



# Technical File

## Chapter 2 - Façades

### 2.2 - Hidden Mechanical Fastening

Cement-bonded particleboards

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Viroc Portugal S.A. reserves the right to modify this document without prior notice.

This Technical File invalidates all previous technical documents.

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## 2. VENTILATED FAÇADES

Viroc panels can be used to clad the façade of buildings, forming a panel-ventilated façade.

Viroc panels have a heterogeneous appearance with differences in tone on the same face, between faces of the same panel or between different productions.

Surfaces may show some irregularities and scaling.

With exposure to the sunlight, the colour of the panels changes slightly, becoming lighter. This variation in tone varies from colour to colour.

When applied to ventilated façades, Viroc panels must be varnished or painted, unless they are applied under the conditions described in Chapter 2.3.

The panels, when placed outdoors, are subject to dimensional variations of +1.0 mm to -3.0 mm per linear metre, when the panel is sealed on both sides and tops. The panel fixing system must allow for this dimensional variation.

### **Ventilated façades are made up of:**

- Viroc panels
- Support structure for the panels and their fixing elements;
- Anchors for fixing the panels to the support structure;
- Thermal insulation;
- Ventilation air layer;
- Complementary profiles for the treatment of singular points.

## 2.2 HIDDEN MECHANICAL FIXING SYSTEM

In this system, the Viroc panels that constitute the façade are fixed to a structure made up of aluminium profiles at the back, which in turn are fixed to a supporting wall.

A ventilated air gap is formed between the cladding panels and the supporting wall, which will give the building its thermal comfort characteristics.

The concealed fastening system consists of the following elements

- a) Aluminium support structure made up of vertically arranged profiles;
- b) Supporting squares and their fixing elements;
- c) Thermal insulation;
- d) Aluminium rail profile, arranged horizontally, to support the clamps;
- e) Supporting clamps;
- f) KARL type AA anchors;
- g) M6 screws;
- h) Viroc panels

Figure 2.2.1 representation of a 3D image of the system.

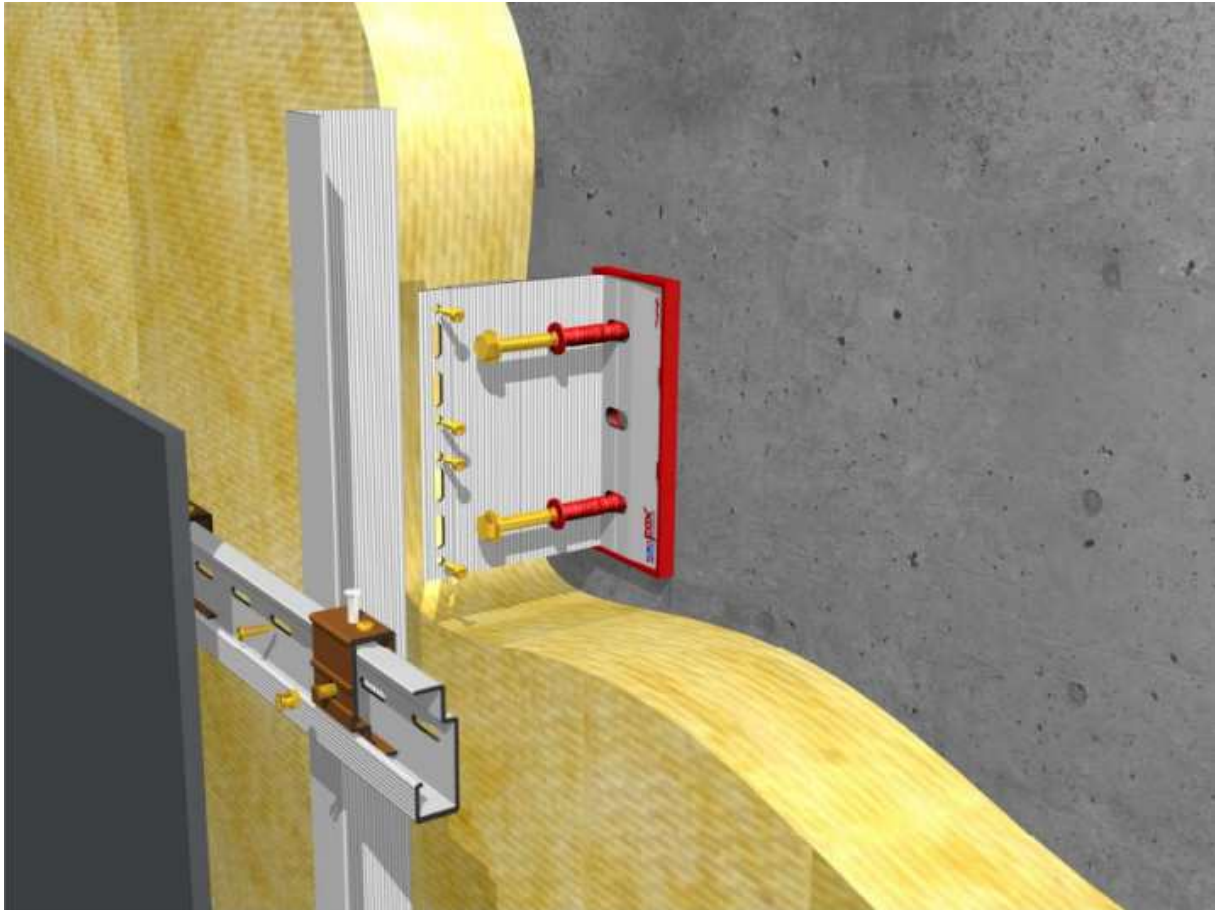


Figure 2.2.1 - 3D image of the Hilti/EuroFox MLZ system

### 2.2.01 Aluminium support frame

The primary structure may consist of aluminium profiles of at least 6000 series aluminium alloy with yield strength equal to or greater than 180 MPa.

The cross-section of the profiles is generally T or L-shaped with a minimum thickness of 2 mm. Other cross-section shapes can be used, provided they have the same performance and durability (see figure 2.2.2).

Because aluminium has a high coefficient of expansion, the design of the structure must allow for the expansion of the profiles. In this sense, the aluminium profiles should not be longer than 6 m and there should be only one fixing point for the supporting squares with restricted expansion movements, located near the top end of the profile. The other fixings must allow the profiles to expand.

The maximum horizontal deformation of the support structure, when subjected to wind loads, may not exceed 3 mm.

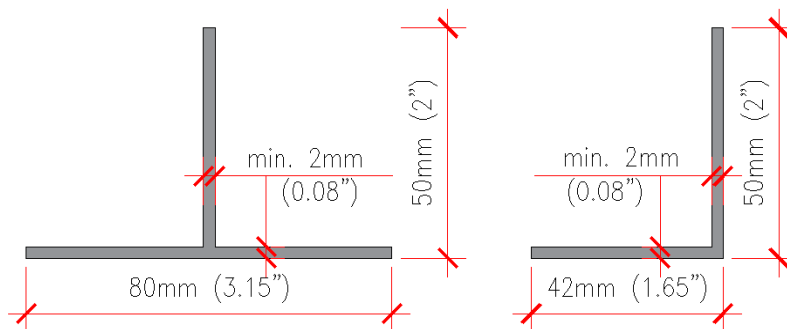


Figure 2.2.2 - Primary structure

6000 series aluminium alloy with  $R_{p0.2} \geq 180$  MPa



The manufacturers described below have aluminium structures that can be used:

ETANCO - FACALU C+ system;

<https://www.etanco.fr/>

HILTI/EUROFOX - Eurofox-MLZ/k-v-00 system;

<https://www.hilti.ie/content/hilti/E1/IE/en/business/business/engineering/eurofox.html>

<https://youtu.be/O29BOB609wo?si=9E4GdclOLJBfQKX->

ALLFACE - F1.40 system;

<https://www.allface.com/>

<https://www.allface.com/assets/downloads/systems/F1.40.pdf>

ALIVA - Ali GLASS S/Ali Stone System 3;

<https://www.aliva.it/>

GIP - GIP-VECO-2000 system,

<https://www.gip-fassade.com/de/>

<https://www.gip-fassade.com/en/systems/veco-2000>

BWM - ATK 103 system;

<https://www.bwm.de/>

<https://www.bwm.de/produkte/atk-103-ansicht/>

NFT-SL - Rapid 850 NFT-SL system;

<https://nft-sl.de/en/>

<https://nft-sl.de/en/back-fixing/850>

U-KON - ATS/LT-228 system;

<https://www.u-konsystems.ca/>

<https://www.u-konsystems.ca/228>

PLASTERSTRIP

<https://www.plasterstrip.com/product-category/fastframe/helping-hand-systems/mechanical-secret-fix/>

Profiles from other manufacturers may be used, provided they are suitable and of similar quality and strength.

### 2.2.02 Aluminium supporting squares

The location of these elements determines the final position of the support profiles, so they must be positioned precisely.

The supporting squares for fixing the aluminium structure must be made of an aluminium alloy equal to or greater than 6060 T5. Supporting squares are generally L-shaped, with several holes and a minimum thickness of 3 mm (see figure 2.2.3).

The supporting squares are dimensioned taking into account the façade own weight, based on a partial security coefficient of 1.5. The vertical deformation of the bracket may not exceed 3 mm for the maximum vertical load.

Because aluminium has a high coefficient of expansion, the design of the structure must allow for the expansion of the profiles. In this sense, the aluminium profiles should not be longer than 6 m and there should be only one point of attachment to the supporting squares with restricted expansion movements, near the top end of the profile. The other fixings must allow the profiles to expand (see figures 2.2.4 and 2.2.5).



Figure 2.2.3 - Aluminium supporting squares, length: 40 to 240 mm  
Alloy 6060 T5, esp. Minimum 3 mm

