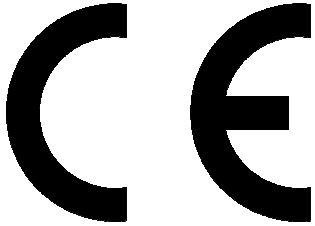


Technical File



Cement bonded particle board

Panneaux de particules liées au ciment

VIROC

*Painel de partículas
aglomeradas com cimento*

*Cement-bonded
particleboard*

*Panneaux de particules
liées au ciment*

*Tableros de partículas
aglomeradas con cemento*

*Zementgebundene
Spanplatten*

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[Avis Technique 2.2/15-1686 V1](#)
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See Viroc technical data sheet.

<https://www.investwood.pt/en/viroc/>

1. DESCRIPTION

1.1 Introduction

Viroc is a composite board made from a cement and wood mixture referred to as Cement Bonded Particle Board (CBPB). It combines the flexibility of wood with the strength and durability of cement, enabling a wide range of indoor and outdoor applications. The production of Viroc board complies with the specifications of EN643 and EN13986 standards, bearing a CE Certification Mark.

The Viroc board is varied in appearance with randomly dispersed different shades, caused by the natural colours of the raw materials used and chemical reactions.

The surfaces may display some irregularities.

Tone differences may be observed on the same face, between the faces of the same board or between different productions.

Board surfaces, when required, can be supplied polished. Polishing consists of surface cleaning of salts, dust and some dirt left over from the manufacturing process, without altering the natural look of the board. The board will retain the stains and variations that characterize it.

When required, boards can be supplied sanded. Sanding is the application of coarse sandpaper to surfaces to minimize variations in thickness. Once sanded, the surfaces are left with wood particles visible. The sanded board has no visible decorative features.

The V-Urban board is a Viroc board, manufactured by Viroc Portugal for use on ventilated façades. This board is supplied varnished. It has an Avis Technique and QB Certification issued by the CSTB, when applied to ventilated façades fastened with screws.

The Viroc board and the V-Urban board have only one visible face. When packaged, this face is the one facing upwards.

1.2 Materials used in manufacturing

Dry weight percentage:

Portland Cement: 61.8%

Pine wood shavings: 22.7%

Water: 10.7%

Non-toxic additives: 1.4%

Pigment: 3.4%

1.3 Dimensions

Manufacturing Dimensions:

Metric	Imperial
2600x1250 mm	102.4x49.2"
3000x1250 mm	118.1x49.2"

1.4 Cutting tolerances

	Metric	Imperial
Length and with	± 3 mm	± 0.12"
Squareness	≤ 2.0 mm/m	≤ 0.20 %
Edge straightness	≤ 1.5 mm/m	≤ 0.15 %

1.5 Colours

The Viroc board is made in 6 different colours. The colour of the boards is made during manufacture by adding a pigment to the pulp. The boards are available in grey, black, white, yellow, red and ochre (see Figures 1.1 to 1.6).

1.6 Thicknesses and thickness tolerances

Unsanded and Polished				Sanded			
Thickness		Tolerance		Thickness		Tolerance	
mm	Inch	mm	Inch	mm	Inch		
8	5/16	±0.7	±0.03	-	-	-	-
10	3/8	±0.7	±0.03	-	-	-	-
12	1/2	±1.0	±0.03	-	-	-	-
16	5/8	±1.2	±0.03	-	-	-	-
19	3/4	±1.5	±0.03	-	-	-	-
22	7/8	±1.5	±0.03	18	0.71	±0.3	±0.012
25	1	±1.5	±0.03	21	0.83	±0.3	±0.012
28	1 1/8	±1.5	±0.03	24	0.95	±0.3	±0.012
32	1 1/4	±1.5	±0.03	28	1.10	±0.3	±0.012

1.7 Mechanical characteristics

Characteristics	Test Method	Performance	Standard
		Metric	Imperial
Density Average	EN 323	≥ 1000 Kg/m ³ 1350 Kg/m ³	≥ 62.5 lb/ft ³ 84.5 lb/ft ³
Modulus of elasticity in bending Category 2 Category 1 Average	EN 310	≥ 4000 N/mm ² ≥ 4500 N/mm ² 6000 N/mm ²	≥ 580150 psi ≥ 652700 psi 870200 psi
Bending strength	EN 310	≥ 9 N/mm ² 12 N/mm ²	≥ 1305 psi 1740 psi
Internal bond	EN 319	≥ 0.5 N/mm ²	≥ 72.5 psi
Internal bond after cyclic test	EN 319 and EN 321	≥ 0.3 N/mm ²	≥ 43.5 psi
Swelling in thickness, 24h	EN 317	≤ 1.5%	≤ 1.5%
Swelling in thickness after cyclic test	EN 319 and EN 321	≤ 1.5%	≤ 1.5%

1.8 Other features

Reaction to fire

B-s1,d0 - Fuel but not flammable

Thermal conductivity

0.22 W/(m.K), 1.526 BTU in/h ft².F

Humidity

On leaving factory: 6 - 12%

Alkalinity

Surface Alkalinity PH: 11 - 13

Formaldehyde

Formaldehyde Category: E1 (EN 13986-Annexe B)

No formaldehyde added (NAF)

Asbestos

Not present

Pentachlorophenol

Not present

Silica

Contains silica remnants from cement

1.9 Sound insulation

Sound reduction index (Rw) (C; Ctr)

Thickness (mm)	Rw (C;Ctr) (dB)
8	31 (-1;-3)
10	32 (-2;-3)
12	33 (-1;-3)
16	35 (-2;-3)
19	35 (-1;-2)
22	37 (-2;-3)

1.10 WeightSpecific weight: Average amount 1350 Kg/m³

Metric system

Thickness mm	Weight per sqm Kg/m ²	Weight of boards (Kg)	
		2600x1250mm	3000x1250mm
8	10.8	35.1	40.5
10	13.5	43.9	50.6
12	16.2	52.7	60.8
16	21.6	70.2	81.0
19	25.7	83.4	96.2
22	29.7	96.5	111.4
25	33.8	109.7	126.6
28	37.8	122.9	141.8
32	43.2	140.4	162.0

Imperial System

Thickness inch	Weight per sqm psf	Weight of boards (lbf)	
		102.4x49.2"	118.1x49.2"
5/16	2.21	77.4	89.3
3/8	2.77	96.8	111.6
1/2	3.32	116.2	134.0
5/8	4.42	154.8	178.6
3/4	5.26	183.9	212.1
7/8	6.08	212.7	245.6
1	6.92	241.8	279.1
1 1/8	7.74	270.9	312.6
1 1/4	8.85	309.5	357.1

1.11 Packing

Number of boards per pallet

Thickness		2600x1250 mm	3000x1250 mm
mm	inch	102.4x49.2"	118.1x49.2"
8	5/16	60	57
10	3/8	48	46
12	1/2	40	38
16	5/8	30	28
19	3/4	25	24
22	7/8	24	23
25	1	21	20
28	1 1/8	18	18
32	1 1/4	16	16

1.12 Quality control in production

VIROC Portugal is a company with the CE Certification Mark. All its testing is therefore carried out in order to comply with the specifications required by the European standards (EN).

All material that does not meet requirements is considered "Non-Compliant" and is not sold with the CE Certification Mark.

In raw materials

- Measurement of wood trunk sugar in all loads until the amount complies.
- Shavings moisture, once a day.

During manufacture

- Particle size of wood shavings, once a day;
- Density and quantity of chemicals, once every 8 hours or whenever the reservoir is filled;
- Humidity of the mixture, twice per hour;
- Liquid thickness, continuous measurement;
- Temperature and humidity in the hardening tunnel, continuous measurement;
- Temperature and humidity in the drying tunnel, continuous measurement;

In the final product

- Thickness on all boards;
- Dimensions, once every 2 hours or whenever thickness changes: Length and Width \pm 3 mm;
- Squareness, once every 2 hours or whenever thickness changes: \leq 2 mm/m;
- Edges straightness, once every 2 hours or whenever thickness changes: \leq 1.5 mm/m;
- Density, once every 8 hours or whenever thickness or colour changes: \geq 1000 Kg/m³;
- Bending strength, once every 8 hours or whenever thickness or colour change: \geq 9 N/mm²;
- Modulus of elasticity, once every 8 hours or whenever thickness or colour change: Category 2 \geq 4000 N/mm², Category 1 \geq 4500 N/mm²;
- Internal bond, once a day or whenever thickness or colour change: \geq 0.5 N/mm²;
- Swelling in thickness 24h, once a day or whenever thickness or colour changes: \leq 1.5 %;
- Internal bond after cyclic test, once a week: \geq 0.3 N/mm²;
- Swelling in thickness after cyclic test, once a week: \leq 1.5 %;
- Moisture of the boards after drying, once every 8 hours or whenever thickness or colour changes.

1.13 Pallet Identification

All pallets are identified with a label containing the following data:

- Manufacturer's name and address;
- Board Type, Rough or Sanded;
- CE Mark logo with Certification number;
- Thickness;
- Colour;
- Dimensions;
- Edges, Normal Cut or tongue and groove/halved joint;
- Number of boards;
- Volume Number.

1.14 Varnishing and painting

Viroc boards should be painted or varnished to improve their resistance to weather exposure. They may also be painted for decorative reasons. VIROC Portugal S.A. recommends sealing the board with a varnish or paint, particularly when the board is applied outdoors, to seal the pores and protect from the effects of sun radiation, rain and temperature variations. Board sealing on all faces and edges increases durability and dimensional stability.

Unpainted/varnished boards are more likely to drip and stain efflorescence. These efflorescence's can be cleaned with mechanical polish and a floor pad. It is not always possible to completely remove these stains or drips.

Boards that are not painted or varnished vary more in dimensions. Under extreme conditions, the board shrinkage may be 0.5 % (5 mm/m), causing the board to buckle out of plane.

Before applying paint or varnish, the board surfaces must be clean of dirt, dust, grease or efflorescence. The boards can be cleaned by polishing with a floor pad or alternatively with a fine grain sandpaper of 120 or more. Cleaning should be undertaken carefully to avoid excessive sanding of the surface which may remove the fines layer and expose the wood fibres, completely altering the appearance.

Paint or varnish must be applied to both sides and tops of the boards and applied through the coats recommended by the manufacturer.

1.15 Cutting, drilling and machining

Boards can be cut, drilled and machined with power or compressed air tools commonly used in carpentry or mechanical metalwork.

Cutting, drilling and machining of Viroc and V-Urban boards releases dust that may contain traces of silica and cement constituent material. Appropriate personal protective equipment such as masks, gloves, goggles, etc. should be worn.

Cutting

The cutting of Viroc boards must be performed with circular saws with high wear-resistant carbide (tungsten) or diamond cutters (see figure 1.7). To make multiple cuts or to cut boards with a thickness of 19 mm or greater, a horizontal cutting table should be used. The cutting table will increase profitability.

Frezite (www.frezite.pt) has saw blades suitable for cutting Viroc and V-Urban boards.

Drilling

Drilling should be performed with non-impact drills using HSS (High Speed Steel) drills suitable for drilling metal (see figure 1.8).

Frezite (www.frezite.pt) has suitable drills for drilling Viroc and V-Urban boards

Edge machining

Simple edge machining can be carried out on site using a portable router (see figure 1.9).

Using the correct cutter, edges can be made by: Beveling, rounding, grooving, etc. (see figure 1.11).

The board edges may be supplied with factory grooves, tongue and groove or halved joint (see figure 1.12).

1.16 Surface polishing

Polishing consists of surface cleaning of salts, dust and some dirt left over from the manufacturing process, without altering the natural look of the board. The board will retain the stains and variations that characterize it.

The Viroc board, when required, can be supplied factory polished, although this operation can be performed on site.

On-site polishing is performed with an orbital sander using floor pads. Floor pads can be purchased from VIROC Portugal S.A. (see figure 1.10).

The floor pads consist of a Scotch Brite scouring-like polypropylene abrasive fibre that removes dirt without damaging the surface layer of the board.

Alternatively, fine sandpaper pads of 120 grit or more may be used.

Care must be taken when cleaning with fine sandpaper in order to avoid excessive sanding and removal of the fine layers from the board surface, exposing the wood fibres.

Watch the instructional video for cleaning a board with an orbital sander: <https://www.youtube.com/watch?v=HeQZNVNOZYI>

1.17 Surface sanding

When required, Viroc boards can be supplied sanded. Sanding consists of roughing the surfaces with coarse sandpaper to minimize thickness variation. Once sanded, the surfaces have wood particles visible. The sanded board has no visible decorative features.

Sanded boards on both sides have a thickness tolerance of ± 0.3 mm (see chapter 1.6).

1.18 Storage

When ready for transportation, the boards are protected by a waterproof plastic screen. The side edges are protected with L-shaped cardboard including those in contact with the strapping of the packaging system. The pallet guards should only be removed to acclimatize the boards to the application site.

Viroc boards should be stored indoors, protected from sunlight and rain, with a flat horizontal base. The pallets will be placed on supports that should be high enough (≥ 8 cm) to allow easy access by a forklift. The maximum clearance between supports should not exceed 800 mm and the maximum distance between the first support and the top of the pallet should not exceed 210 mm.

If the pallets are to be stacked on top of each other, all support bases must be aligned vertically to prevent deformations.

Stacking up to 6 pallets up to 4 metres high (13.1 feet) is allowed (see figure 1.13).

1.19 Handling

Whenever possible, the handling of the boards should be performed using appropriate equipment, such as the use of forklifts, panel lifters, etc.

If the boards have to be moved manually, this process must be performed board by board in the vertical position so that they remain flat without deforming (see figure 1.14).

The weight of the boards is indicated in chapter 1.10, so their manual movement should not be performed without sufficient people being present.

Good manual handling practices should be followed and appropriate personal protective equipment used, following the rules of European Health and Safety legislation, Osha.Europa.eu (Factsheet 73):

<https://osha.europa.eu/pt/tools-and-publications/publications/factsheets/73/view>

1.20 Acclimatisation

When leaving the factory, the boards' humidity ranges from 6 to 12%.

To ensure proper installation conditions, the board must adapt to the temperature and humidity conditions of the installation location. To do this, the straps that surround the pallets should be cut and the protec-

tive plastic screen removed. Boards must be left at least 72 hours (3 days) to acclimate to the installation site before being applied.

The boards at the top of the pallets, whose straps have already been removed, may buckle, forming an upwardly facing hollow. This phenomenon is natural and happens due to the differential loss of moisture between the two surfaces. However, the process is reversible. The board will be flat again when both surfaces are in moisture balance. For this, the back of the board must be turned upwards and kept in that position until this balance is reached. The same effect will be achieved by wetting the concave face (surface up) with water (see figure 1.15).

1.21 Application

VIROC Portugal S.A. is the manufacturer of Viroc and V-Urban boards and does not customize them. The boards may be purchased from a distributor authorized directly by the contractors or subcontractors who perform this service.

VIROC Portugal S.A. simply manufactures the boards. Fasteners, structure and any other element may be purchased directly by the customizing company, provided that they comply with all the characteristics specified in this Technical Dossier.

Table 1 provides a summary of recommended thicknesses for each application.

1.22 Colour variation

The Viroc and V-Urban Board, when exposed outdoors, undergoes slight changes in colour, making it a little lighter. This shade variation depends from colour to colour.

In a colour development study by the Polytechnic Institute of Viseu (IPV), the development of the boards was measured when aged in different environments.

The table below shows the average colour variations observed (Delta E) when exposed to Xenon Chamber and QUV after 1500 hours of exposure.

Colour	Delta E	
	Xenon	QUV
Ash	7	2
Black	14	2
White	13	10
Yellow	6	1
Red	12	4
Ochre	13	3

1.23 Maintenance

Viroc and V-Urban boards do not require maintenance.

In outdoor applications where the board is varnished or painted, an inspection should be performed every 5 years to verify that varnishing or painting is in good condition.

If no anomaly is detected, a new inspection should be scheduled after 5 years.

When severe wear or any deficiency of the varnish or paint applied to the board is detected, it should be water jet cleaned with neutral detergent and repainted.

1.24 Technical Assistance

VIROC Portugal S.A. has a Technical Department that can provide technical assistance both in the design and construction phase.

1.25 Declaration of performance (DoP)

Under Regulation (EU) No. 305/2011 of the European Parliament and the Council, which establishes harmonized conditions for the marketing

of construction products, the Viroc panel holds a CE Marking Certificate and guarantees to comply with all characteristics and properties declared in the declaration of performance.

The declaration of performance (DoP) can be downloaded from the Investwood website.

2. VENTILATED FACADES

Viroc boards can be used to for building facade cladding to form a board-ventilated facade.

Viroc boards are specifically manufactured for use in ventilated façades and have an Avis Technique and a QST Certification issued by the CSTB.

Both boards are varied in appearance with differences in tone on the same face, between faces of the same board or between different productions.

The surfaces may display some irregularities.

With sun exposure, the board colour changes slightly and becomes lighter. This shade variation depends from colour to colour (see chapter 1.22).

When applied to Ventilated Façades, Viroc boards will need to be varnished or painted unless applied as indicated in Chapter 2.5.

Ventilated facades consist of:

- Panelling
- Support structure of the boards and their fastening elements;
- Screws or rivets for fastening the boards to the support structure;
- Ventilation air layer;
- Thermal insulation;
- Complementary profiles for treatment of singular points.

2.1 General

2.1.1 General specifications

Recommended thicknesses

12 mm (1/2") and 16 mm (5/8")

Surface mass

12 mm: 16.2 ± 1.2 kg/m²;

16 mm: 21.6 ± 1.6 kg/m².

Wind

The exposure to wind perpendicular to the flat of the board, equivalent to a pressure or depression (in kN/m²) whose limit amount is listed in Tables 2, 3 and 4, in case the boards are fastened with screws.

V-URBAN Boards

V-Urban boards are Viroc manufactured boards designed to be applied to ventilated facades, provided with a finish on all surfaces. When the board is cut on site, the edges of the boards will have to be treated.

Board manufacturing dimensions

2600x1250 mm, 3000x1250 mm

Any intermediate dimensions that are obtained by cutting the standard dimension board are possible.

Dimensional tolerances of boards

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

Cutting tolerances

Length and width: \pm 3 mm

Squaring: \leq 2 mm/m

Edge linearity: \leq 1.5 mm/m

Impact Resistance

EN 1128 Hard Body Impact Energy

12 mm, E = 12.9 Joules, Rupture Energy

16 mm, E = 12.8 Joules, Rupture Energy

Impact test according to ETAG 034

Impact Type	Energy	Result
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	Rupture 034034(Fail)

2.1.2 Timber supports

The mullions of the façade boards shall consist of wild pine wood fastened to the supporting structure (wall) by means of galvanized steel or stainless-steel brackets, with metal anchorages or anchorages made of metal screws and plastic bushings.

The timber that forms the mullions must be at least of strength category C18 according to EN 338 and durability class 2 or 3 in accordance with EN 335. Durability class 2 timber will need to be protected with a protective strip.

At the time of installation, the wooden mullions shall not exceed 18% moisture content, with a maximum difference of 4% between consecutive elements. The relative humidity of the wooden mullions shall be determined according to the method described in EN 13183-2 with a tip moisture meter.

The section of the mullions is generally rectangular with a minimum dimension of 40x50 mm (see figure 2.1).

The design of these elements will be carried out taking into account that the deformations caused by climatic agents (temperature, hygrometry, wind, etc.) do not jeopardize the normal functioning of the façade. Deformation due to wind loads (pressure or depression) shall not exceed the L/200 limit of the gap between support fixings.

The width of the mullions shall be such as to permit correct positioning of the anchorages and shall be capable of absorbing minor positioning errors. The screw shall not be less than 15 mm from the end of the mullions.

The maximum distance between the bases of the wooden mullions shall be 650 mm. The alignment of the mullions shall be verified between adjacent features and not more than 2 mm apart.

2.1.3 Galvanized steel profiles

The galvanized steel metal profiles shall be fastened to the supporting structure by means of galvanized steel or stainless-steel frames, with metal anchorages or anchorages consisting of metal screws and plastic bushings.

The steel constituent of the support profiles shall be of the minimum strength class S220GD + Z (275 g/m² zinc) according to EN 10346.

The section of the profiles is generally Omega, C- or L-shaped with a minimum thickness of 1.5 mm. Other profile shapes may be used provided they have equal performance and durability (see figures 2.2 and 2.3).

Omega profiles are used at the intersection of 2 boards. C-profiles are used as intermediate supports. L-profiles are used for the treatment of singular points of facades.

The design of these elements will be carried out by taking into account that the deformations caused by climatic agents (temperature, hygrometry, wind, etc.) do not affect the normal functioning of the façade. Deformation due to wind loads (pressure or depression) shall not exceed the L/200 limit of the gap between support fastenings.

The width of the profiles shall be such as to permit correct positioning of the anchorages and shall be capable of absorbing minor positioning errors and the screw shall not be less than 10 mm from the end.

The maximum distance between the bases of the profiles shall be 650 mm. The alignment of the profiles shall be verified between adjacent elements and not more than 2 mm apart.

2.1.4 Aluminium profiles

The aluminium metal profiles shall be fastened to the supporting structure by m034eans of aluminium brackets, with metal anchors or anchorages consisting of metal screws and plastic bushings.

The constituent aluminium of the metal profiles shall be at least alloy in the 6000 series, having a yield strength Rp0.2 of more than 180 MPa.

The section of the profiles is generally T- or L- shaped with a minimum thickness of 2 mm, and other section shapes may be used, provided they have equal performance and durability.

T-shaped profiles are used at the intersection of 2 boards. L-profiles are used as intermediate supports and are also used to make singular points of the façade (see figure 2.4).

The design of these elements will be carried out taking into account that the deformations caused by climatic agents (temperature, hygrometry, wind, etc.) do not jeopardize the normal functioning of the façade. Deformation due to wind loads (pressure or depression) shall not exceed the L/200 limit of the gap between support fastenings.

The width of the profiles should be of a size to allow correct positioning of the fastenings, with the capacity to absorb small positioning errors, and the screw should not be less than 10 mm from the end.

The maximum distance between the bases of the profiles shall be 650 mm. The alignment of the profiles shall be verified between adjacent elements and not more than 2 mm apart.

2.1.5 Protective strips

Timber mullions that are of class 2 durability according to EN 335 must be protected from rainwater with a protective band at all times.

This band shall be impermeable and of a width greater than 10 mm on each side.

The strips may be made of flexible PVC or EPDM (see figures 2.5).

2.1.6 Support brackets

The frame fastening brackets shall be metallic and made of a durable metal alloy made of corrosion-treated steel, stainless steel or aluminium alloy.

The minimum strength class of steel is S220GD according to EN 10147. If the brackets are made of aluminium, the alloy must be 6060 T5 or greater.

In coastal areas at a distance of 3 km from the sea, the brackets shall have special corrosion protection with a zinc weight of 275 g/m² or more. They should be in stainless steel or aluminium alloy.

The brackets are generally L-shaped, with several holes. If they are made of galvanized steel, the minimum thickness is 2.5 mm and 3 mm if they are made of aluminium.

Figures 2.6 and 2.7 show the recommended brackets.

The design of the brackets is carried out by taking into account the façade's own weight per m², based on a partial safety factor of 1.5.

The vertical deformation of the bracket may not exceed 3 mm for the maximum vertical load.

Connection to wooden mullions

When the mullions are made of wooden beams, the brackets are connected to the mullions by a $\varnothing \geq 6.0$ mm screw in the oval hole and another $\varnothing \geq 3.5$ mm screw in one of the circular holes to lock the movement (see figure 2.8).

Connection to galvanized steel profiles

For mullions made of galvanized steel metal profiles, the connection may be made by a self-tapping screw in the oval hole and another screw in one of the circular holes to block movement. The connection can be made with self-tapping screws $\varnothing \geq 5.5$ mm or rivets $\varnothing \geq 4.8$ mm (see figure 2.9).

Connection to aluminium profiles

When the mullions are made of aluminium metal profiles, due to the high expansion coefficient, the structure must be designed as a free expansion structure, in which, along the length of the profile, there will be only one point fastened to one of the support brackets and all other connections to the brackets must allow free expansion of the profile.

Fixed connections

These are made with 2 screws/rivets placed in the circular holes, blocking the movement.

Sliding connections

They are made with 1 or 2 screws/rivets placed vertically in the oval holes.

The connection can be made with self-tapping screws $\varnothing \geq 5.5$ mm in stainless steel or rivets $\varnothing \geq 4.8$ mm (see figure 2.10).

2.1.7 Anchorages for fastening the brackets

The anchorages for fastening the brackets to the wall can be made by metal plugs (M8) or plastic plugs ($\varnothing 10$ mm) with a metal screw ($\varnothing 7$ mm), the metal items being protected against corrosion or stainless steel.

The strength and stability of anchorages shall be designed and constructed in order that the loads to which they will be subjected during their lifetime do not have any of the following consequences:

- The total or partial rupture of the structure;
- Deformations that reach unacceptable proportions;
- Damage to other parts of structures, equipment or installations after excessive deformation of the supporting structure;
- Damage that is large scale in relation to the root cause.

Anchorages shall withstand the shear, tensile loads and the combination of both forces during the expected life of the structure, ensuring:

- Adequate resistance to failure (ultimate strength limit states);
- Adequate resistance to displacement (Service Limit States).

Anchorages shall have CE-mark European Technical Assessment (ETA) certification or, alternatively, a DH (Approval Document) containing the characteristic resistant values and their respective safety coefficients.

For anchorages that do not have any type of ETA or DH certification, the strength values shall be proven on site by carrying out load tests.

Metal bushings are usually suitable for concrete supports. Metal screw plastic bushings are suitable for concrete supports and solid or hollow element masonry.

Figures 2.11 and 2.12 show examples of this type of anchorages.

2.1.8 Thermal insulation

The thermal insulation will be dimensioned according to the thermal conditioning rules of the Regulation for Thermal Behaviour Specifications for Buildings

Its attachment to the bracket should be carried out by appropriate mechanical devices.

The bushings for fastening the thermal insulation to the supporting structure will have a head diameter of 90mm, body diameter of 8 to 10mm and a depth suitable for the thickness of the insulation to be installed (see figure 2.13).

2.1.9 Auxiliary Assembly Tools

There are several auxiliary tools that can be used to facilitate assembly work (see figures 2.14 to 2.16).

2.1.10 General Assembly Principles

A stereotomy referred to by the architectural design should be followed. There is no preferred direction for the assembly. The system allows assembly of all intermediate sizes and shapes. Viroc and V-Urban boards can be fitted horizontally or vertically.

2.1.11 Assembly Operations

The assembly of a façade consists of the following operations:

- a. Marking and identification of façade items;
- b. Assembling of support brackets;
- c. Assembling of thermal insulation;
- d. Assembling the profiles/support brackets;
- e. Fastening of boards;
- f. Treatment of singular points.

2.1.12 Assembling the support brackets

Support brackets are fastened to the wall by means of anchors (metal or plastic plugs with metal screws) that will support the metal or wooden profiles where the cladding boards are supported.

The location of these items determines the final position of the supporting profiles, so their positioning must be performed accurately.

2.1.13 Heat Insulation Assembly

These are fastened to the bracket by means of plastic bushings or similar material, usually with a wide head with a length appropriate to the thickness of the insulation.

2.1.14 Assembling the support structure

The support profiles (timber or metal) are fitted vertically according to the specifications and technical drawings presented in this document, duly adapted to the stereotomy of the architectural plan.

2.1.15 Joint Treatment

Viroc and V-Urban boards are arranged so that joints between boards, both vertical and horizontal, have a minimum opening of 5 mm and a maximum of 8 mm. Joints may remain open or closed with a profile for aesthetic reasons (see figures 2.19 and 2.20).

2.1.16 Air Blade Ventilation

The ventilated façade, as recommended in this Technical Dossier, forms a continuous air current between the back of the board and the heat insulation face.

The minimum opening for air current ventilation is 20 mm thick. This distance is important at the bottom of the façade (air inlet) as well as at the top of the façade (air outlet) and must be respected.

At the base of the façade, the opening should be protected by a grid or perforated plate to prevent rodents from entering (see figure 2.18).

At the top of the façade, the opening is protected by a casing that prevents water from entering directly into the air trap.

The air trap must be partitioned, both vertically and horizontally, without ever impeding the free movement of air. The partitioning of the air trap may be made of galvanized steel sheet or aluminium.

2.1.17 On-site cutting of Viroc and V-Urban boards

During the execution of a work, cuts will have to be made in boards. Edges produced by cutting a board will have to be sealed to prevent water from entering by painting or varnishing.

2.1.18 Cleaning the boards after application

When Viroc and V-Urban boards are fitted, water jet cleaning and mild detergent may be applied.

2.1.19 Replacing a board

Removing the existing board and assembling a new board.

If fastening is by screws, it may be necessary to repair the hole area where the old boards were fastened. If the new screws are fastened in another location, no repair is required.

If the fastening is done by gluing the boards, any remaining material that sticks to the existing structure must be cleaned.

2.2 SCREW OR RIVET FASTENING SYSTEM



The fastening system with screws, developed by VIROC Portugal which uses V-Urban boards, has a [Avis Technique](#) and a [QB Certification](#) issued by CSTB (Centre Scientifique et Technique du Bâtiment) in France.



Fastening the boards

Boards, when placed outside, are subject to dimensional variations of the order of +1.0 mm to -3.0 mm per linear metre when sealed and from +1.5 mm to -5.0 mm per linear metre when rough.

The diameter of the holes and the width of the joints should take into account these dimensional variations.

In the outer fastening of the board, the diameter of the holes will be made with a diameter larger than the body of the screw, in order to allow shrinkage and expansion. In the centre area bearings, the diameter of the holes will be made with a diameter equal to that of the body of the screw, securely fastening the board.

Its function is to ensure the proper positioning of the boards and enable dimensional variations without exertion. The fastening is from the fastened points in order to position the board. The moving points will only be executed later, in order to avoid the introduction of tensions as the boards fall.

Fastenings towards the edge of the boards will be made at a distance of 50 to 75 mm.

To apply the rivets, a spacer must be used which is placed on the riveting tool head to allow a gap of 0.5 mm between the board surface and the back of the rivet head. This free space is used to allow for expansion and contraction of the boards. To facilitate the placement of rivets in the centre of the holes, auxiliary tools may be used.

Care should be taken not to over tighten the screws to avoid blocking dimensional variations using depth-limit screwdrivers. Excessive tightening may block the expansion and contraction of the boards and cause corners and edges to rupture.

Timber structure

The structure will be as indicated in chapter 2.1.

Maximum application format on site

The largest dimension of the board to be applied to ventilated façade on wooden structure is 3000x1250 mm (see figure 2.21).

Minimum application format on site

The smallest board size to be applied to ventilated façade is 300 mm. Viroc Portugal does not recommend that the ratio of board length to width be greater than 3 ($L/B \leq 3$). Very long and narrow boards tend to break easily.

Screws

The screws for fastening Viroc and V-Urban boards to a timber structure shall be made of stainless steel of class A2 minimum with a body diameter of 4.8 mm and a 16 mm head. A neoprene washer should be fitted to control the clamping force.

Screws with lower head diameter may be used provided they are fitted with a 16 mm diameter metal washer with neoprene. The pull-out strength of the screw (P_k) must be greater than 2.0 kN for a wood penetration depth of 22 mm (see figure 2.22).

The positioning of the screws for fastening the façade boards should be perpendicular to the surface, with a maximum error of 2.5° and correct tightness, without crushing the neoprene washer (see figure 2.23) and not less than 15 mm from the edge of the wooden beam (see figure 2.24).

SFS Intec and ETANCO manufacture specific façade screws and can provide colour-lacquered screws and washers.

Details

Figures 2.25 to 2.40 show examples of various details and noteworthy areas of the façade.

Metal structure

The structure will be as indicated in chapters 2.1.

Maximum application format on site

The largest dimension of the board to be applied to ventilated façade on metallic structure (galvanized steel or aluminium) is 1500X1250 mm (see figure 2.41).

Minimum application format on site

The smallest board size to be applied to ventilated façade is 300 mm. Viroc Portugal does not recommend that the ratio of board length to width be greater than 3 ($L/B \leq 3$). Very long and narrow boards tend to break easily.

Screws

Bimetal screws should be used, with stainless steel body and carbon steel drill tip. The diameter of the head shall be 16 mm and the body at least 5.5 mm. Smaller head diameter screws may be used provided they are fitted with a 16 mm diameter metal neoprene washer.

The length of the screw must be sufficient to match the thickness of the board with that of the metal profile (see figure 2.42).

The pull-out strength of the screw (P_k) must be greater than 2.0 kN for any type of structure (galvanized steel, stainless steel or aluminium).

The positioning of the screws for fastening the façade boards should be perpendicular to the plane, with a maximum error of 2.5° and with suitable tightness, without crushing the neoprene washer (see figure 2.45) and not less than 10 mm from the edge of the profile (see figure 2.46).

SFS Intec and ETANCO manufacture specific façade screws and can supply them colour-lacquered. Those from other manufacturers may be used provided that they guarantee the same performance.

Rivets

The rivets to be used will consist of an aluminium or stainless-steel body and a stainless-steel pull chuck. The body diameter of the rivet should be at least 4.8 mm and the length must be adequate to secure the board thickness to the frame (see figure 2.43).

