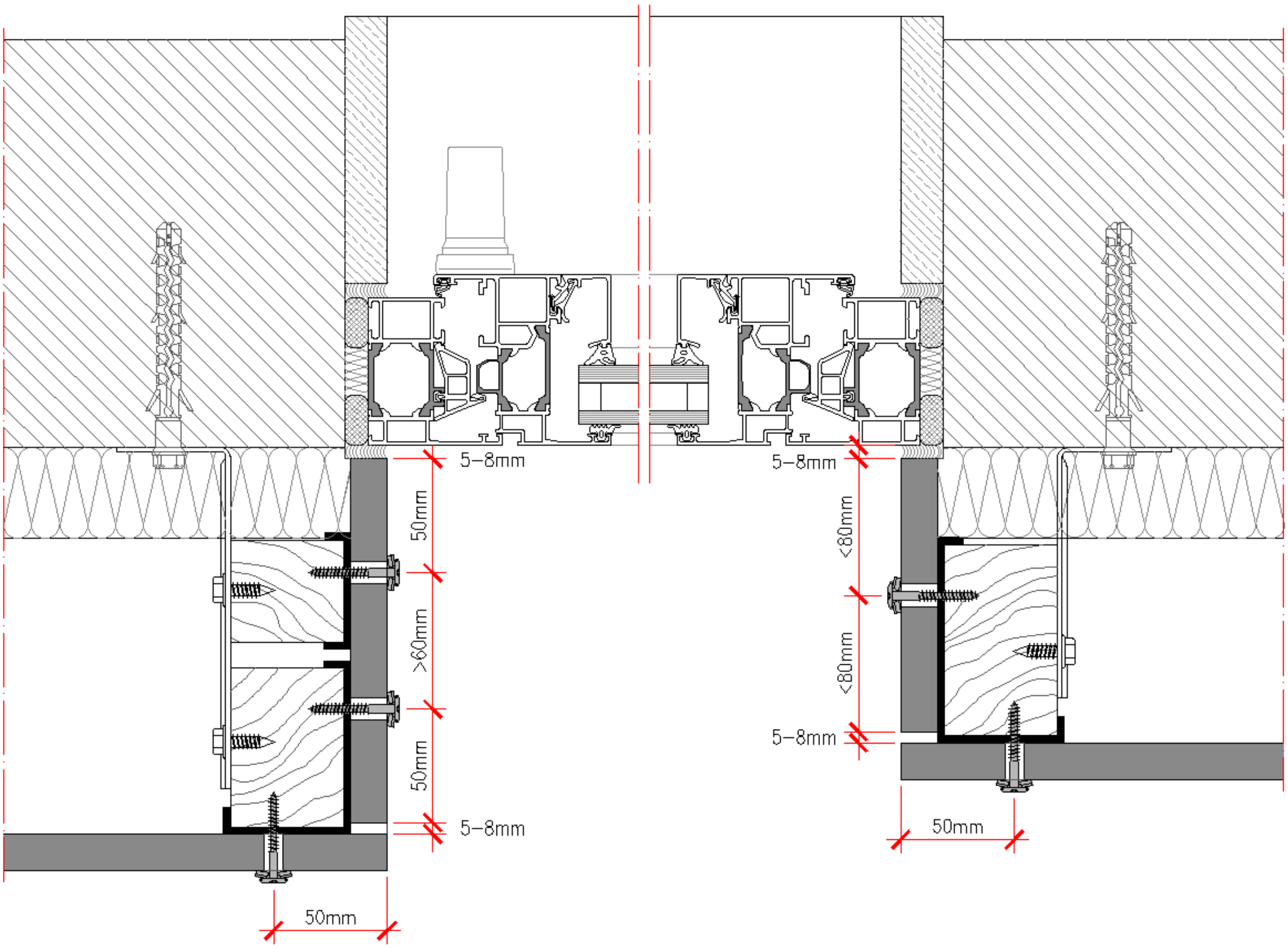


Figure 2.3.39 - Horizontal section, window opening

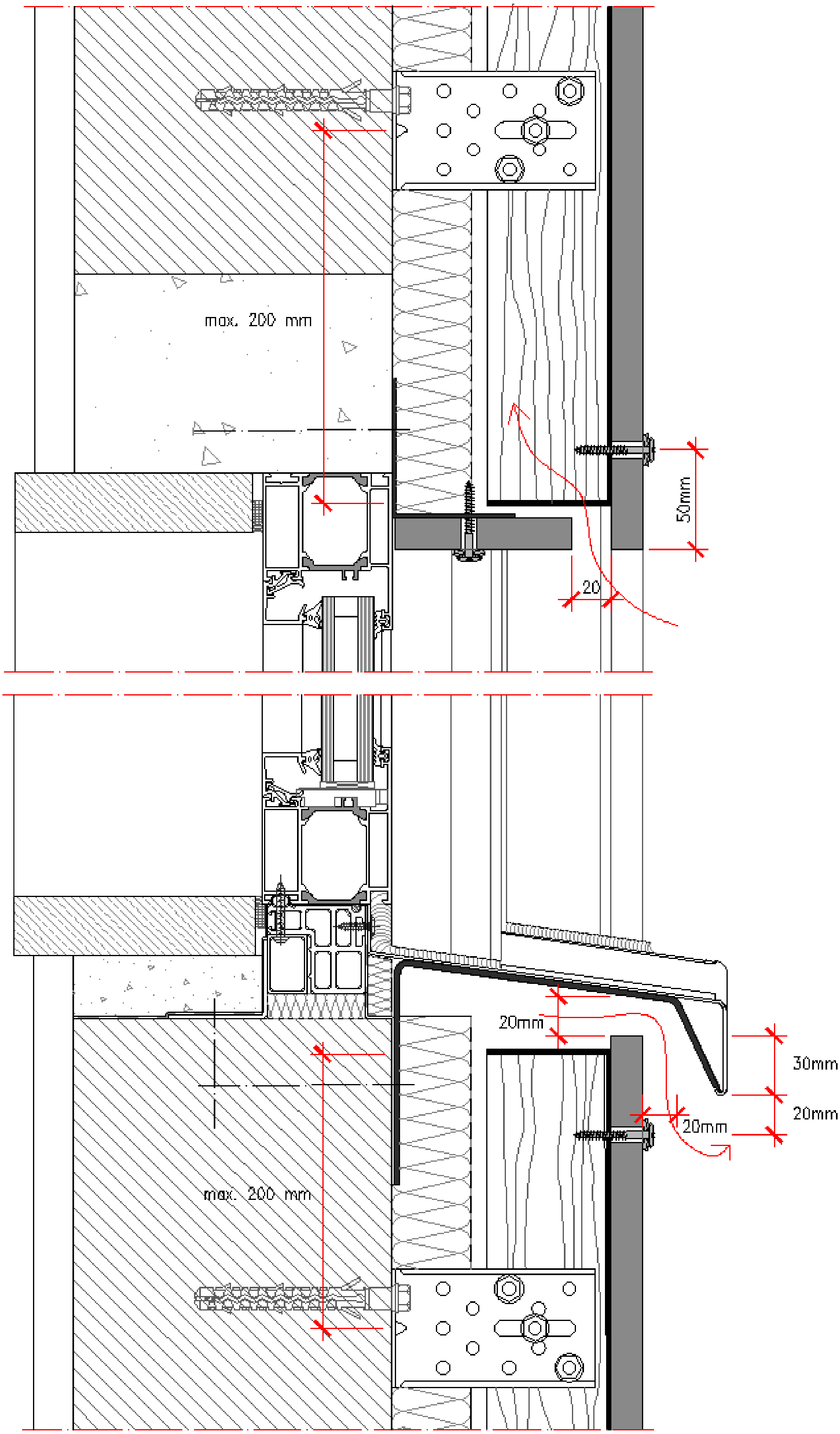


Figure 2.3.40 - Vertical section, window opening

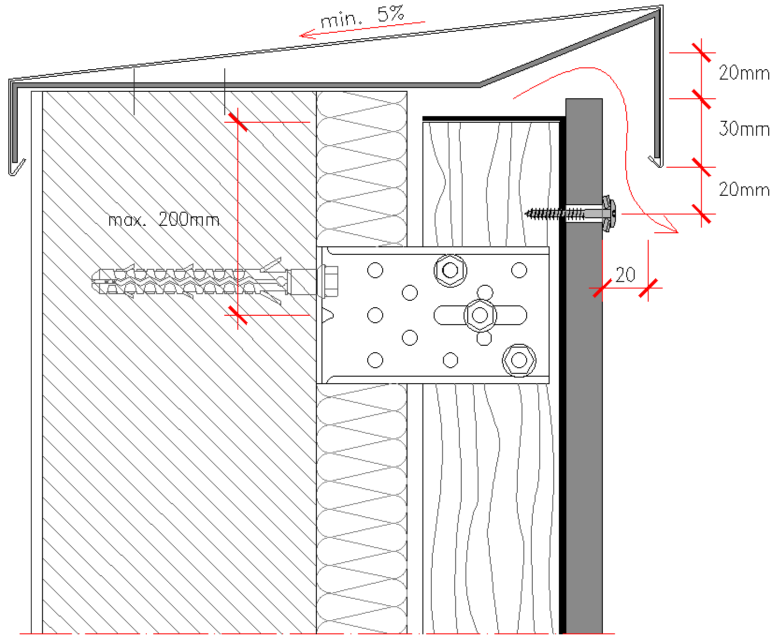