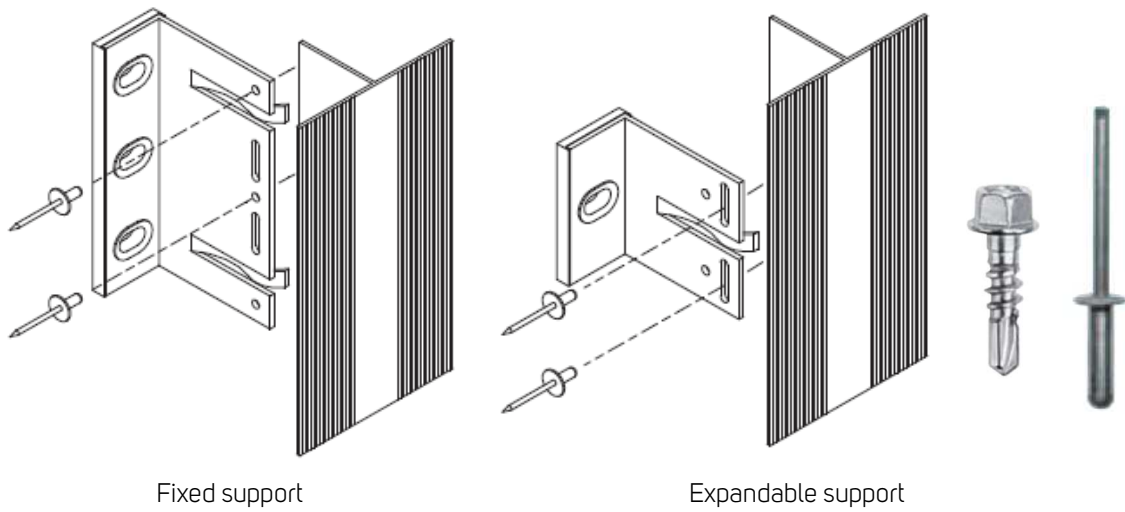
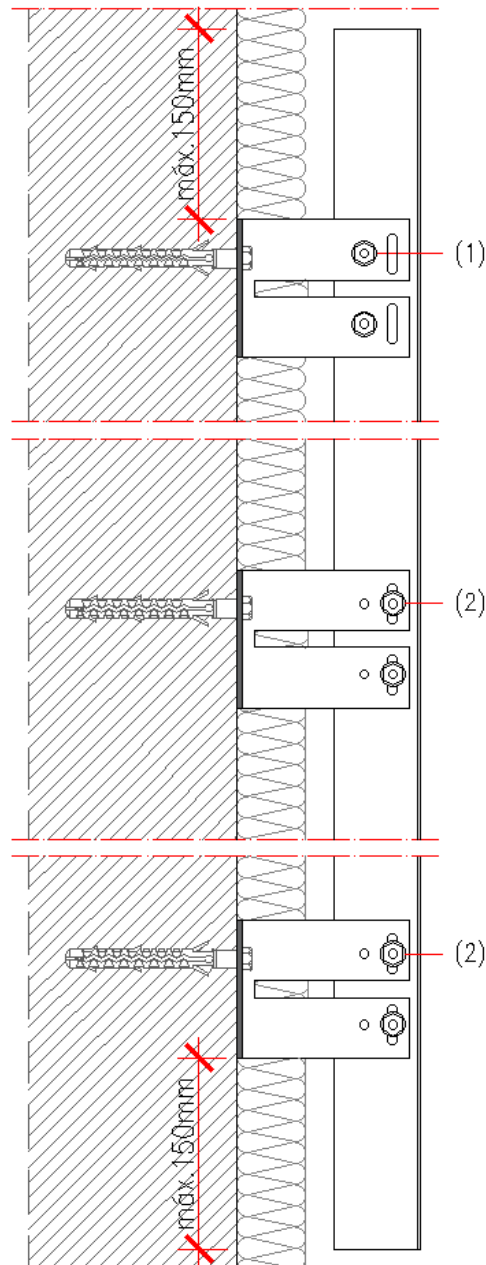


Figure 2.2.4 - Fixing the aluminium profiles to the supporting squares



- (1) Fixed Support;
- (2) Dilatable support.

Figure 2.2.5 - Fixing the aluminium profiles to the supporting squares

### 2.2.03 Thermal cutting of supporting squares

Due to the high coefficient of thermal transmission, the supporting squares can be insulated from the supporting wall with bases for thermal cutting (see figure 2.2.6).

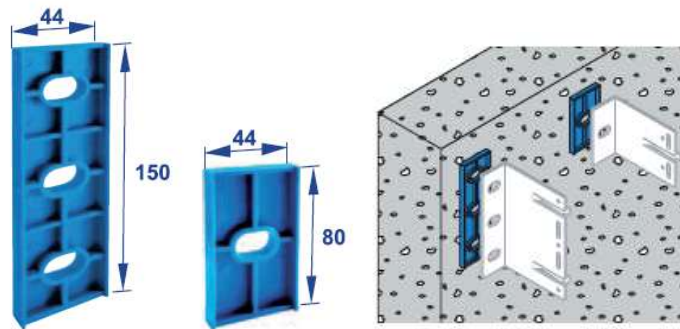


Figure 2.2.6 - Thermal cutting device for supporting squares

#### 2.2.04 Anchors for fixing the supporting squares

The supporting squares are fixed to the support wall using anchors, which can be plastic bushings with a diameter of 10 mm and stainless steel screws with a diameter of 7 mm (see figure 2.2.7).

With regard to the mechanical strength and stability of the anchors, they must be designed and built in such a way that the loads to which they will be subjected during their useful life do not involve one of the following consequences:

- Total or partial breakdown of the structure;
- Deformations that reach unacceptable proportions;
- Damage to other parts of structures, equipment or installations following excessive deformation of the supporting structure;
- Damage of great proportionality to the cause that originated it;

The anchorages must withstand shear loads, tensile loads and a combination of both during the expected service life of the structure, ensuring:

- Adequate resistance to failure (Ultimate Strength Limits);
- Adequate resistance to displacement (Serviceability Limit States).

Anchorage must have an ETA (European Technical Assessment) certification with CE marking or, alternatively, a DH (Document of Homologation) containing the characteristic strength values and the respective security coefficients.

For anchorages that do not have any type of ETA or DH certification, the resistance values must be proven through technical documents or by carrying out load tests.

Metal bushings are generally suitable for concrete supports. Plastic bushings with metal screws are suitable for concrete supports and masonry with solid or hollow elements.



Figure 2.2.7 - Plastic anchor Ø10 mm

Ø7mm stainless steel screw, minimum length 75 mm

Hilti frame assembly video

<https://youtu.be/029BOB609wo?si=5XR2M80bEveAjih0>

#### 2.2.05 Bushings for fixing thermal insulation

The thermal insulation is dimensioned in accordance with the thermal conditioning rules of the Regulation on the Thermal Behaviour Characteristics of Buildings (RCCTE).

It is fixed to the support using plastic bushings or similar material, normally with a wide head and the appropriate length for the thickness of the insulation (see figure 2.2.8).



Figure 2.2.8 - Bushing fixing the thermal insulation to the support structure

### 2.2.06 Rail profile arranged horizontally to support the clamps

The rail profiles are arranged horizontally and fixed to the primary structure using self-drilling A2 stainless steel screws with a diameter of 5.5, at the rate of two screws for each intersection. The alloy that constitutes these profiles is of class 6060 T6 or higher according to EN 755-2 (see figures 2.2.9 and 2.2.10).



Figure 2.2.9 - Rail profile for supporting the clamps



Figure 2.2.10 - Stainless steel screw 5.5x25, for fixing the rail profile

### 2.2.07 Clamps

The clamps are the elements fixed to the back of the panel that rest on the C-shaped rail profile arranged horizontally. There are 3 types of clamps: standard, fixed and adjustable. All panels use the 3 types of clamps.

See figures 2.2.11, 2.2.12 and 2.2.13.

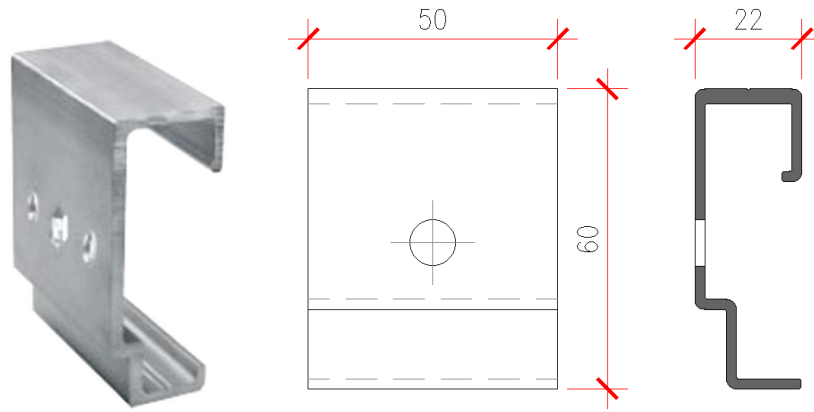


Figure 2.2.11 - Standard clamp

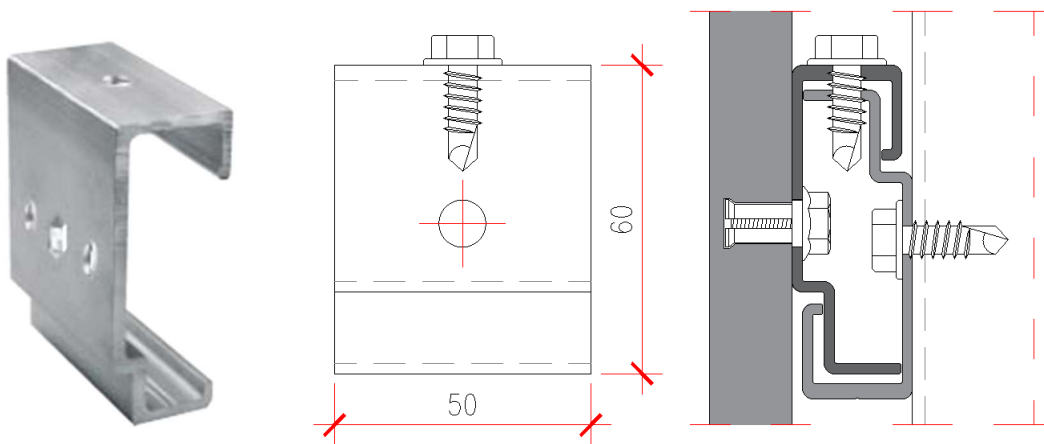


Figure 2.2.12 - Fixed clamp

The screw shown in figure 2.2.10 can be used to block movement.

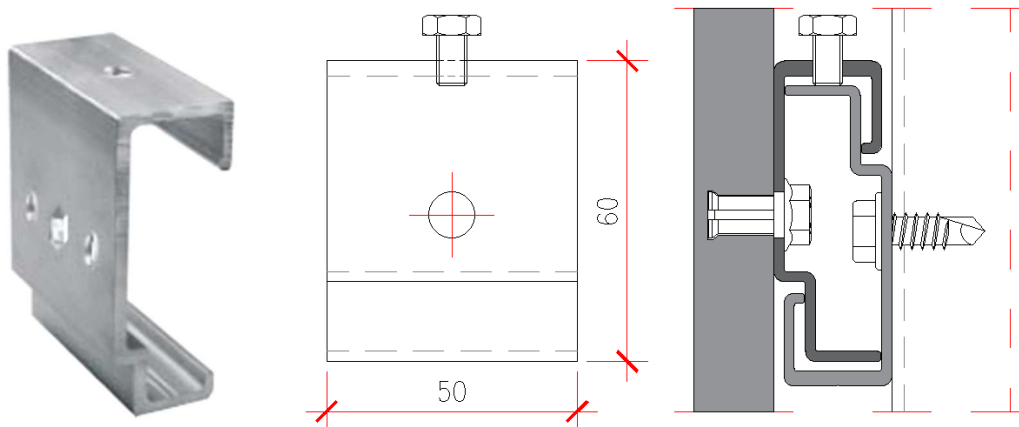


Figure 2.2.13 - Adjustable clamp, same as fixed clamp with metric screw for adjustment

### 2.2.08 KARL system anchoring

The KARL® Undercut Anchor KH AA is manufactured by KEIL and is suitable for Viroc panels.

The clamps are fixed to the back of the panels using these anchors (see figure 2.2.14).

Viroc panel thickness	Anchoring	Screw
12 mm	KARL type AA hs=8.5	M6x11.5 Ds=14
16 mm	KARL type AA hs=10	M6x13 Ds=14



Figure 2.2.14 - KARL type AA anchor

The value of the characteristic pull-out resistance (Pk) of KARL anchors is:

Viroc panel thickness	Anchoring	Characteristic value Pk
12 mm	KARL hs=8.5	1170 N
16 mm	KARL hs=10	1370 N

### 2.2.09 Recommended thicknesses of the Viroc façade panels and their tolerances

Thickness: 12 mm  $\pm$  1.0 mm; 16 mm  $\pm$  1.2 mm

See the Viroc panel technical data file for the range of thicknesses and colours available.