The pull-out strength of the rivet (P_k) must be greater than 2.0 kN for any type of structure (galvanized steel, stainless steel or aluminium).

When the boards are fastened with rivets a clamping limiter must be fitted to the rivet tip to allow normal shrinkage and expansion of the board (see figure 2.44).

The positioning of the screws for fastening the façade boards should be perpendicular to the plane, with a maximum error of 2.5° and not less than 10 mm from the edge of the profile (see figure 2.46).

SFS Intec and ETANCO manufacture specific façade rivets and can supply them colour-lacquered.

Details

Figures 2.47 to 2.62 show examples of various details and noteworthy areas of the galvanized steel frame facade.

Figures 2.63 to 2.78 show examples of various details and noteworthy areas of the aluminium frame facade.

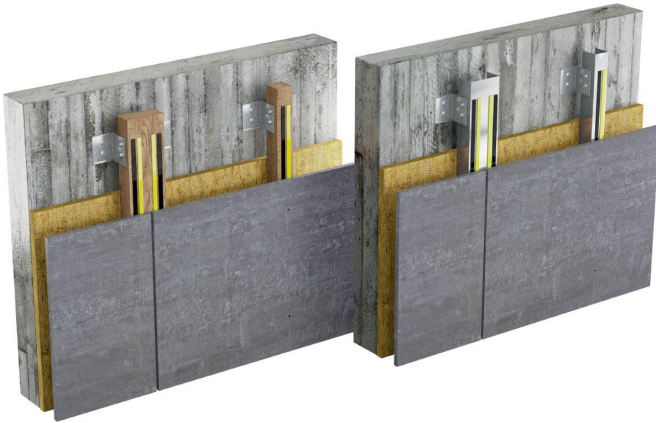
Wind safety check

The Quantifying of wind actions is carried out according to Eurocode 1.

The table of wind resistance loads was based on experimental tests for the most conditioning situation of a board's resistance to wind actions: suction action.

Figure 2.79 shows an example of how the permissible wind pressure is quantified when acting on the boards.

2.3 COMBINED FASTENING SYSTEM



Fastening System

The system used to fasten the boards to the structure consists of a combined system, using screws and glue with mastic adhesive. The fixtures located in the peripheral area, near the edges, will have to allow the normal movements of expansion and retraction of the board, and will be through a gluing system. The fixtures located in the central area of the board will have to block these movements, and must be with screws.

Bonding system with mastic adhesive

Mastic adhesive fastening systems consist of 4 items:

1. Mastic adhesive: Polyurethane, MS Polymer or Hybrid;
2. Double-sided adhesive tape;
3. Adhesion primer to apply to the support structure;
4. Adhesive primer for application to Viroc or V-Urban board.

Sikatak panel system from Sika and Simson panel tack system from Bostik are suitable for this application. The manufacturers of these systems should always be consulted for best advice and correct application (see figures 2.82).

Timber structure

The structure will be as indicated in chapter 2.1.

Maximum application format on site

The largest dimension of the board to be applied to ventilated façade on wooden structure is 3000x1250 mm (see figure 2.80). If the Viroc board is black, the maximum dimension of the board to be applied is 1500x1250 mm (see Figure 2.94).

Minimum application format on site

The smallest board size to be applied to ventilated façade is 300 mm. Viroc Portugal does not recommend that the ratio of board length to width be greater than 3 ($L/B \leq 3$). Very long and narrow boards tend to break easily.

Screws

The screws for fastening the boards to the timber frame shall be stainless steel with a body diameter of 4.8 mm (see figure 2.81).

SFS Intec and ETANCO manufacture specific façade screws and can supply them colour-lacquered.

Details

Figures 2.85 to 2.93 show examples of various details and noteworthy areas.

Metal structure

The structure will be as indicated in chapter 2.1.

The section of the profiles is generally C- or L shaped with a minimum thickness of 1.5 mm. Other profile shapes may be used provided they have equal performance and durability (see figure 2.97).

Maximum application format on site

The largest dimension of the board to be applied to ventilated façade on metallic structure (galvanized steel or aluminium) is 1500x1250 mm (see figure 2.94).

Minimum application format on site

The smallest board size to be applied to ventilated façade is 300 mm. Viroc Portugal does not recommend that the ratio of board length to width be greater than 3 ($L/B \leq 3$). Very long and narrow boards tend to break easily.

Screws

Bimetal screws should be used, with stainless steel body and carbon steel drill tip. The diameter of the screw body shall be at least 5.5 mm.

The length of the screw must be adequate, taking into account the thickness of the board and the support profile (see figure 2.95).

The pull-out strength of the screw (P_k) must be greater than 2.0 kN for any type of structure (galvanized steel, stainless steel or aluminium).

Rivets

The rivets to be used will consist of an aluminium or stainless-steel body and a stainless-steel pull chuck. The diameter of the rivet body shall be at least 4.8 mm.

The length of the rivet must be adequate, taking into account the thickness of the board and the support profile (see figure 2.96).

The pull-out strength of the rivet (P_k) must be greater than 2.0 kN for any type of structure (galvanized steel, stainless steel or aluminium).

SFS Intec and ETANCO manufacture specific façade screws and rivets and can supply them colour-lacquered.

Details

Figures 2.100 to 2.109 show examples of various details and noteworthy areas of the galvanized steel frame façade.

Figures 2.110 to 2.119 show examples of various details and noteworthy areas of the aluminium frame façade.

Implementation procedure

Cleaning of Viroc board

Proceed to clean the Viroc board, removing any dirt, grease or dust by gentle polishing with a floor pad.

Gluing system adhesion primer application

In areas that will be in contact with the gluing system, the adhesion primer should be applied directly to the Viroc board, forming bands approximately 50 mm wide vertically.

Viroc board sealing

In areas adjacent to the application of the adhesion primer on the back face of the board, a varnish or paint will be applied.

Do not apply any type of sealant (varnish or paint) to the sides where the adhesion primer was applied. The adhesive will be glued to these areas, so the presence of a sealant will impair glue.

After curing, the board is turned and sealed on the front face and edges with the number of coats recommended by the manufacturer.

Application of adhesion primer on the structure

After cleaning and degreasing the structure, the adhesion primer will be applied to the support structure.

Board levelling and support

A temporary support is placed on the base where the Viroc board will be placed, which will be used during the gluing operation. This base will be pre-levelled and, after the board is glued, is removed.

Application of double-sided adhesive tape on the structure

A double-sided adhesive tape will be applied to the support structure after the adhesion primer has cured.

The double-sided adhesive tape should be close to the edges of the board to prevent pressing the board against the frame during the gluing operation and from crushing the mastic adhesive into the visible area of the joint.

Application of mastic adhesive on the structure

In parallel to the double-sided adhesive tape, at a distance of not more than 1 cm, a mastic bead of adhesive with a suitable nozzle will be applied, usually with a V-shaped cut-out.

Viroc board application

Immediately after the mastic bead of adhesive has been applied, the protective tape of the double-sided adhesive tape is removed. The Viroc board, previously sealed, is supported on the support base and against the structure. The areas of the board glued to the frame are pressed to ensure perfect contact with the adhesive (see figures 2.83, 2.98 and 2.110).

Levelling wedges and temporary supports

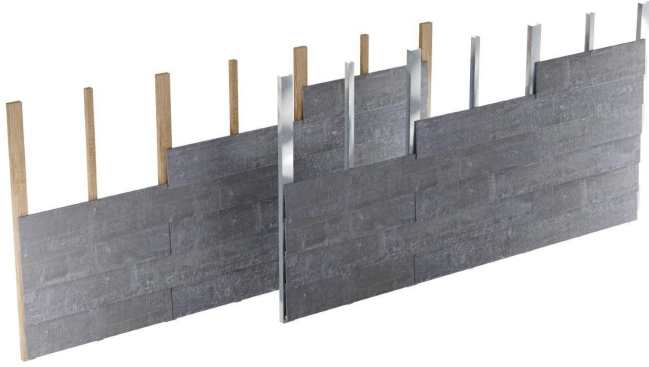
When boards are placed in sun-exposed areas, they may tend to warp the edges immediately after application, while the mastic is fresh and flexible.

In these situations, while the mastic is still fresh, the tape may not be strong enough to prevent this deformation from occurring. To avoid this warping, additional shims (8 to 10 per board) should be bolted to the support structure in the joint area.

The shims should only be removed 3 days after application, by which time the mastic is already solidified and sufficiently strong to withstand all loads (see figures 2.84 and 2.99).

Note: Double-sided adhesive tape has two functions: to guarantee a thickness of 3 mm between the frame and the board and to support its weight while the mastic adhesive is fresh and without resistance. The tape is longer required when the adhesive strand hardens and is attached.

2.4 CLIN SYSTEM



Fastening System

The Viroc facades with the CLIN system are produced by partially overlapping the Viroc board boards with a thickness of 16 mm. They are fastened to the support structure by screws and bonded with mastic adhesive.

Alternatively, the mastic adhesive may be replaced by VHG 3M double-sided adhesive tape.

The support structure of the façade may be made of timber profiles or metal profiles. The distance between support profiles shall be a maximum distance of 625 mm (see figure 2.120).

CLIN System Viroc board format

The standard dimensions of the CLIN System boards are 1250x300 mm (see figure 2.121).

Upon request, the visible edge of the board may be bevelled (see figure 2.122).

Screws

The screws for fastening the Viroc boards to the frame should be suitable for timber or metal and made of galvanized steel with a screw body diameter of 4.8 mm (see figure 2.123).

Timber structure

The wooden structure will be as indicated in chapter 2.1.

Metal structure

The metal structure will be as indicated in chapter 2.1.

The section of the profiles is generally C- or L-shaped with a minimum thickness of 1.5 mm. Other profile shapes may be used provided they have equal performance and durability (see figure 2.131).

Assembly sequence

The CLIN system is installed from the bottom up. In the first row, a 40x16 mm Viroc slat is placed, which will serve as the basis for the start of the façade and guarantee the same inclination of the initial boards. A wooden slat may be used as an alternative to the Viroc slat.

Boards should be arranged so that the vertical joints are misaligned. These joints shall have a maximum opening of 3 mm and be located over the frame features (see figure 2.120).

Details

Figures 2.124 to 2.130 show examples of various details and noteworthy areas of the timber frame facade.

Figures 2.133 to 2.138 show examples of various details and noteworthy areas of the galvanized steel frame facade.

Figures 2.139 to 2.144 show examples of various details and noteworthy areas of the aluminium frame facade.

2.5 UNPAINTED OR UNVARNISHED VENTILATED FAÇADE



VIROC Portugal always recommends that Viroc boards be varnished or painted when they are used as cladding for facades, forming a ventilated facade.

This chapter addresses the application of unvarnished and unpainted Viroc boards to ventilated facades.

Fastening the boards

The boards are fastened with 16 mm diameter wide head screws or rivets. Screws with other head diameters may be used provided that these screws are fitted with a washer with a diameter of 16 mm.

The boards are fastened in the same way as that described previously in the Façade System - Fastening with screws in chapter 2.1.

Maximum application format on site

The largest dimension of the board to be applied to ventilated façade without the board being varnished is 1250x600 mm (see figure 2.144).

Minimum application format on site

The smallest board size to be applied to ventilated façade is 300 mm. Viroc Portugal does not recommend that the ratio of board length to width be greater than 3. Very long and narrow boards tend to break easily.

Timber structure

The structure will be as indicated in chapter 2.1.

Screws

The screws for fastening Viroc and boards to timber frame shall be made of stainless steel of class A2 minimum with a body diameter of 4.8 mm and a 16 mm head. A neoprene washer should be fitted to control the clamping force.

The pull-out strength of the screw (P_k) must be greater than 2.0 kN for a wood penetration depth of 22 mm (see figure 2.145).

The positioning of the screws for fastening the façade boards should be perpendicular to the plane, with a maximum error of 2.5° and with suitable tightness without crushing the neoprene washer (see figure 2.23).

SFS Intec and ETANCO manufacture specific façade screws and can provide colour-lacquered screws and washers.

Details

All details of the bolted fastened façade system apply. Figures 2.25 to 2.40 show examples of various details and noteworthy areas of the façade.

Galvanized steel structure

The structure will be as indicated in chapters 2.1.

Screws

Bimetal screws should be used, with stainless steel body and carbon steel drill tip. The diameter of the head shall be 16 mm and the body at least 5.5 mm. Smaller head diameter screws may be used provided they are fitted with a 16 mm diameter metal neoprene washer.

The length of the screw must be adequate to match the thickness of the board with that of the metal profile (see figure 2.146).

The pull-out strength of the screw (P_k) must be greater than 2.0 kN for any type of structure (galvanized steel, stainless steel or aluminium).

The positioning of the screws for fastening the façade boards should be perpendicular to the plane, with a maximum error of 2.5° and with suitable tightness, without crushing the neoprene washer (see figure 2.45) and not less than 15 mm from the edge of the profile (see figure 2.46).

SFS Intec and ETANCO manufacture specific façade screws and can supply them colour-lacquered.

Rivets

The rivets to be used will consist of an aluminium or stainless-steel body and a stainless-steel pull chuck. The body diameter of the rivet should be at least 4.8 mm and the length must be adequate to secure the board thickness to the frame (see figure 2.147).

The pull-out strength of the rivet (P_k) must be greater than 2.0 kN for any type of structure (galvanized steel, stainless steel or aluminium).

When the boards are fastened with rivets, a clamping limiter must be fitted to the rivet tip to allow normal shrinkage and expansion of the board (see figure 2.148).

SFS Intec and ETANCO manufacture specific façade rivets and can supply them colour-lacquered.

Details

Full details of the bolted fastened façade system are applicable. Figures 2.47 to 2.62 show examples of various details and noteworthy areas of the galvanized steel frame facade.

Aluminium Structure

Due to the high coefficient of expansion, aluminium structures cannot be used.

Wind safety check

The Quantifying of wind actions is carried out according to Eurocode National Annex 1 (RSA).

The table of wind resistance loads was based on experimental tests for the most conditioning situation of a board's resistance to wind actions: suction action.

Figure 2.79 shows an example of how the resistance of a board to the permissible pressure of wind action is quantified.

Drips

With the wetting and drying cycles of the boards due to the action of rain, there is a possibility that the constituent salts of the cement migrate to the surface forming efflorescence's. These efflorescence's may form streams, salt streaks on the boards with water dripping.

These salt run-offs on the surface of the boards can be minimized if the boards have been polished when applied and there is no run-off from the roof rainwater directly onto the boards.

Warping

Since the board is not sealed, there is a possibility that it will bend out of the plane, forming concave or convex concavities with a maximum dimension of 5 mm.

Claims

In this uncoated Viroc board application system, no complaints will be accepted due to board salt run-offs or warping.

3. WALLS



Viroc boards can be used to make partition walls or interior wall cladding. When applied to interior partition walls, they may be varnished, painted or unfinished (rough). It is the installer's responsibility to check the safety conditions of the support structure, namely the distance between supports and the width of the supports for proper installation of the boards.

Viroc boards undergo slight dimensional variations as the relative humidity and temperature vary. Viroc boards are expected to accommodate a maximum dimensional range from -0.1% (shrinkage) to + 0.05% (swelling) in an interior application.

Board fastening must take into account the distances as shown in figure 3.1.

Screws, when placed too close to the edges, may cause the board to rupture.

Features that make up the partition walls and wall cladding

- Cladding boards;
- Support structure of the boards, which may be made of timber or metal and their fastening elements;
- Screws or rivets for fastening the boards to the support structure;
- Sound insulation

3.1 General specifications

Application

Interior

Recommended thicknesses

10 mm in dry indoor areas;

12 mm in humid indoor areas (bathrooms and kitchens).

Maximum dimension of boards

3000x1250 mm

Any intermediate dimensions that are obtained by cutting the standard dimension board are possible.

Dimensional tolerances of boards

Thickness: 10 mm \pm 0.7 mm; 12 mm \pm 1.0 mm

Cutting tolerances

Length and width: \pm 3 mm

Brackets: \leq 2 mm/m

Edge linearity: \leq 1,5 mm/m

3.2 Fastening elements

The boards by the type of structure can be fastened with screws, nails, rivets or glued with mastic.

Screws

Timber frame screws shall have a minimum anchor length (nailed depth to timber) of 20 mm (see figure 3.2).

When the support structure is made of metal, in addition to the proper length of the screw body, the drill bit must be of a size adequate enough to pierce the thickness of the metal to which it will be attached (see figure 3.3).

When fastening with screws, the maximum distance between screws should not exceed 625 mm.

Other types of screws may be used provided they have equal performance and durability.

Nails

With a timber structure, galvanized steel or stainless-steel nails can be used to fix the boards to the structure.

There are headless nails that are virtually invisible (see figure 3.4).

When fastening with nails, the distances between fixings should not exceed 625 mm in the horizontal direction and 400 mm in the vertical direction.

Nails should be applied using a suitable air gun. Before definitive fastening of the boards is initiated, a series of tests must be performed to adjust the proper pressure and force for proper nailing (see figure 3.5).

Rivets

With a metal frame, rivets with aluminium body and stainless-steel nail can be used to fix the boards to the frame (see figure 3.6).

Rivets may be applied with a manual, electric or compressed air riveting tool.

Mastic adhesive

Mastic glue systems can be used to glue Viroc boards to wooden or metal structures. This type of fastening consists of:

- Adhesion primer to apply to the support structure;
- Adhesive primer for Viroc board.
- Double-sided adhesive tape;
- Mastic adhesive.

The adhesive tape is 3 mm thick and functions to fasten the boards while the mastic is cool, i.e. without resistance. This ensures a thickness of 3 mm of the bead without crushing it.

Sika and Bostik have suitable mastics for this application. The manufacturers of these systems should always be consulted for best advice and correct application (see figure 3.7).

VHB duct tape

A variant to the mastic glue system is the use of double-sided VHB duct tape.

The tape must be applied according to the manufacturer's instructions in order that it sticks to the surfaces without peeling off.

Dual-Lock duct tape

For boards that need to be removable, they can be fastened with 3M Dual-Lock adhesive tape (see figure 3.8).

3.3 Partition Walls

Support structure

Viroc boards can be supported on wooden mullions or galvanized steel profiles. Figures 3.9 and 3.10 show the types of wooden beams and galvanized steel sections that can be used. Other types of sections may be used provided they offer equal performance and durability.

The support structure must have a sufficient width to allow the correct positioning of the fastenings, respecting the minimum distances between the screws and the edge of the boards. In addition, it must be able to absorb small positioning errors.

Note that in the joint area between boards, when the structure is made of galvanized steel, it is normal to duplicate the profiles in this area to respect the distance between the screws and the edges.

The maximum clearance between support elements is 625 mm, their alignment must be verified between adjacent elements and should not differ by more than 5 mm.

In a timber support structure, and according to EN 338, the Resistance Category is at least C18.

In a galvanized steel frame in accordance with EN 10327, the profile class is at least DX51D (Z +) and the steel sheet thickness 1 mm.

The design of these elements will be carried out taking into account that the deformations caused by their use cannot jeopardize the normal functioning of the wall. The deformation shall not exceed the L/300 limit of the gap between the fastening of these elements.

The profiles used in the plasterboard walls, although of identical geometric shape, are not suitable for supporting the Viroc boards.

Horizontal section

Figures 3.11 and 3.12 show horizontal sections of timber and galvanized steel partition walls respectively. Figure 3.13 represents a vertical section of a wooden and galvanized steel structure.

3.4 Wall cladding

Support structure

The support structure of the wall cladding may be made of timber or galvanized steel profiles. Figures 3.9 and 3.14 show the standard sections of the profiles used. Other profiles may be used provided they maintain equal strength and durability.

The structure that will support Viroc boards must be aligned and properly straightened. If the wall to be covered is very misaligned, it may be necessary to straighten the support structure using support brackets, forming a structure similar to that of the ventilated facades (see chapter 2).

The support structure must be wide enough to allow the correct positioning of the fastenings, respecting the minimum distances between the screws and the edge of the boards and be able to absorb small positioning errors.

The maximum clearance between support elements shall be 625 mm, their alignment shall be verified between adjacent elements and shall not differ by more than 5 mm.

In a timber support structure, and according to EN 338, the Resistance Category is at least C18.

In a galvanized steel frame in accordance with EN 10327, the profile class is at least DX51D (Z +) and the steel sheet thickness 1 mm.

The design of these elements will be carried out taking into account that the deformations caused by their use cannot jeopardize the normal functioning of the wall. The deformation shall not exceed the L/300 limit of the gap between fixings of these elements.

Horizontal section

Figures 3.15 and 3.16 show horizontal sections of timber and galvanized steel partition walls respectively. Figure 3.17 represents a vertical section of a wooden and galvanized steel structure.

3.5 Joints between boards

The joints between boards should guarantee a gap of 2 to 3 mm and can be filled with a silicone or mastic bead (see figures 3.18 and 3.19).

3.6 Board Edges

The edges of the boards can be machined in a bevel shape of 2 to 3 mm (see figure 3.20).

3.7 Soundproofing

Viroc Portugal has several partition wall solutions made with Viroc boards, which are tested for their acoustic performance.

Figures 3.21 to 3.29 show the tested wall settings and the results obtained, namely the airborne sound insulation index R_w according to ISO 140-3.

Wall	Structure		$R_w(C;Ctr)$ [dB]
1+1	Simple	C90	47(-4;-11)
2+1	Simple	C90	47(-1;-1)
2+2	Simple	C90	55(-1;-5)
1+1	Double	C70+40+C70	59(-3;-11)
2+1	Double	C70+40+C70	59(-3;-11)
3+1	Double	C70+40+C70	61(-4;-11)
2+2	Double	C70+40+C70	62(-2;-7)
3+2	Double	C70+40+C70	64(-2;-7)
3+1+2	Double	C70+40+C70	65(-2;-7)

3.8 Fire resistance

Viroc Portugal has two fire resistant wall solutions that have been tested.

Both solutions have been produced according to the European standard EN 13501-2.

Figures 3.30 to 3.33 show the tested wall settings and the results obtained.

Wall	Fire resistance
150 mm	EI90
200 mm	EI120

3.9 Special finishes

Partition walls and cladding made of Viroc boards may be busbarred for a continuous appearance or covered with ceramic tiles.

The materials for this type of finish will have to be adapted to the dimensional variations that the board has, and be highly flexible.

MAPEI, with the support of Viroc Portugal, has developed an integral busbar solution with painted finish or ceramic glue, using a special mortar. For further information, contact Viroc Portugal or MAPEI.

4. FLOORINGS

Due to their strength, Viroc boards can be used as a support feature and finish for floors, supported by beams or as a covering material for a new or existing floor.

When supported by wooden or metal beams, the maximum spacing between them shall not exceed 600 mm.

The support of a roof supported by beams with Viroc boards must respect the same conditions as a floor.

It is the installer's responsibility to check the safety conditions of the support structure, namely the distance between supports and the width of the supports for proper installation of the boards.

Viroc boards undergo slight dimensional variations as the relative humidity and temperature vary. Viroc boards are expected to accommodate a maximum dimensional range from -0.1% (shrinkage) to + 0.05% (swelling) in an interior application.

4.1 Supported on Beams



Application

Interior

Thickness

Minimum 18 mm

Maximum dimension of boards

3000x1250 mm.

Any intermediate dimensions that are obtained by cutting the standard dimension board are possible.

Cutting tolerances

Length and width: ± 3 mm

Brackets: ≤ 2 mm/m

Edge linearity: ≤ 1.5 mm/m

4.1.1 Screw Location

Fastening the boards with screws near the edges must take into account the minimum distances as shown in figure 4.1.

A screw placed too close to the edge may cause the board to rupture.

The joints between boards should be misaligned as shown in figure 4.2.

4.1.2 Support structure

Viroc boards can be supported on a wooden or metal structure. The boards should be positioned so that their longitudinal length is perpendicular to the direction of the support structure. The structure that will support Viroc boards must be aligned and properly straightened.

The support structure must be wide enough to allow the correct positioning of the fastenings, respecting the minimum distances between the screws and the edge of the boards and be able to absorb small positioning errors (see figure 4.6)

The maximum clearance between support elements (openings) shall be 600 mm. Their alignment should be checked between adjacent elements and should not differ by more than 5 mm.

4.1.3 Fastening elements

The boards can be fastened with screws or glued with a mastic glue system.

Screws

When the support structure is made of timber, the screws should have a minimum anchoring length (depth embedded in the timber) of 30 mm.

When the support structure is metal, in addition to the proper length of the screw body, the drill bit must be adequate enough in size to pierce the thickness of the metal to which it will attach.

Figures 4.3 and 4.4 show screws that can be used to fix Viroc boards.

SFS Intec and ETANCO have suitable screws. Those from other manufacturers may be used provided that they guarantee the same performance.

Mastic

Mastic glue systems can be used to bond to glue Viroc boards to wooden or metal structures.

This type of fastening consists of:

- Adhesion primer to apply to the support structure;
- Adhesive primer for Viroc board.
- Double-sided adhesive tape;
- Mastic adhesive.

The adhesive tape is 3 mm thick and has the function of fastening the boards while the mastic is cool, i.e. flexible. This ensures a 3 mm thickness of the bead without being crushed (see figures 4.9 and 4.10).

Sika and Bostik have suitable systems for this application. The manufacturers of these systems should always be consulted for best advice and correct application (see figure 4.5).

4.1.4 Safety Check

The safety check of a board is performed according to Eurocode 1 and 5 requirements, taking into account the National Application Documents (RSA).

In verifying the Safety of Ultimate Limit States, the following amounts shall be adopted:

- Specific weight (γ), 13.5 kN/m³;
- Density (ρ), 1350 Kg/m³;
- Typical flexural breaking stress ($f_{m,k}$), 9.0 MPa;
- Typical tensile breakage stress ($f_{v,k}$), 1.0 MPa;
- Partial Safety Coefficient (γ_M), 1.3
- Modification factor (k_{mod})
 - Permanent actions, $k_{mod} = 0.30$
 - Long-term actions, $k_{mod} = 0.45$
 - Mid-term actions, $k_{mod} = 0.65$
 - Short-term actions, $k_{mod} = 0.85$

$$M_{Rd} = k_{mod} \cdot W \cdot f_{m,k} / \gamma_M ; V_{Rd} = k_{mod} \cdot A_v \cdot f_{v,k} / \gamma_M$$

In verifying the Safety of Ultimate Limit States, the following amounts shall be adopted:

- Elastic modulus (E_m), 4500 MPa;
- Deformation factor (k_{def}), 2.25
- Long-term deformation, $\delta_{\infty} = \delta_{instantaneous} \times (1+k_{def})$

The deformation of the boards cannot affect the normal functioning of flooring. Maximum deformation due to wind loads (pressure or depression) shall not exceed the L/250 limit of the gap between support fixings.

Figures 4.11 and 4.12 show the example of a safety check.

Table 5 shows a Load Chart for quick flooring safety check.

4.1.5 Special finishes

Flooring with Viroc boards can be finished with lamparquet timber covering, parquet, hardwood or any type of parquet or ceramic finish.

The materials for this type of finishing will have to be adapted to the dimensional variations of the board, and need to have a lot of elasticity.

Sika and Bostik have suitable elastic sealants for this application. The manufacturers of these systems should always be consulted for best advice and correct application.

4.2 Resting on continuous support



Application

Interior

Thickness

Minimum 12 mm

Maximum dimensions

3000x1250 mm.

Any intermediate dimensions that are obtained by cutting the standard dimension board are possible.

Cutting tolerances

Length and width: ± 3 mm

Brackets: ≤ 2 mm/m

Edge linearity: ≤ 1.5 mm/m

4.2.1 Support structure

Viroc board can be supported on a new or existing continuous support. In both situations, the support should be level and in good condition to support the new coating. Surfaces must be clean of dirt or grease to ensure good adhesion.

4.2.2 Fastening elements

The boards will be fastened to the support by means of an elastic polyurethane mortar, continuously spread over the surface with a notched trowel (see figures 4.13 and 4.14).

Sika and Bostik have suitable mortars for this application. The manufacturers of these systems should always be consulted for best advice and correct application.

4.3 Surface treatment

Boards shall be protected with scratch-resistant paint or varnish suitable for floors.

Before applying the varnish on the boards, the surface must be completely clean and dry, free of grease, dust or salts. Cleaning can be performed by polishing with floor pads. VIROC Portugal has suitable pads which can be supplied upon request. Alternatively, surface cleaning may be carried out by sanding with a fine grain pad of 120 or more.

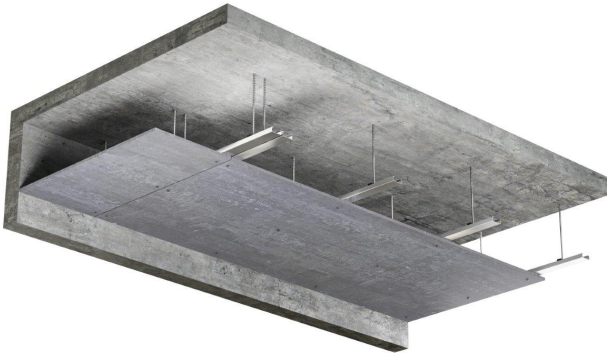
4.4 Joints between boards

The joints between boards should have a gap of 2 to 3 mm and can be filled with a silicone or mastic bead (see figures 4.7).

4.5 Board Edges

The edges of the boards can be machined in a bevel shape of 2 to 3 mm (see figure 4.8).

5. SUSPENDED CEILINGS



Viroc boards can be used as cladding for a suspended ceiling. The support structure will be made of galvanized steel or timber, with equidistant supports, which should not exceed 600 mm.

It is the installer's responsibility to check the safety conditions of the support structure, namely the distance between supports and the size of the supports for the correct installation of the boards.

Viroc boards undergo slight dimensional variations subject to changes in humidity and temperature. It is expected that the Viroc board will have to accommodate a maximum dimensional variation from -0.1% (shrinkage) to + 0.05% (swelling) in an indoor application and -0.3% (shrinkage) to + 0.1% (swelling) in an outdoor application.

The fastening of the boards will have to take into account the distances as shown in figure 5.1.

5.1 General specifications

Application

Interior and exterior

Thickness

10 mm in dry indoor areas;

12 mm in exterior areas or humid indoor areas, such as bathrooms and kitchens.

Maximum dimensions

3000x1250 mm.

Any intermediate dimensions that are obtained by cutting the standard dimension board are possible.

Cutting tolerances

Length and width: ± 3 mm

Brackets: ≤ 2 mm/m

Edge Linearity: ≤ 1.5 mm/m

5.2 Fastening elements

The boards are fastened with screws or rivets suitable for galvanized steel or timber structure.

Figures 5.2 and 5.3 show screws and rivets that can be used for fastening Viroc boards to ceilings.

5.3 Support structure

5.3.1 Flexible support structure

The flexible support system consists of a flexible suspended structure, with C-shaped profiles which are suspended through threaded rods anchored to the ceiling. The connection between the threaded rods and the suspension profiles is made with 1 mm thick galvanized steel T-47-

type pivots, similar to those used in the plasterboard suspended ceiling structures (see figures 5.4, 5.5 and 5.6).

Galvanized steel support C-profiles must be DX51D (Z+) Category in compliance with EN10327 standard and have a minimum thickness of 1 mm.

The profiles used in plasterboard suspended ceilings, although of identical geometric shape, are not suitable to support the weight of the Viroc boards.

The structural features should always be directed perpendicular to the largest dimension of the board, with equidistant spacing. The distance between the support profiles should never exceed 600 mm (see figure 5.1).

The support structure in the area between board joints will need to be doubled to allow for effortless expansion and contraction of the boards, the board functioning as an independent swing (see figures 5.7 and 5.8).

If the structure in the area of the joints is not duplicated, there is a possibility that the boards will break in the area of the fastenings near the edges.

Vertical cut

Figures 5.8 and 5.9 show longitudinal and transverse sections in the direction of the board acting as the suspended ceiling.

5.3.2 Rigid support structure

The rigid support structure can be made with metal or wooden profiles, attached to the ceiling through rigid features such as support brackets.

Timber structure

The structure will be as indicated in chapter 2.1.

The section of the wooden beams is rectangular with a minimum dimension of 40x50 mm (see Figure 5.10).

Metal structure

The structure will be as indicated in chapter 2.1.

Other profile shapes may be used provided they are equal in performance and durability (see figures 5.11 5.12 and 5.13).

Support brackets

The support structure can be fastened by means of galvanized steel or aluminium frames, depending on the type of structure. Galvanized steel brackets can be used in wooden frame or galvanized steel frame, while aluminium brackets can be used with aluminium profiles.

The brackets shall comply with the requirements of Chapter 2.1.

Board installation

Since the fastening structure is rigid and does not allow the normal dimensional variations of the boards, a hole must be drilled in the boards in order to allow this behaviour and to maintain its integrity.

In the peripheral fastenings of the board, the diameter of the holes will be larger than that of the screw body, allowing for shrinkage and expansion. In the central bearing, the diameter of the holes will be the same as that of the body of the screw, securing the board rigidly.

Its function is to ensure the proper positioning of the boards and enable dimensional variations without applying force. Fastening is applied from the fixed points in order to position the board. The moving points will only be executed later, in order to avoid the introduction of tensions.