Figure 2.3.41 – Top detail
(Crucial to avoid efflorescence)

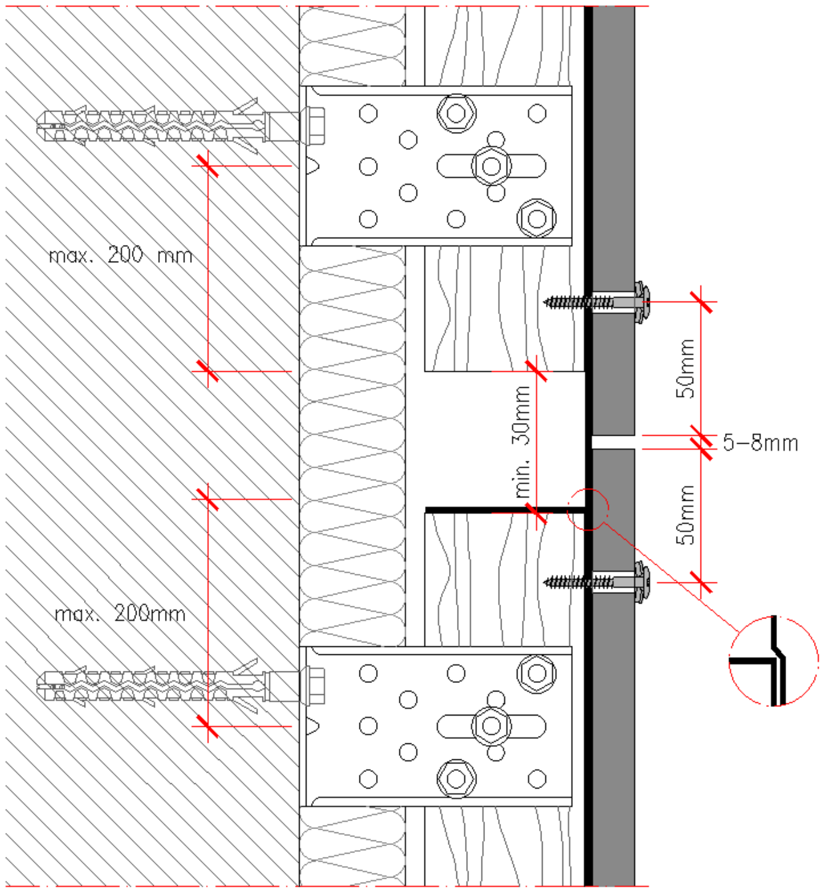


Figure 2.3.42 - Structure fractionation: Profiles with length ≤ 6 m

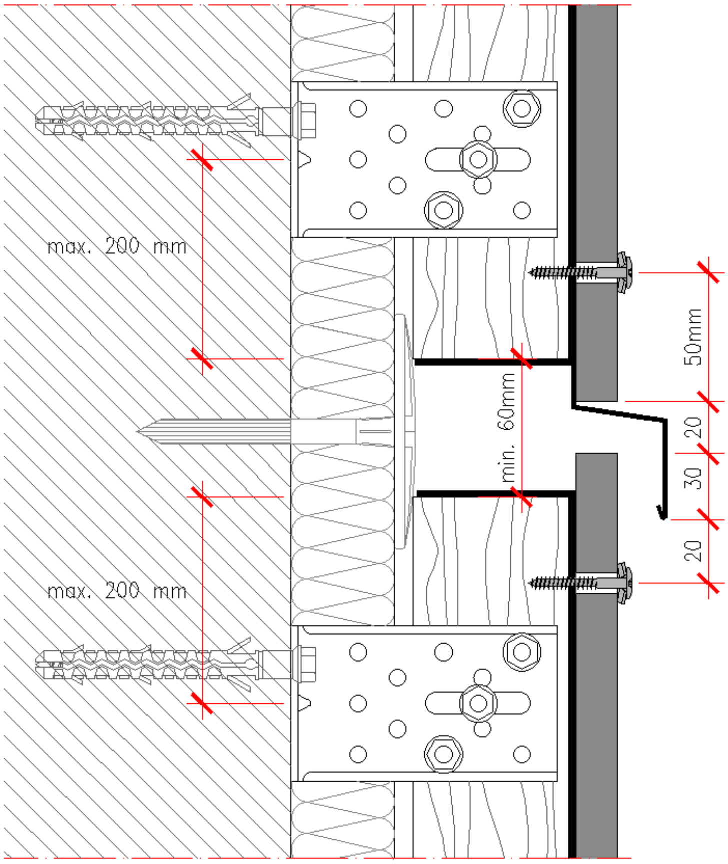
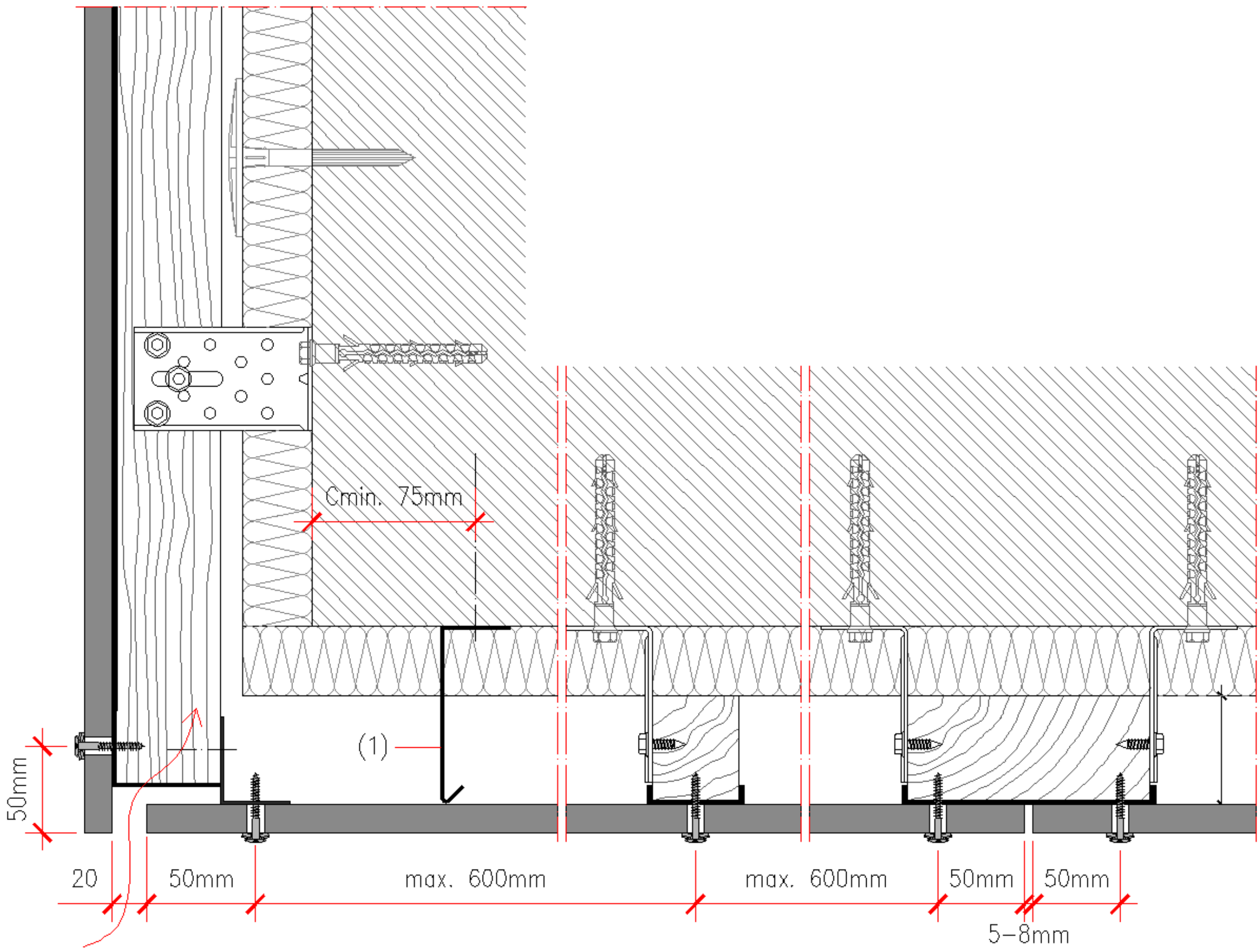