Note: Not all colours are produced as standard in the 16 mm thickness.

### 2.2.10 Panel weight

12 mm: 16.2  $\pm$  1.2 kg/m<sup>2</sup>;

16 mm: 21.6  $\pm$  1.6 kg/m<sup>2</sup>.

### 2.2.11 Maximum format for the façade panels

The maximum recommended size is 1500x1250 mm.

Larger dimensions may be used. Please note that larger panels are more difficult to install.

Any intermediate dimensions obtained by cutting the panels are possible.

Tolerances: cutting

Length and width:  $\pm$  3 mm

Squareness:  $\leq$  2 mm/m

Edge straightness:  $\leq$  1.5 mm/m

### 2.2.12 Minimum format for the façade panels

The minimum size of the panel to be applied to a ventilated façade is 300 mm.

Viroc Portugal does not recommend that the ratio between the length and width of the panel exceeds 3 ( $L/B \leq 3$ ).

A panel that is too long and narrow tends to break easily.

### 2.2.13 Façade assembly operations

A façade is installed as follows:

- a. Marking and identification of the façade elements;
- b. Mounting the supporting squares;
- c. Installation of thermal insulation;
- d. Assembly of the support profiles/mounts arranged vertically;
- e. Mounting the rail profile horizontally;
- f. Varnishing of Viroc panels on both sides and tops;
- g. KARL system anchors;
- h. Fixing the clamps to the back of the panel;
- i. The panels are fixed by snapping onto the rail profiles;
- j. Treatment of singular points.

### 2.2.14 Marking and identification of façade elements

There is no preferred assembly orientation. The system allows the assembly of all sizes and formats of intermediate dimensions. Viroc panels can be placed horizontally or vertically.

The aim is to follow the stereotomy defined by the architectural project.

### 2.2.15 Mounting the supporting squares

The location of these elements determines the final position of the support profiles, so they must be positioned precisely.

### 2.2.16 Fixing the supporting squares to the supporting wall

The supporting squares are fixed to the support wall using anchors made up of plastic bushing with a diameter of 10 mm and metal screws with a diameter of 7 mm.

### 2.2.17 Fitting the thermal insulation

The thermal insulation is dimensioned in accordance with the thermal conditioning rules of the Regulation on the Thermal Behaviour Characteristics of Buildings (RCCTE).

It is fixed to the support using plastic bushing plugs or similar material, normally with a wide head and the appropriate length for the thickness of the insulation.

### 2.2.18 Mounting the support profiles

The support profiles are arranged vertically in accordance with the specifications and technical drawings presented in this document, duly adapted to the stereotomy of the architectural project.

The maximum distance between profiles/mounts is 1.2 m. The alignment of the uprights must be checked between adjacent elements and must not differ by more than 2 mm.

### 2.2.19 Fixing the profiles to the supporting squares

Due to the high expansion coefficient of aluminium profiles, the structure must be designed in such a way as to allow the upright profiles to expand.



The fixed connections are made with 2 screws/rivets placed in the circular bolt holes, blocking movement, and located at the top of the profiles.

The expandable connections are made using 2 screws/rivets placed in the vertically oval shaped bolt holes. The connection can be made with  $\varnothing \geq 5.5$  mm stainless steel self-drilling screws or  $\varnothing \geq 4.8$  mm rivets (see figure 2.2.15).



Figure 2.2.15 - Primary structure fixed with supporting squares to the support

### 2.2.20 Fixing the rail profiles horizontally

The rail profiles are C-shaped, arranged horizontally and fixed to the vertical profiles using two 5.5x25 self-drilling screws at each intersection. They are arranged with a maximum distance between them of 600 mm and in such a way that the clamps anchored to the back of the Viroc panels support them correctly. Its location must not have an error of more than 2 mm (see figure 2.2.16).



Figure 2.2.16 - View of the rail profile arranged horizontally

### 2.2.21 Cutting Viroc panels

Cuts to be made in Viroc panels should be made using a portable circular saw with suitable cutting blades. The cutting edges of the disk must be made of hard metal, usually tungsten carbide inserts (see figure 2.2.17).

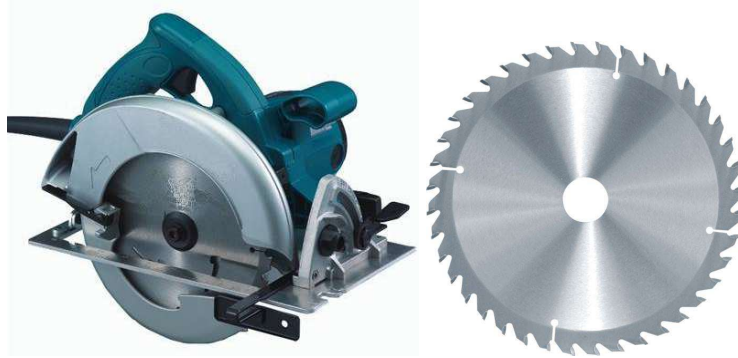


Figure 2.2.17 - Circular saw with tungsten cutting disc

### 2.2.22 Drilling Viroc panels

To drive the anchors into the back of the panel, the KARL system has drills with stops to drill the panel to the correct depth (see figure 2.2.18). The drill must be in drill mode, without impact.



Figure 2.2.18 - KARL system stopper hole

### 2.2.23 Surface preparation of Viroc panels

Viroc panels are supplied raw and unfinished. The surfaces show some irregularities and imperfections, such as small incrustations, stains, scratches, small wood chips and salts from chemical reactions.

Before a finishing varnish is applied, the surfaces must be completely clean and dry, with no grease, dust or surface salts. The surfaces that will be visible should be cleaned/polished with an abrasive cleaning disk or alternatively the surface can be sanded with fine 120 grit sandpaper or higher.

Cleaning/polishing does not alter the natural appearance of the panel; it maintains the stains and heterogeneities that characterise it, as well as some salts and incrustations that are embedded in the surface.

The link below shows a video screening how Viroc panels are polished.

<https://www.youtube.com/watch?v=HeQZNVNOZYI>

### 2.2.24 Varnishing or painting Viroc panels

When used on ventilated façade, Viroc panels must be varnished. Exceptionally, they can be applied without varnish or paint if they are installed under the conditions described in Chapter 2.3.

The purpose of applying varnish to the Viroc panel is to protect it from the aggressions of the environment in which it is located, such as exposure to sunlight and bad weather, increasing its durability, making it easier to clean and maintaining its appearance over time. The application of a varnish changes the tone of the natural colour of the Viroc panel, giving it a "wet" appearance with some shine. After drying, the wet look is softened.

There are no specific paints or varnishes to be applied to Viroc panels. The panel has a surface alkalinity (PH) of 11 to 13, so paints and varnishes suitable for concrete and wood surfaces at the same time are usually the best when applied to a Viroc panel. Paints and varnishes made from acrylic resins or aliphatic polyurethane resins are suitable as they do not yellow on

exposure to UV rays. Solvent-based varnishes are the ones that have shown the best performance, but water-based varnishes are the ones that least alter the original colour of the panel.

Generally speaking, varnishes are easy to apply, but it is very important to bear in mind that the application must be continuous and constant, to ensure that the finish is homogeneous on the panel and that the surface does not become stained and have different shades. The panels must always be painted/varnished on both sides and tops, and the application procedures, supplied by the respective manufacturers, must always be followed for the recommended coats.

The application of paints and varnishes, when carried out on site, should be in a dry, clean place away from the sunlight.

### 2.2.25 Fixing the clamps to the Viroc panels

The clamps are fixed to the back of the panel by tightening the screws attached to the KARL anchors manufactured by KEIL, which are driven into the panel.

The KARL System has the right tools for setting the anchors (see figure 2.2.19).

Link to visualisation of the anchors in the panel.

<https://youtu.be/DSHI3Obn0fY>

<https://youtu.be/Znhp-D9RsZc>



Figure 2.2.19 - Tool for driving the anchors into the Viroc panel

### 2.2.26 Panel installation

After the clamps have been attached to the back of the panels, they are fitted into the C-shaped rail profile.

Assembly is carried out from the bottom up, so that the clamps on the top of the panels can be accessed.

Two of the end clamps must be adjustable clamps, so that the levelling of the structure can be corrected. A self-tapping screw will be placed in one of the clamps to block movement (fixed clamp).

Figures 2.2.20 and 2.2.21 show the location of the clamps and their type.

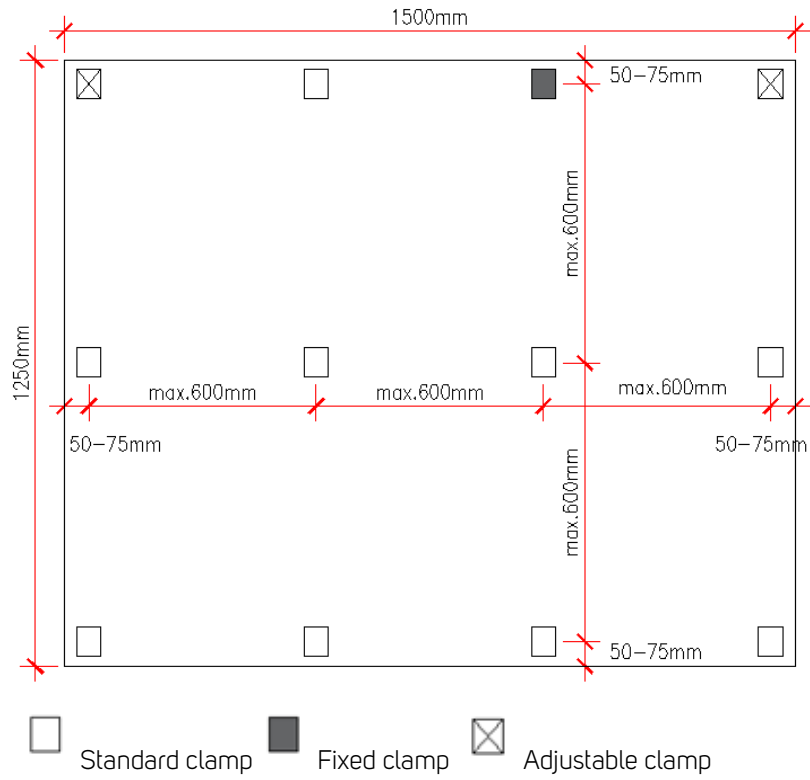


Figure 2.2.20 - Location of clamps, panel arranged horizontally

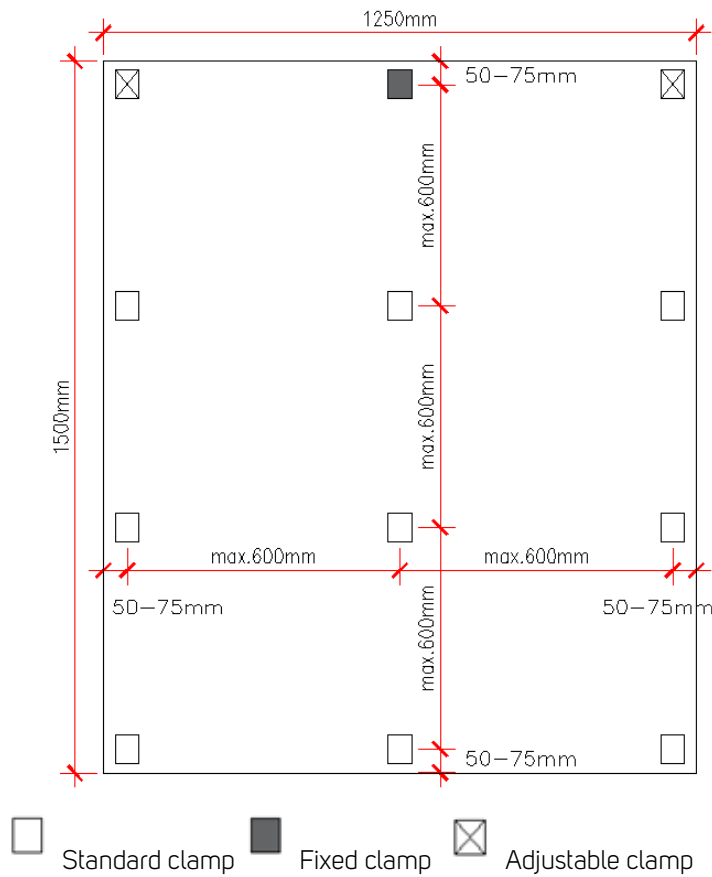


Figure 2.2.21 - Location of clamps, panel arranged vertically

### 2.2.27 Joints between panels

Viroc panels are installed so that the joints between the panels, both vertical and horizontal, have a gap of between 5 and 8 mm.