Fastenings near the periphery of the boards will be made at a distance of 50 to 75 mm.

Care should be taken not to over tighten the screws in order to avoid blocking dimensional variations using depth-limit screwdrivers. Excessive tightening may block the expansion and contraction of the boards and cause corners and edges to rupture.

When fastening with rivets, it is necessary to use a spacer, which is placed on the rivet head to leave a gap of 0.5 mm between the board surface and the back of the rivet head. This free space is used to create clearance and allow dimensional variations of the boards. In

order to facilitate the placement of the rivets in the centre of the holes, auxiliary tools may be used to centre the holes (see figure 5.14).

Vertical cut

Figures 5.15, 5.16 and 5.17 show vertical sections of the various types of rigid structure.

5.4 Surface treatment

Exterior boards should be protected with paint or varnish.

Before applying the varnish on the boards, the surfaces must be completely clean and dry, without grease, dust or salts. Cleaning can be performed by polishing with floor pads. VIROC Portugal has suitable pads which you can supply on request. Alternatively, surface cleaning may be carried out by sanding with a fine grain pad of 120 or more.

5.5 Joints between boards

The joints between boards should have a gap of 5 mm (see figures 5.7, 5.15, 5.16 and 5.17).

TABLES

Applications Thickness

Application	Thicknesses (mm)								
	8	10	12	16	19	22	25	28	32
Facades			•	•					
Walls and wall cladding		•	•						
Suspended ceilings		•	•						
Floor covering			•	•					
Flooring					•	•	•	•	•
Furniture	•	•	•	•	•	•	•	•	•

Table 1 - Summary of Applications by Thickness

Wind load table

Facade system with board fastening with screws and rivets

Maximum permissible pressure on boards when subjected to wind action (suction)

		Horizontal distance between screws 400 mm (16")								
Thickness of the panel	(HxV)	Wind load pressure	Vertical distance between screws							
			300mm kN/m2	12" psf	400mm kN/m2	16" psf	500mm kN/m2	20" psf	600mm kN/m2	24" psf
12 mm 0.472"	2 x 2		3.5	73	2.8	58	2.3	49	2.0	42
	2 x 3		3.6	75	2.6	53	2.0	42	1.6	34
	2 x N		3.7	78	2.7	57	2.2	45	1.8	37
	3 x 2		3.1	65	2.6	53	2.2	46	2.0	41
	N x 2		3.4	71	2.7	57	2.3	49	2.0	42
	3 x 3		3.0	62	2.2	46	1.7	36	1.4	30
	3 x N		3.2	66	2.4	49	1.9	39	1.6	33
	N x 3		3.2	67	2.4	49	1.9	39	1.6	32
16 mm 0.630"	2 x 2	7.3	152	5.8	121	4.8	101	4.2	87	
	2 x 3	7.6	159	5.4	113	4.2	88	3.5	72	
	2 x N	7.8	163	5.8	121	4.6	96	3.8	79	
	3 x 2	6.6	138	5.4	113	4.6	97	4.1	86	
	N x 2	7.1	149	5.8	121	4.9	103	4.3	90	
	3 x 3	3.3	68	2.4	50	1.9	40	1.6	33	
	3 x N	3.5	73	2.6	54	2.1	43	1.7	36	
	N x 3	3.5	74	2.6	54	2.1	43	1.7	36	

Table 2 - Permissible pressure, 400 mm spacing between horizontal screws

Horizontal distance between screws 500 mm (20")										
Thickness of the panel	(HxV)	Wind load pressure	Vertical distance between screws							
			300mm kN/m2	12" psf	400mm kN/m2	16" psf	500mm kN/m2	20" psf	600mm kN/m2	24" psf
12mm 0.472"	2 x 2		2.9	61	2.3	49	1.9	40	1.7	35
	2 x 3		3.0	63	2.2	46	1.7	35	1.4	29
	2 x N		3.0	63	2.3	49	1.8	38	1.5	31
	3 x 2		2.5	51	2.0	42	1.7	35	1.5	31
	N x 2		2.7	56	2.2	45	1.8	38	1.6	33
	3 x 3		2.3	49	1.7	36	1.4	29	1.1	24
	3 x N		2.5	53	1.9	39	1.5	31	1.2	26
	N x 3		2.6	53	1.9	39	1.5	31	1.2	26
16mm 0.630"	2 x 2		6.1	126	4.8	101	4.0	84	3.5	72
	2 x 3		6.3	132	4.6	97	3.6	75	2.9	61
	2 x N		6.2	130	4.9	103	3.9	81	3.2	66
	3 x 2		5.2	108	4.2	88	3.6	75	3.2	66
	N x 2		5.7	118	4.6	96	3.9	81	3.4	70
	3 x 3		2.6	54	1.9	40	1.5	32	1.3	26
	3 x N		2.8	58	2.1	43	1.6	34	1.4	28
	N x 3		2.8	59	2.1	43	1.6	34	1.4	28

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

Horizontal distance between screws 600 mm (24")										
Thickness of the panel	(HxV)	Wind load pressure	Vertical distance between screws							
			300mm kN/m2	12" psf	400mm kN/m2	16" psf	500mm kN/m2	20" psf	600mm kN/m2	24" psf
12mm 0.472"	2 x 2		2.5	52	2.0	42	1.7	35	1.4	30
	2 x 3		2.5	52	2.0	41	1.5	31	1.2	25
	2 x N		2.5	51	2.0	42	1.6	33	1.3	27
	3 x 2		2.0	42	1.6	34	1.4	29	1.2	25
	N x 2		2.2	46	1.8	37	1.5	31	1.3	27
	3 x 3		1.9	40	1.4	30	1.1	24	0.9	20
	3 x N		2.1	43	1.6	32	1.2	26	1.0	21
	N x 3		2.1	44	1.6	33	1.2	26	1.0	21
16mm 0.630"	2 x 2		5.2	108	4.2	87	3.5	72	3.0	62
	2 x 3		5.2	108	4.1	86	3.2	66	2.6	53
	2 x N		5.1	107	4.3	90	3.4	70	2.8	58
	3 x 2		4.3	89	3.5	72	2.9	61	2.6	53
	N x 2		4.7	98	3.8	79	3.2	66	2.8	58
	3 x 3		2.1	44	1.6	33	1.3	26	1.0	22
	3 x N		2.3	48	1.7	36	1.4	28	1.1	24
	N x 3		2.3	49	1.7	36	1.4	28	1.1	24

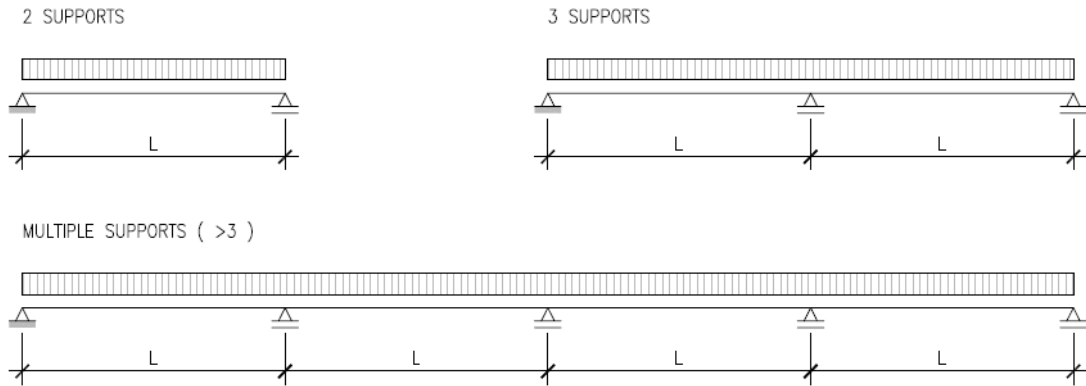
Table 4 - Permissible pressure, 600 mm spacing between horizontal screws

Uniform Load Chart

Ultimate Strength: 9 N/mm² / 1300 psi

Modulus of Elasticity: 4500 N/mm² / 652 700 psi

Safety factor: 3



Panel Thickness		Span (L)		2 or 3 Supports				Multiple Supports			
				Max. Load		L/250		Max. Load		L/250	
mm	inch	m	inch	kN/m ²	psf	kN/m ²	psf	kN/m ²	psf	kN/m ²	psf
18 (*)	0.709	0.3	12	14.2	296	14.2	296	16.6	346	16.6	346
		0.4	16	7.9	164	7.9	164	9.2	193	9.2	193
		0.5	20	4.9	103	4.9	103	5.8	121	5.8	121
		0.6	24	3.4	70	2.9	60	4.0	83	4.0	83
19	0.748	0.3	12	15.8	330	15.8	330	18.5	386	18.5	386
		0.4	16	8.8	183	8.8	183	10.3	215	10.3	215
		0.5	20	5.5	115	5.5	115	6.5	136	6.5	136
		0.6	24	3.8	78	3.4	71	4.4	93	4.4	93
21 (*)	0.827	0.3	12	19.3	403	19.3	403	22.6	473	22.6	473
		0.4	16	10.7	224	10.7	224	12.6	263	12.6	263
		0.5	20	6.8	141	6.8	141	8.0	166	8.0	166
		0.6	24	4.6	96	4.6	96	5.4	114	5.4	114
22	0.866	0.3	12	21.2	443	21.2	443	24.8	519	24.8	519
		0.4	16	11.8	247	11.8	247	13.8	289	13.8	289
		0.5	20	7.4	156	7.4	156	8.8	183	8.8	183
		0.6	24	5.1	106	5.1	106	6.0	125	6.0	125
24 (*)	0.945	0.3	12	25.3	528	25.3	528	29.6	618	29.6	618
		0.4	16	14.1	294	14.1	294	16.5	345	16.5	345
		0.5	20	8.9	186	8.9	186	10.4	218	10.4	218
		0.6	24	6.1	127	6.1	127	7.2	149	7.2	149
25	0.984	0.3	12	27.4	573	27.4	573	32.1	671	32.1	671
		0.4	16	15.3	319	15.3	319	17.9	374	17.9	374
		0.5	20	9.7	202	9.7	202	11.4	237	11.4	237
		0.6	24	6.6	138	6.6	138	7.8	162	7.8	162
26	1.024	0.3	12	29.7	620	29.7	620	34.8	726	34.8	726
		0.4	16	16.5	346	16.5	346	19.4	405	19.4	405
		0.5	20	10.5	219	10.5	219	12.3	257	12.3	257
		0.6	24	7.2	150	7.2	150	8.4	176	8.4	176
28	1.102	0.3	12	34.5	720	34.5	720	40.3	843	40.3	843
		0.4	16	19.2	401	19.2	401	22.5	471	22.5	471
		0.5	20	12.2	254	12.2	254	14.3	298	14.3	298
		0.6	24	8.3	174	8.3	174	9.8	205	9.8	205
32	1.260	0.3	12	45.1	941	45.1	941	52.8	1102	52.8	1102
		0.4	16	25.2	526	25.2	526	29.5	616	29.5	616
		0.5	20	16.0	333	16.0	333	18.7	391	18.7	391
		0.6	24	10.9	229	10.9	229	12.9	269	12.9	269

Table 5 – Uniform load chart

FIGURES

Viroc board Unsanded and Sanded



Figure 1.1 – Viroc Grey, Unsanded/Sanded



Figure 1.2 – Viroc Black, Unsanded/Sanded



Figure 1.3 – Viroc White, Unsanded/Sanded



Figure 1.4 – Viroc Yellow, Unsanded/Sanded

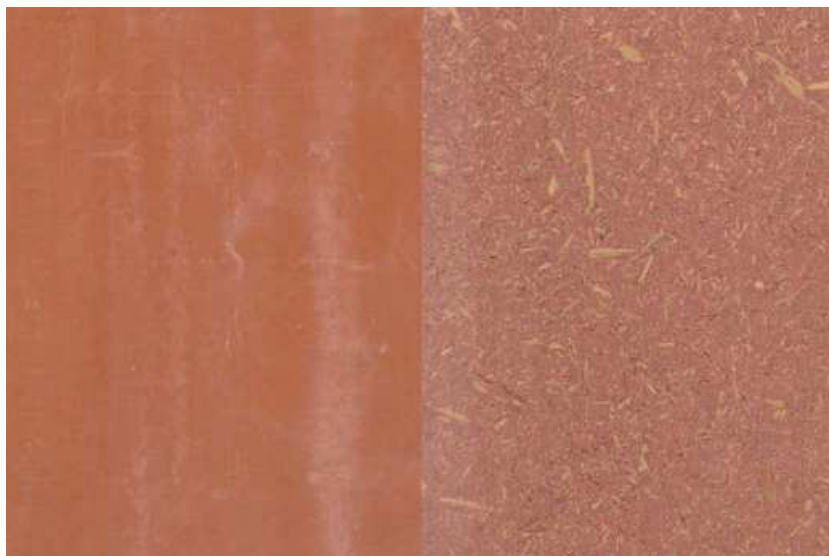


Figure 1.5 – Viroc Red, Unsanded/Sanded

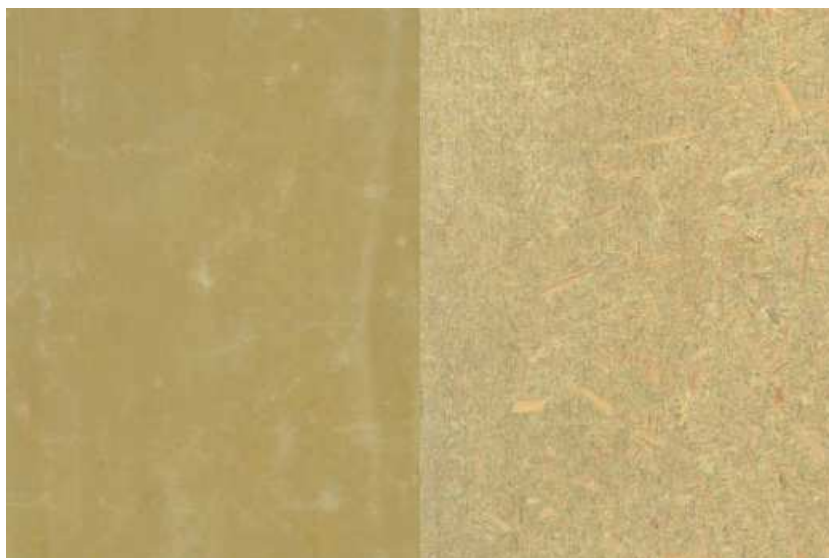


Figure 1.6 – Viroc Ochre, Unsanded/Sanded

Viroc board cutting, drilling & machining

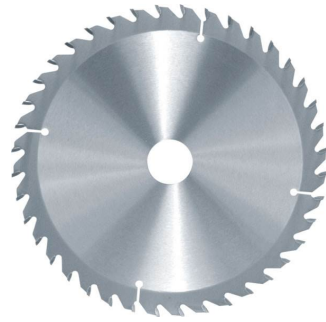


Figure 1.7 - Circular saw with tungsten cutting disc



Figure 1.8 - HSS drill and drill bits (for metal drilling)



Figure 1.9 - Electric router and edge milling cutters



Figure 1.10 - Orbital Sander and Floor Pad

Edge machining



Figure 1.11 - Edge machining. Bevel, rounding and milling.

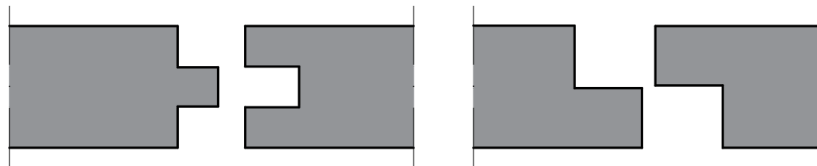


Figure 1.12 - Edge machining. Tongue and groove and half-lap joint

Storage

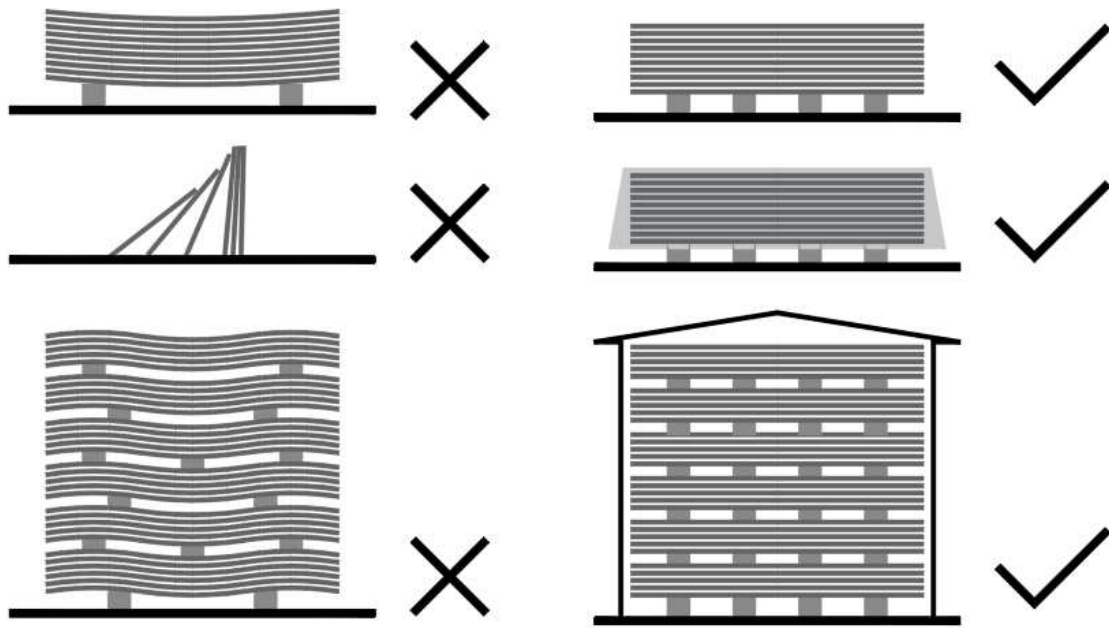


Figure 1.13 – Storage of Viroc boards

Handling



Figure 1.14 – Handling of Viroc boards

Acclimatization



Figure 1.15 - Warping of top board

Ventilated facades

Wooden mullions

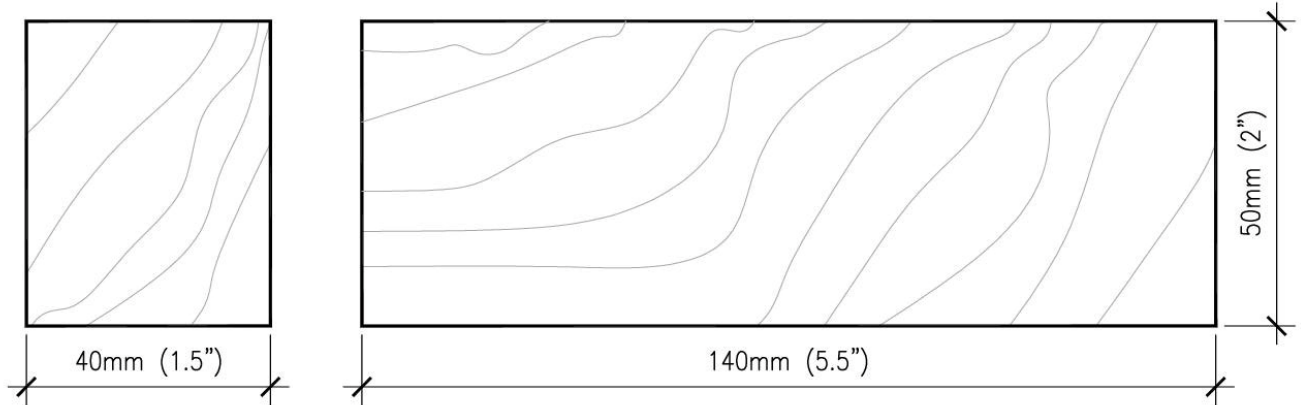


Figure 2.1 - Timber Structure

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

Galvanized steel profiles

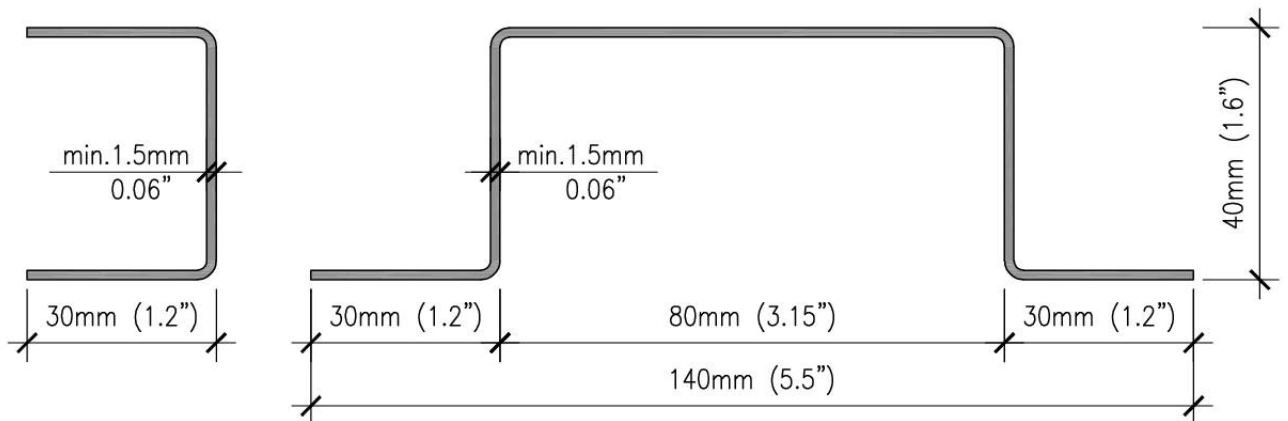


Figure 2.2 - Galvanized Steel Profiles

Minimum resistance category S220GD (EN 10346)

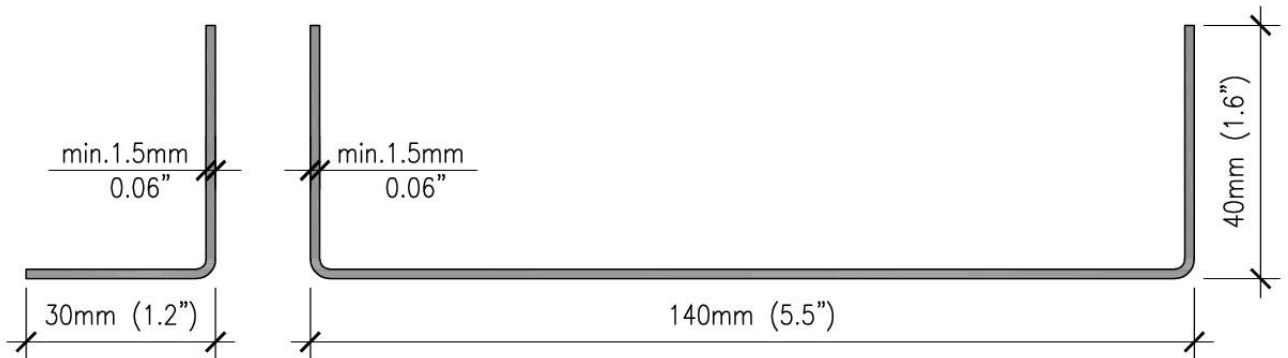


Figure 2.3 - Galvanized Steel Profiles (Alternative)

Minimum resistance category S220GD (EN 10346)

Aluminium profiles

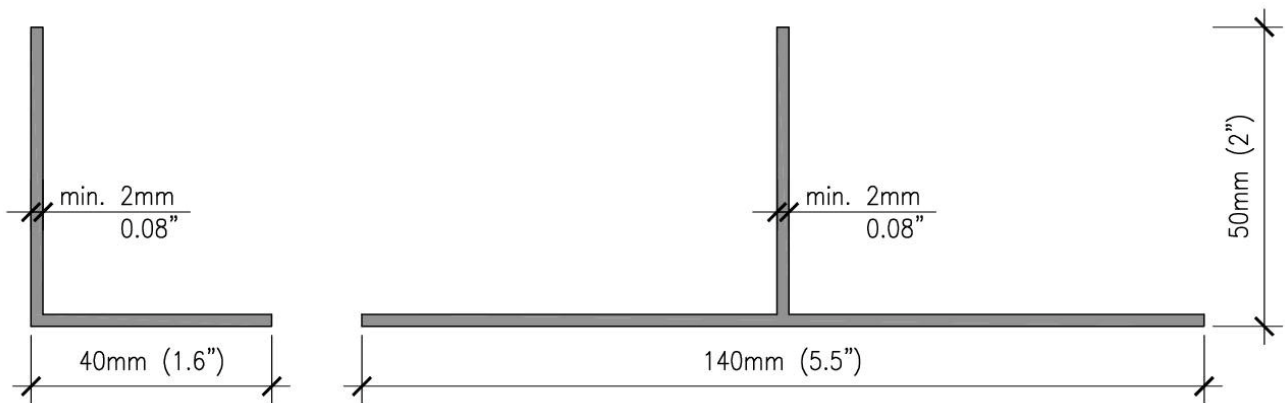


Figure 2.4 - Aluminium Structure

6000 Series Alloy with $R_{p0.2} \geq 180$ MPa

Profile FAÇALU L 50x42 and Profile FAÇALU T 140x52, Etanco

Accessory Items



Adhesive or flexible PVC EPDM band, SFS Intec and Etanco

Figure 2.5 - Protective band to be placed on durability category 2 wooden mullions.

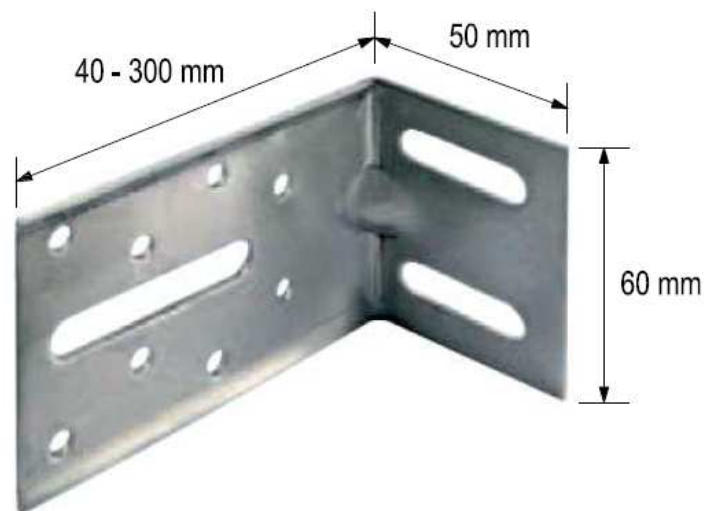


Figure 2.6 - Support brackets made of galvanized steel
Minimum resistance category S220GD. Minimum thickness 2.5 mm

SFS Intec: Equerre Bardage B and Etanco: Isolco 3000 P/Ga



Bracket to be placed in the middle of the profile
Etanco: Equerre Isolco LR80



Bracket to be placed at the ends of the profile
Etanco: Equerre Isolco LR150

Figure 2.7 - Aluminium support brackets
Alloy 6060 T5, minimum thickness 2.5mm

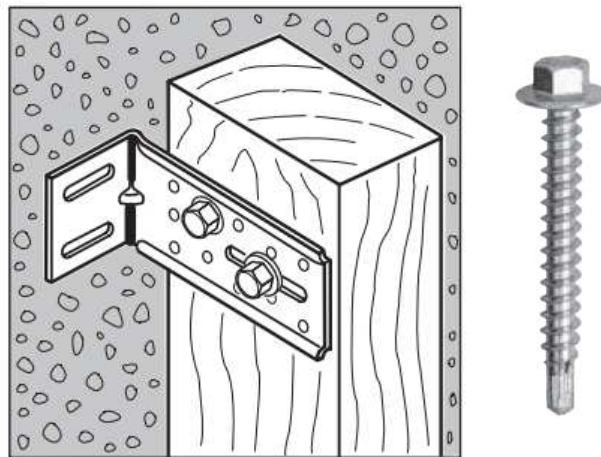


Figure 2.8 - Attachment of the wooden mullions to the support brackets
(screw $\text{Ø} \geq 6 + \text{Ø} \geq 3.5$)

SFS Intec: SW3-T-H15-6.5x50; Etanco: Tirefound TH/SH 7x50

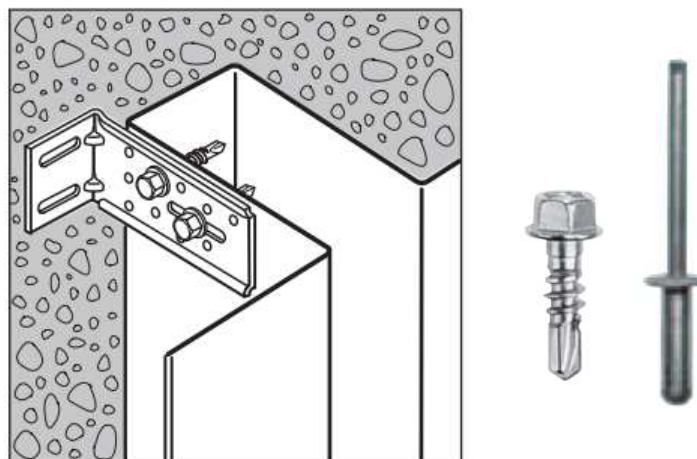


Figure 2.9 - Fastening galvanized steel profiles to the support brackets
(screws $\text{Ø} \geq 5.5$ or rivets $\text{Ø} \geq 4.8$)

Screws - SFS Intec: SD 5-H15-5.5x22; Etanco: Fastovis PI TH / Zn 5.5x25
Rivets - SFS Intec SSO-D15-S-5.0x18; Etanco: Rivet N.E.-CL Alu-Inox 5x12

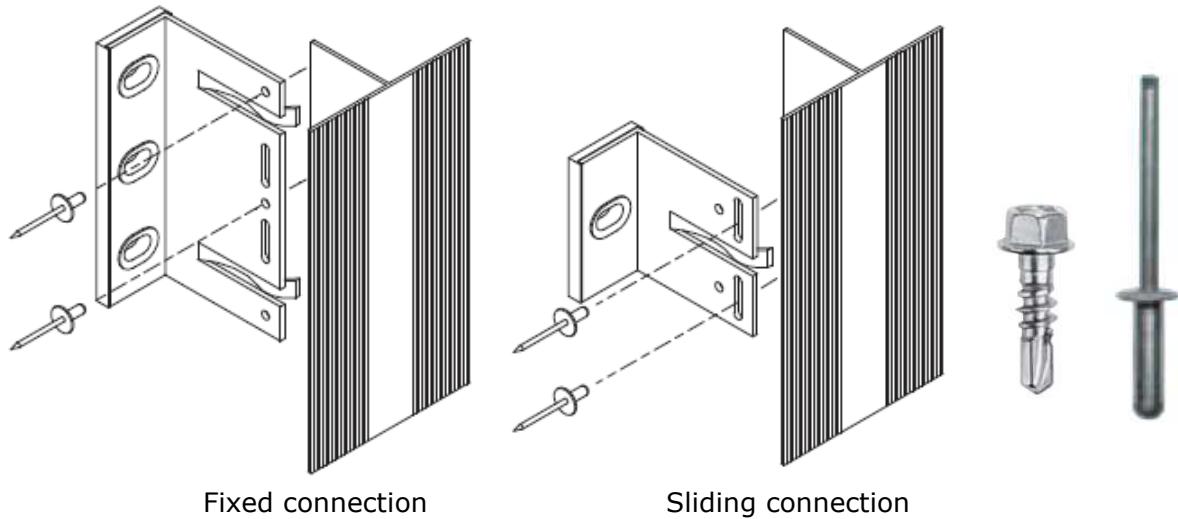


Figure 2.10 - Fastening the aluminium profiles to the support brackets
(screws $\varnothing \geq 5.5$ or rivets $\varnothing \geq 4.8$)

Screws - SFS Intec: SLA 5/6-S4-6.0x21; Etanco: Profile TH/InA2-5.5x25



Figure 2.11 - Plastic Anchor $\varnothing 10\text{mm}$

Stainless steel or galvanized steel screw $\varnothing 7\text{mm}$, minimum length 75 mm
SFS Intec: MQLK H18 - 10x80; Etanco: Marcovis TUP4 10/15x85



Figure 2.12 - M8 Metal Anchor

Stainless steel or galvanized steel, minimum length 80mm

SFS Intec: m3 - 8x80; Etanco: Baraco FM Crack – M8x75



Figure 2.13 - Thermal Insulation anchor for the support structure

SFS Intec: MDH – 8x60 to 240; Etanco: INCO 8/60 to 120



Figure 2.14 - Centring Screwdriver, SFS Intec



Figure 2.15 - Hole Centring Wrench, Etanco: ML 1000

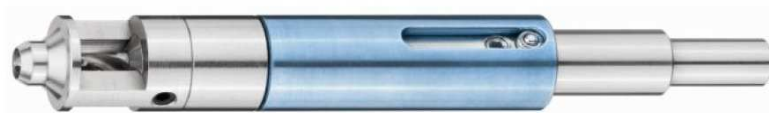


Figure 2.16 - Hole Centring Tool, SFS Intec



Figure 2.17 - Z350 galvanized steel angle plate esp. 2.5 mm
(For corner angles see Figure 2.30)