Figure 2.3.43 – Structure fractionation: Profiles with length > 6 m



Compartmentalization of the Air Gap (1)

Figure 2.3.44 - Detail of the façade - false ceiling connection

2.1.47 Details, Galvanised Steel Structure

Figures 2.3.45 to 2.3.60 show examples of various details and unique areas of the façade.

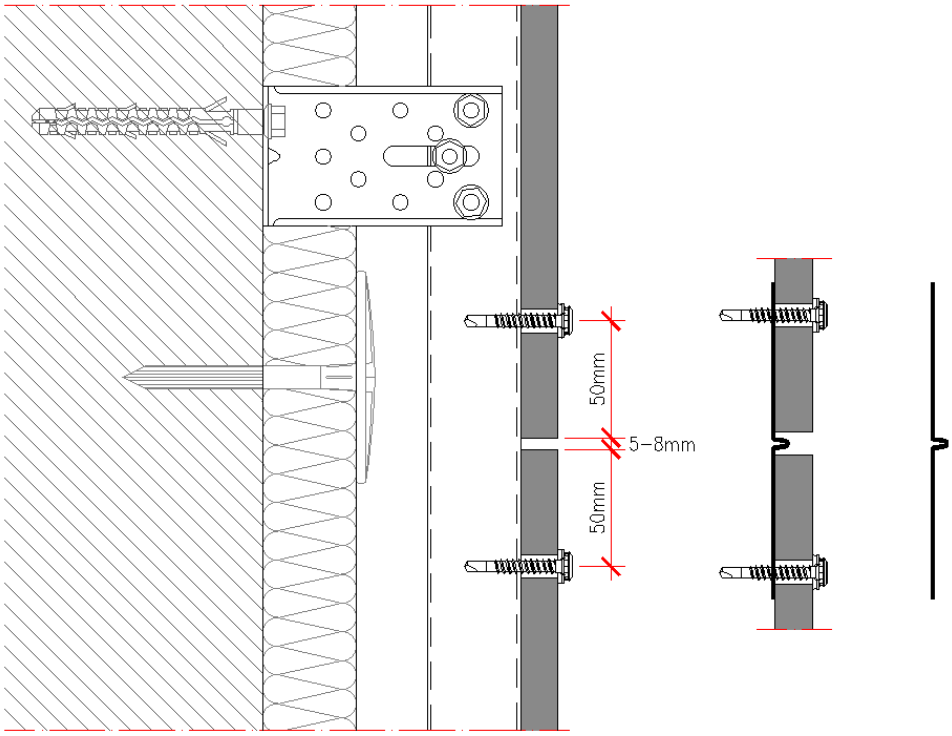


Figure 2.3.45 - Vertical section, joint between panels

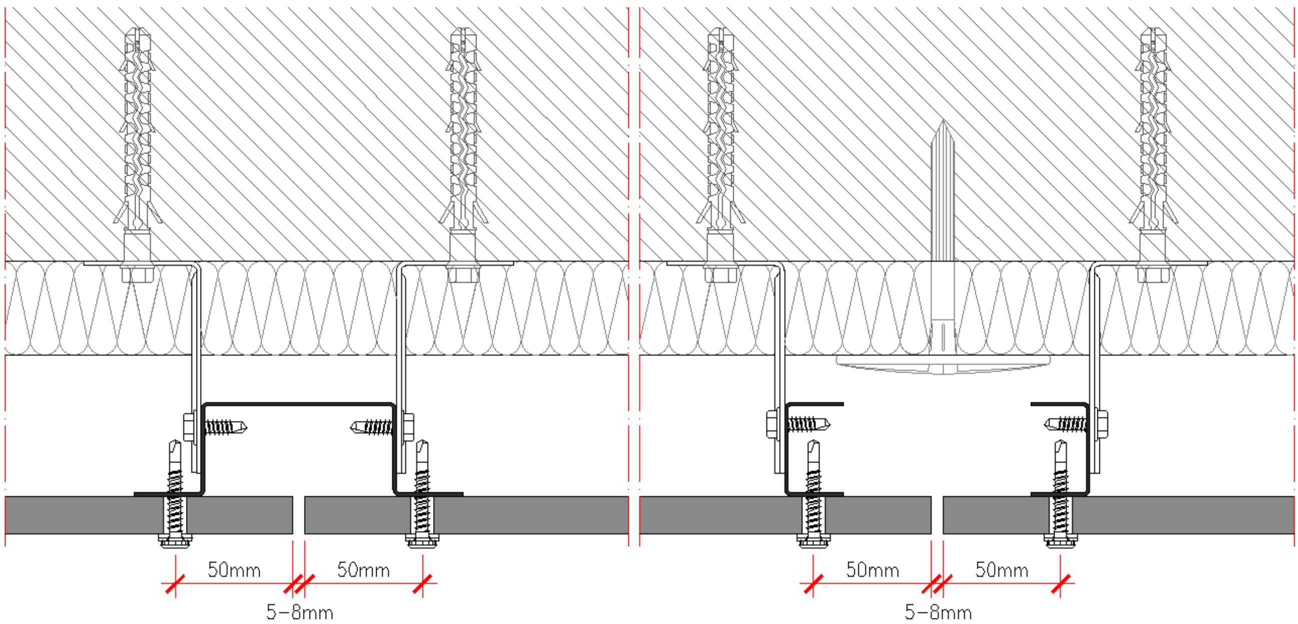


Figure 2.3.46 - Horizontal section, joint between panels