### 2.2.28 Air foil ventilation

The ventilated façade, as recommended in this Technical File, forms a continuous sheet of air between the back of the panel and the thermal insulation.

The minimum opening for ventilation of the air foil is 20 mm thick. This distance must be respected even in areas where there may be obstructions.

At the base of the façade, the opening must be protected by a grille or perforated plate to prevent birds or rodents from entering (see figure 2.2.22).



Figure 2.2.22 - Perforated anti-rodent profile

At the top of the façade, the opening is protected by a ruffle to prevent water from entering directly into the air gap.

The air gap must be partitioned, both vertically and horizontally, without impeding the free circulation of air.

The purpose of this compartmentalisation is to prevent fire from spreading between different floors or elevations in the event of a fire.

The air gap can be partitioned using galvanised steel or aluminium sheeting. See general details.

Detailed drawings of these areas are presented in chapter 2.2.35.

### 2.2.29 Angle profiles

Some manufacturers of accessory elements for façade have auxiliary profiles for finishing the corners of the façade. The use of these profiles is optional (see figures 2.2.23 and 2.2.24).



Figure 2.2.23 - Corner angle profiles



Figure 2.2.24 - Corner angle profiles

### 2.2.30 Cleaning the panels after application

The panels can be cleaned using a jet of water with neutral detergent.

### 2.2.31 Replacing a panel

To replace a façade panel, the existing panel must first be removed.

Since the panels are rigidly fixed to one of the clamps on the top of the panels, it is necessary to access the upper area of the panel to be replaced in order to loosen the screw that locks the panel in place.

### 2.2.32 Impact resistance

Hard Body Impact Energy EN 1128

12 mm, E = 12.9 Joules, Burst Energy

16 mm, E = 12.8 Joules, Burst Energy

## Impact test according to ETAG 034

12 mm thick panel

Type of Impact	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	Fail

### 2.2.33 Wind action

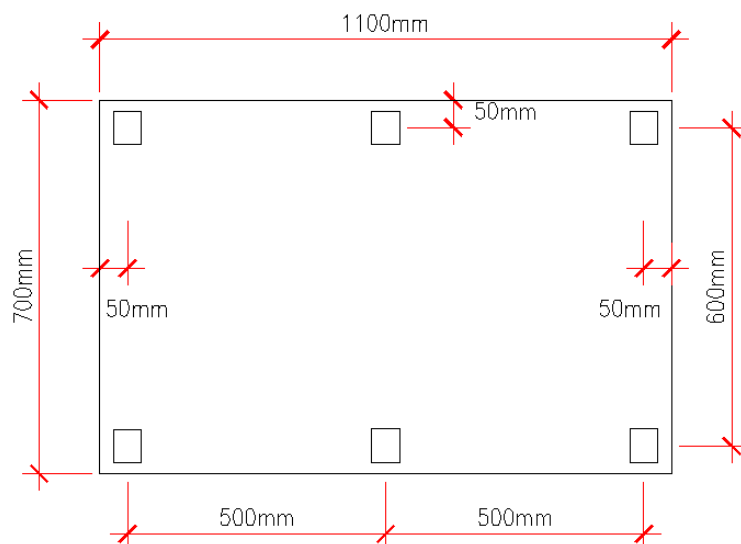
Exposure to wind action perpendicular to the plane of the panel corresponds to a pressure or depression (in  $\text{kN/m}^2$ ), which resistance design values are shown in Tables 1 to 5.

The wind resistance load tables were drawn up on the basis of pull-out tests on KARL anchors, resulting from experimental tests and obtained with a security coefficient of 3.5.

Wind loads are quantified in accordance with the National Annex of Eurocode 1 (RSA).

### 2.2.34 Example of Safety check of a Viroc panel to wind loads

For a 12 mm thick Viroc panel with the configuration shown below, what is the maximum permissible wind load?



Configuration: 3x2, horizontal distance 500 mm and vertical distance 600 mm.

Using Table 3

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"	700 mm	28"
		kN/m2	psf	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	2,0	42	1,4	29	1,0	21
	2 x N	2,0	42	2,0	42	1,8	37	1,5	31	1,3	27
	N x 2	2,7	56	2,1	45	1,8	37	1,4	29	1,0	21
	N x N	1,4	30	1,1	22	0,9	18	0,7	15	0,6	13
16 mm 5/8"	2 x 2	3,2	66	3,2	66	3,2	66	2,2	46	1,6	34
	2 x N	3,2	66	2,6	55	2,1	44	1,7	36	1,5	31
	N x 2	3,1	65	2,5	52	2,1	44	1,8	37	1,6	33
	N x N	1,7	35	1,3	26	1,0	21	0,8	17	0,7	15

Table 3 - Permissible pressure, 500 mm spacing between horizontal fixings

The design value for the resistance of the Viroc panel to wind pressure ( $w_{rd}$ ) is 1.4 KN/m<sup>2</sup> (29 psf).

Note: The action of the wind exerts a pressure or depression on the panel. This is a constraint when it acts as a depression, since the panel is fixed only by the anchor and breakage occurs by cutting/punching the panel in these areas.



### 2.2.35 Details

Figures 2.2.25 to 2.2.38 show examples of various details and unique areas of the façade.