Etanco: 120x180 Angle Plate



Figure 2.18 - Perforated Anti-rodent Profile
(see figures 2.33, 2.70, 2.54, 2.88, 2.104, 2.114, 2.126, 2.134 and 2.140)
SFS Intec: Profile PV-A; Etanco: Antirouneur Alu Grille



Figure 2.19 - Corner Angle Profiles
(Optional use)
SFS Intec: Profile PFS-K-A and PFS-Q-A; Etanco: P.A.S. Al/PrL

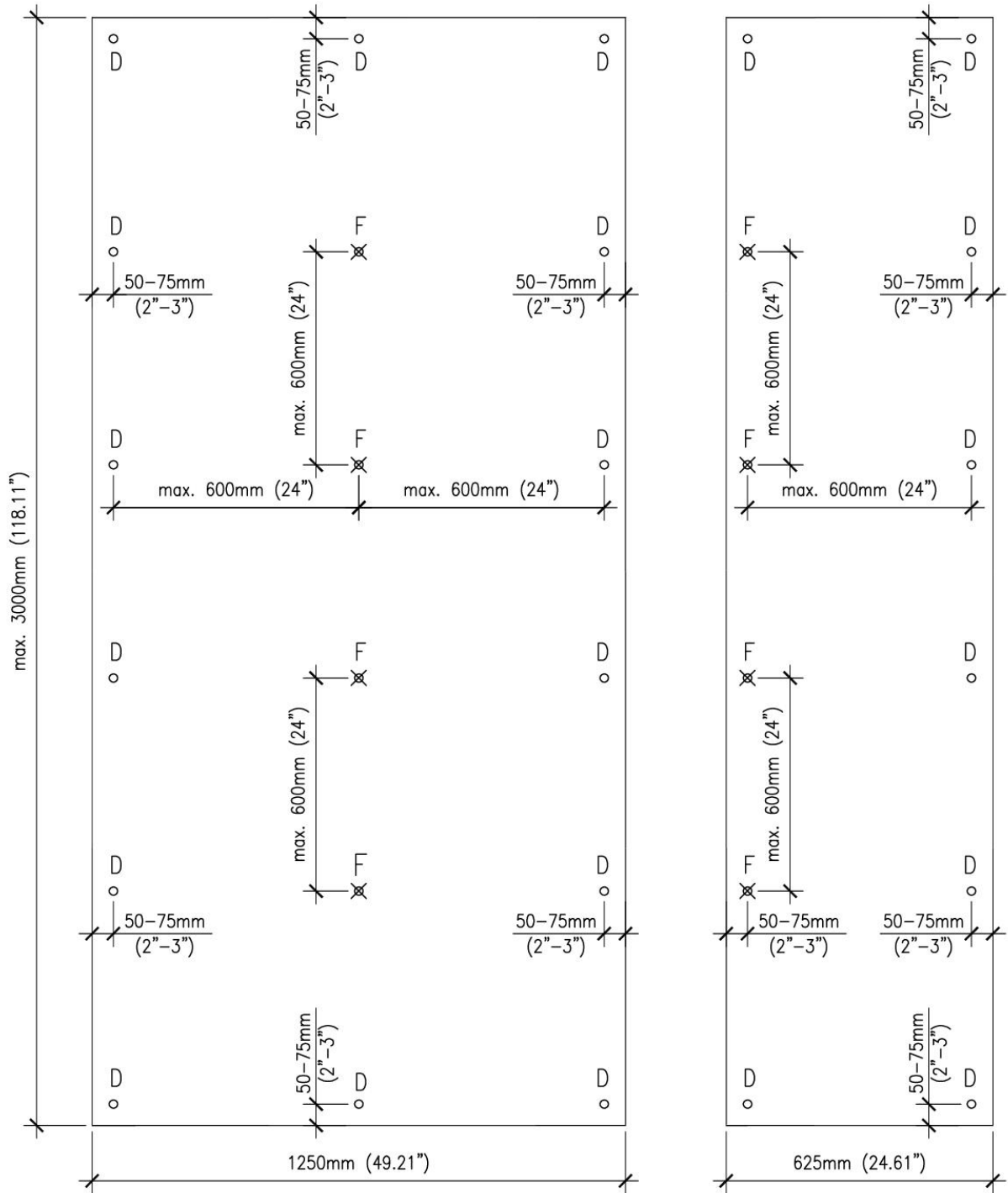


Figure 2.20 - Corner Angle Profiles
(Optional use)
SFS Intec: PFR-A profile; Etanco: P.A.R. profile Al/PrL

Façade - Fastening system with screws or rivets

Timber structure

Board size and fastening location



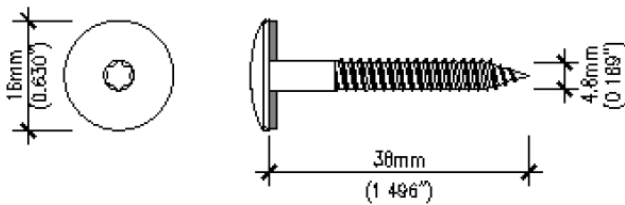
○ D - Sliding support - \varnothing 10mm ⊗ F - Fix Support - \varnothing 5mm

Figure 2.21 - Maximum board size and fastening location

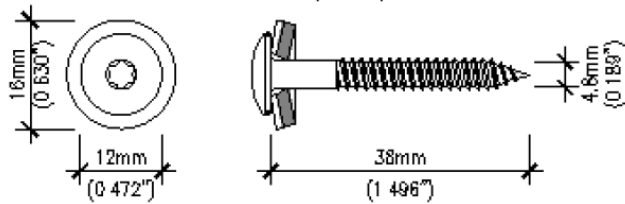
Screws for fastening the boards

Thickness	Maximum dimension of panels	Hole Dimension		Screw	Manufacturer
		Fixed point	Sliding point		
12 (0.472")	3000 x 1250 (118.11" x 49.21")	5 mm (0.20")	10 mm (0.40")	TW-S-D16-4.8x38 + Washer	SFS Intec
				Torx Panel Bois TB16 4.8x38 A16	ETANCO
				TW-S-D12-S16-4.8x38	SFS Intec
				Torx Panel Bois TB12 4.8x38 A16	ETANCO
16 (0.630")	3000 x 1250 (118.11" x 49.21")	5 mm (0.20")	10 mm (0.40")	TW-S-D12-S16-4.8x44	SFS Intec
				TW-S-D12-S16-4.8x60	SFS Intec
				Torx Panel Bois TB12 4.8x60 A16	ETANCO

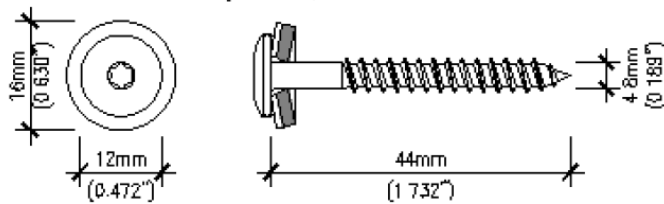
TW-S-D16-4.8x38 + Washer (SFS Intec)
Torx Panel Bois TB16 4.8x38 A16 (ETANCO)



TW-S-D12-S16-4.8x38 (SFS Intec)
Torx Panel Bois TB12 4.8x38 A16 (ETANCO)



TW-S-D12-S16-4.8x44 (SFS Intec)



TW-S-D12-S16-4.8x60 (SFS Intec)
Torx Panel Bois TB12 4.8x60 A16 (ETANCO)

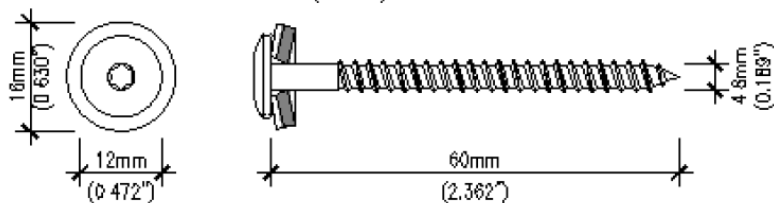


Figure 2.22 - Timber Frame Screws

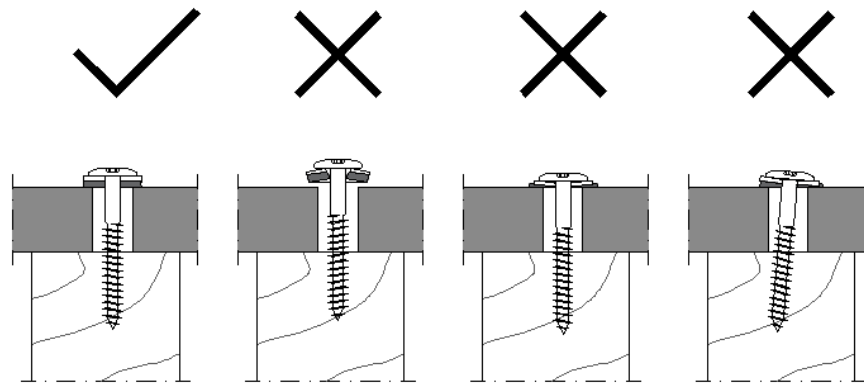


Figure 2.23 - Tightening and correct screw positioning

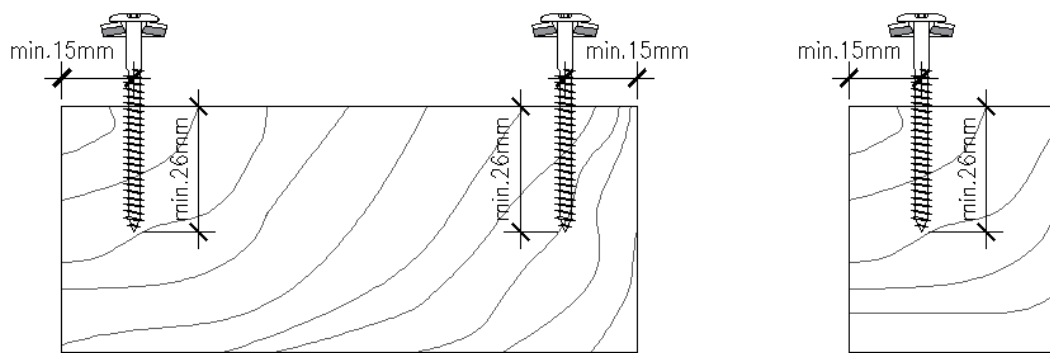


Figure 2.24 - Minimum distance from screws to edge of bar

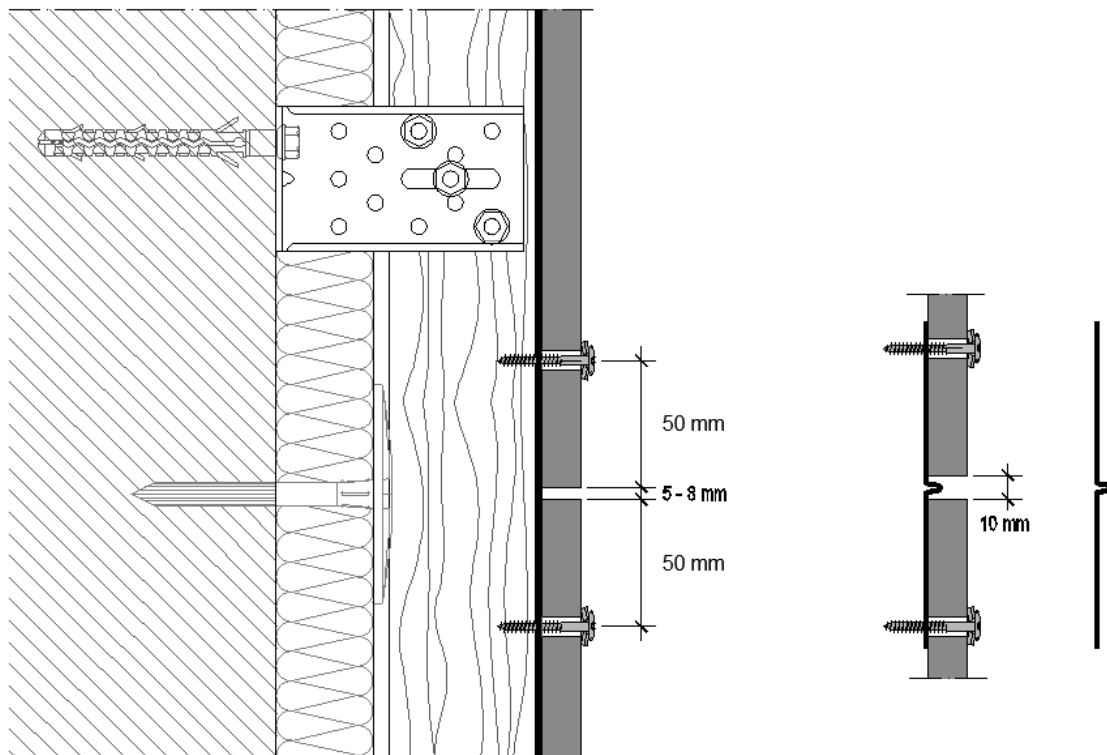


Figure 2.25 - Vertical section, joint between boards

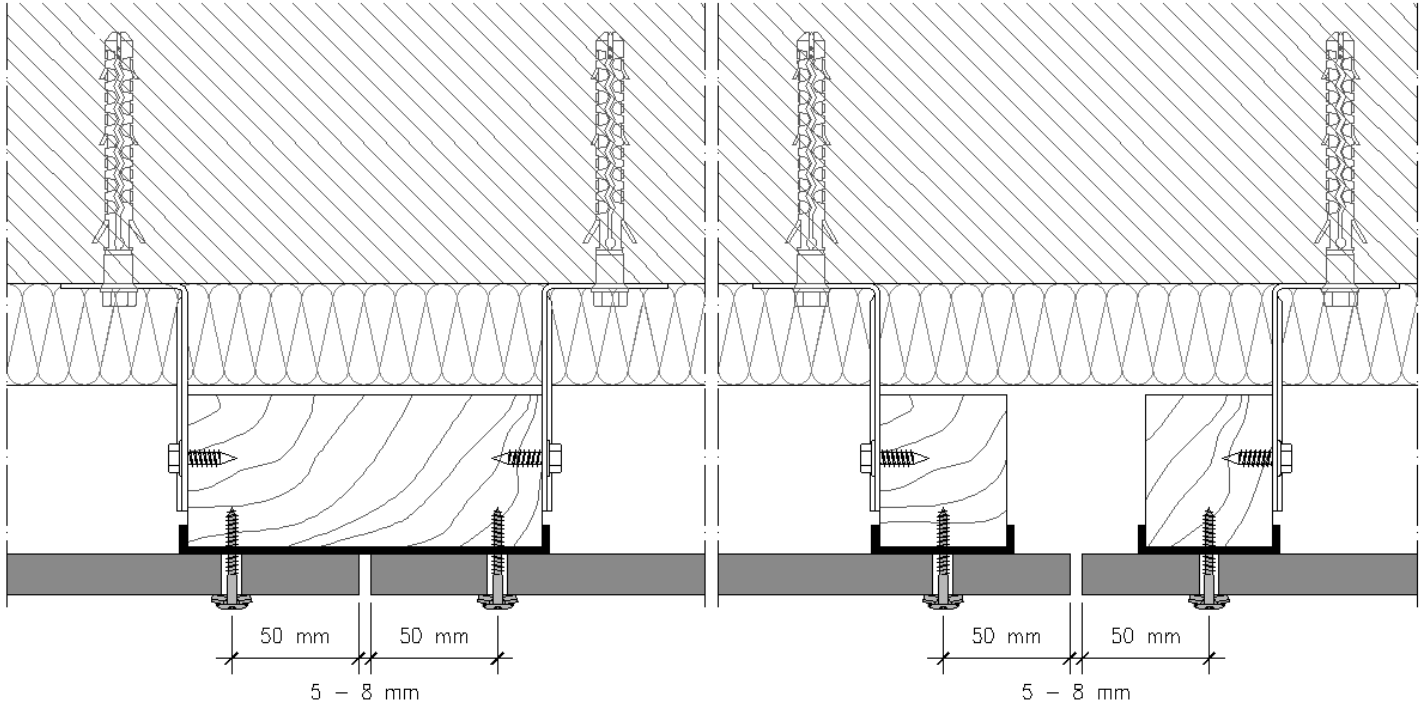


Figure 2.26 - Horizontal section, joint between boards

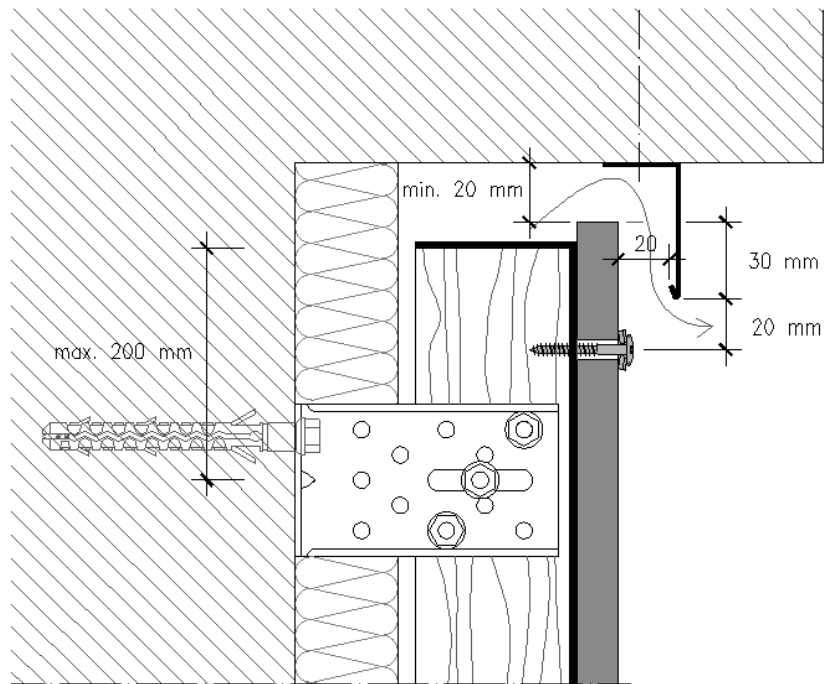


Figure 2.27 - Finishing under balcony

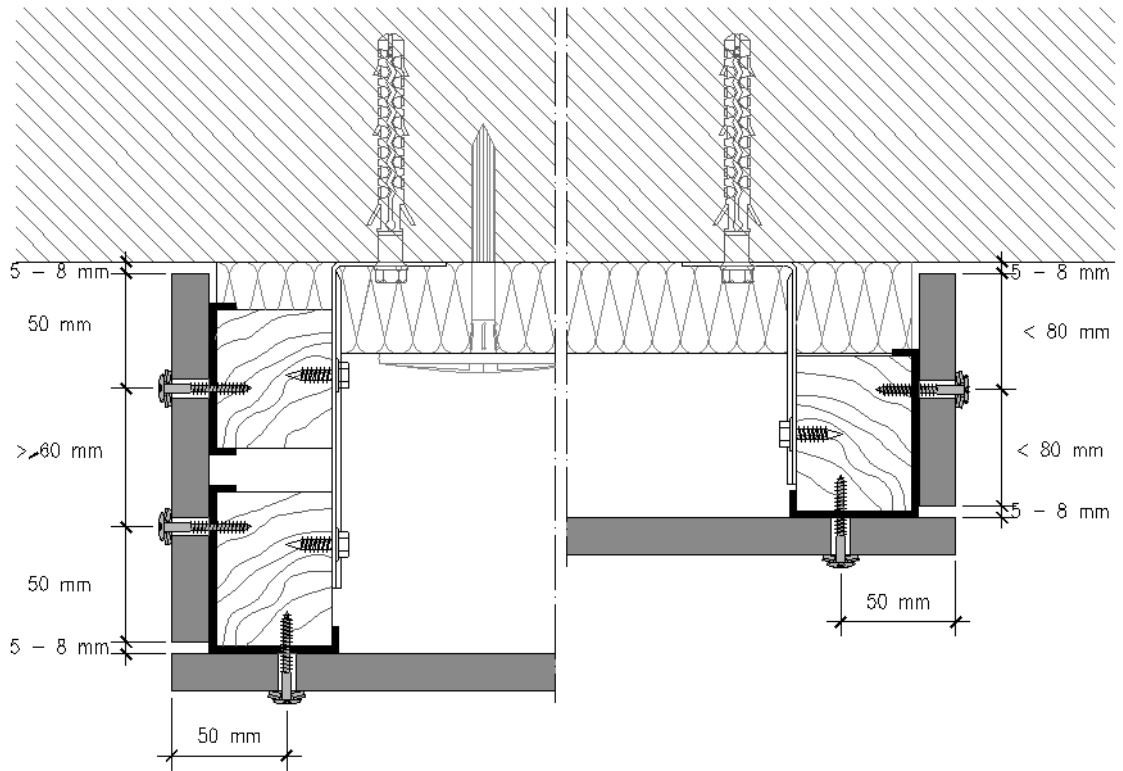


Figure 2.28 - Side Shot

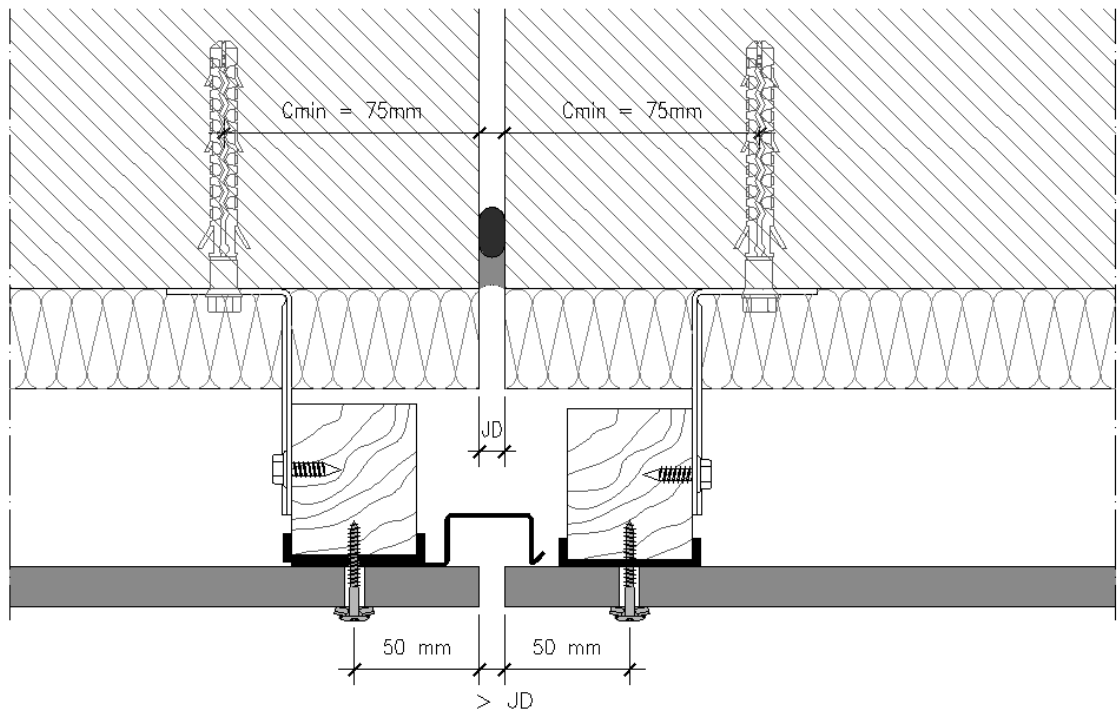
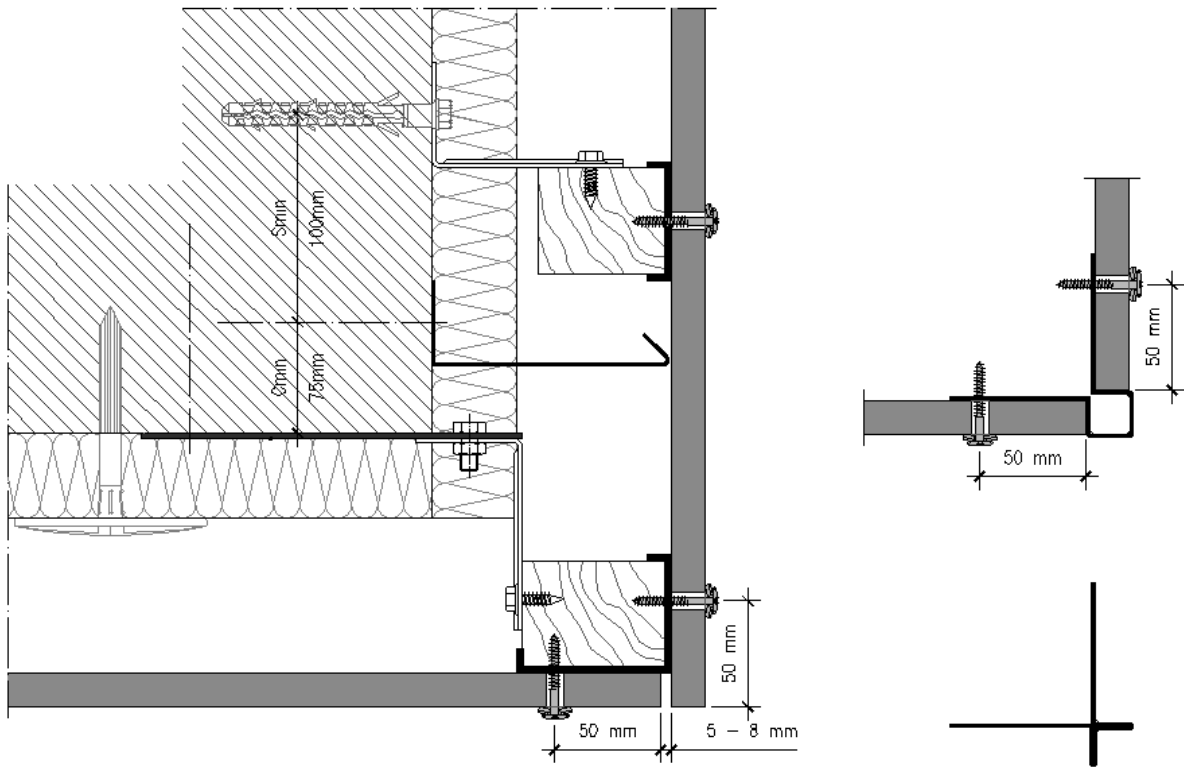
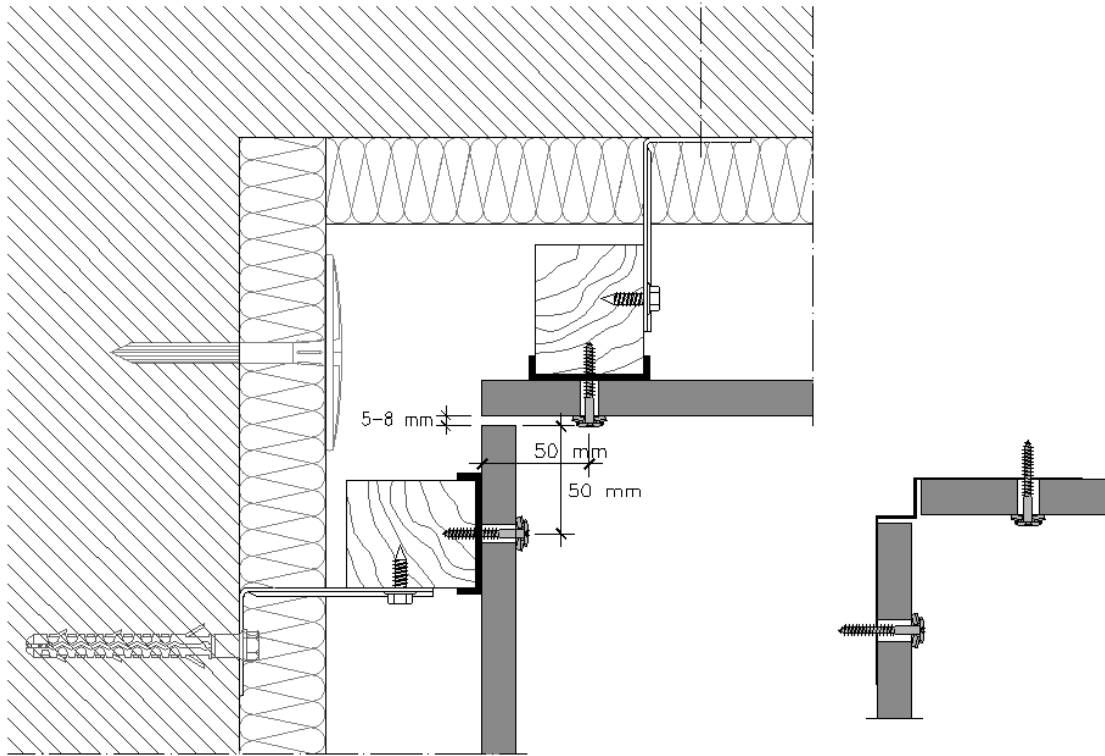