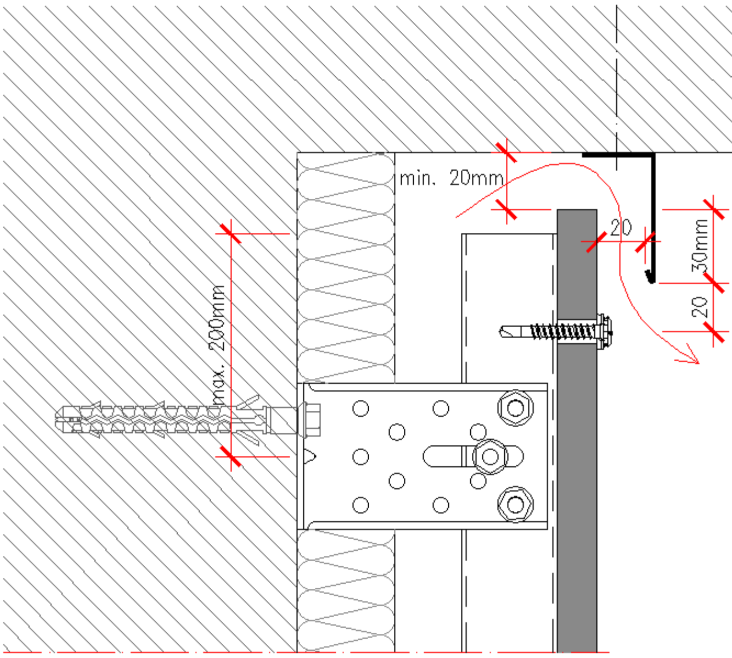


Figure 2.3.47 – Edge under balcony

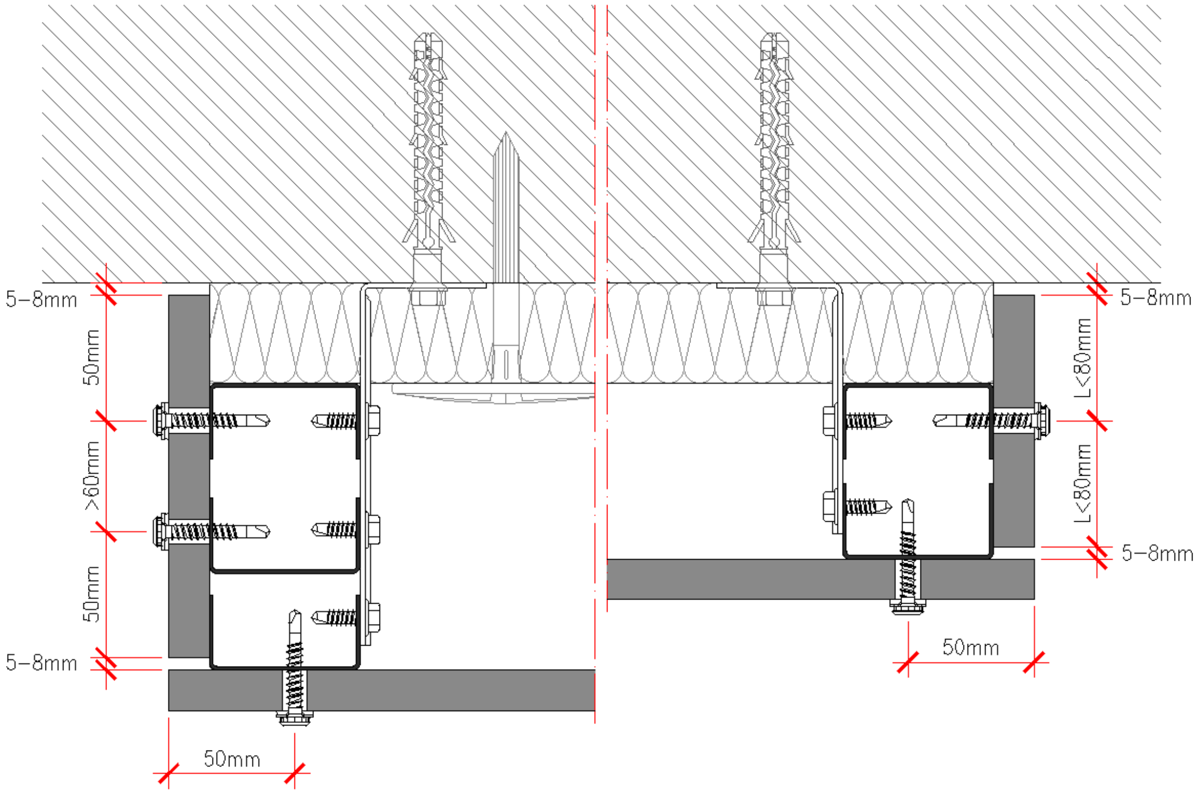


Figure 2.3.48 – Lateral edge

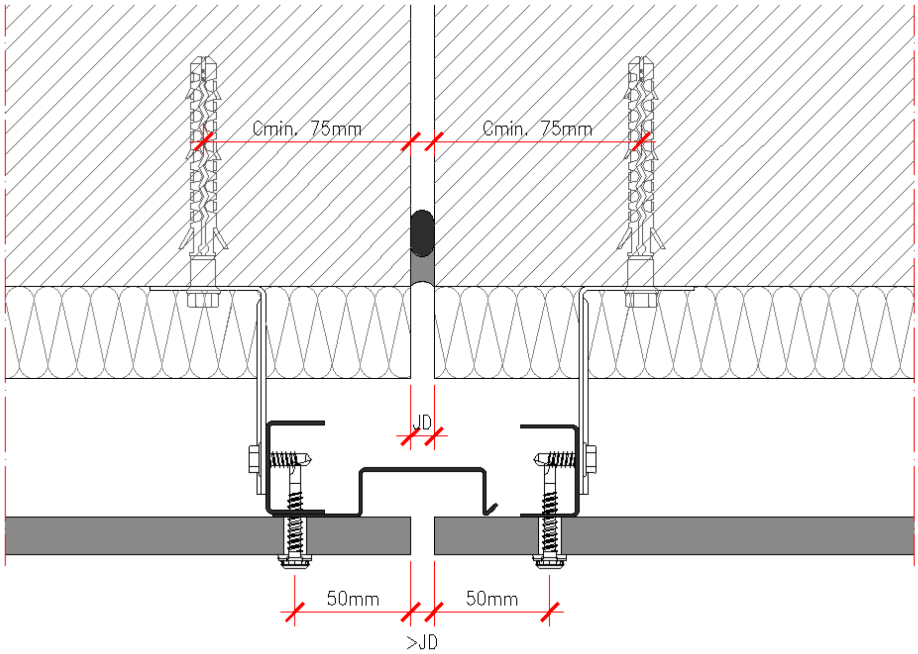


Figure 2.3.49 - Expansion Joint

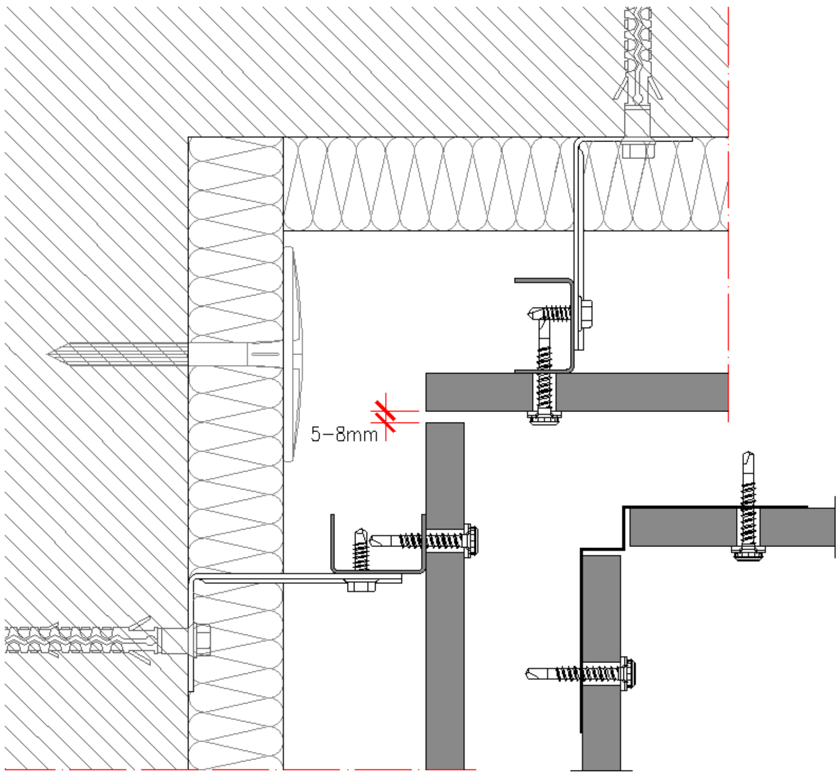
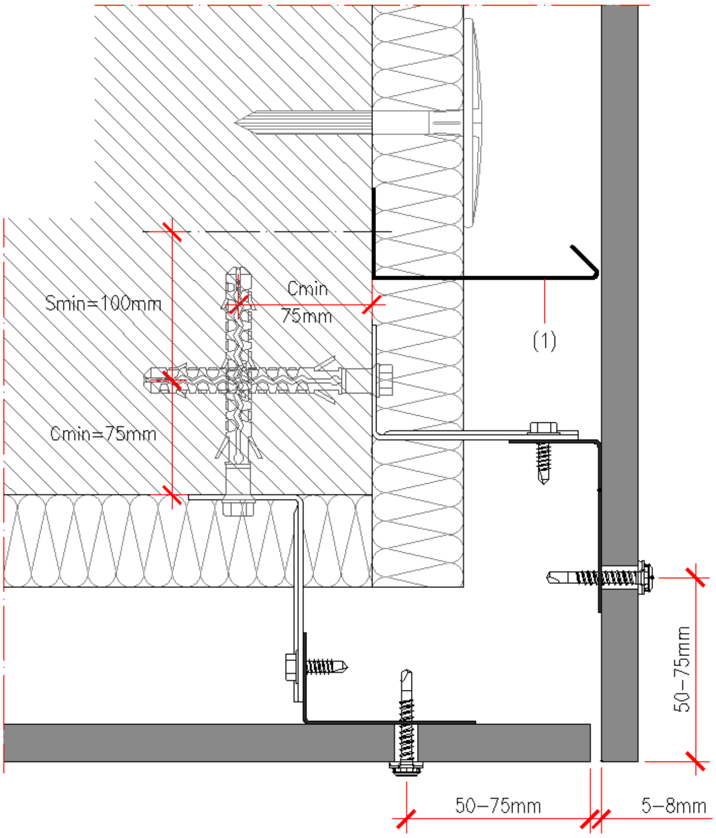
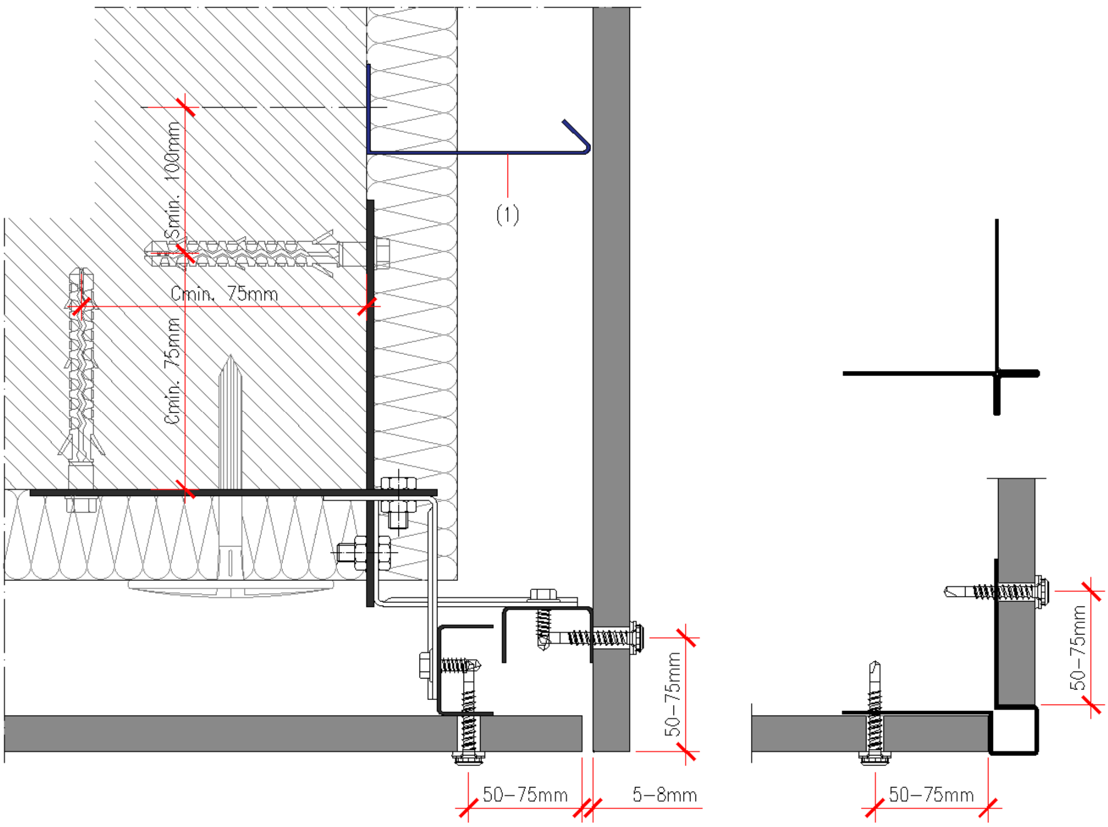


Figure 2.3.50 - Corner angle (90 º)



Air Gap Compartimentation (1)
Figure 2.3.51 - Corner Angle (270 º)