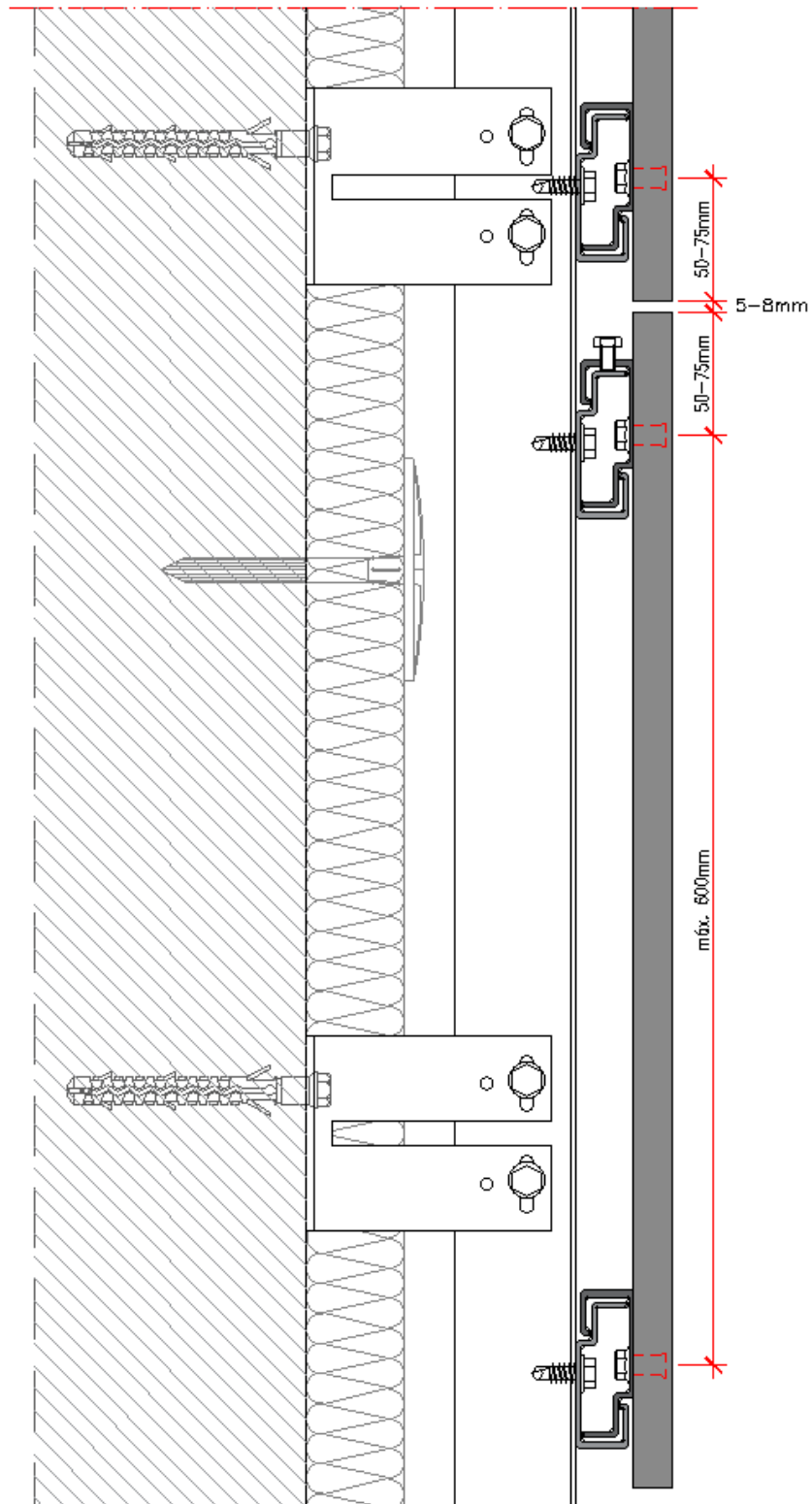


Figure 2.2.25 - Vertical section

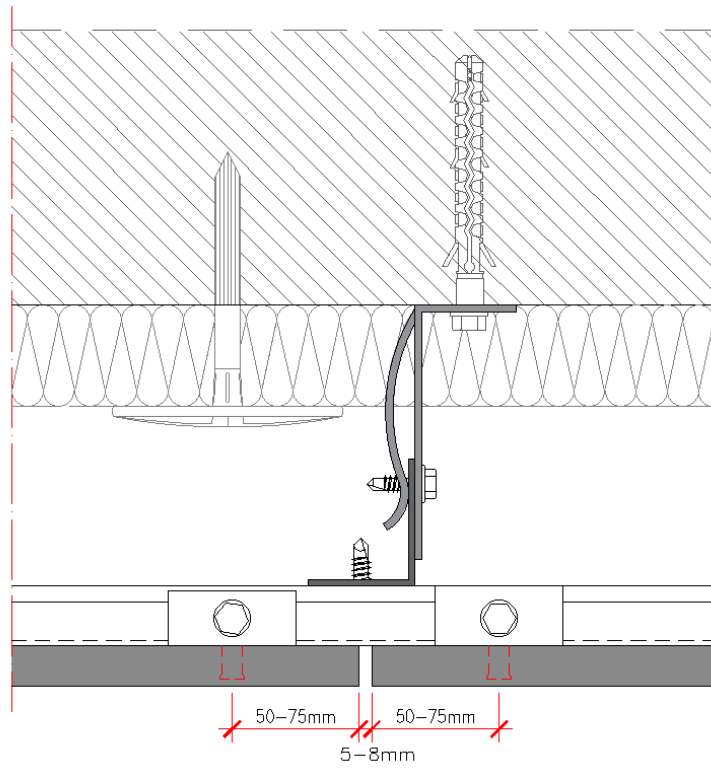


Figure 2.2.26 - Horizontal section

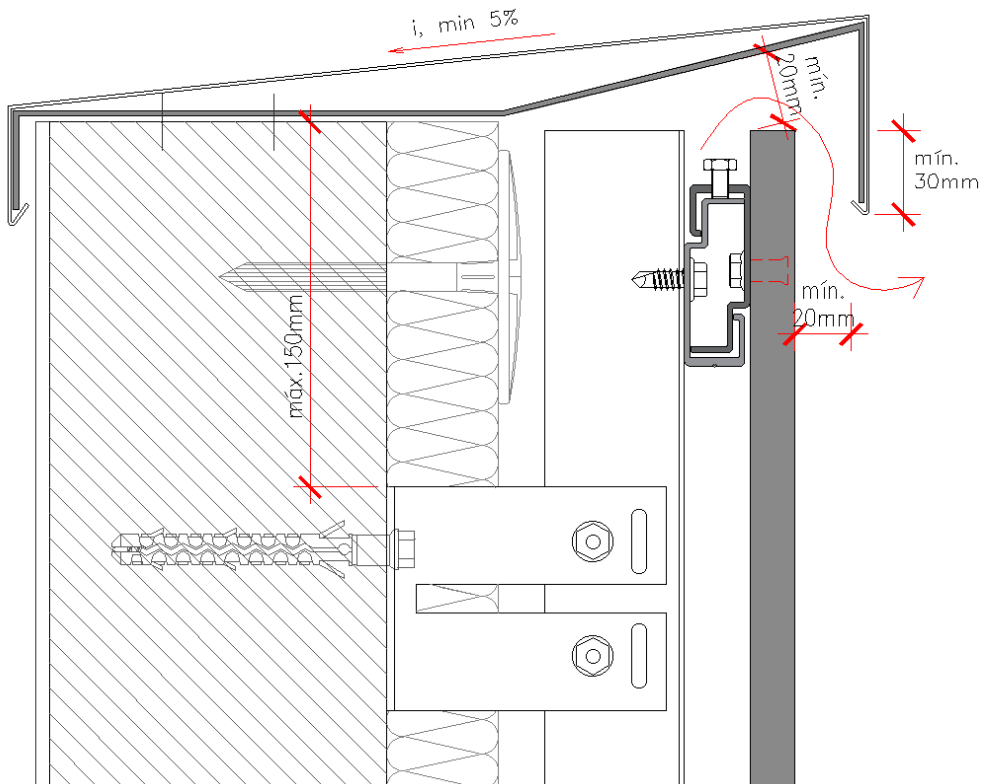


Figure 2.2.27 - Detail of the top trim

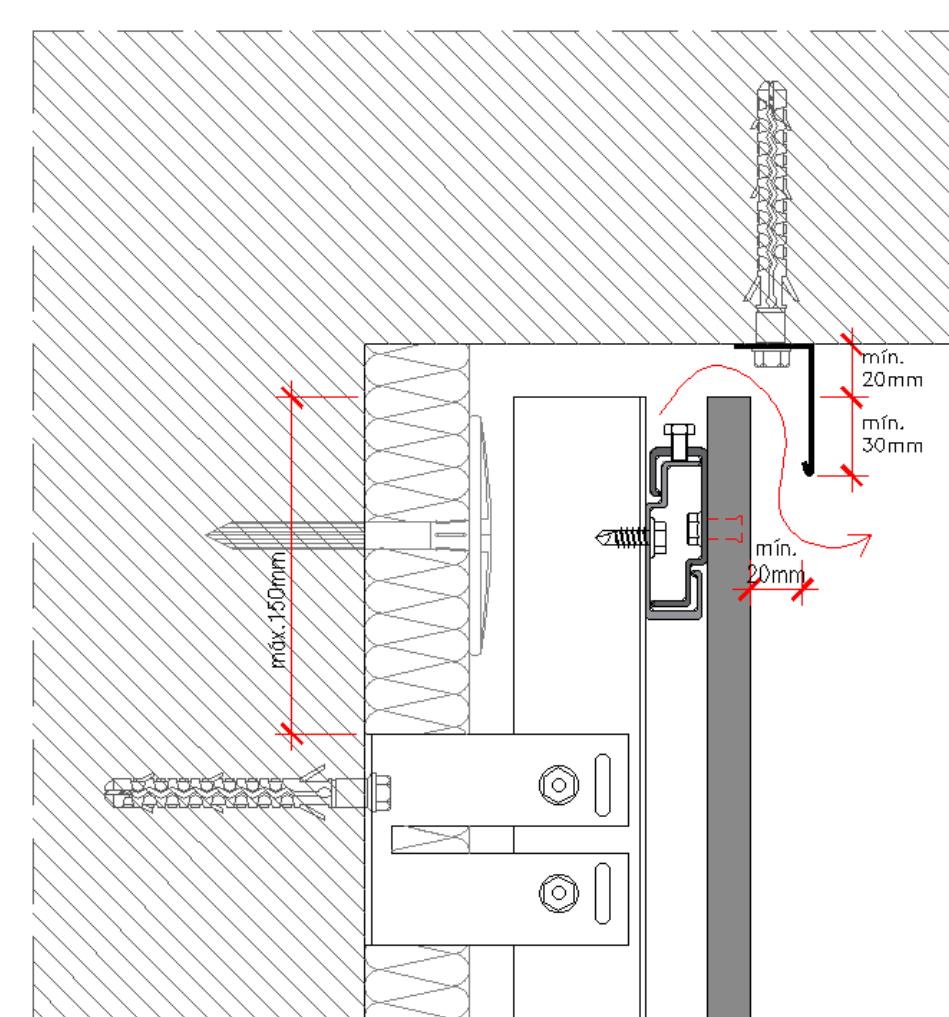
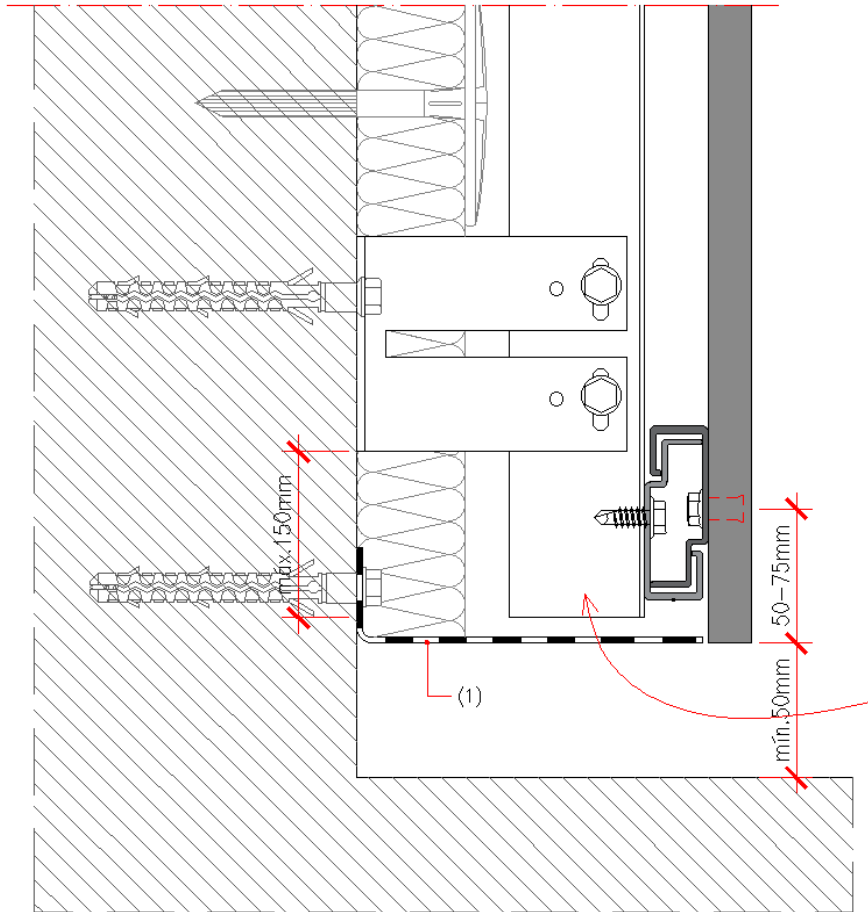
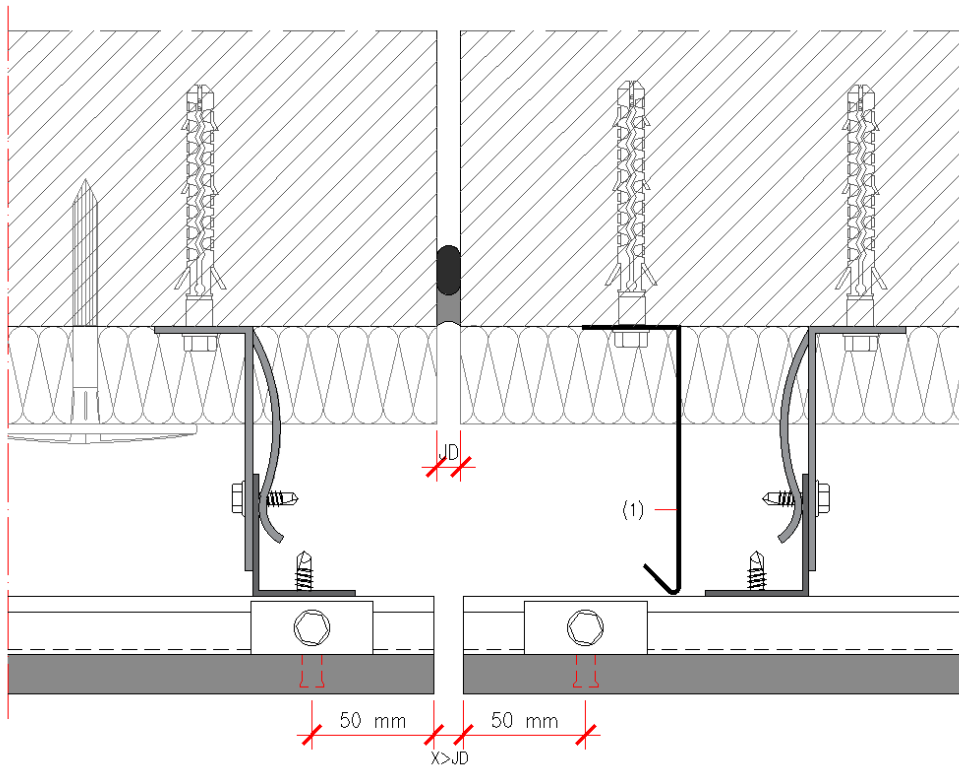