Figure 2.29 - Expansion joint



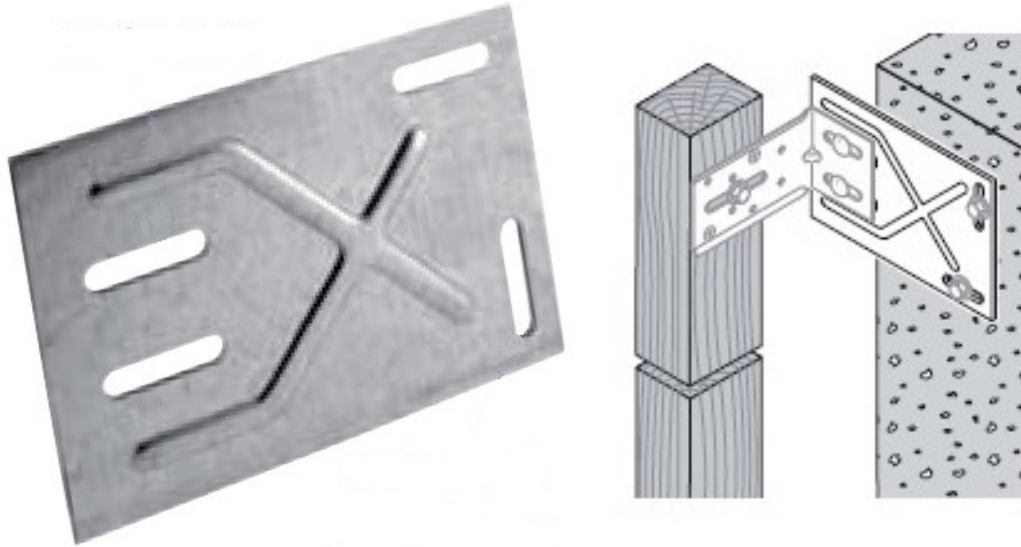


Figure 2.32 - Angle Auxiliary Board
 Etanco: 120x180 Angle Plate

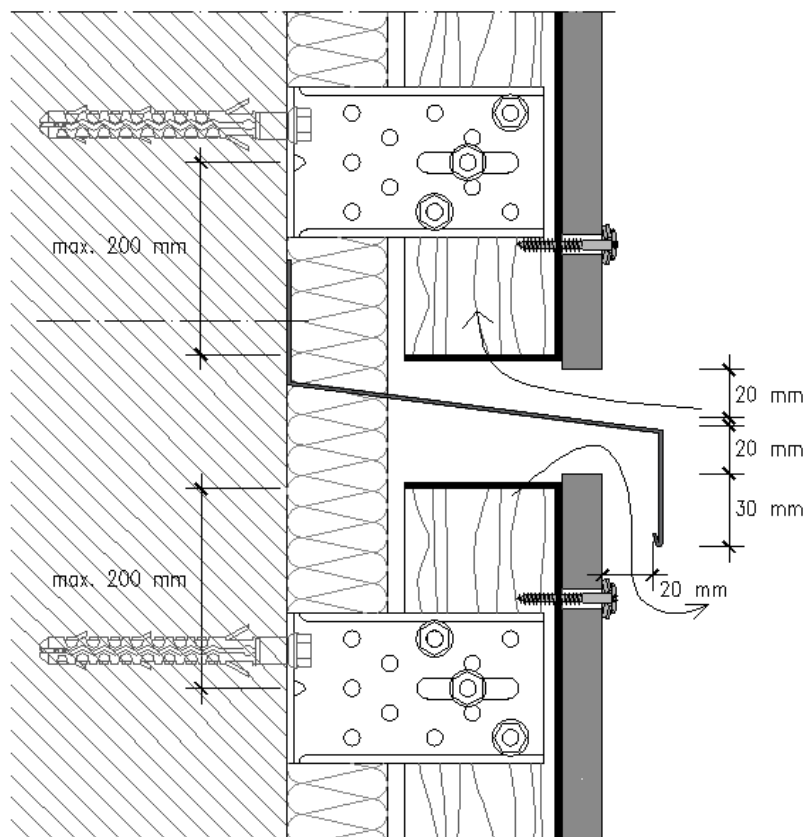


Figure 2.33 - Horizontal air trap partition

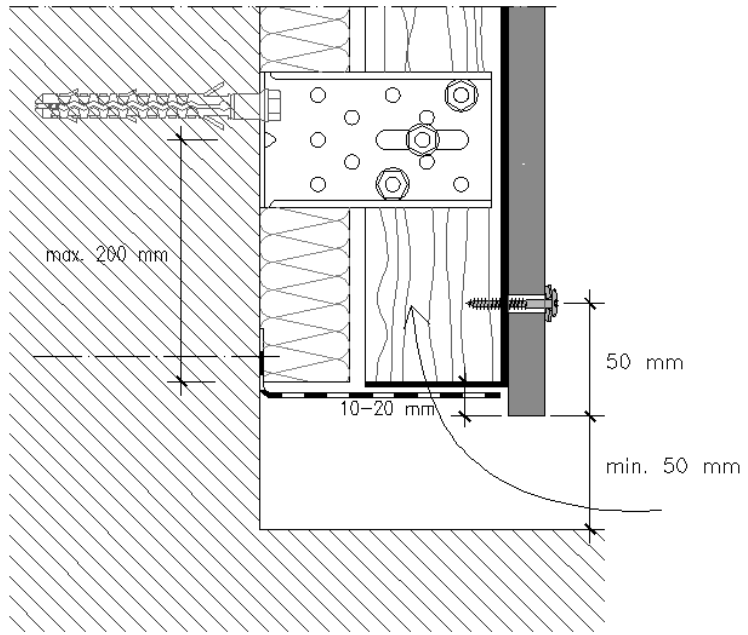


Figure 2.34 - Detail of the base, anti-rodent grill

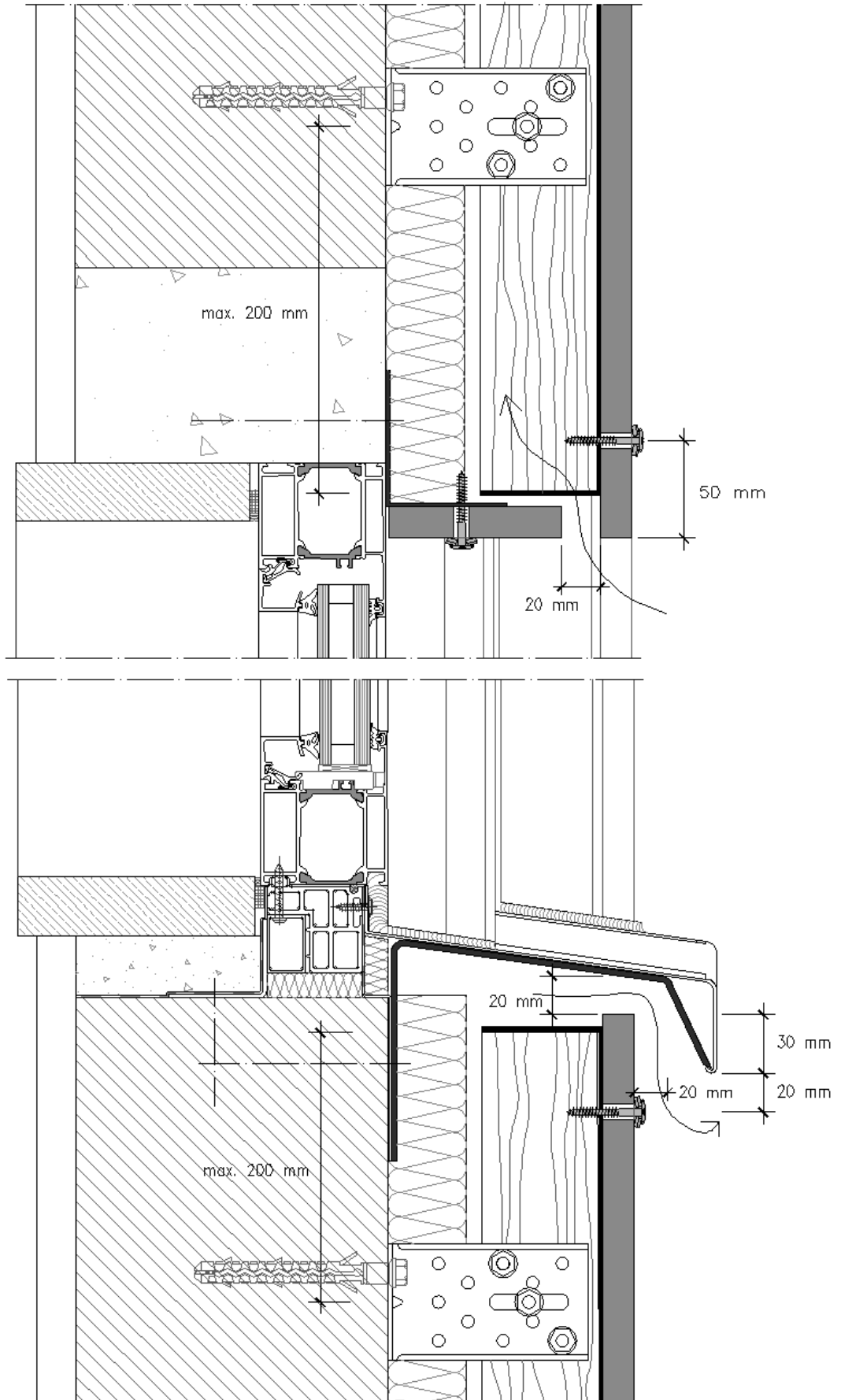


Figure 2.35 - Vertical section, window span

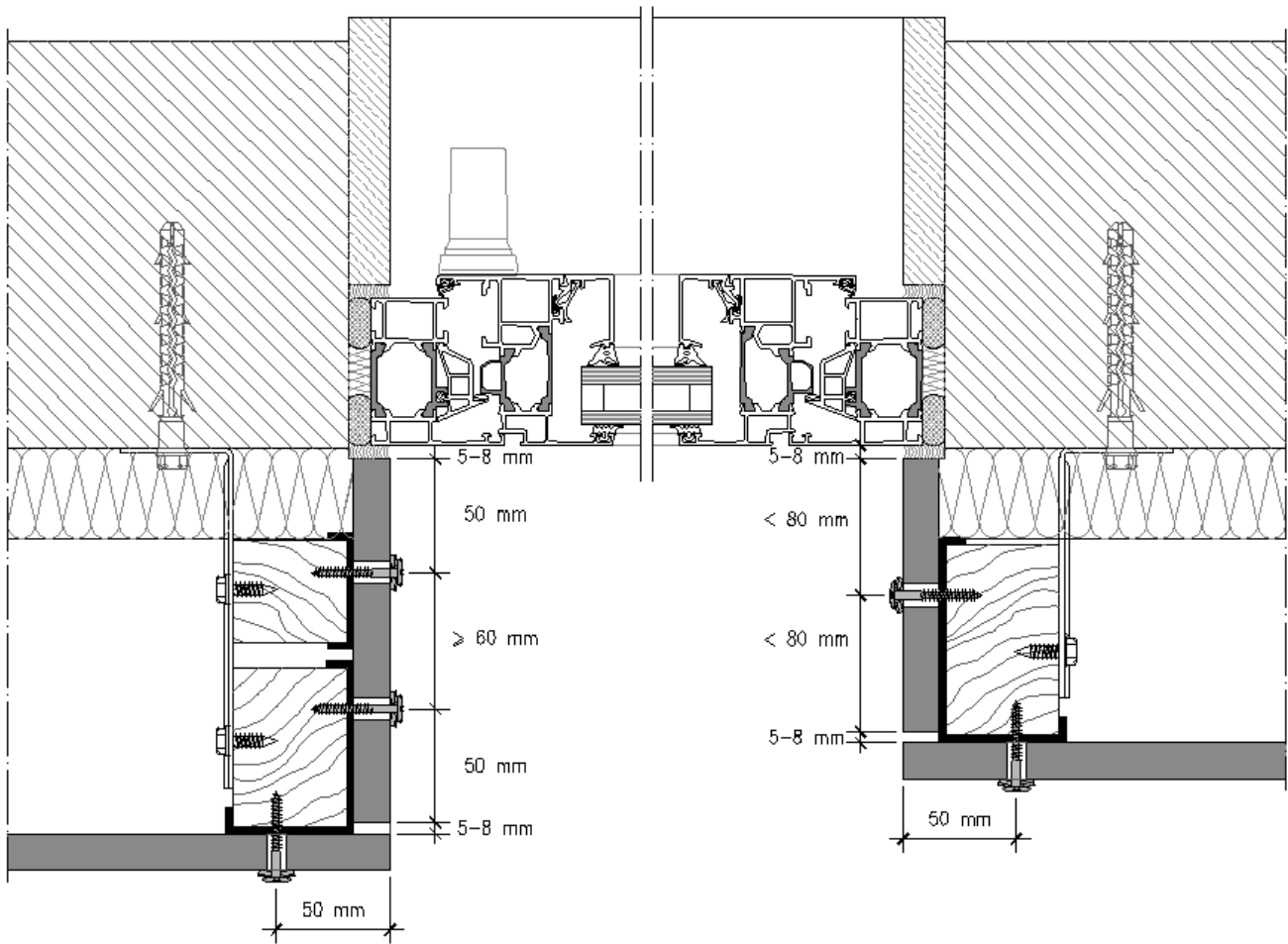


Figure 2.36 - Horizontal section, window span

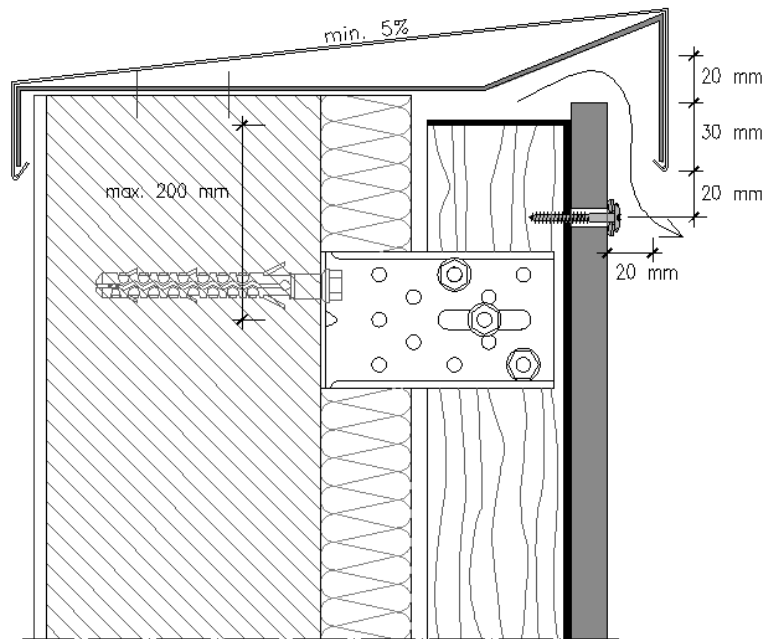


Figure 2.37 - Detail of the top

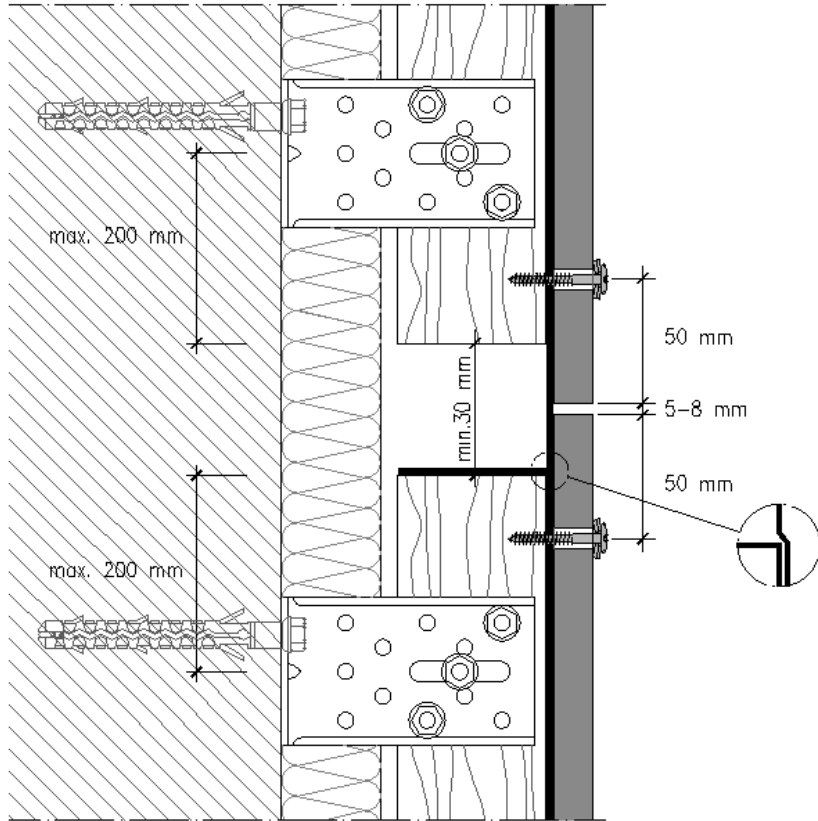


Figure 2.38 - Structure fractionation: Profiles with length ≤ 5.4 m

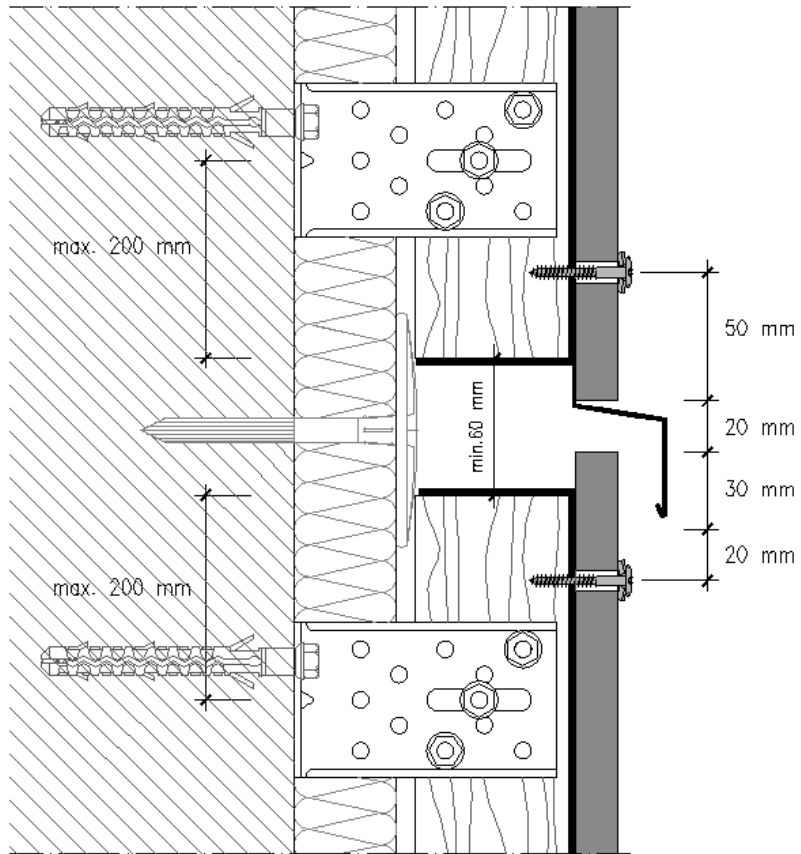


Figure 2.39 - Structure fractionation: Profiles with length > 5.4 m

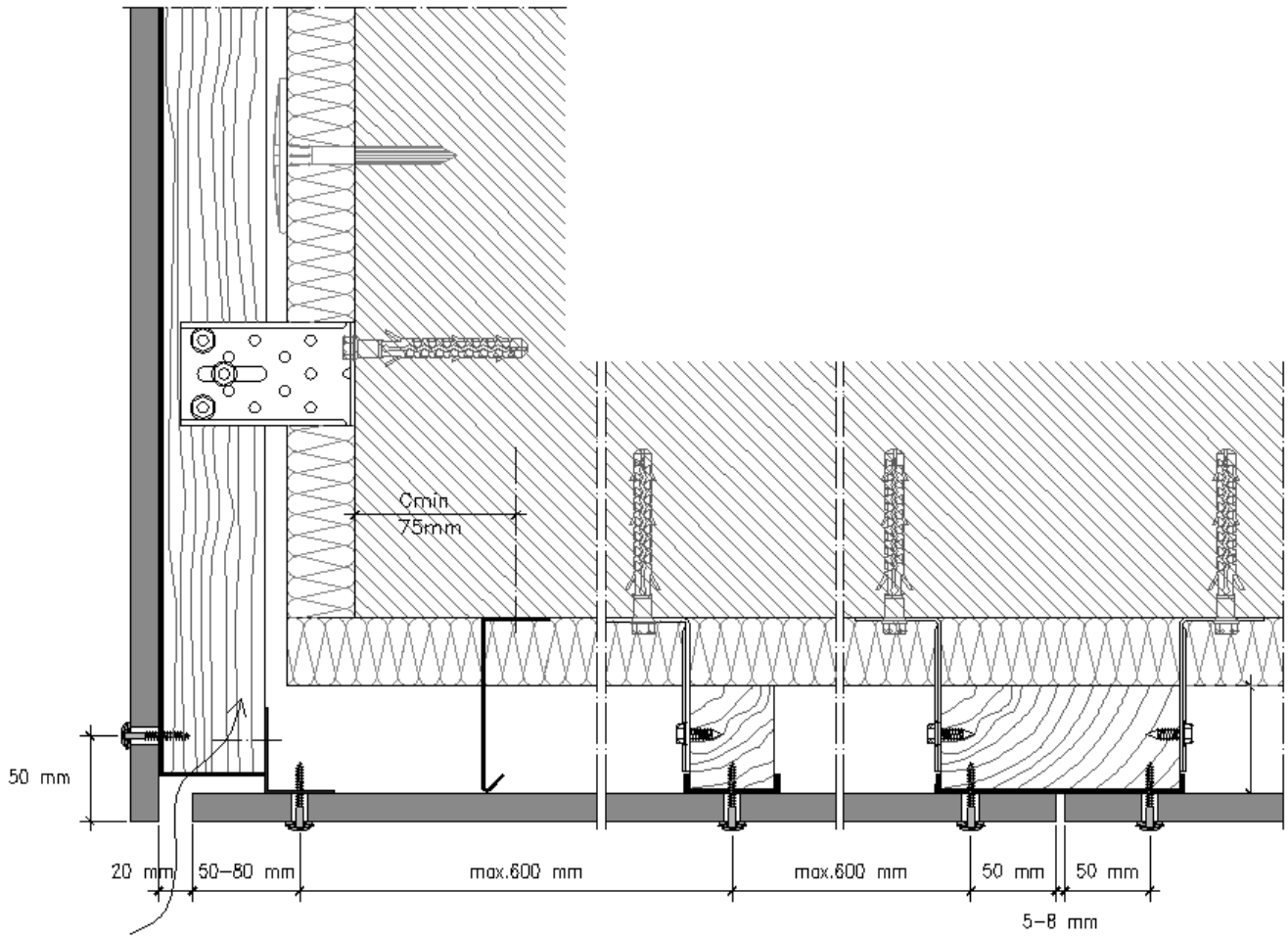
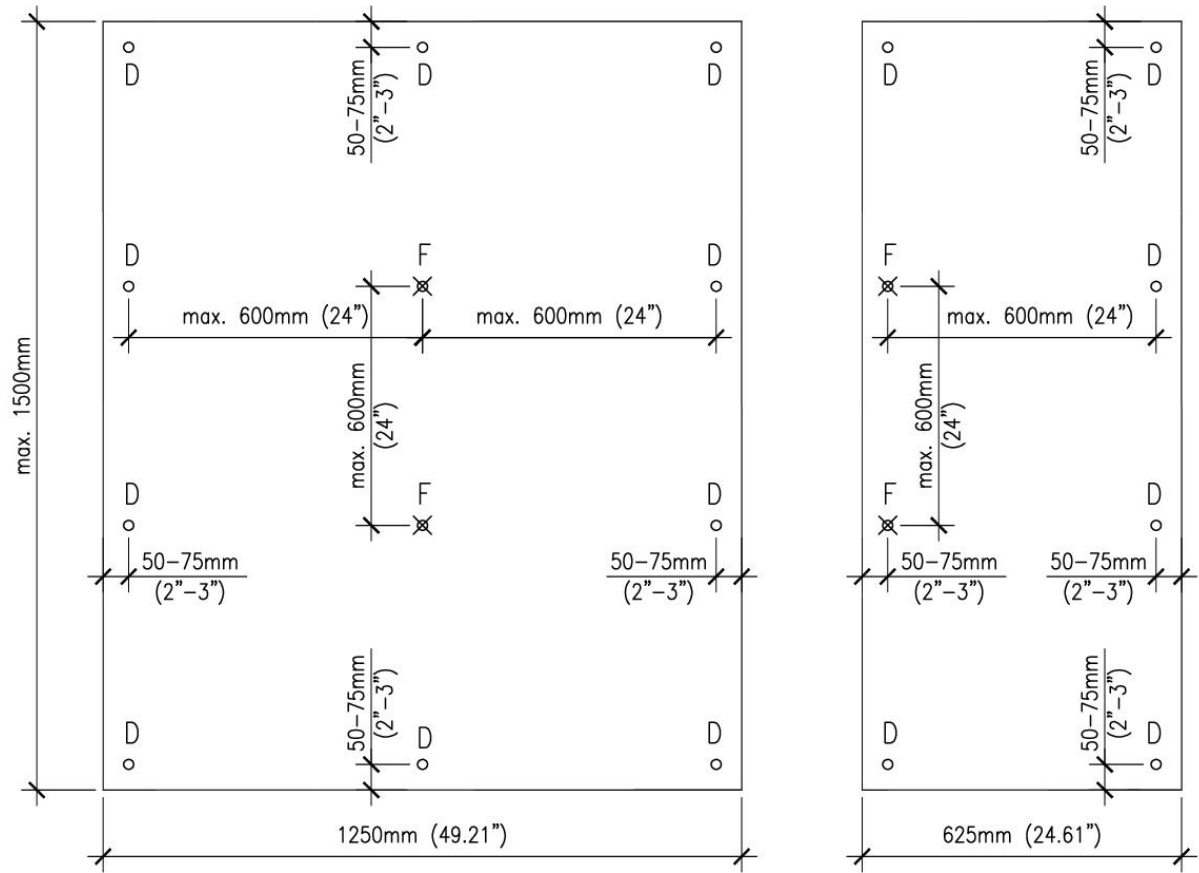


Figure 2.40 - Detail of the facade connection - suspended ceiling

Galvanized Steel Structure
Board size and fastening location



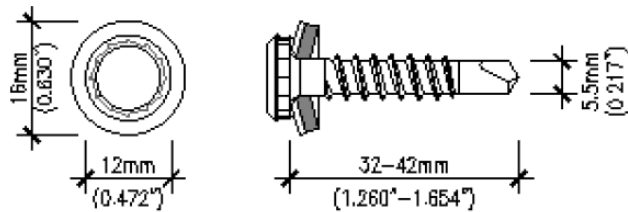
○ D - Sliding support - \varnothing 10mm ⊗ F - Fix Support - \varnothing 5mm

Figure 2.41 - Maximum board size and fastening location

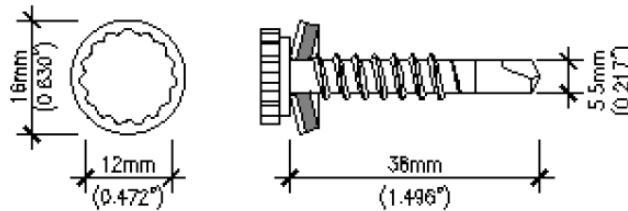
Screws and rivets for board fastening

Thickness	Maximum dimension of panels	Hole Dimension		Screw/Revit	Manufacturer
		Fixed point	Sliding point		
12 mm (0.472")	1500 x 1250 (59.06" x 49.21")	5 mm (0.20")	10 mm (0.40")	SX3/15-L12-S16-5.5x32 STARCOLOR/Zn 5.5x38 A16 DRILLNOX STAR 5.5x38 A16 AP16-5.0x21 RVET N.E. CEL Alu/Inox-4.8x22	SFS Intec ETANCO ETANCO SFS Intec ETANCO
16 mm (0.630")	1500 x 1250 (59.06" x 49.21")	5 mm (0.20")	10 mm (0.40")	SXW-L12-S16-5.5x42 STARCOLOR/Zn 5.5x38 A16 DRILLNOX STAR 5.5x50 A16 AP16-5.0x21 RVET N.E. CEL Alu/Inox-4.8x22	SFS Intec ETANCO ETANCO SFS Intec ETANCO

SX3/15-L12-S16-5.5x32, SXW-L12-S16-5.5x42 (SFS Intec)



STARCOLOR/Zn 5.5x38 A16 (ETANCO)



DRILLNOX STAR 5.5x38 A16, DRILLNOX STAR 5.5x50 A16 (ETANCO)

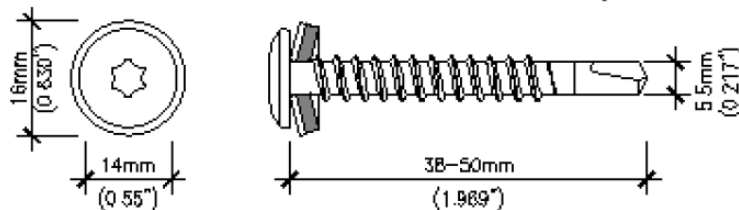


Figure 2.42 - Screws for metal frame

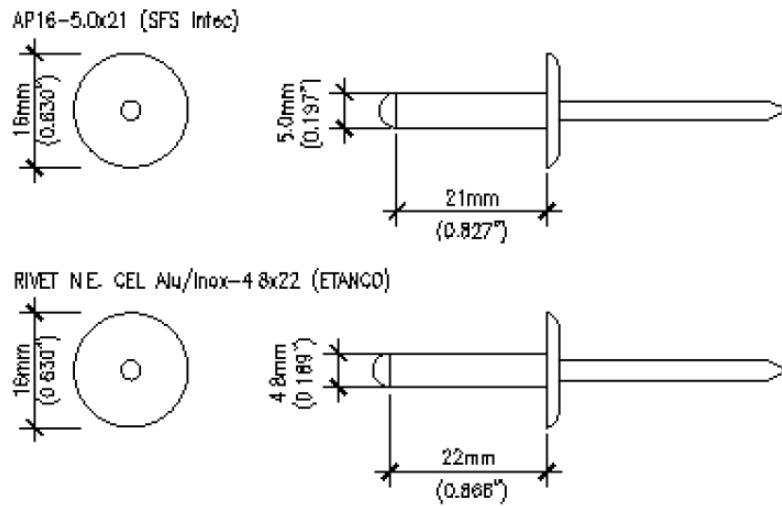


Figure 2.43 - Metal Frame Rivet

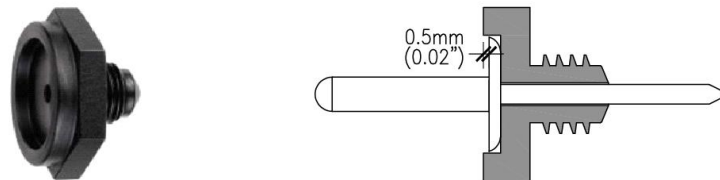


Figure 2.44 - Clamping Limiter, place on Riveter Head

Mandatory Use

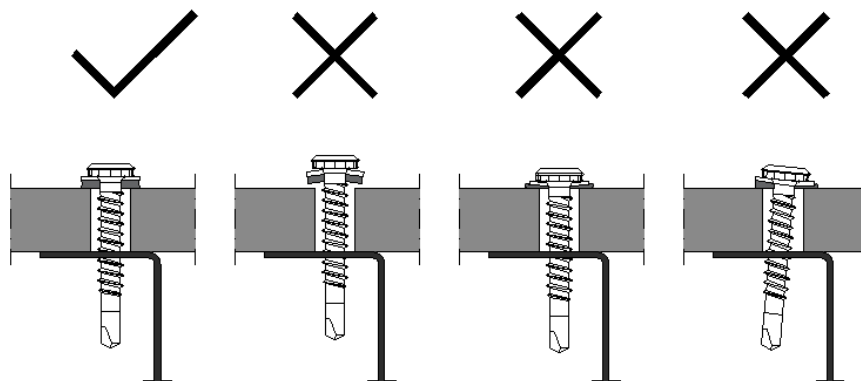


Figure 2.45 - Tightening and correct screw positioning

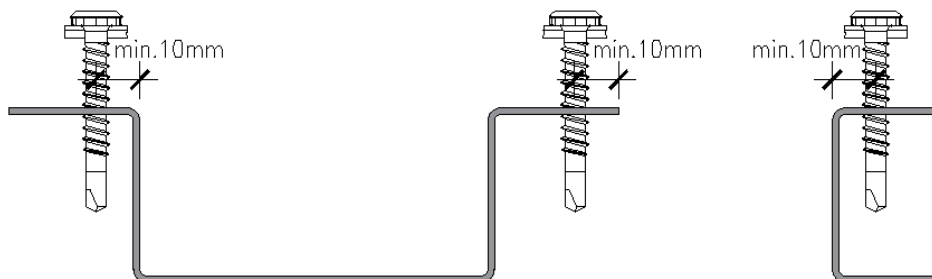


Figure 2.46 - Correct positioning of screws or rivets
(minimum distance to edge of profile 10 mm)