Air Gap Compartimentation (1)
Figure 2.3.52 - Corner Angle (270 º), Variant

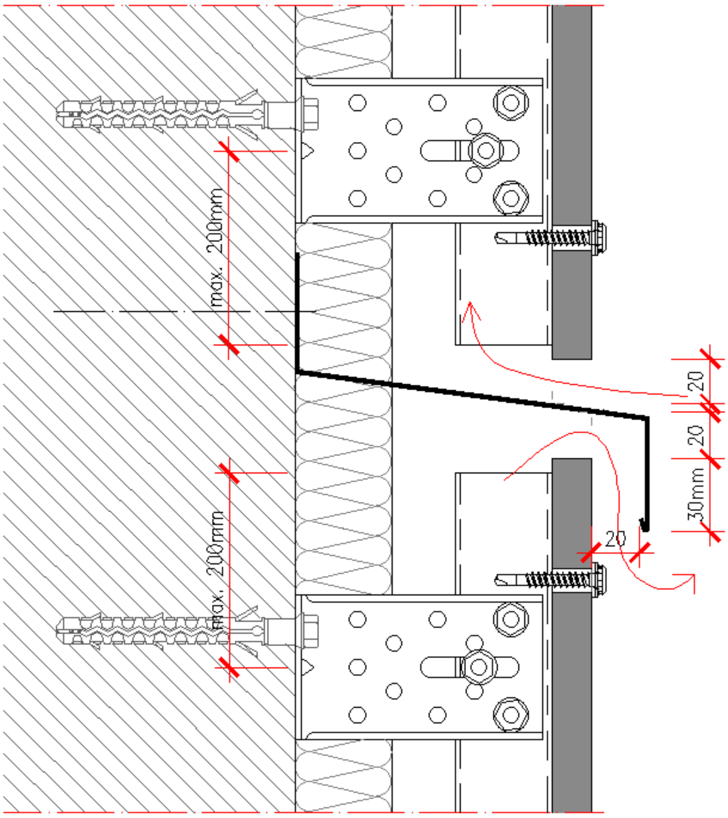


Figure 2.3.53 - Horizontal air gap compartmentation

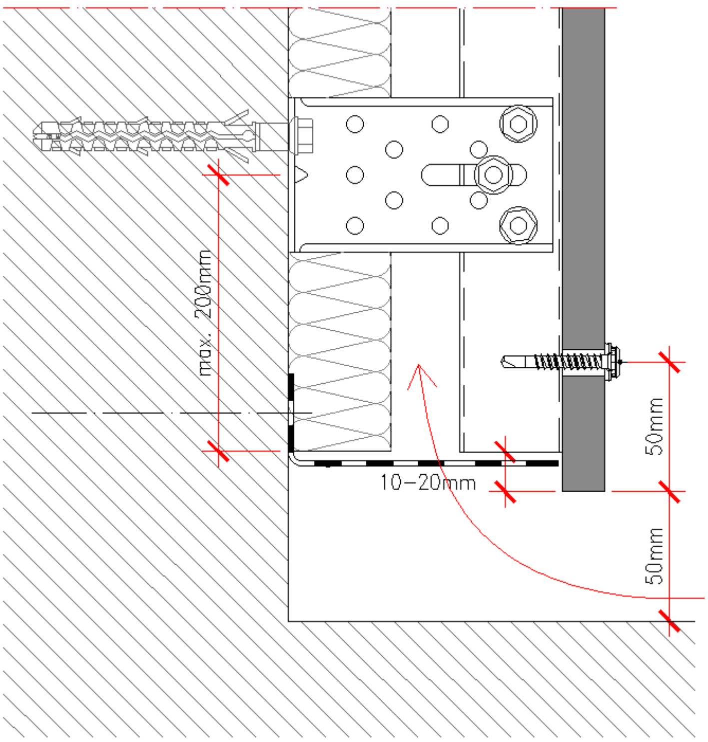