Figure 2.2.28 - Detail of the balcony finish



(1) Anti-rodent grille

Figure 2.2.29 - Detail of base



(1) Compartmentalisation of the air foil

Figure 2.2.30 - Detail of expansion joint

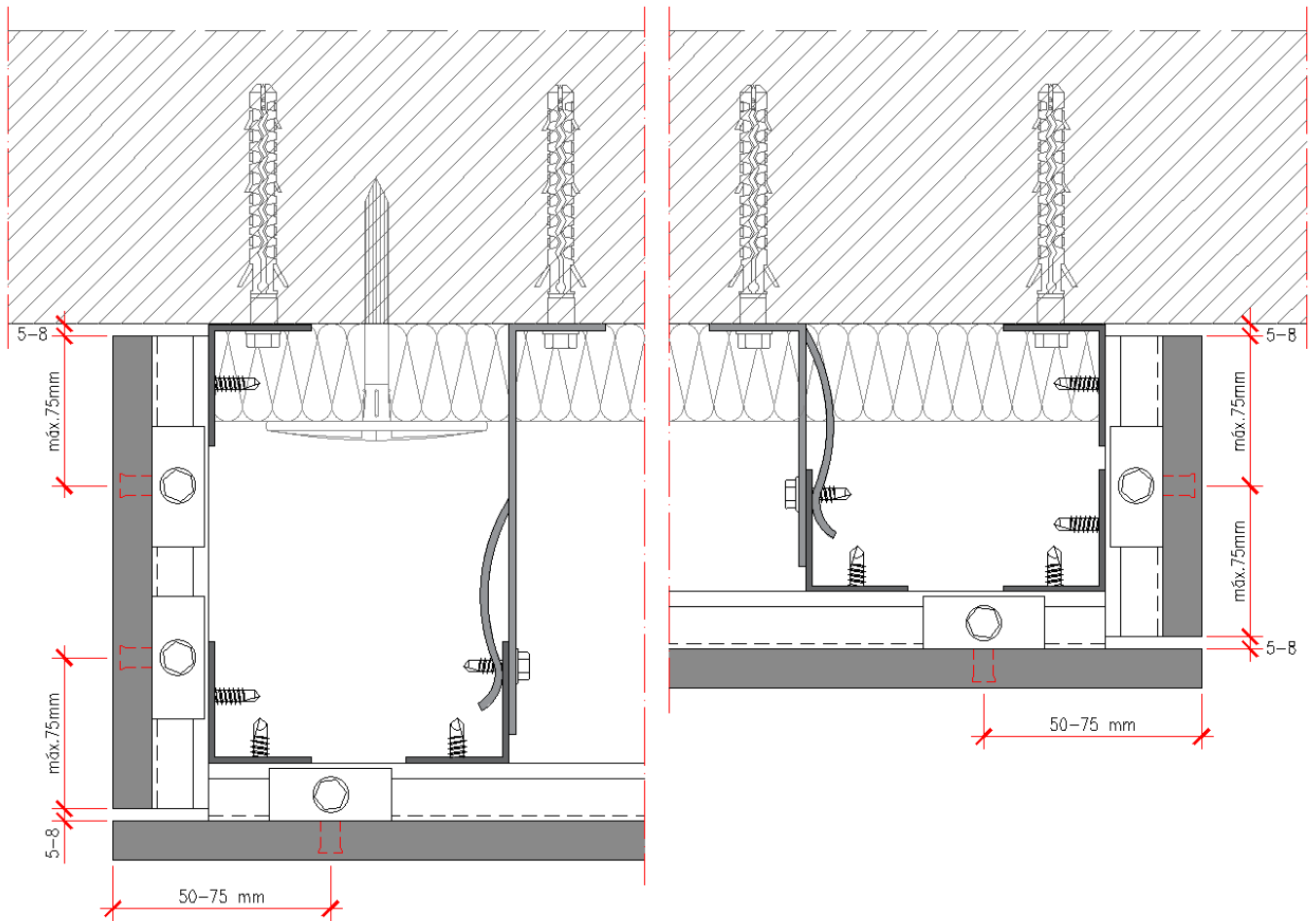
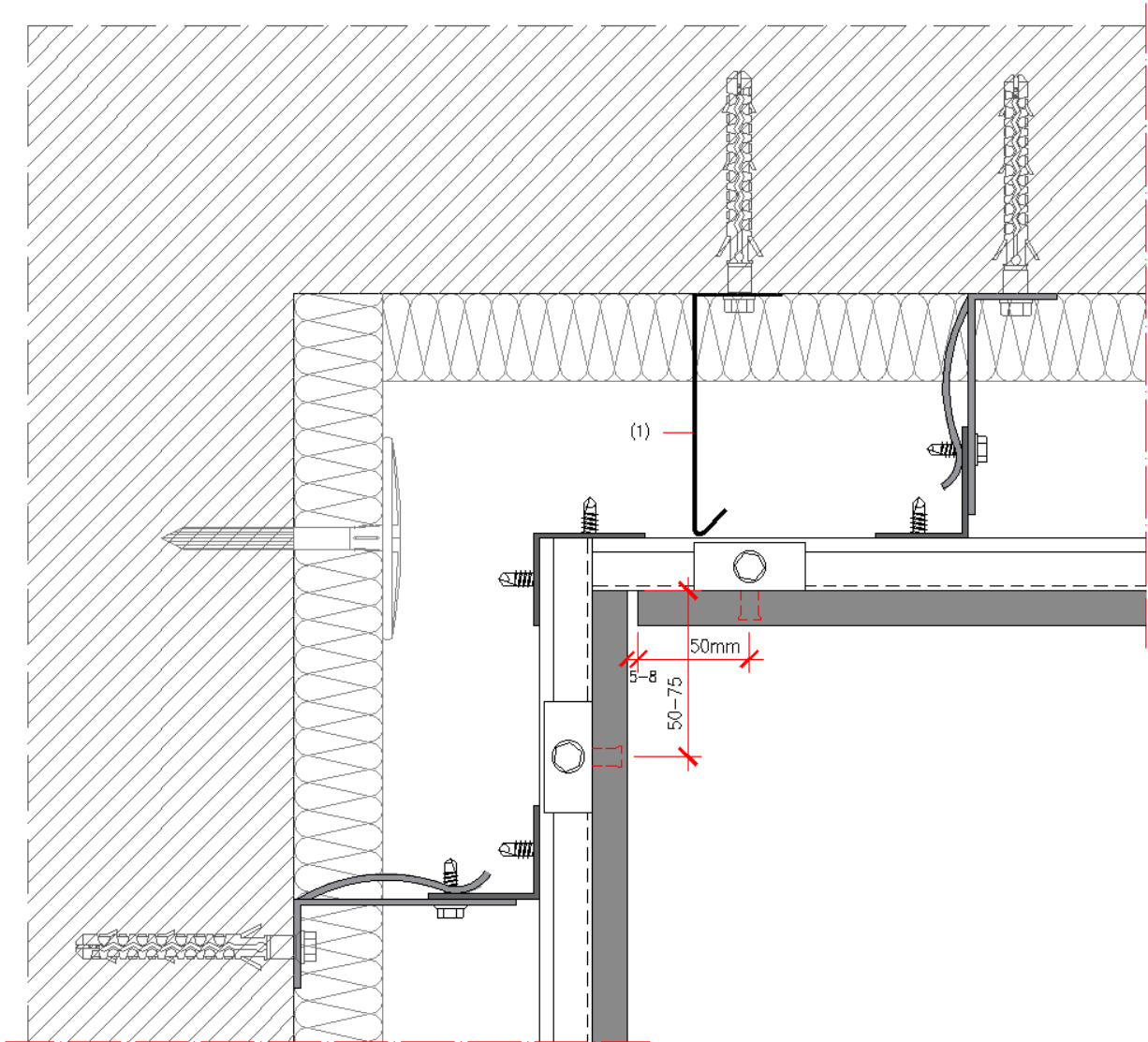
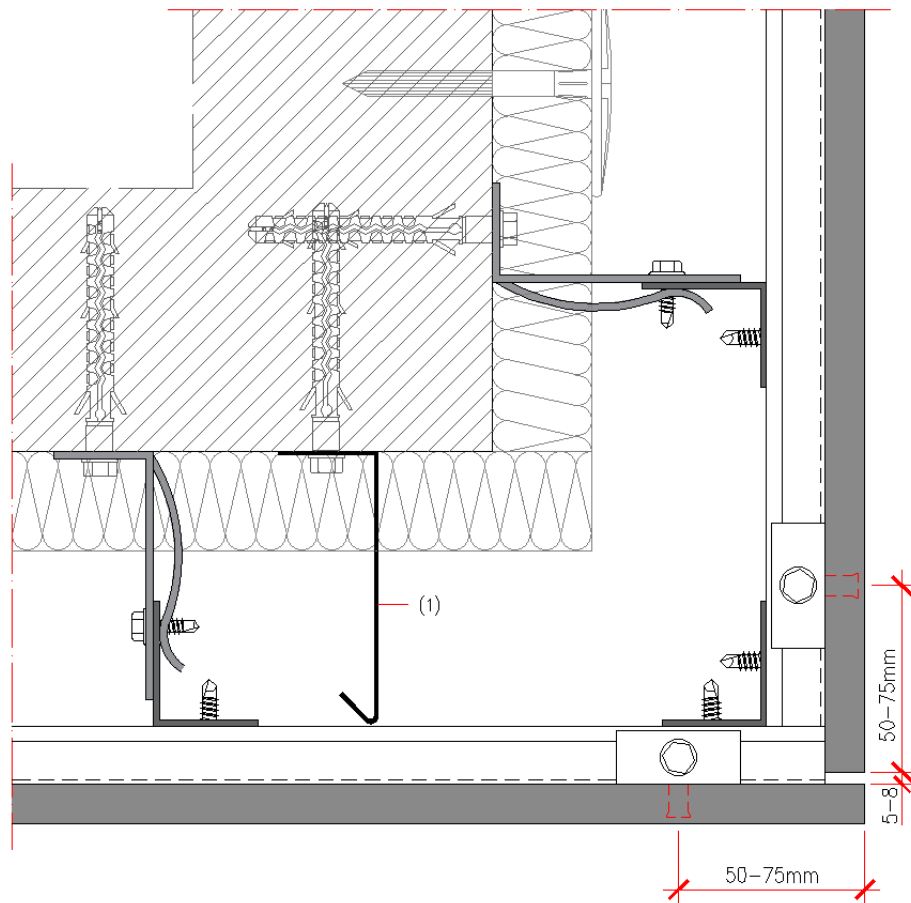