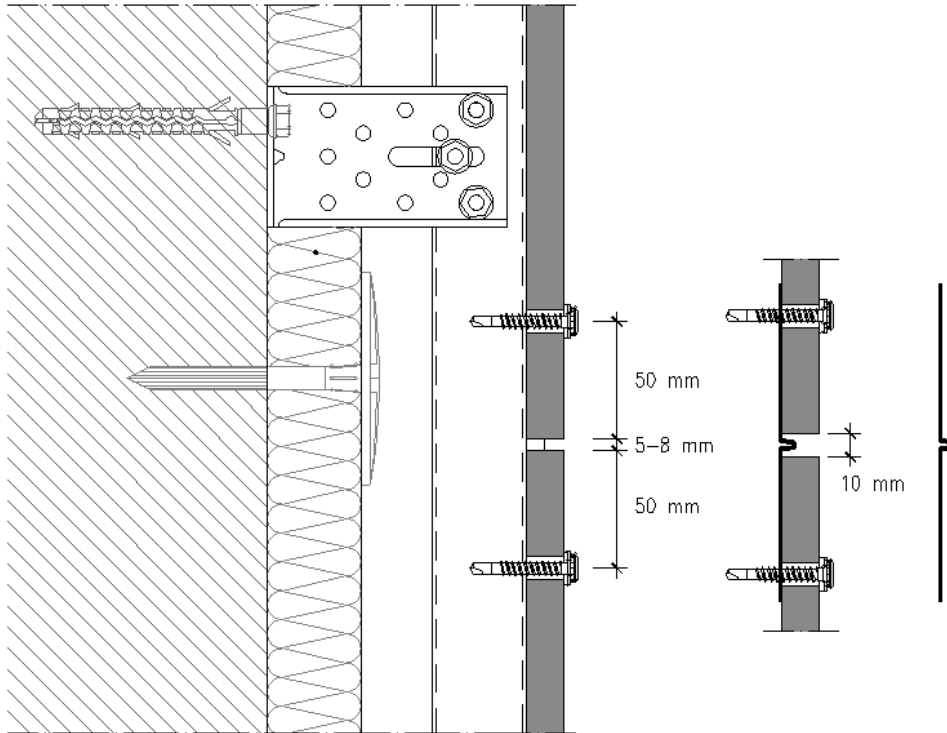


Figure 2.47 - Vertical section, joint between boards

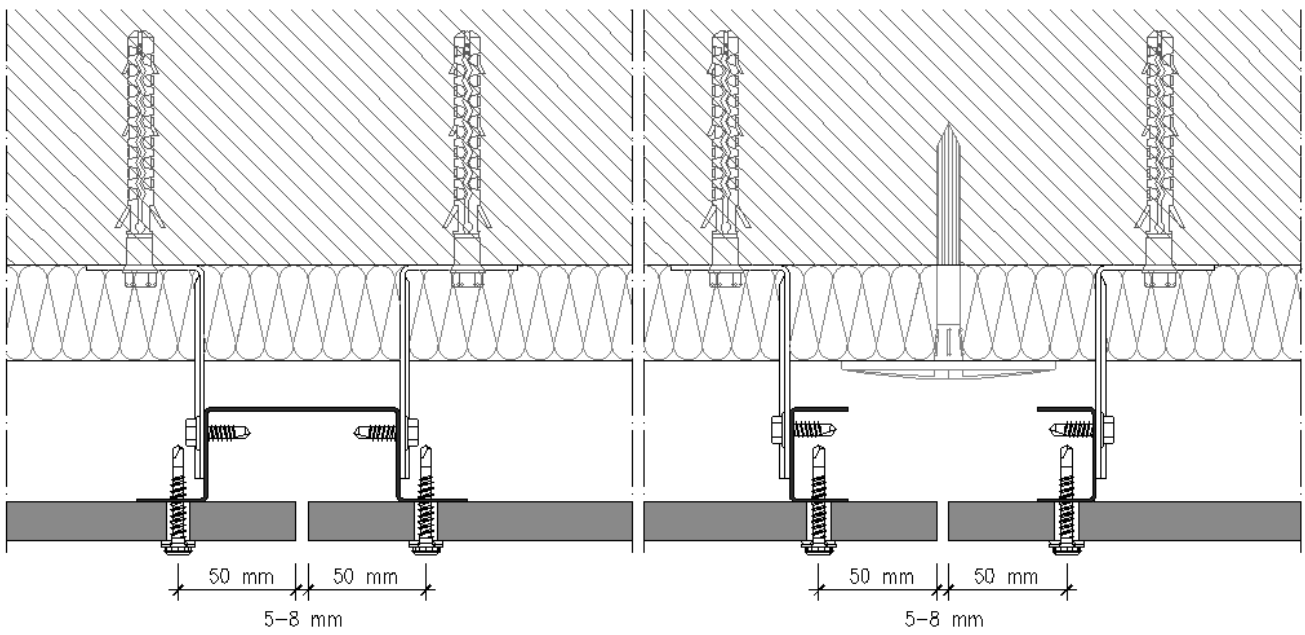


Figure 2.48 - Horizontal section, joint between boards

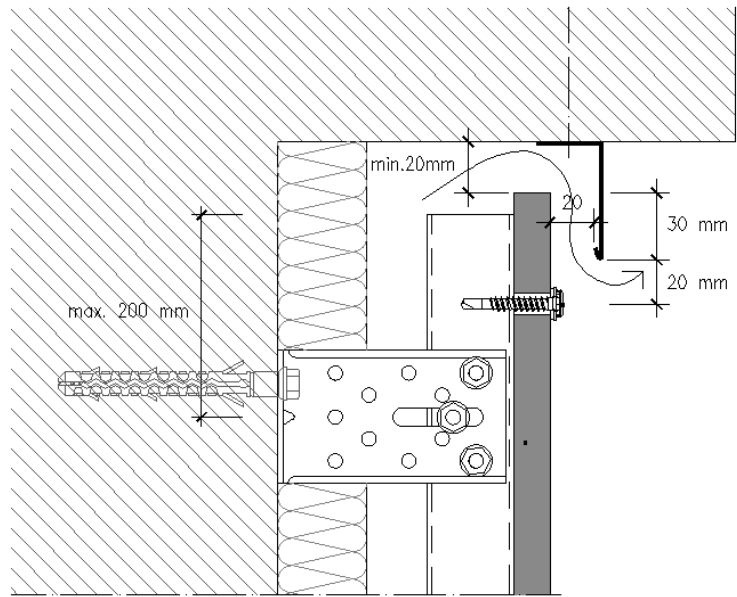


Figure 2.49 - Finishing under balcony

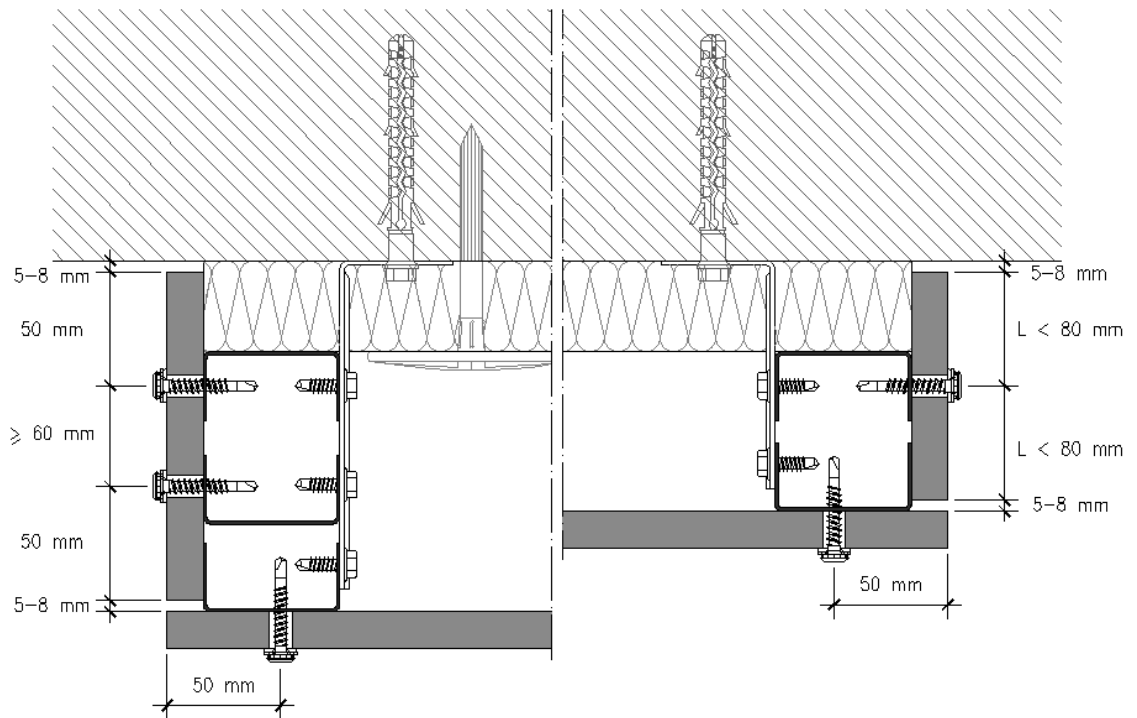


Figure 2.50 - Side Shot

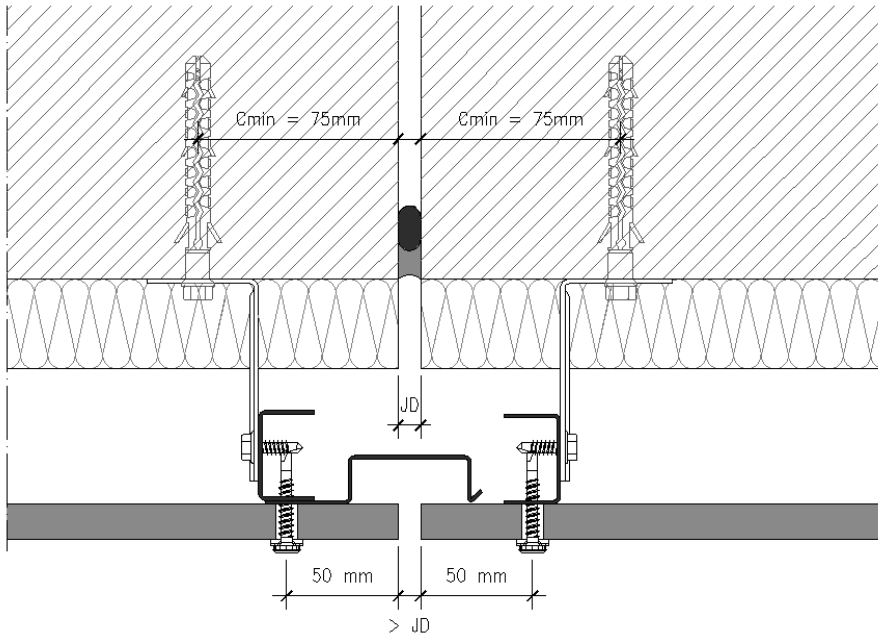


Figure 2.51 - Expansion joint

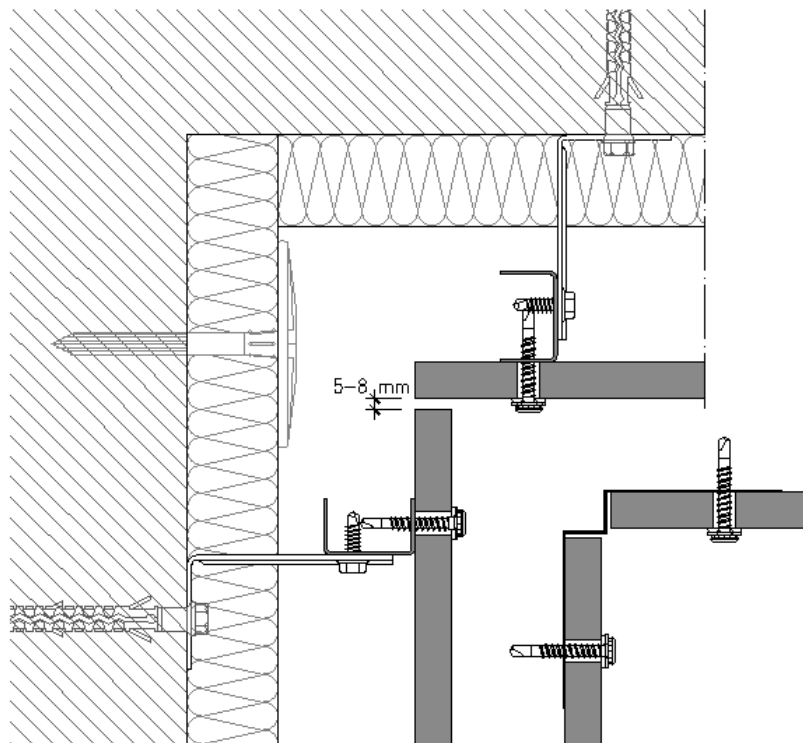


Figure 2.52 - Corner Angle

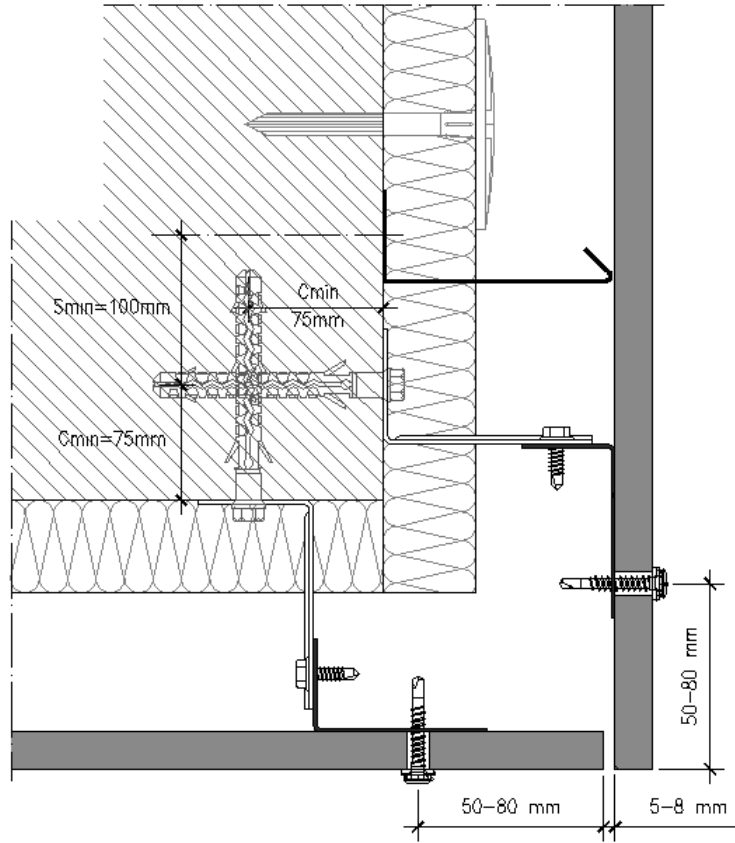


Figure 2.53 - Corner Angle

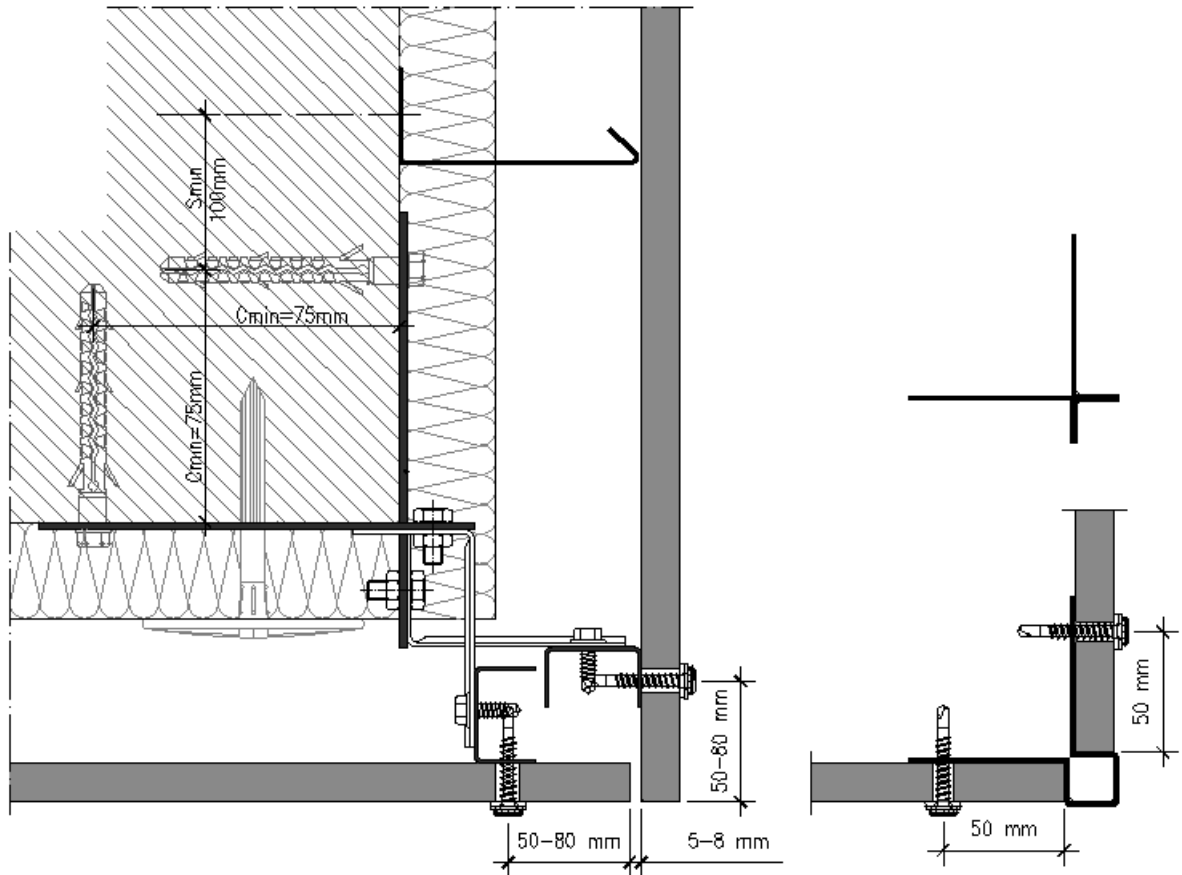


Figure 2.54 - Corner angle, variant
Angle plate, see figure 2.17

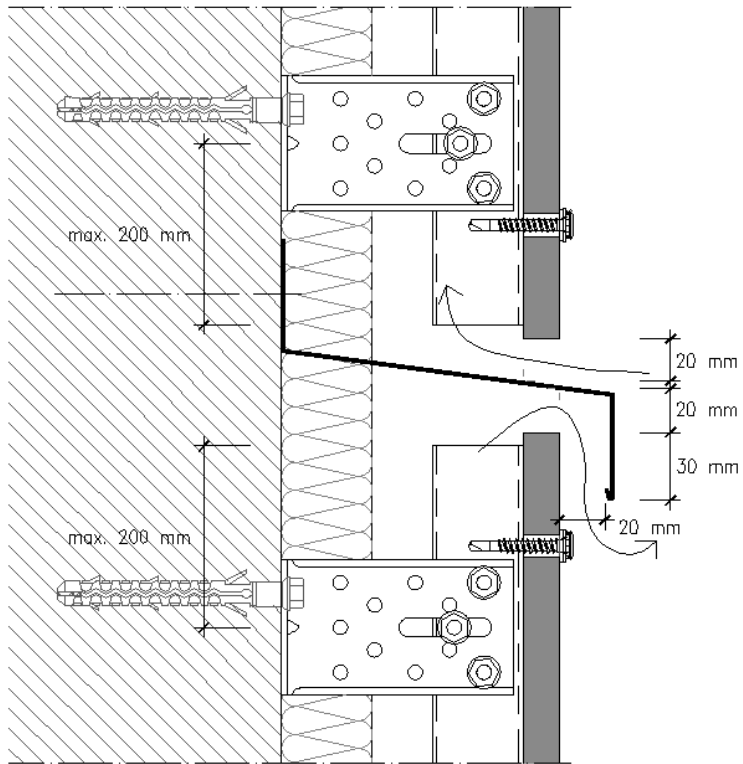


Figure 2.55 - Horizontal air trap partition

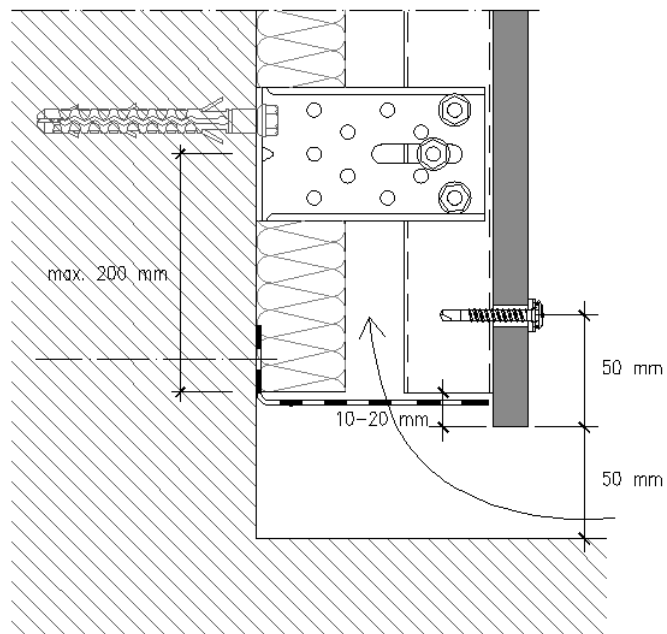


Figure 2.56 - Detail of the base, anti-rodent grill

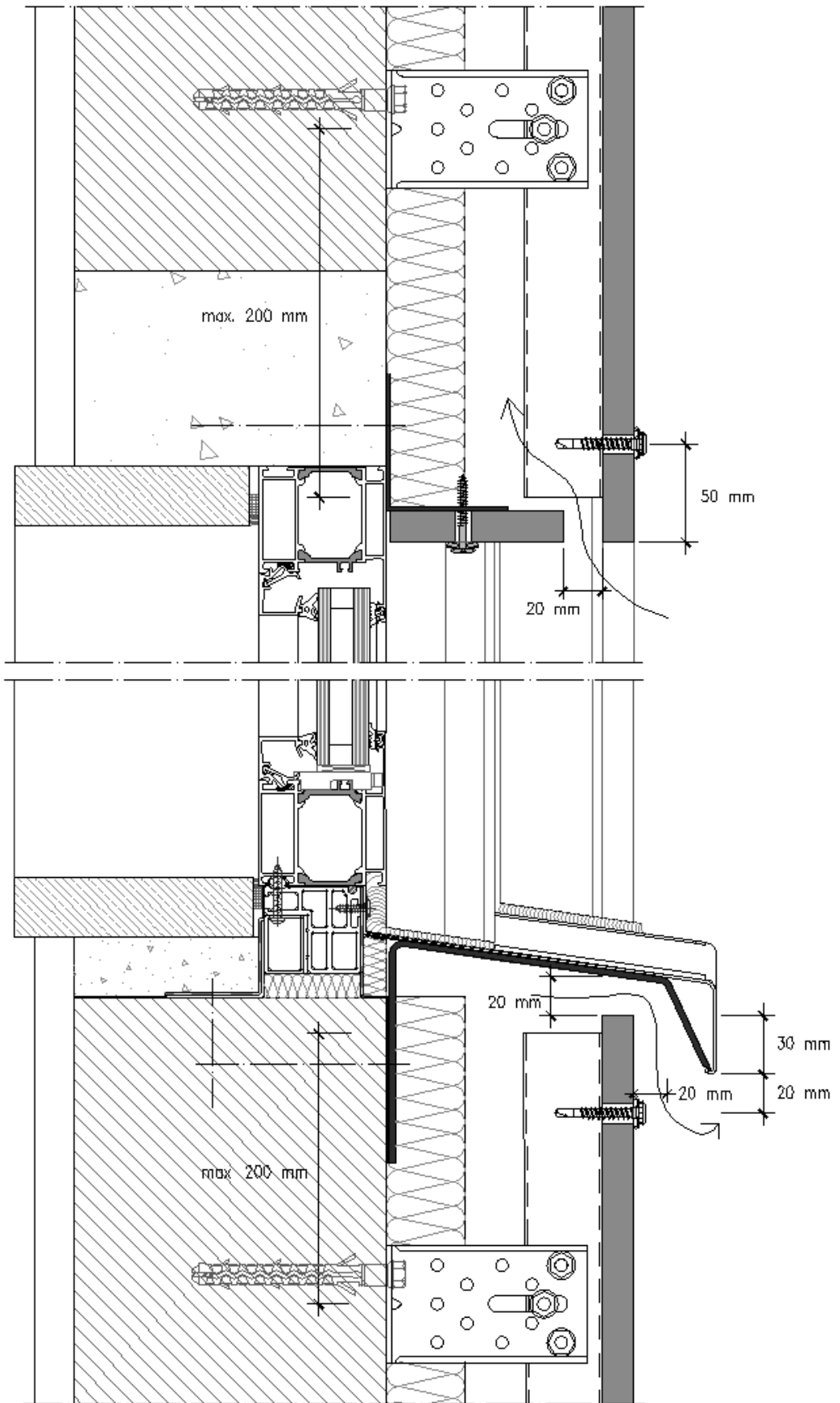


Figure 2.57 - Vertical section, window span

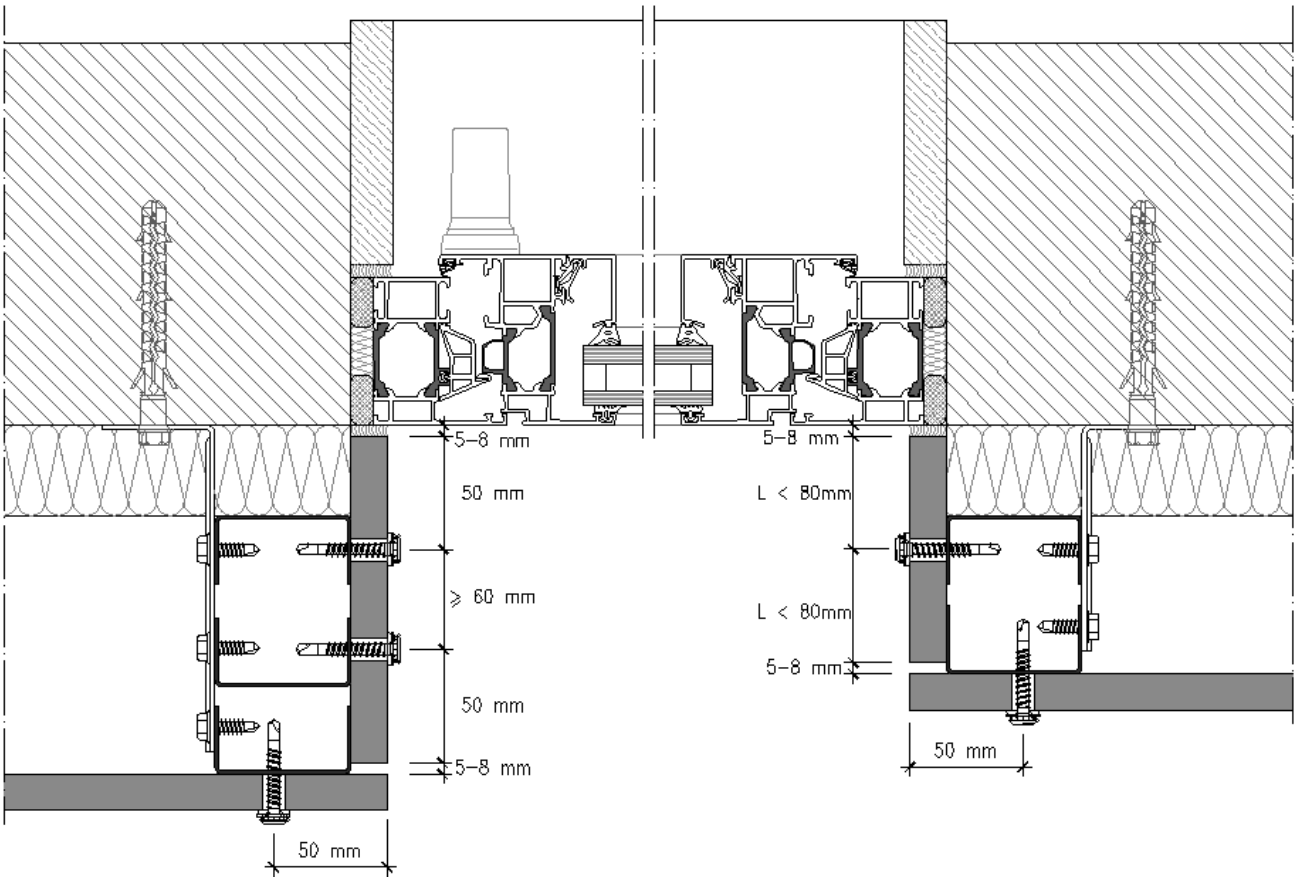


Figure 2.58 - Horizontal section, window span

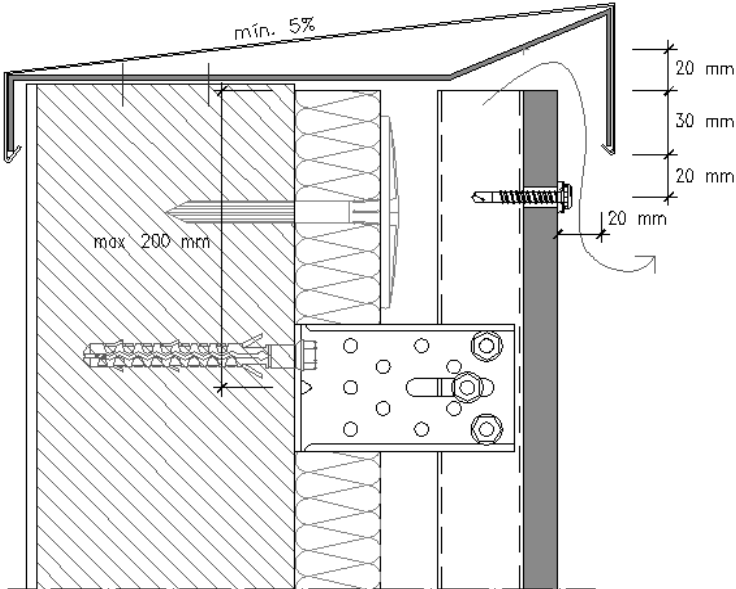


Figure 2.59 - Detail of the top

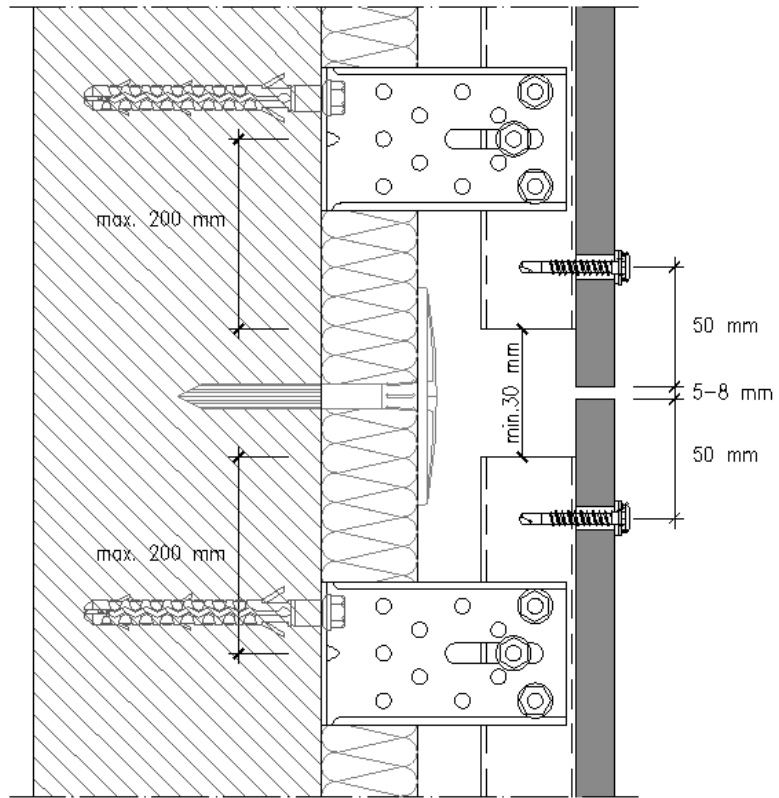


Figure 2.60 - Structure fractionation: Length profiles ≤ 5.4 m

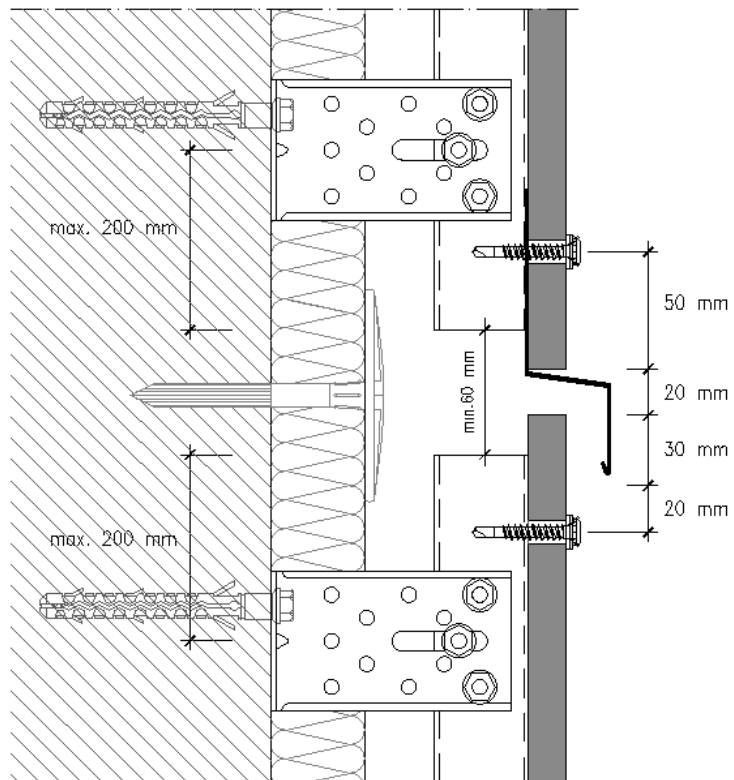


Figure 2.61 - Structure fractionation: Profiles with length > 5.4 m

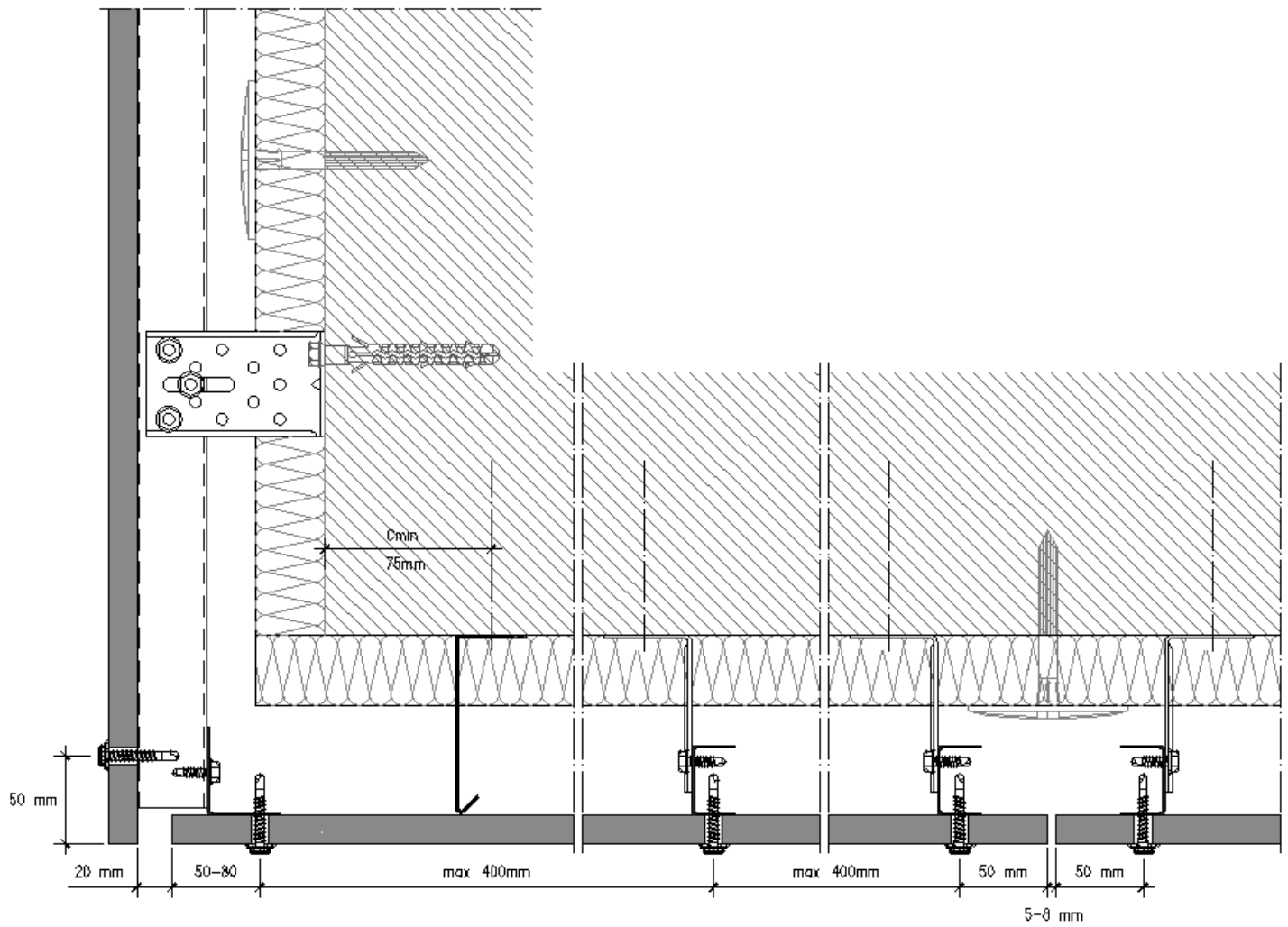


Figure 2.62 - Detail of the facade connection - suspended ceiling

Aluminium Structure

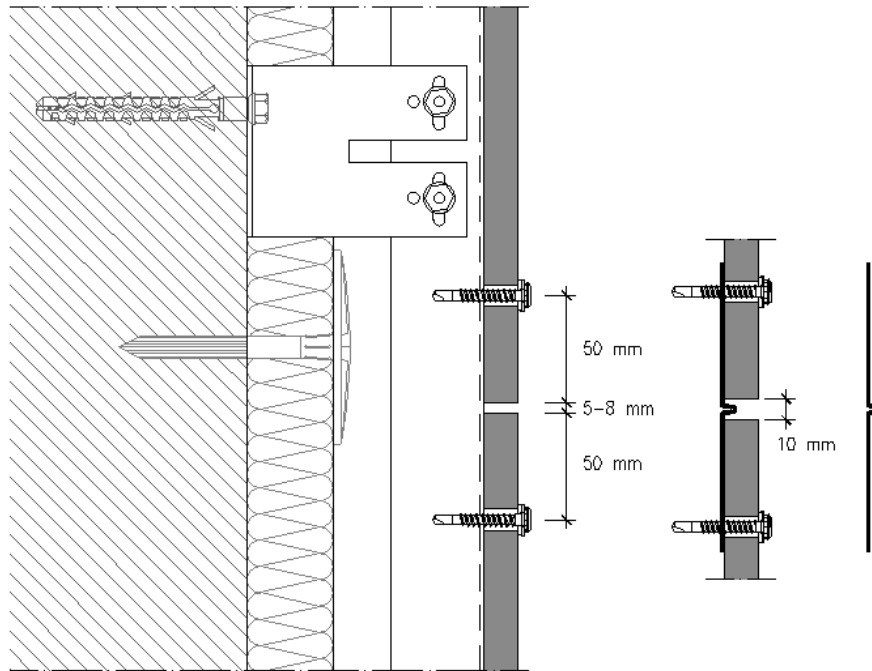


Figure 2.63 - Vertical section, joint between boards

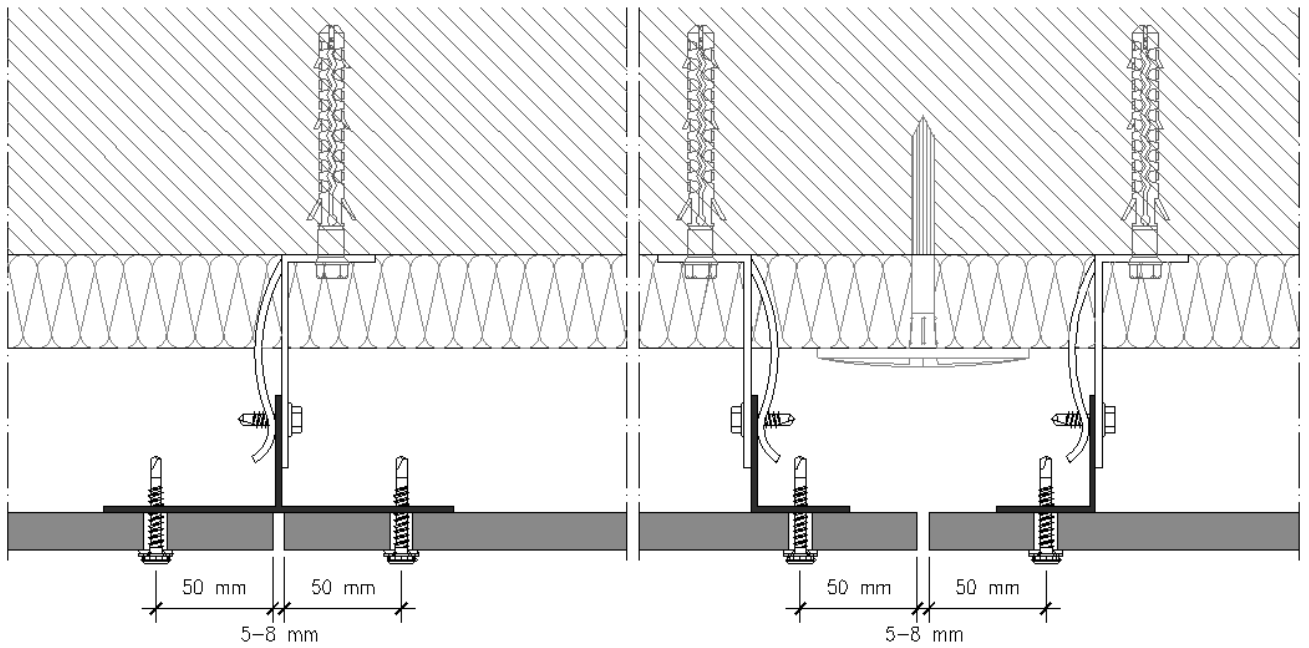


Figure 2.64 - Horizontal section, joint between boards

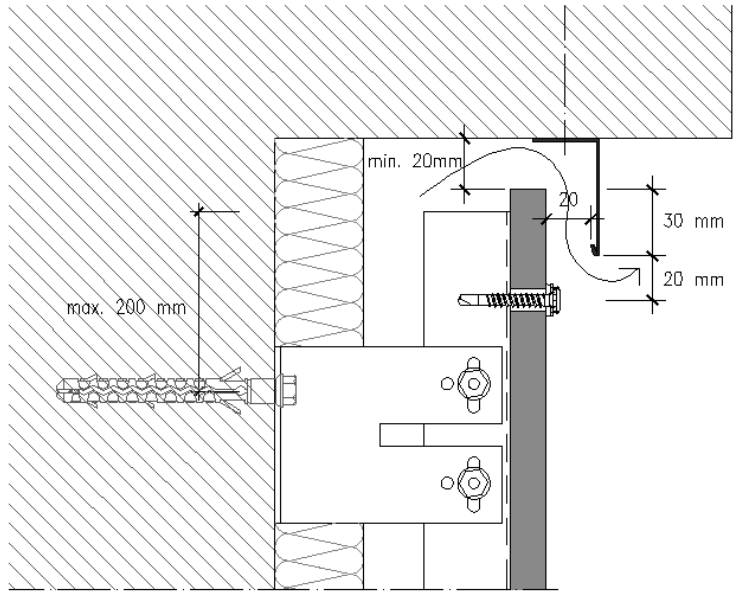


Figure 2.65 - Finishing under balcony

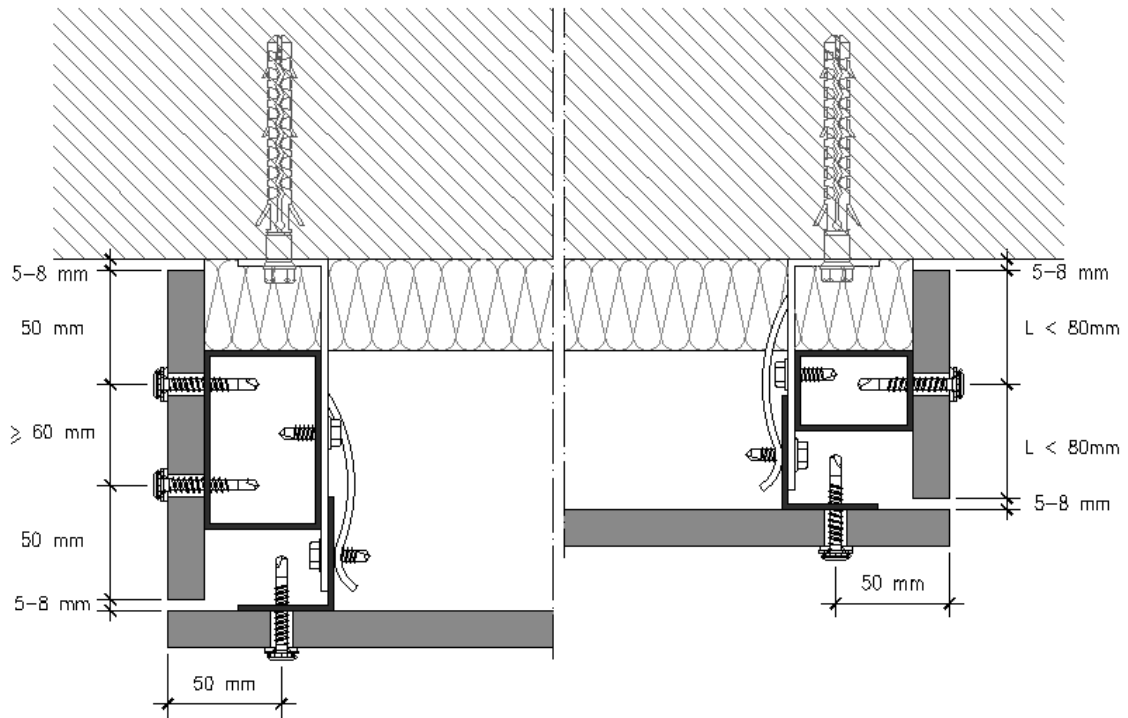


Figure 2.66 - Side Shot

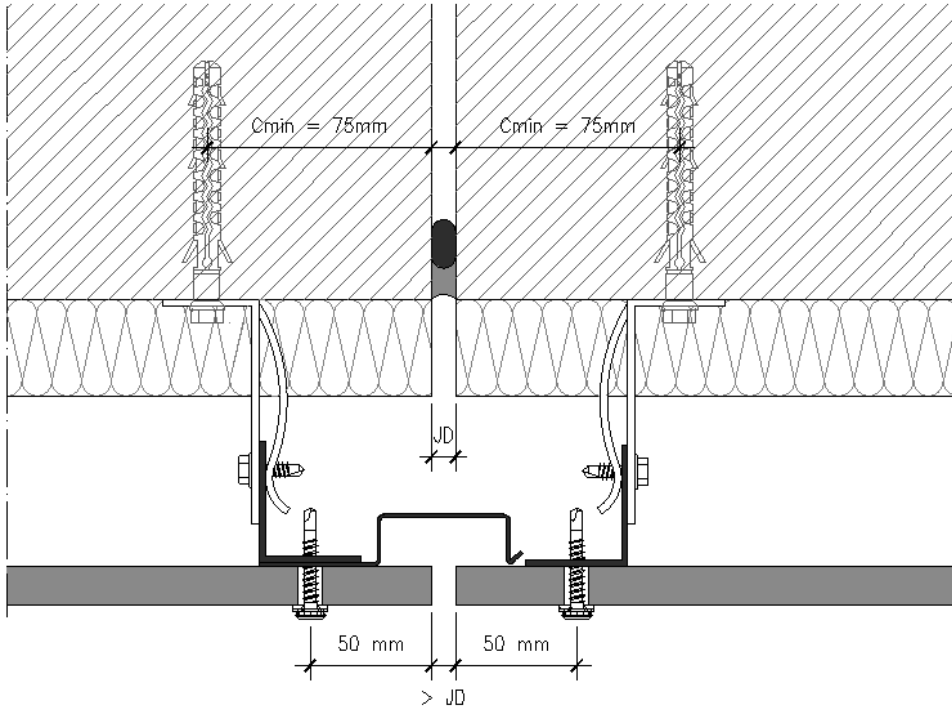


Figure 2.67 - Expansion joint

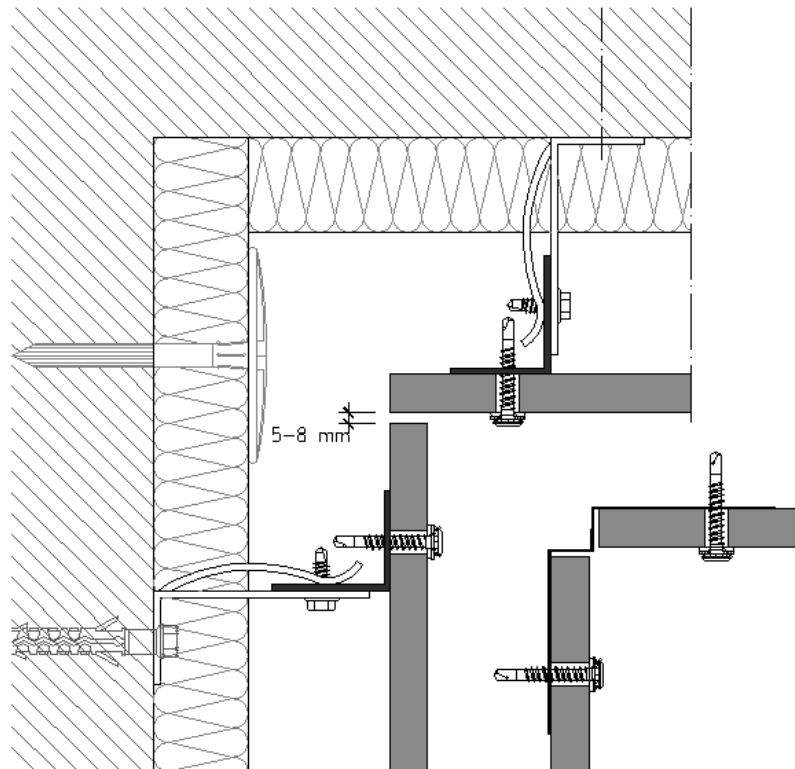


Figure 2.68 - Corner Angle

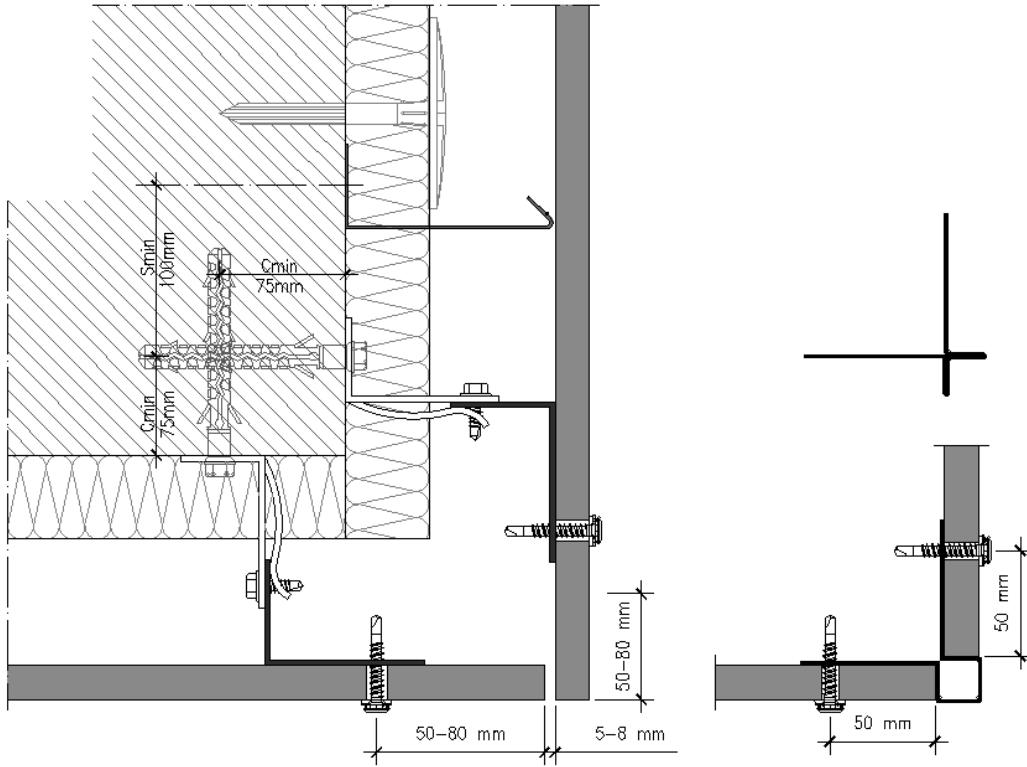


Figure 2.69 - Corner Angle