Figure 2.3.54 – Base detail, anti-rodent grille

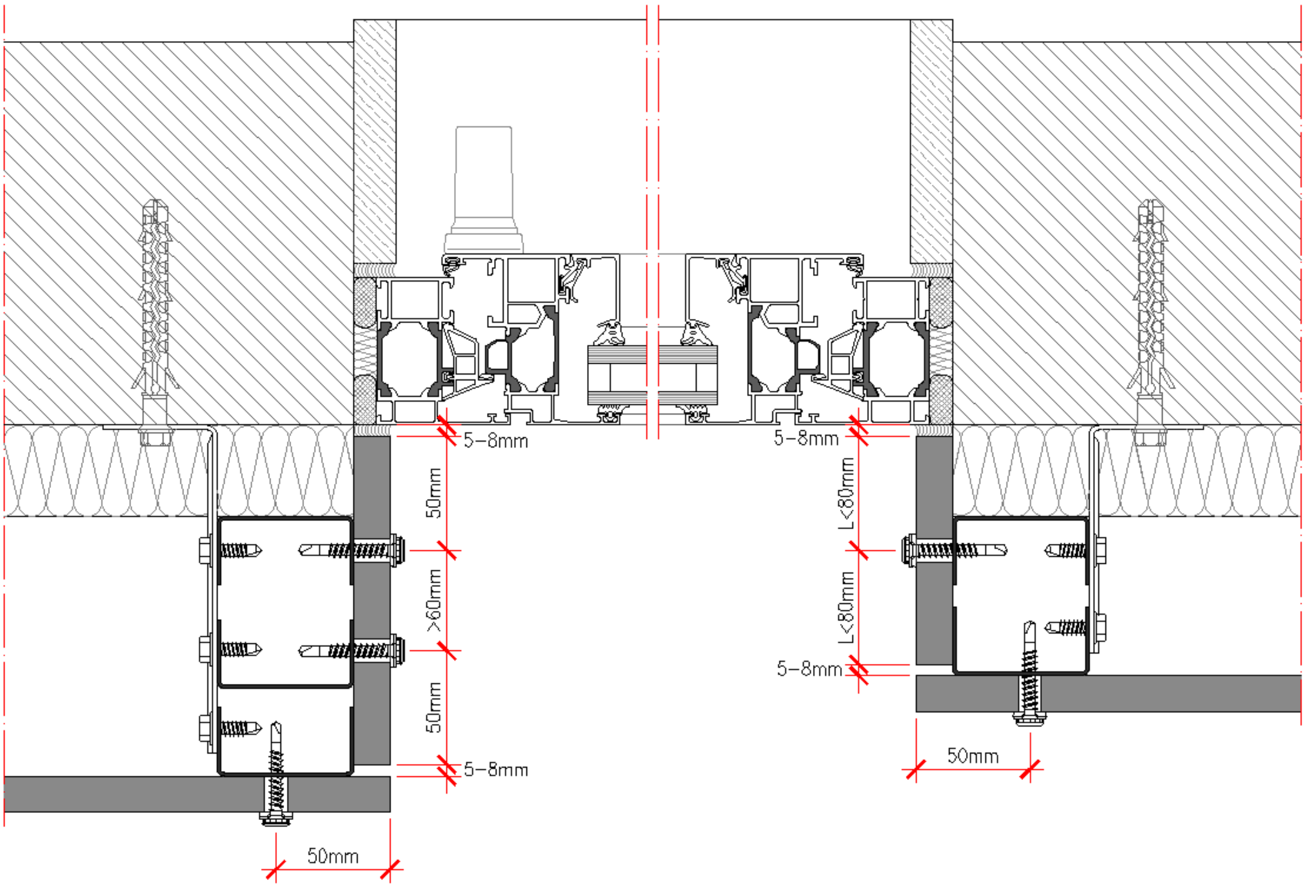


Figure 2.3.55 - Horizontal section, window opening

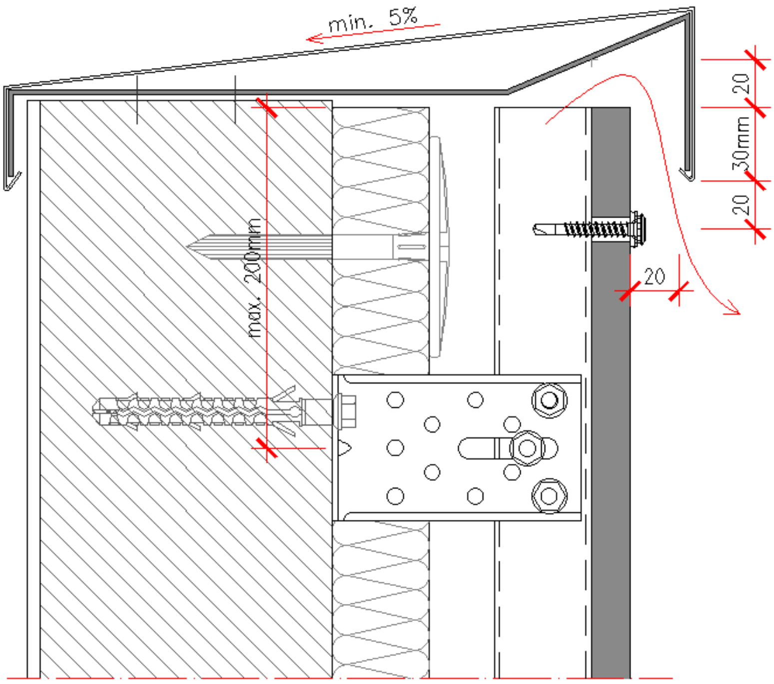


Figure 2.3.56 – Top detail

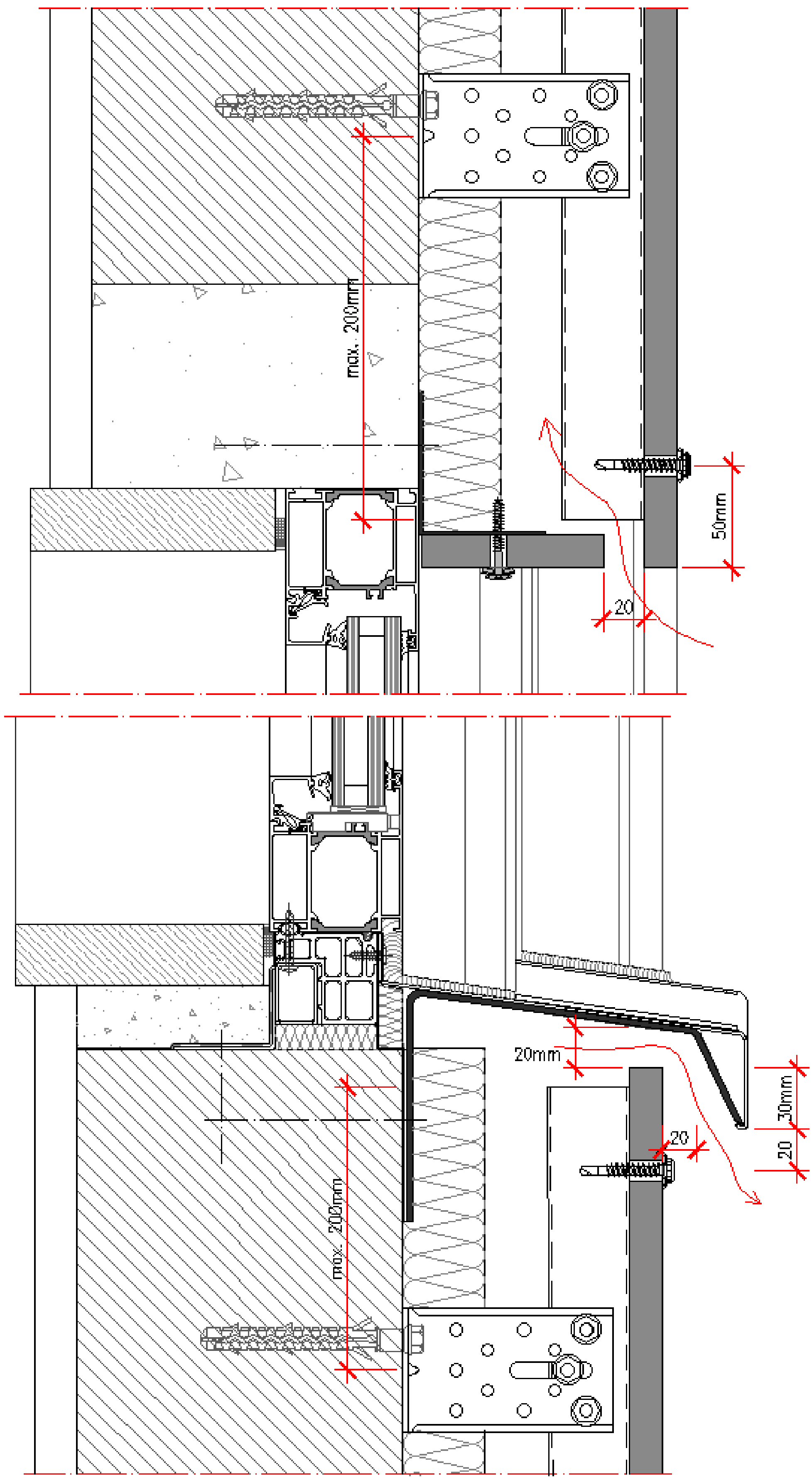