Figure 2.2.31 - Detail of side trim



(1) Compartmentalisation of the air foil

Figure 2.2.32 - Detail of corner angle



(1) Compartmentalisation of the air foil

Figure 2.2.33 - Detail of the corner angle

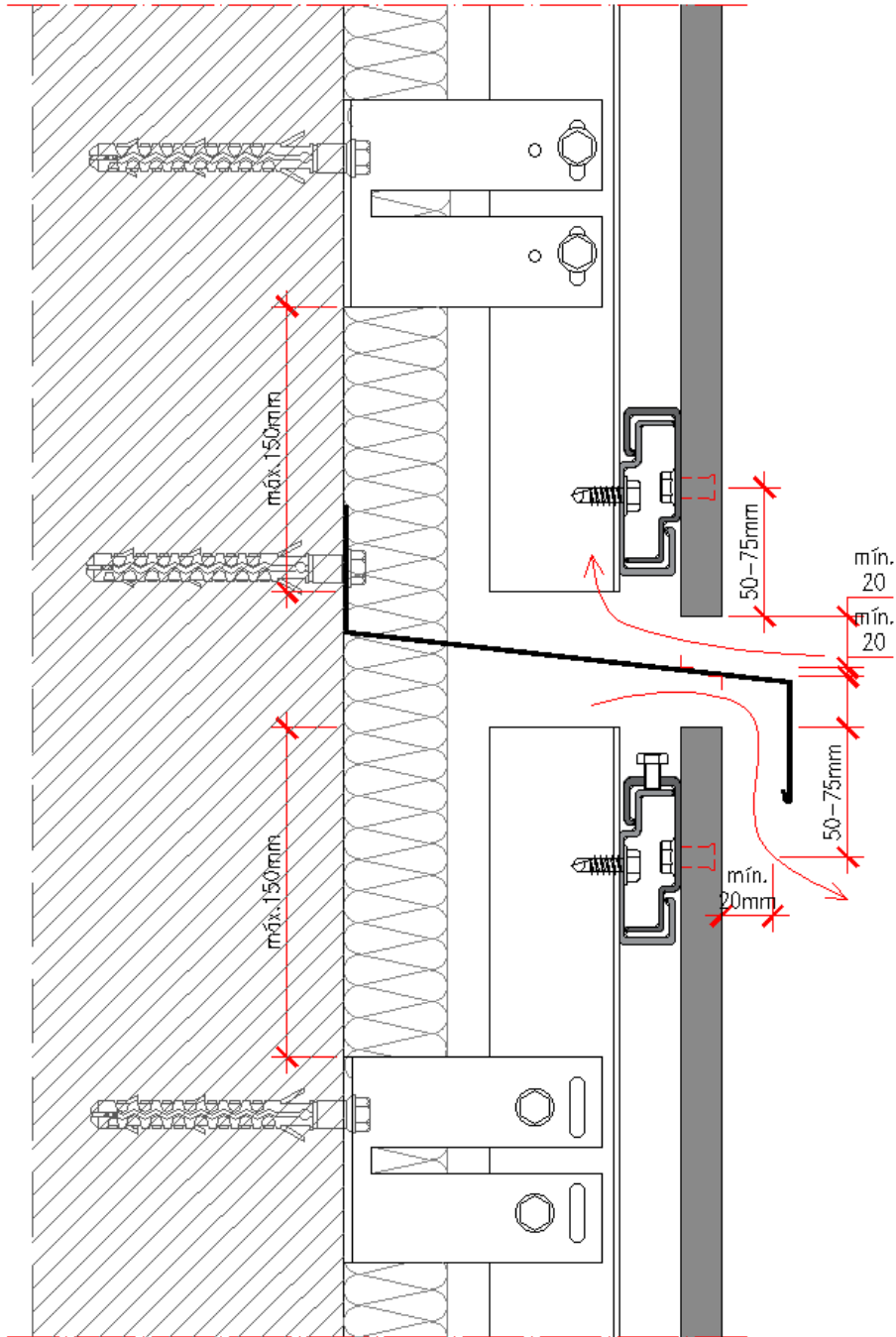


Figure 2.2.34 - Horizontal compartmentalization of the air foil



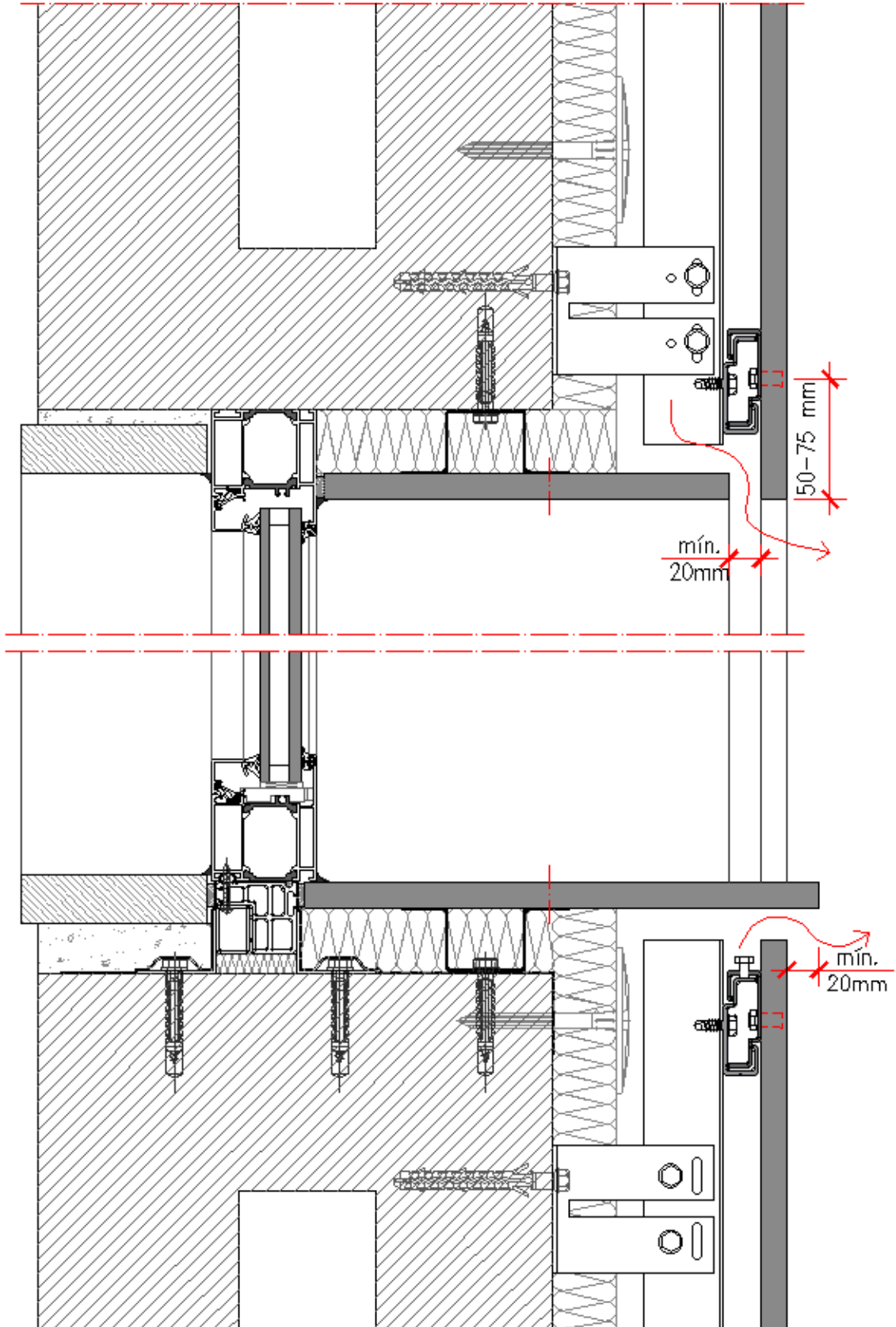


Figure 2.2.35 - Detail of window opening, vertical section

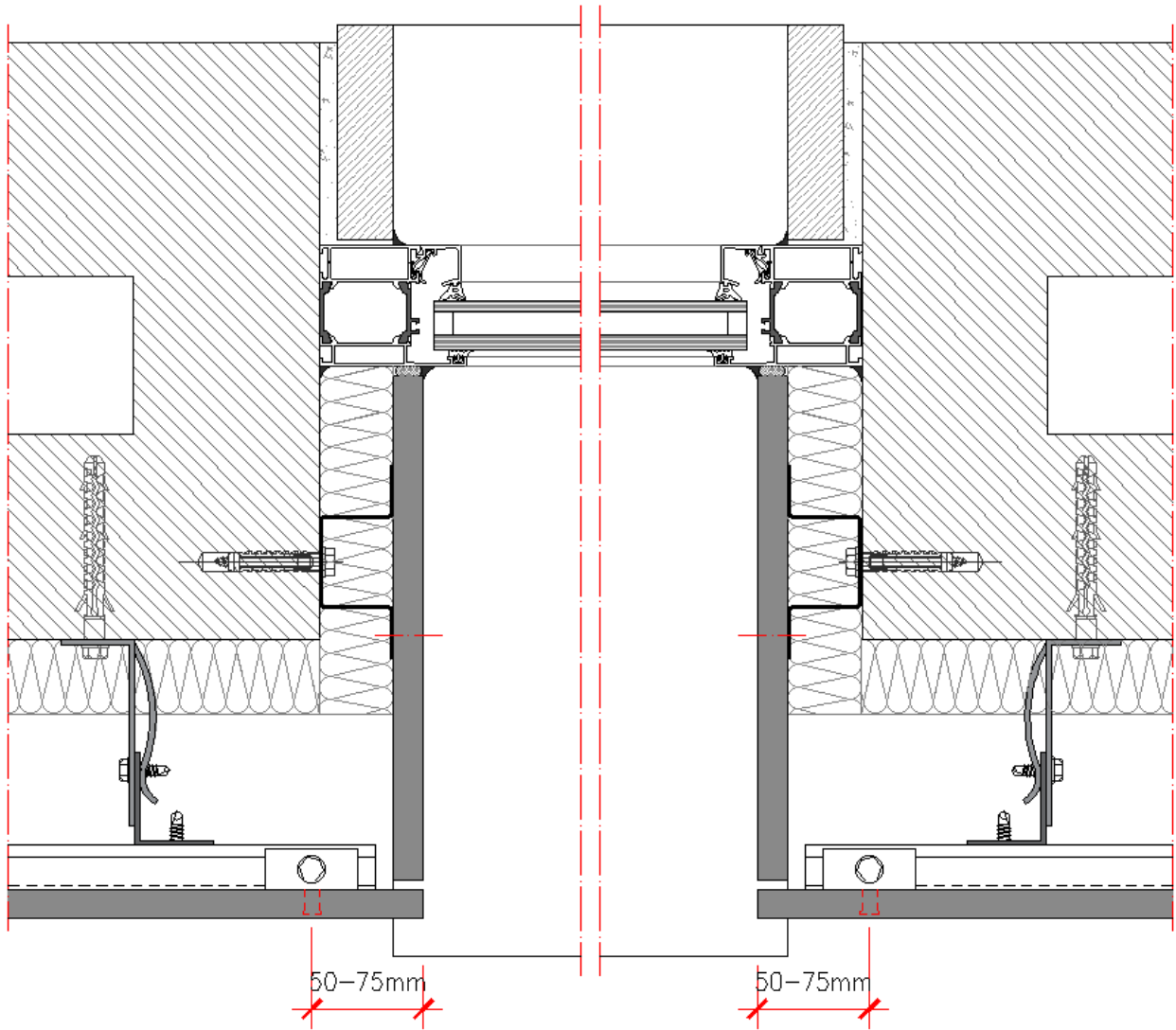


Figure 2.2.36 - Detail of window opening, horizontal section

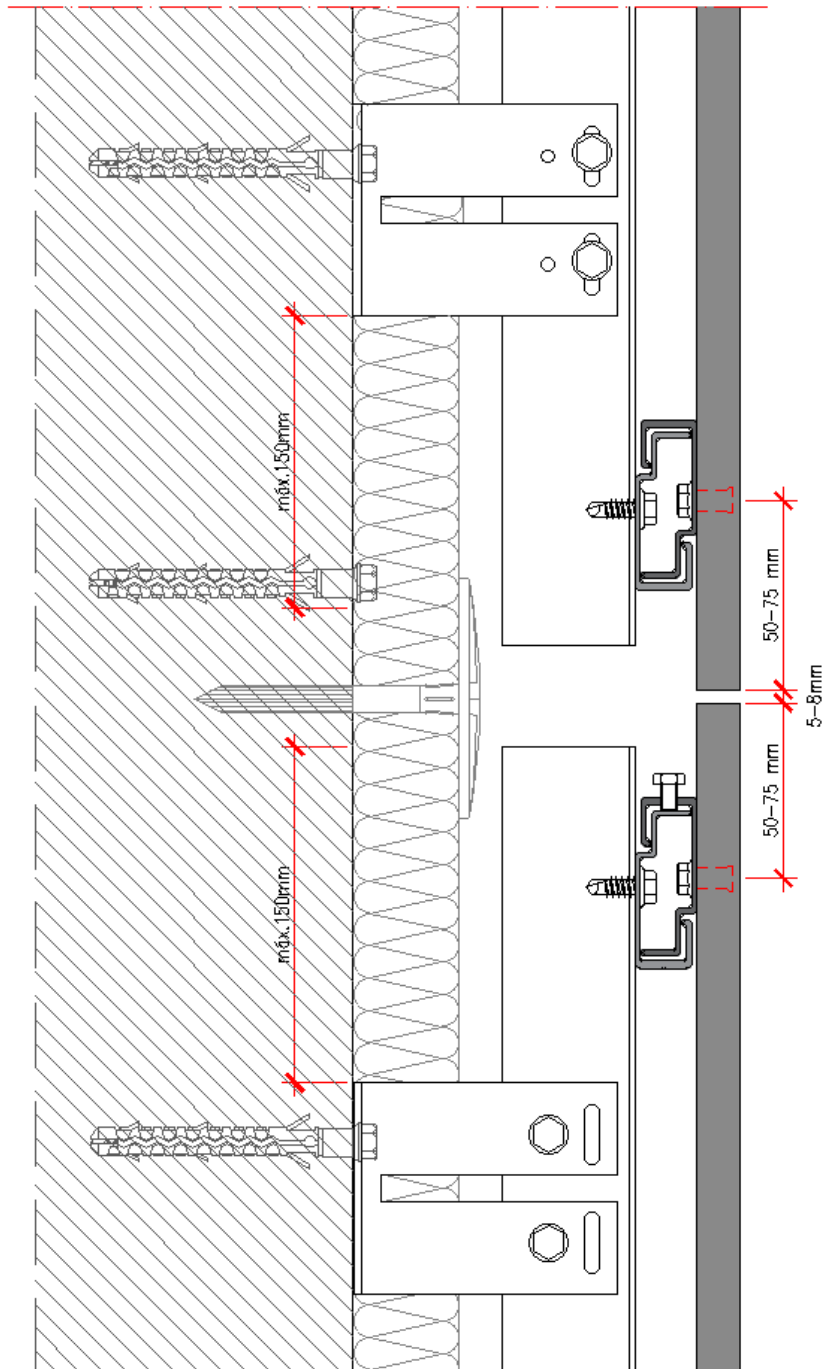
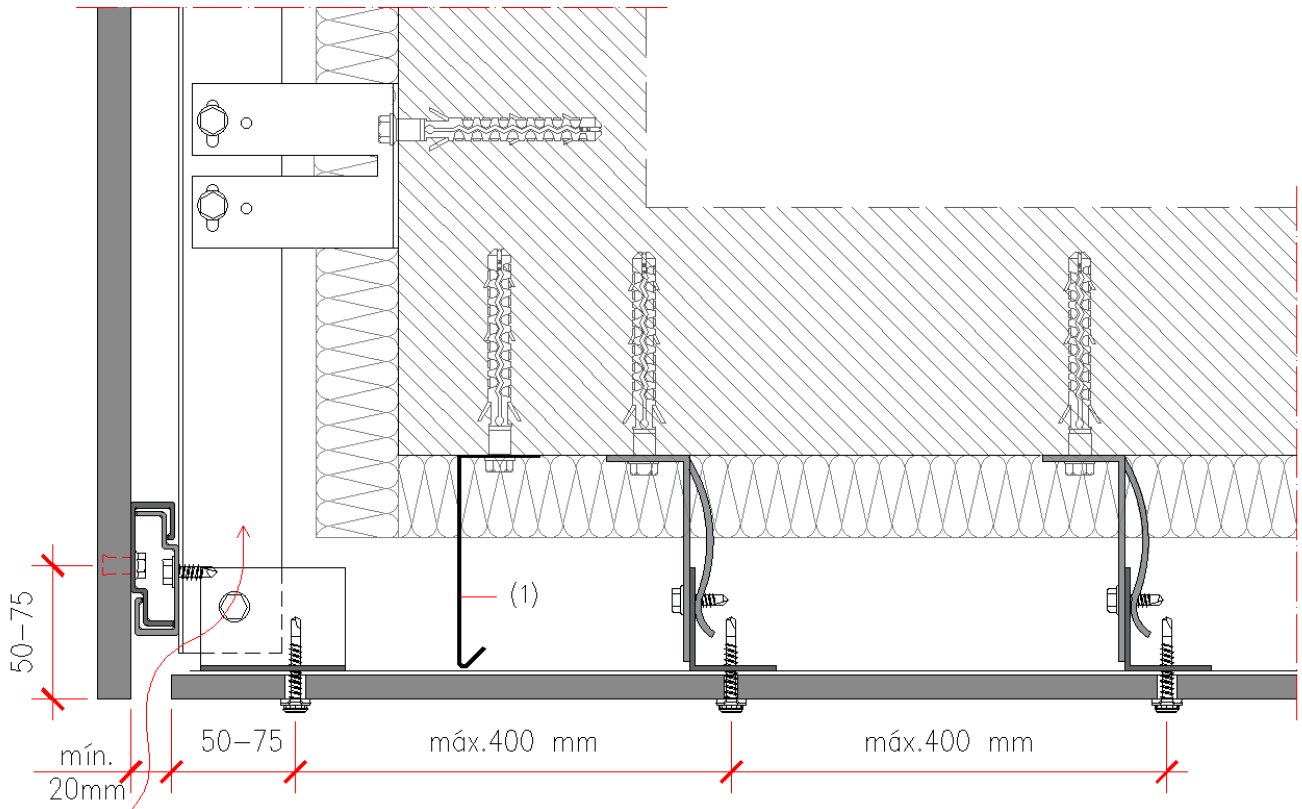


Figure 2.2.37 - Fractionation of the structure



(1) Compartmentalization of the air foil

Figure 2.2.38 - Detail of Façade-Tiling connection

## TABLES

Wind load table

Façade system with concealed mechanical fixing

Maximum pressure on panels when subjected to wind action (suction)

H number of screws arranged horizontally

V number of screws arranged vertically

$N \geq 3$

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"	700 mm	28"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	5,5	116	3,1	65	2,0	42	1,4	29	1,0	21
	2 x N	4,5	93	3,3	70	2,7	56	2,2	47	1,9	40
	N x 2	4,5	93	3,1	65	2,0	42	1,4	29	1,0	21
	N x N	2,4	50	1,8	37	1,4	30	1,2	25	1,0	21
16 mm 5/8"	2 x 2	9,8	204	7,4	154	4,7	99	3,3	69	2,4	50
	2 x N	5,2	109	3,9	82	3,1	65	2,6	55	2,2	47
	N x 2	5,2	109	4,2	87	3,5	73	3,0	62	2,4	50
	N x N	2,8	58	2,1	44	1,7	35	1,4	29	1,2	25

Table 1 - Maximum pressure, 300 mm spacing between horizontal fixings

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"	700 mm	28"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	3,1	65	3,1	65	2,0	42	1,4	29	1,0	21
	2 x N	3,1	65	2,7	56	2,1	45	1,8	37	1,5	32
	N x 2	3,3	70	2,7	56	2,0	42	1,4	29	1,0	21
	N x N	1,8	37	1,3	28	1,1	22	0,9	19	0,8	16
16 mm 5/8"	2 x 2	4,9	103	4,9	103	3,2	66	2,2	46	1,6	34
	2 x N	4,2	87	3,1	65	2,5	52	2,1	44	1,8	37