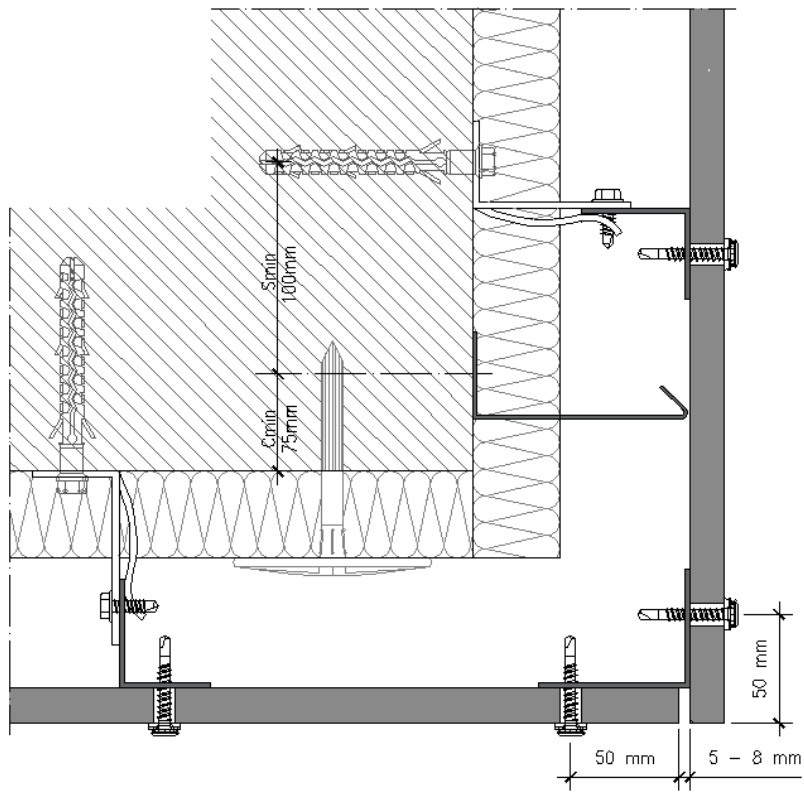


Figure 2.70 - Corner angle, variant

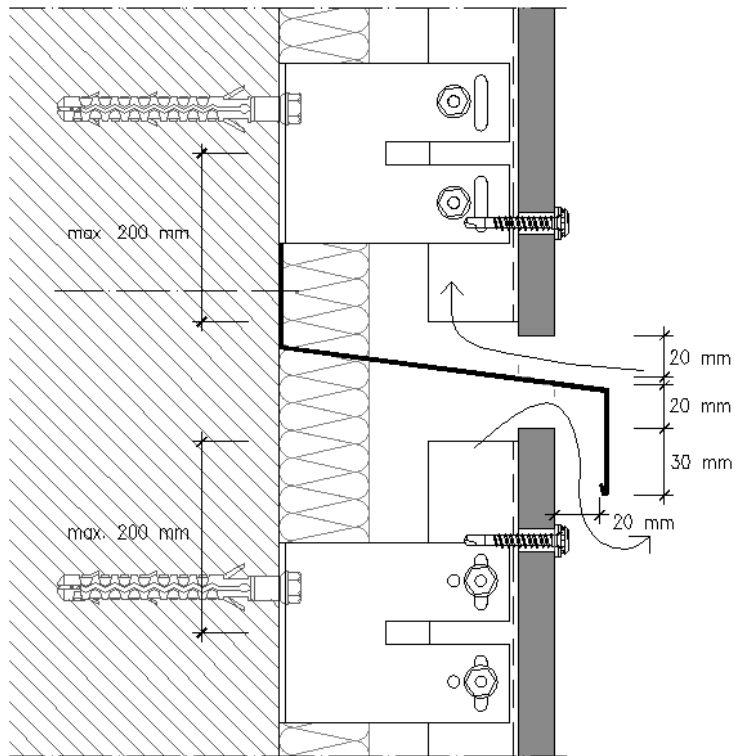


Figure 2.71- Horizontal air gap partition

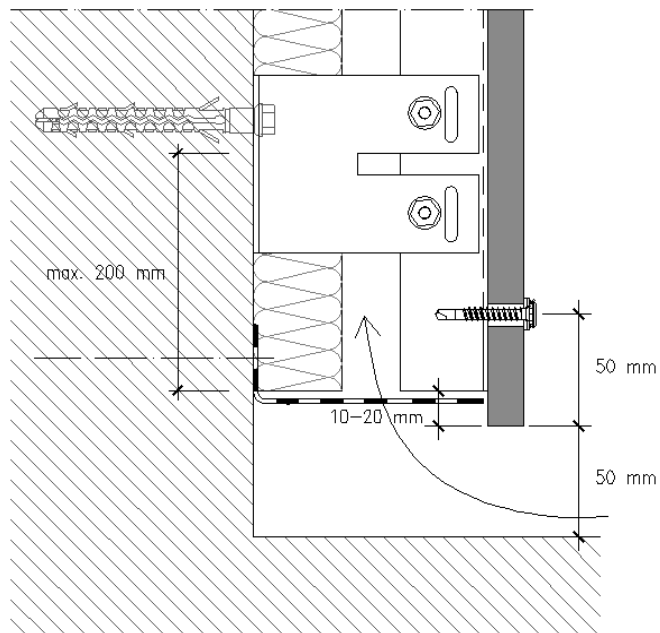


Figure 2.72 - Detail of the base, anti-rodent grill

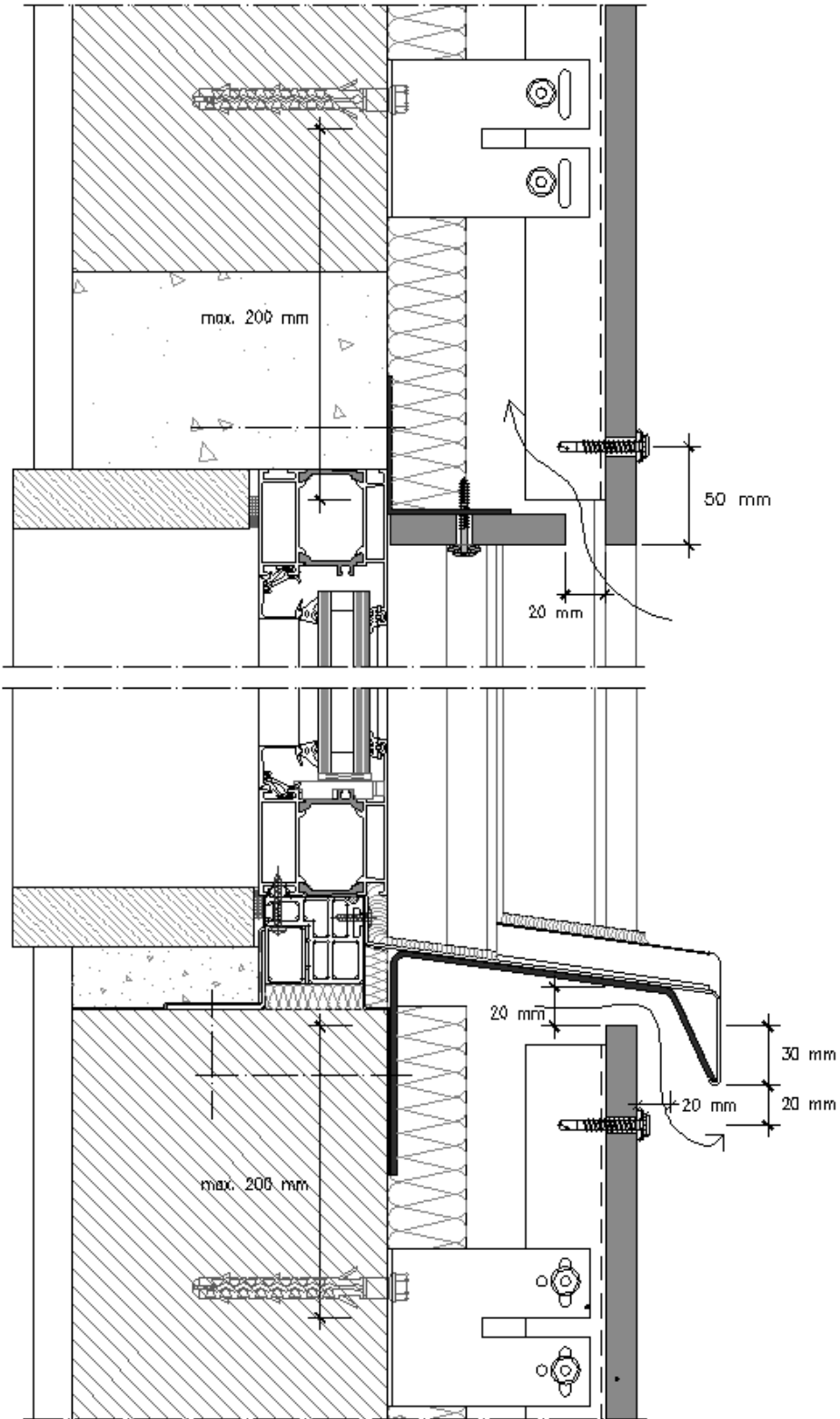


Figure 2.73 - Vertical section, window span

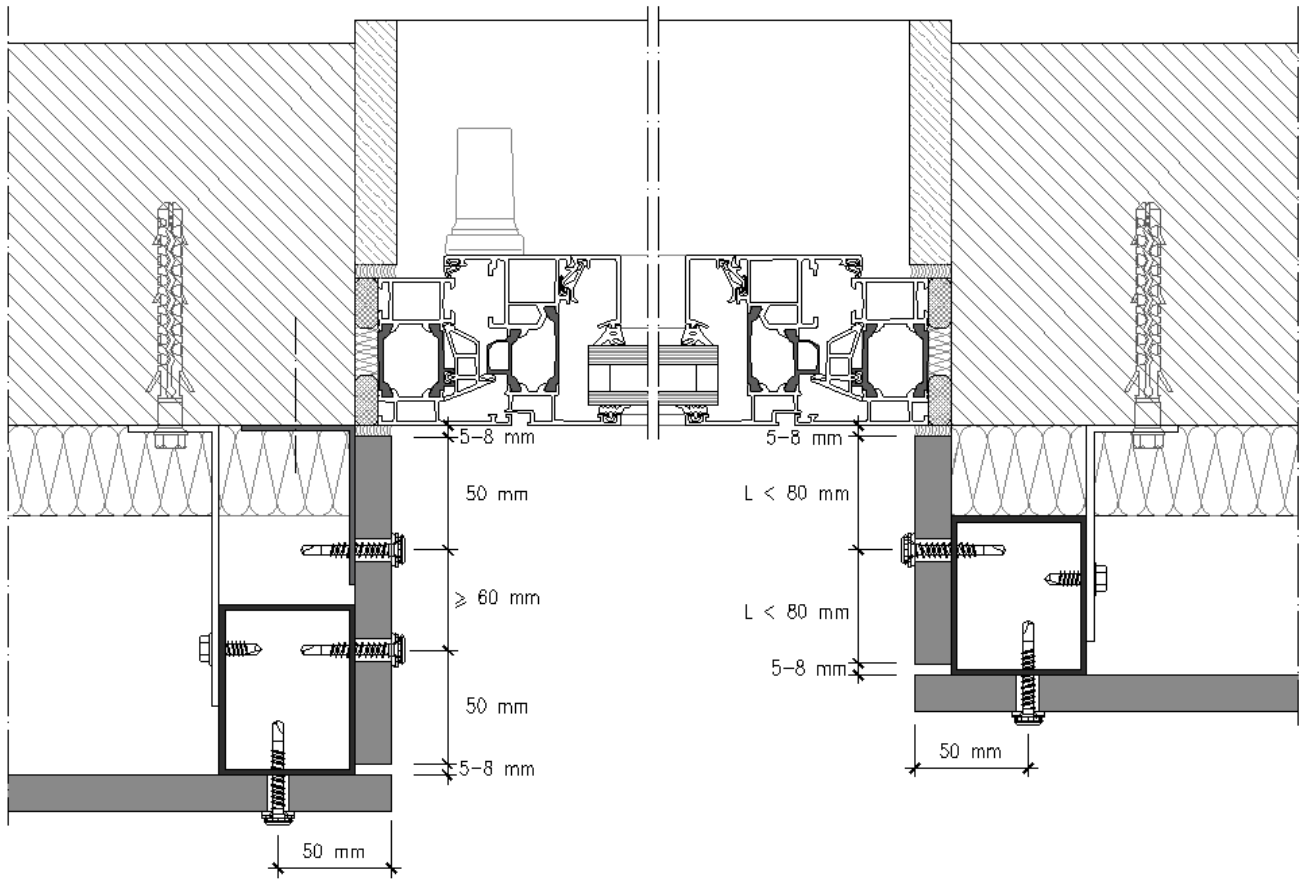


Figure 2.74 - Horizontal section, window span

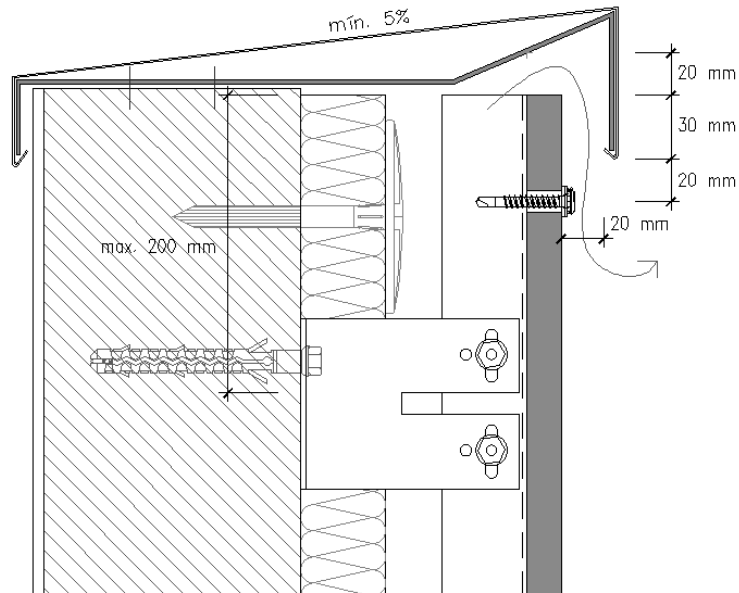


Figure 2.75 - Detail of the top

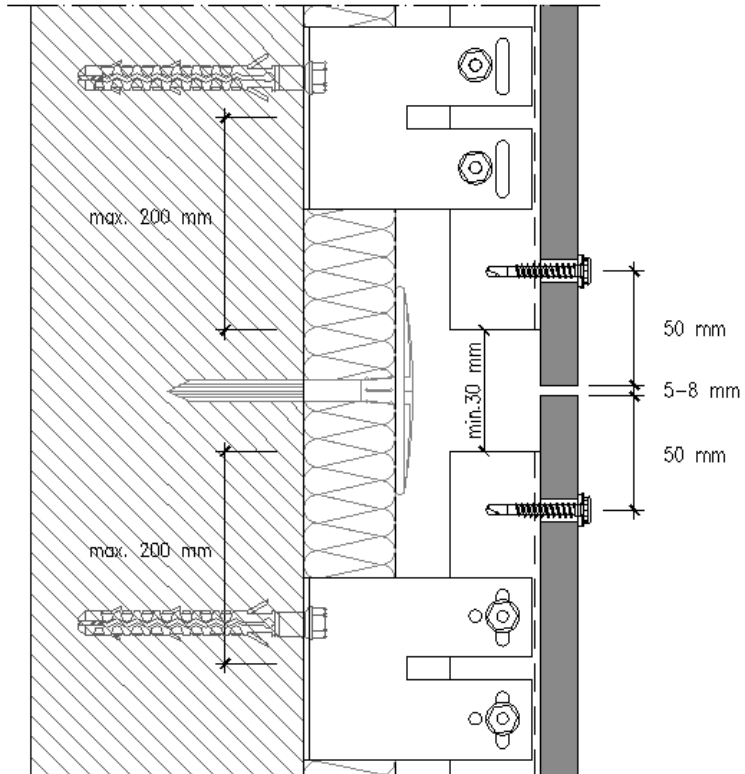


Figure 2.76 - Structure fractionation: Length profiles ≤ 5.4 m

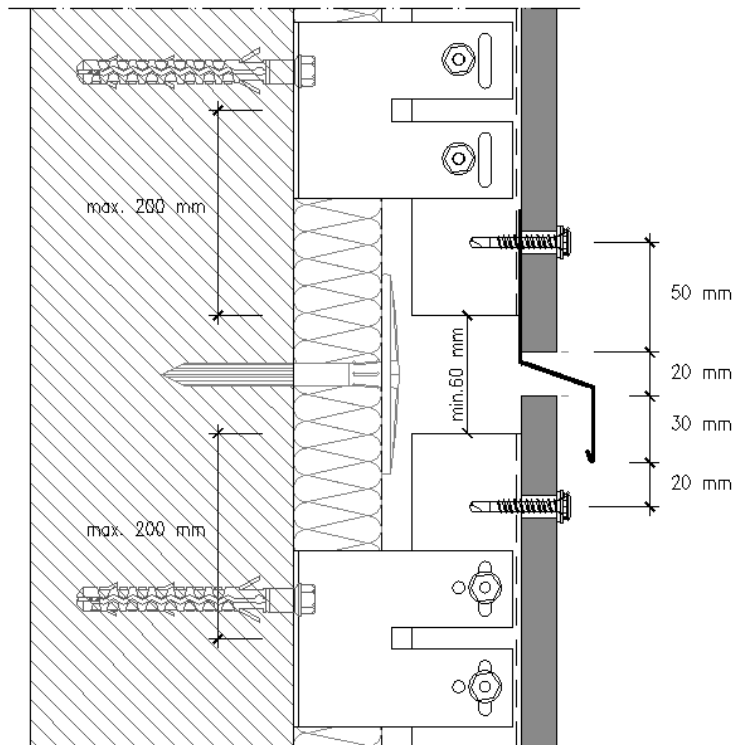


Figure 2.77 - Structure fractionation: Profiles with length > 5.4 m

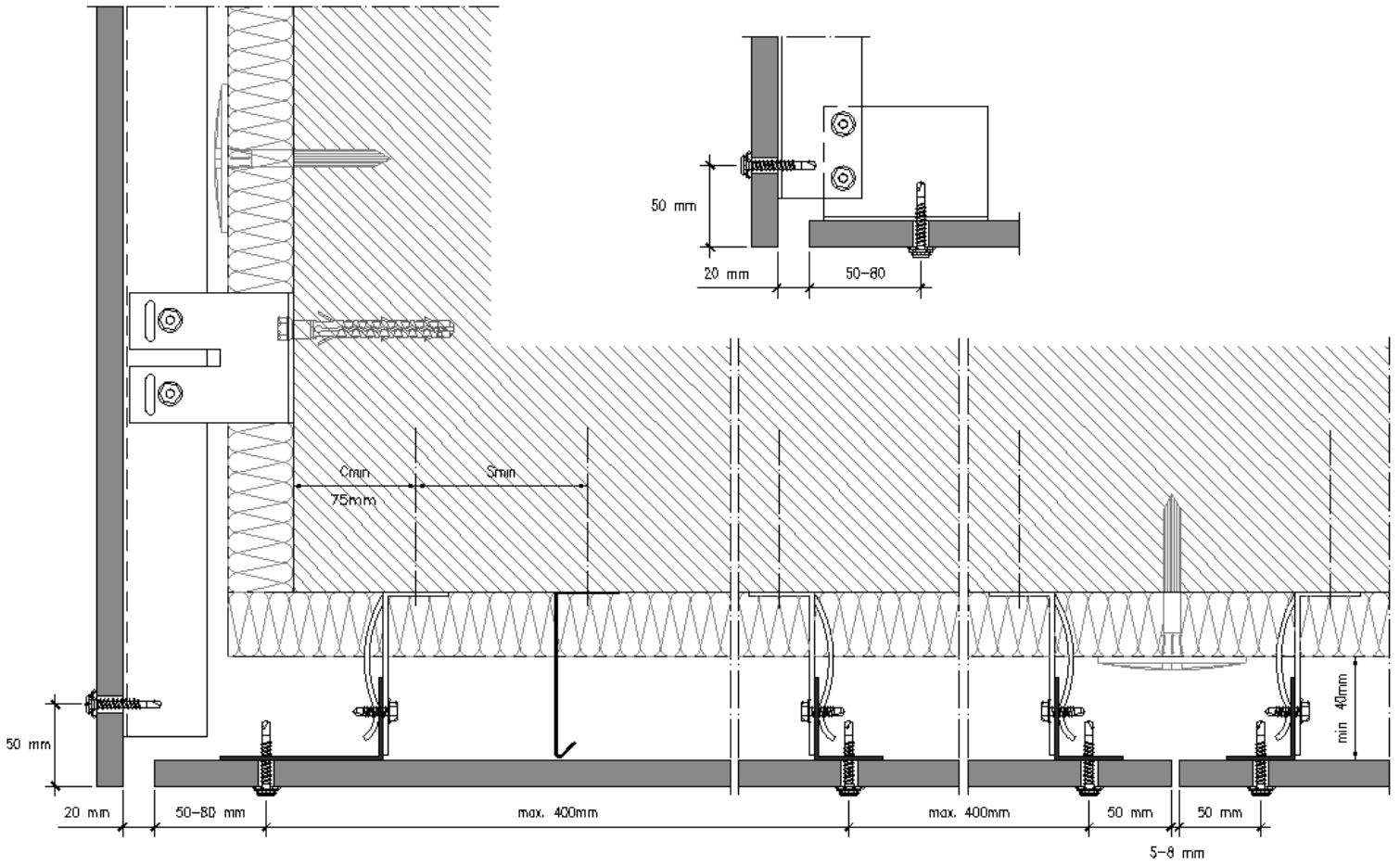
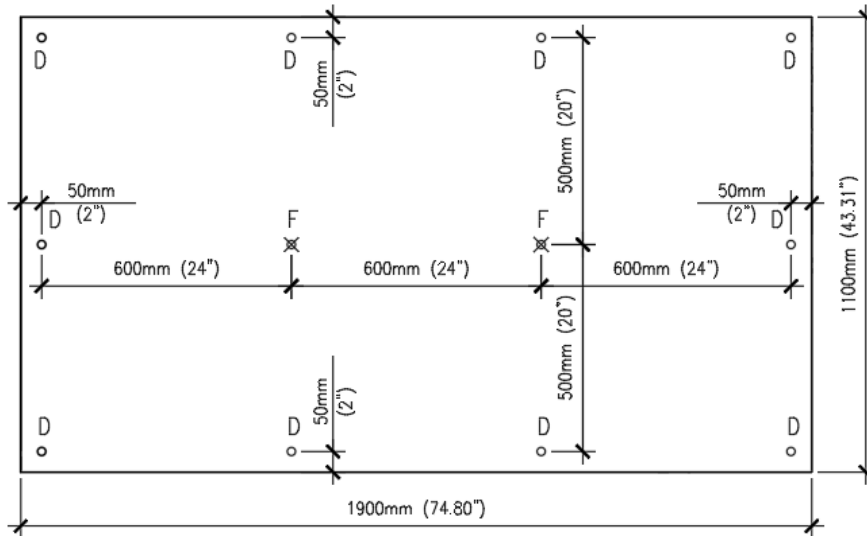


Figure 2.78 - Facade connection detail - suspended ceiling

Quantifying of a board's wind resistance

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



Fastening Configuration:

Number of Horizontal Screws: 4

Number of vertical screws: 3,

Set-up: 4x3, N>3 => Nx3

Horizontal Screw Distance: 600 mm, => See Table 4

Upright Screw Distance: 500 mm

Thickness of the panel	(HxV)	Wind load pressure	Horizontal distance between screws 600 mm (24")							
			Vertical distance between screws 500mm (20")				Vertical distance between screws 600mm (24")			
			300mm kN/m ²	12" psf	400mm kN/m ²	16" psf	500mm kN/m ²	20" psf	600mm kN/m ²	24" psf
12mm 0.472"	2 x 2		2.5	52	2.0	42	1.7	35	1.4	30
	2 x 3		2.5	52	2.0	41	1.5	31	1.2	25
	2 x N		2.5	51	2.0	42	1.6	33	1.3	27
	3 x 2		2.0	42	1.6	34	1.4	29	1.2	25
	N x 2		2.2	46	1.8	37	1.5	31	1.3	27
	3 x 3		1.9	40	1.4	30	1.1	24	0.9	20
	3 x N		2.1	43	1.6	32	1.2	26	1.0	21
	N x 3		2.1	44	1.6	33	1.2	26	1.0	21
16mm 0.630"	2 x 2		5.2	108	4.2	87	3.5	72	3.0	62
	2 x 3		5.2	108	4.1	86	3.2	66	2.6	53
	2 x N		5.1	107	4.3	90	3.4	70	2.8	58
	3 x 2		4.3	89	3.5	72	2.9	61	2.6	53
	N x 2		4.7	98	3.8	79	3.2	66	2.8	58
	3 x 3		2.1	44	1.6	33	1.3	26	1.0	22
	3 x N		2.3	48	1.7	36	1.4	28	1.1	24
	N x 3		2.3	49	1.7	36	1.4	28	1.1	24