Figure 2.3.57 - Vertical section, window opening

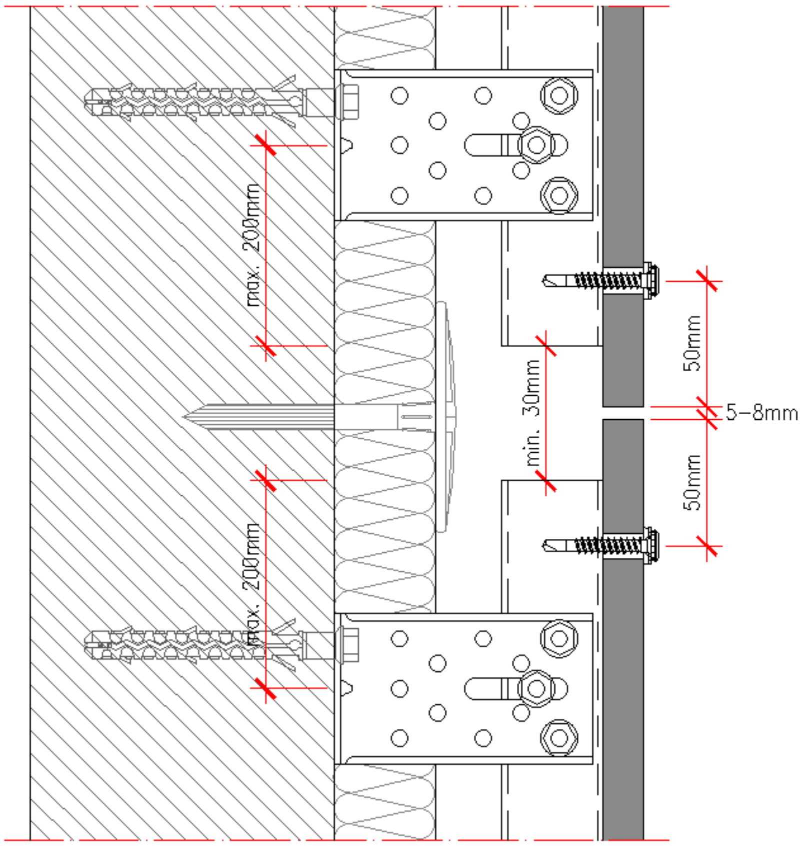


Figure 2.3.58 – Structure fractionation: Profiles with length ≤ 6 m

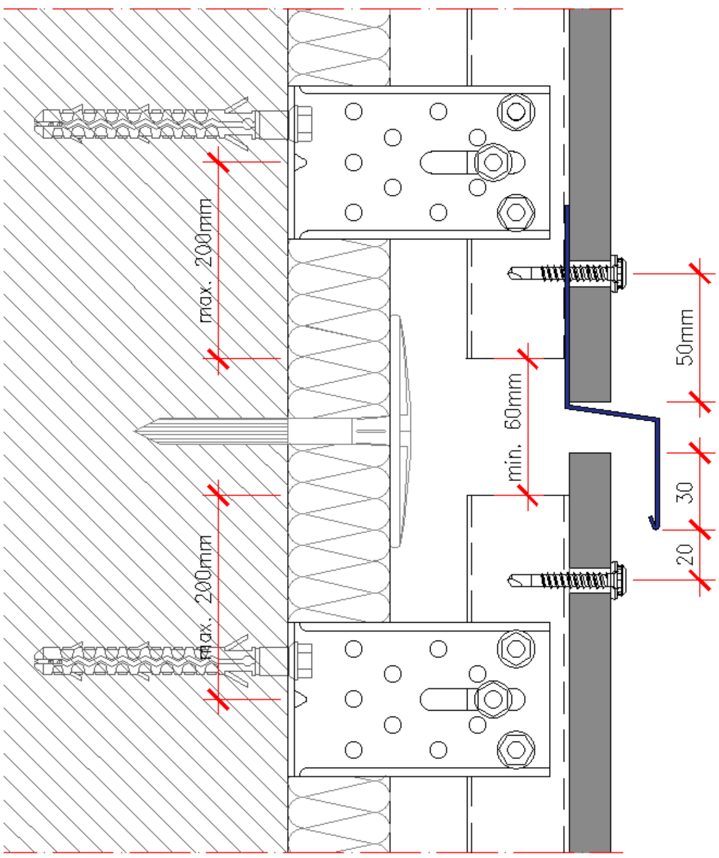
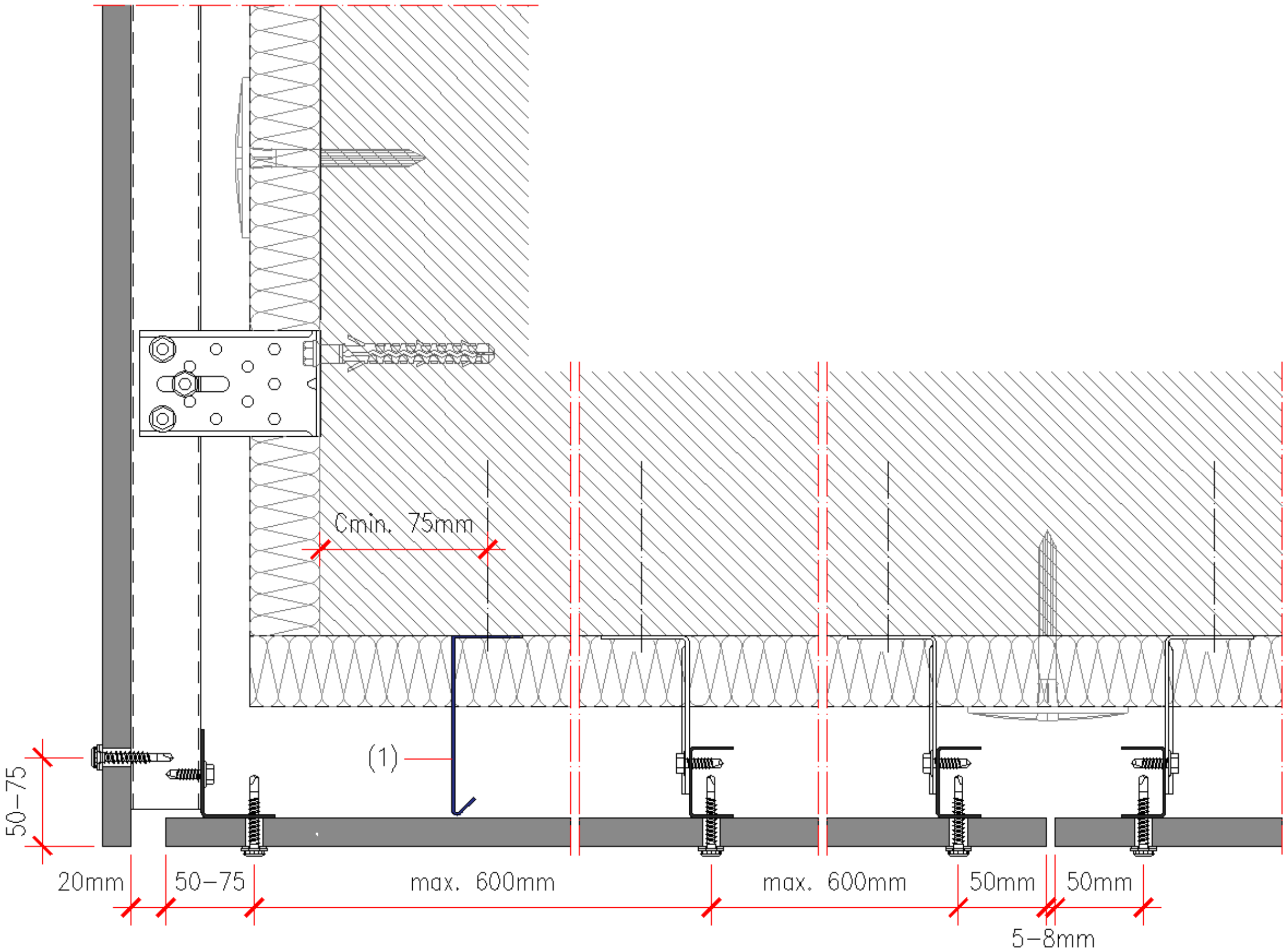