	N x 2	3,9	82	3,1	65	2,6	55	2,2	46	1,6	34
	N x N	2,1	44	1,6	33	1,3	26	1,0	22	0,9	19

Table 2 - Maximum pressure, 400 mm spacing between horizontal fixings

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"	700 mm	28"
		kN/m2	psf	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	2,0	42	1,4	29	1,0	21
	2 x N	2,0	42	2,0	42	1,8	37	1,5	31	1,3	27
	N x 2	2,7	56	2,1	45	1,8	37	1,4	29	1,0	21
	N x N	1,4	30	1,1	22	0,9	18	0,7	15	0,6	13
16 mm 5/8"	2 x 2	3,2	66	3,2	66	3,2	66	2,2	46	1,6	34
	2 x N	3,2	66	2,6	55	2,1	44	1,7	36	1,5	31
	N x 2	3,1	65	2,5	52	2,1	44	1,8	37	1,6	33
	N x N	1,7	35	1,3	26	1,0	21	0,8	17	0,7	15

Table 3 - Maximum pressure, 500 mm spacing between horizontal fixings

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"	700 mm	28"
		kN/m2	psf	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	1,4	29	1,0	21
	2 x N	1,4	29	1,4	29	1,4	29	1,3	27	1,1	23
	N x 2	2,2	47	1,8	37	1,5	31	1,3	27	1,0	21
	N x N	1,2	25	0,9	19	0,7	15	0,6	12	0,5	11
16 mm 5/8"	2 x 2	2,2	46	2,2	46	2,2	46	2,2	46	1,6	34
	2 x N	2,2	46	2,2	46	1,8	37	1,5	31	1,3	27
	N x 2	2,6	55	2,1	44	1,7	36	1,5	31	1,3	27
	N x N	1,4	29	1,0	22	0,8	17	0,7	15	0,6	12

Table 4 - Maximum pressure, 600 mm spacing between horizontal fixings

Horizontal distance between screws 700 mm ( 28")											
Thickness of panel	(H x V)	Vertical distance between screws									
		300 mm	12"	400 mm	16"	500 mm	20"	600 mm	24"	700 mm	28"
		kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf	kN/m2	psf
12 mm 1/2"	2 x 2	1,0	21	1,0	21	1,0	21	1,0	21	1,0	21
	2 x N	1,0	21	1,0	21	1,0	21	1,0	21	1,0	20
	N x 2	1,9	40	1,5	32	1,3	27	1,1	23	1,0	20
	N x N	1,0	21	0,8	16	0,6	13	0,5	11	0,4	9
16 mm 5/8"	2 x 2	1,6	34	1,6	34	1,6	34	1,6	34	1,6	34
	2 x N	1,6	34	1,6	34	1,6	33	1,3	27	1,1	23
	N x 2	2,2	47	1,8	37	1,5	31	1,3	27	1,1	23
	N x N	1,2	25	0,9	19	0,7	15	0,6	12	0,5	11

Table 5 - Maximum pressure, 700 mm spacing between horizontal fixings