Figure 2.3.59 – Structure fractionation: Profiles with length > 6 m



Air gap compartimentation (1)

Figure 2.3.60 - Detail of the façade - false ceiling connection

WIND LOAD TABLES

Maximum pressure on the panels when subjected to wind action (suction),   N>3

Horizontal distance between screws 300 mm (12")									
Thickness of panel	(H x V)	Vertical distance between screws							
		300 mm	12"	400 mm	16"	500 mm	20"	600 mm	24"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	3,7	78	3,0	62	2,0	42	1,4	29
	2 x 3	3,4	71	2,6	53	2,0	43	1,7	36
	2 x N	3,4	71	2,6	53	2,0	43	1,7	36
	3 x 2	3,4	71	2,7	57	2,0	42	1,4	29
	N x 2	3,4	71	2,7	57	2,0	42	1,4	29
	3 x 3	3,1	64	2,3	48	1,8	39	1,5	32
	3 x N	3,1	64	2,3	48	1,8	39	1,5	32
	N x 3	3,1	64	2,3	48	1,8	39	1,5	32
16 mm 5/8"	2 x 2	7,8	163	6,2	130	4,7	99	3,3	69
	2 x 3	7,2	150	5,4	113	4,3	90	3,6	75
	2 x N	7,2	150	5,4	113	4,3	90	3,6	75
	3 x 2	7,2	150	5,8	120	4,7	99	3,3	69
	N x 2	7,2	150	5,8	120	4,7	99	3,3	69
	3 x 3	3,4	71	2,5	53	2,0	43	1,7	35
	3 x N	3,4	71	2,5	53	2,0	43	1,7	35
	N x 3	3,4	71	2,5	53	2,0	43	1,7	35

Table 1 – Maximum pressure, 300 mm spacing between screws horizontally

Horizontal distance between screws 400 mm (16")									
Thickness of panel	(H x V)	Vertical distance between screws							
		300 mm	12"	400 mm	16"	500 mm	20"	600 mm	24"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	3,0	62	2,4	50	2,0	42	1,4	29
	2 x 3	2,7	57	2,0	43	1,6	34	1,4	28
	2 x N	2,7	57	2,0	43	1,6	34	1,4	28
	3 x 2	2,6	53	2,0	43	1,7	36	1,4	29
	N x 2	2,6	53	2,0	43	1,7	36	1,4	29
	3 x 3	2,3	48	1,7	36	1,4	29	1,2	24
	3 x N	2,3	48	1,7	36	1,4	29	1,2	24
	N x 3	2,3	48	1,7	36	1,4	29	1,2	24
16 mm 5/8"	2 x 2	6,2	130	5,0	104	4,2	87	3,3	69
	2 x 3	5,8	120	4,3	90	3,5	72	2,9	60
	2 x N	5,8	120	4,3	90	3,5	72	2,9	60
	3 x 2	5,4	113	4,3	90	3,6	75	3,1	64
	N x 2	5,4	113	4,3	90	3,6	75	3,1	64
	3 x 3	2,5	53	1,9	40	1,5	32	1,3	27
	3 x N	2,5	53	1,9	40	1,5	32	1,3	27
	N x 3	2,5	53	1,9	40	1,5	32	1,3	27

Table 2 - Maximum pressure, 400 mm spacing between screws horizontally

Horizontal distance between screws 500 mm (20")									
Thickness of panel	(H x V)	Vertical distance between screws							
		300 mm	12"	400 mm	16"	500 mm	20"	600 mm	24"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	2,0	42	2,0	42	1,7	35	1,4	29
	2 x 3	2,0	42	1,7	36	1,4	28	1,1	24
	2 x N	2,0	42	1,7	36	1,4	28	1,1	24
	3 x 2	2,0	43	1,6	34	1,4	28	1,2	24
	N x 2	2,0	43	1,6	34	1,4	28	1,2	24
	3 x 3	1,8	39	1,4	29	1,1	23	0,9	19
	3 x N	1,8	39	1,4	29	1,1	23	0,9	19
	N x 3	1,8	39	1,4	29	1,1	23	0,9	19
16 mm 5/8"	2 x 2	4,7	99	4,2	87	3,5	72	3,0	62
	2 x 3	4,7	99	3,6	75	2,9	60	2,4	50
	2 x N	4,7	99	3,6	75	2,9	60	2,4	50
	3 x 2	4,3	90	3,5	72	2,9	60	2,5	52
	N x 2	4,3	90	3,5	72	2,9	60	2,5	52
	3 x 3	2,0	43	1,5	32	1,2	26	1,0	21
	3 x N	2,0	43	1,5	32	1,2	26	1,0	21
	N x 3	2,0	43	1,5	32	1,2	26	1,0	21

Table 3 - Maximum pressure, 500 mm spacing between screws horizontally

Horizontal distance between screws 600 mm (24")									
Thickness of panel	(H x V)	Vertical distance between screws							
		300 mm	12"	400 mm	16"	500 mm	20"	600 mm	24"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	1,4	29	1,4	29	1,4	29	1,2	25
	2 x 3	1,4	29	1,4	29	1,2	24	1,0	20
	2 x N	1,4	29	1,4	29	1,2	24	1,0	20
	3 x 2	1,7	36	1,4	28	1,1	24	1,0	20
	N x 2	1,7	36	1,4	28	1,1	24	1,0	20
	3 x 3	1,5	32	1,2	24	0,9	19	0,8	16
	3 x N	1,5	32	1,2	24	0,9	19	0,8	16
	N x 3	1,5	32	1,2	24	0,9	19	0,8	16
16 mm 5/8"	2 x 2	3,3	69	3,3	69	3,0	62	2,5	53
	2 x 3	3,3	69	3,1	64	2,5	52	2,1	43
	2 x N	3,3	69	3,1	64	2,5	52	2,1	43
	3 x 2	3,6	75	2,9	60	2,4	50	2,1	43
	N x 2	3,6	75	2,9	60	2,4	50	2,1	43
	3 x 3	1,7	35	1,3	27	1,0	21	0,8	18
	3 x N	1,7	35	1,3	27	1,0	21	0,8	18
	N x 3	1,7	35	1,3	27	1,0	21	0,8	18

Table 4 - Maximum pressure, 600 mm spacing between screws horizontally