The permissible load for a 12mm thick board with the configuration indicated is:

1.2 kN/m² (26 psf)

Note: Wind action exerts a pressure or depression on the board. This is required when acting as a depression, since the board is fastened only by the screw head and the breakage occurs by cutting/punching the board in these areas.

Figure 2.79 - Example of quantifying the wind resistance of a board

Facade - Combined fastening system

Timber structure

Board size and fastening location

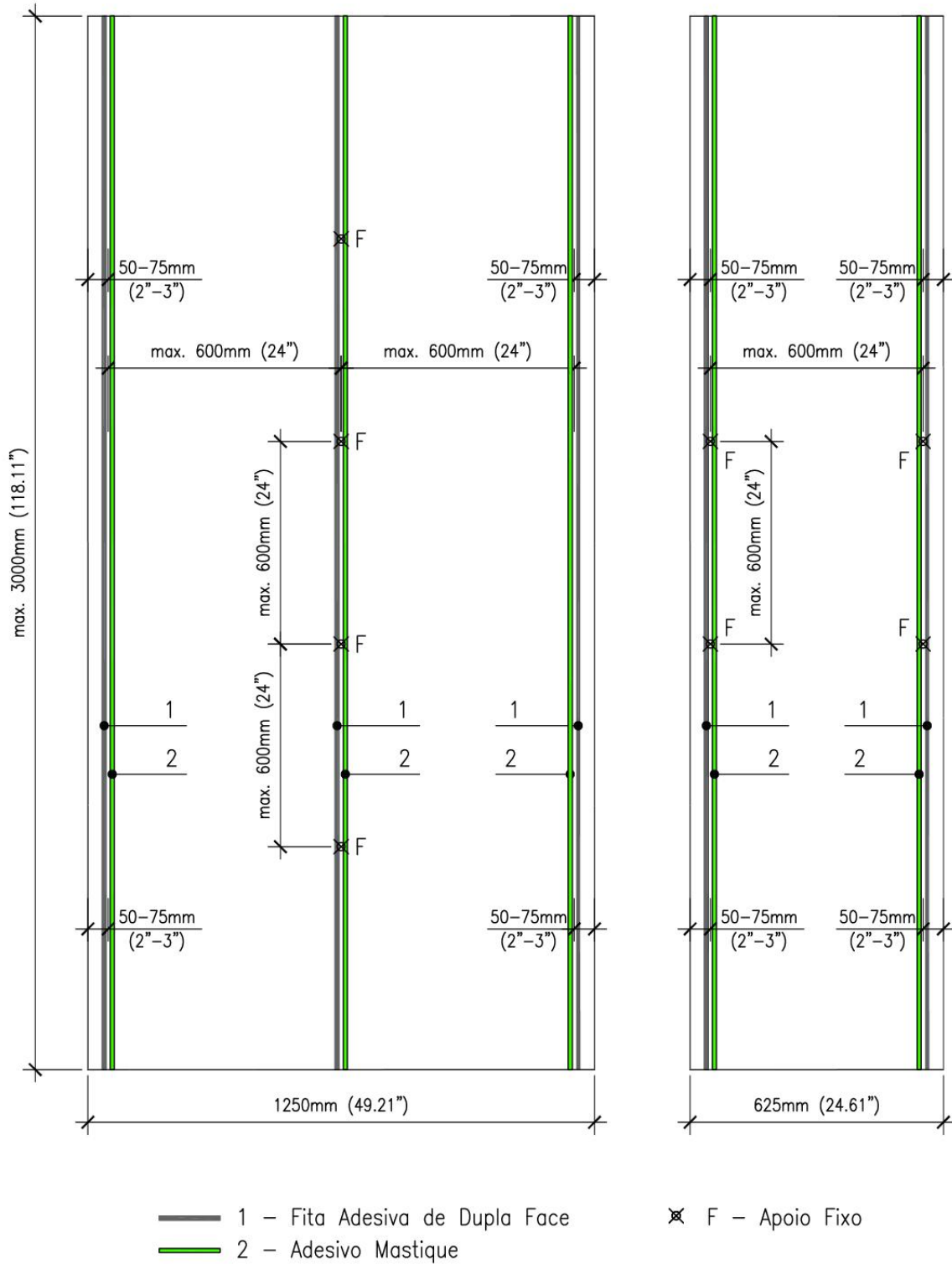
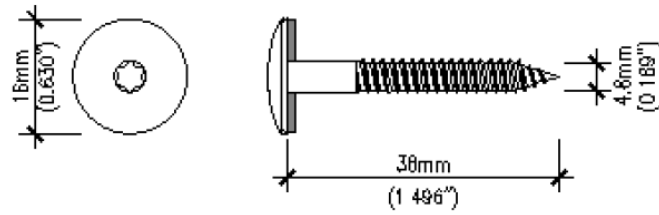


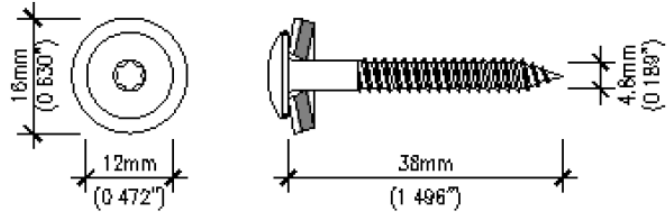
Figure 2.80 - Board Size and Location of the Combined Fastening System

Note: Double-sided adhesive tape is always placed near the end of the board, the mastic adhesive on the inside

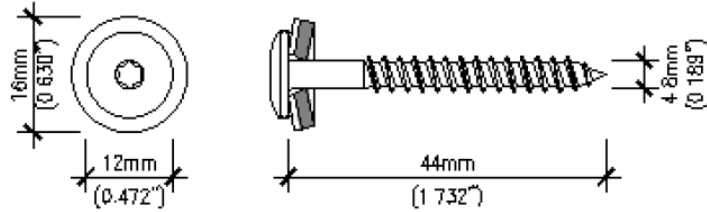
TW-S-D16-4 8x38 + Washer (SFS Intec)
 Tarx Panel Bois TB16 4.8x38 A16 (ETANCO)



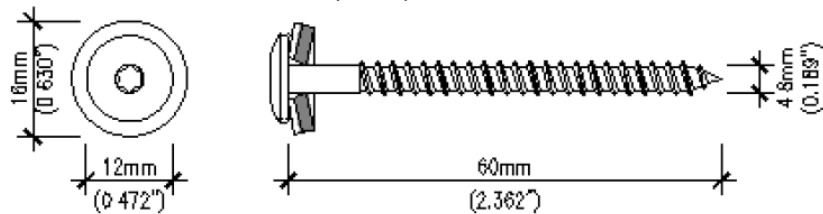
TW-S-D12-S16-4 8x38 (SFS Intec)
 Tarx Panel Bois TB12 4.8x38 A16 (ETANCO)



TW-S-D12-S16-4.8x44 (SFS Intec)



TW-S-D12-S16-4.8x60 (SFS Intec)
 Tarx Panel Bois TB12 4.8x60 A16 (ETANCO)



SWI Ø5.5x38 Head Ø12 (SFS Intec)

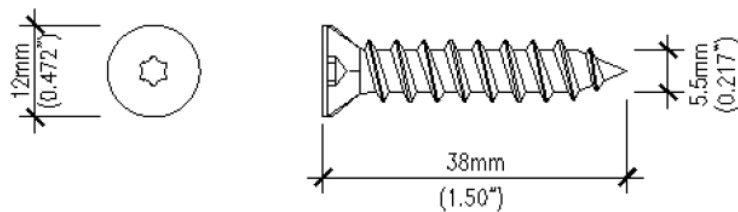


Figure 2.81 - Timber Frame Screws



Figure 2.82 - Mastic board glue system
(Sikatack Panel from Sika and Simson PanelTack from Bostik)

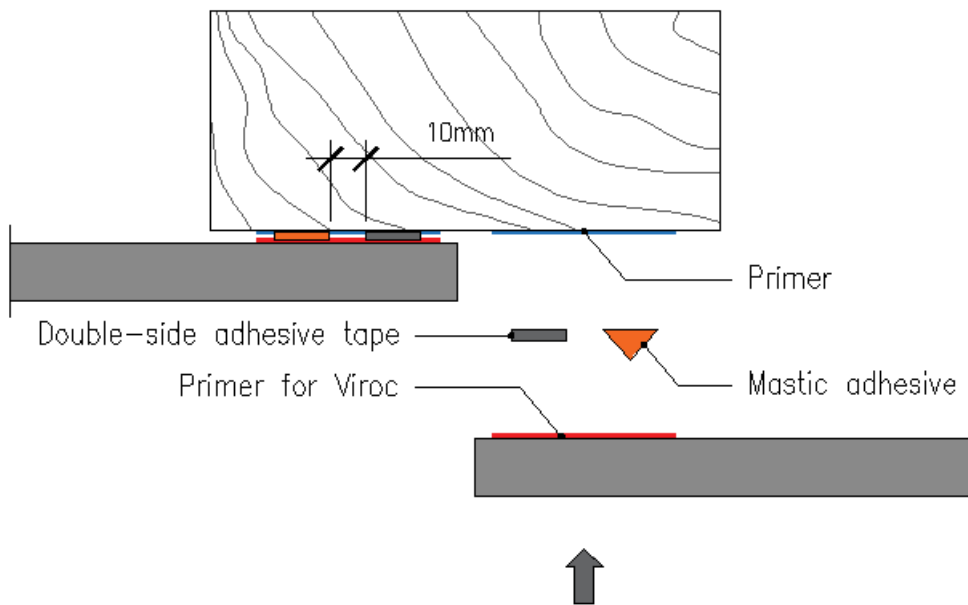


Figure 2.83 - Detail of gluing in a joint area

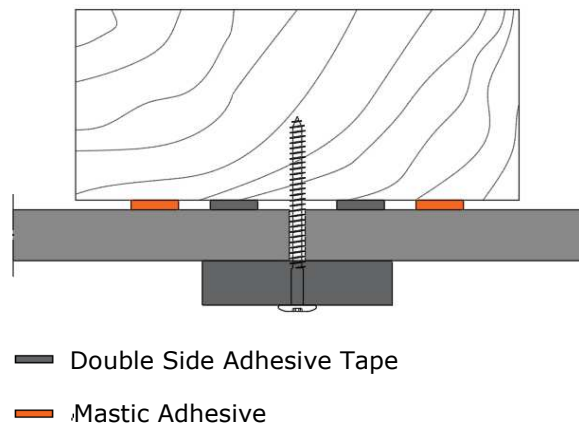


Figure 2.84 - Levelling wedge and temporary support

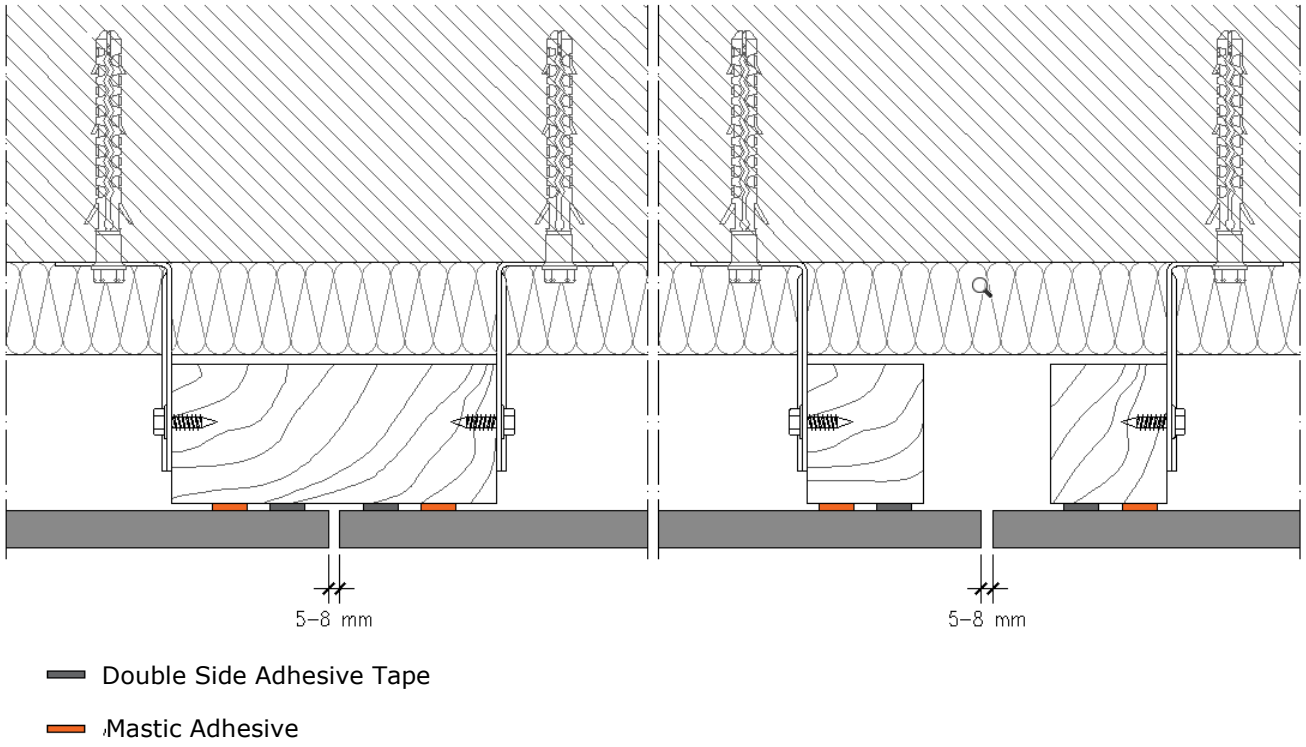


Figure 2.85 - Horizontal section, joint between boards

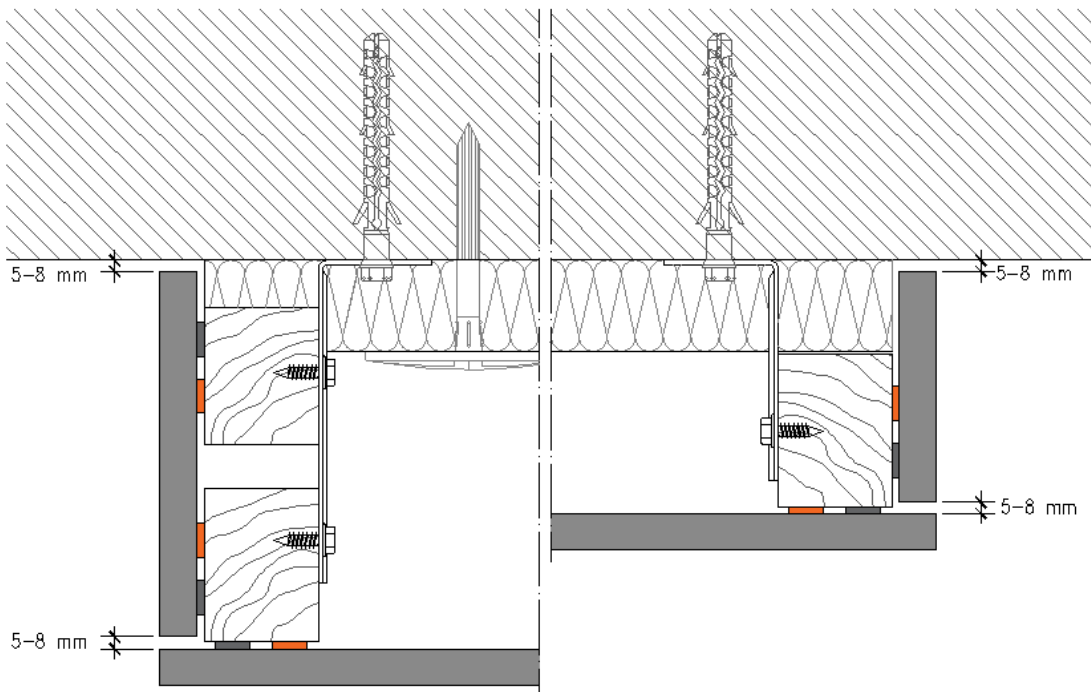


Figure 2.86 - Side Shot

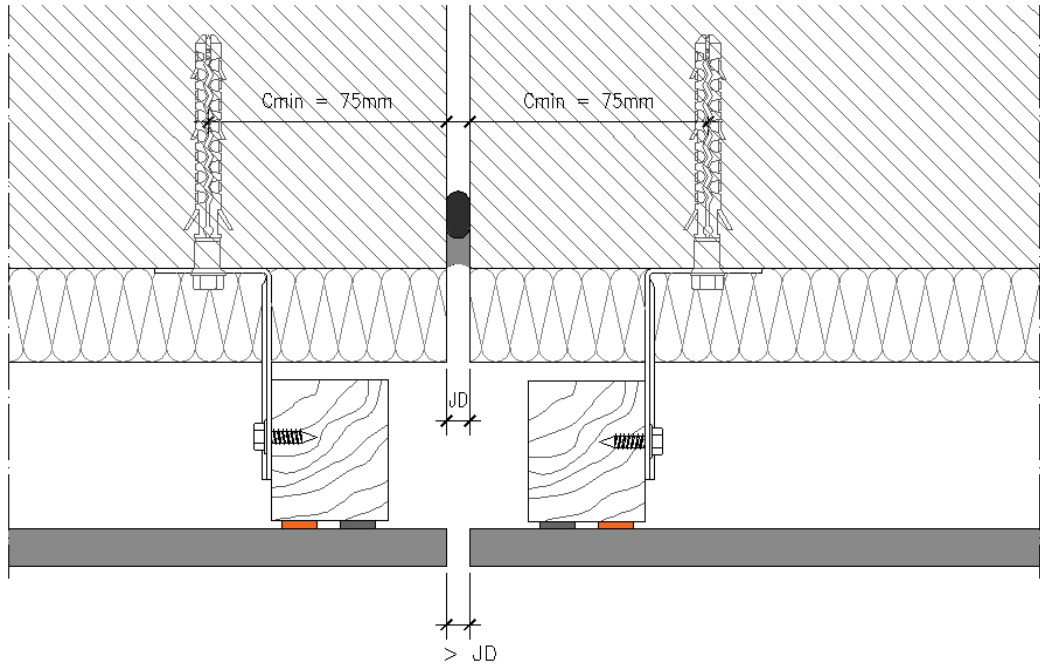


Figure 2.87 - Expansion joint

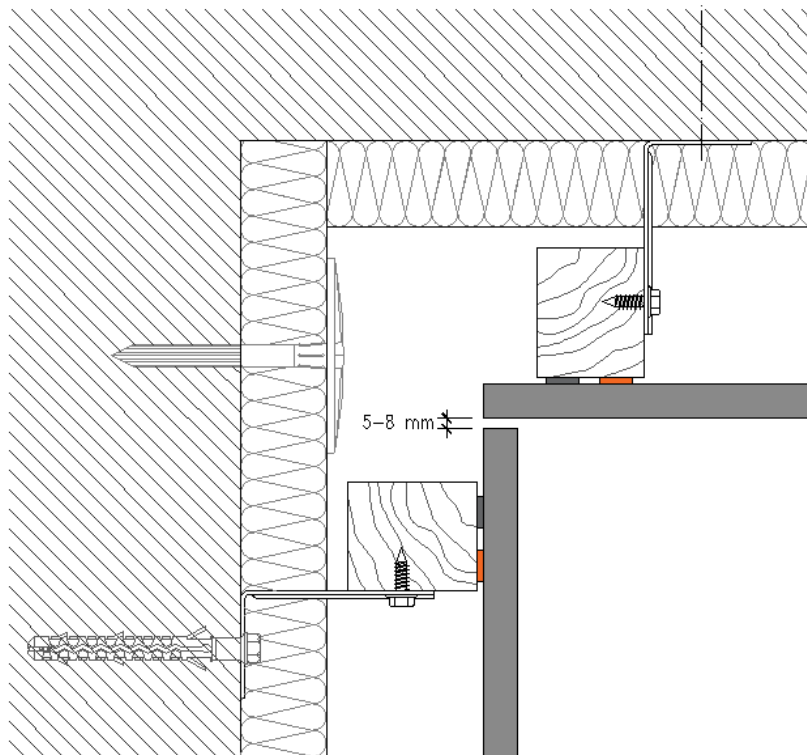


Figure 2.88 - Corner Angle

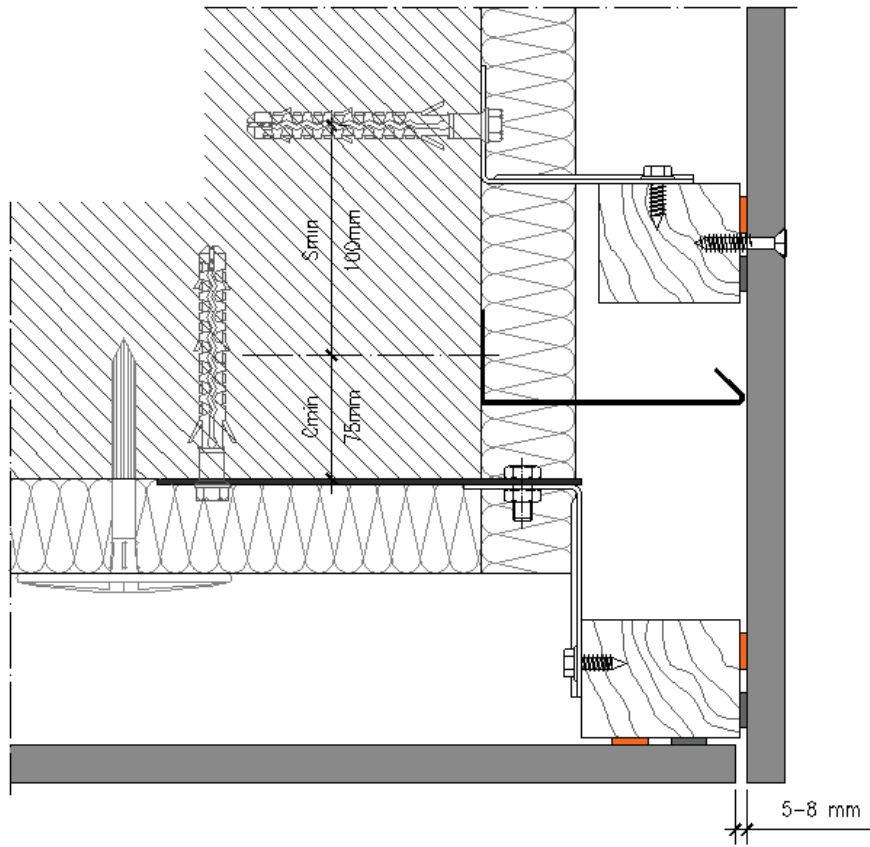


Figure 2.89 - Corner Angle

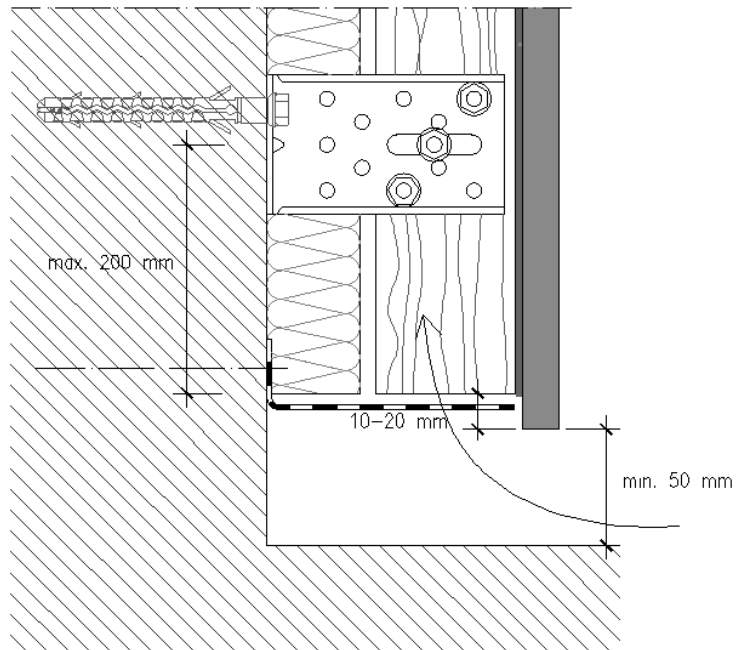


Figure 2.90 - Detail of the base, anti-rodent grill

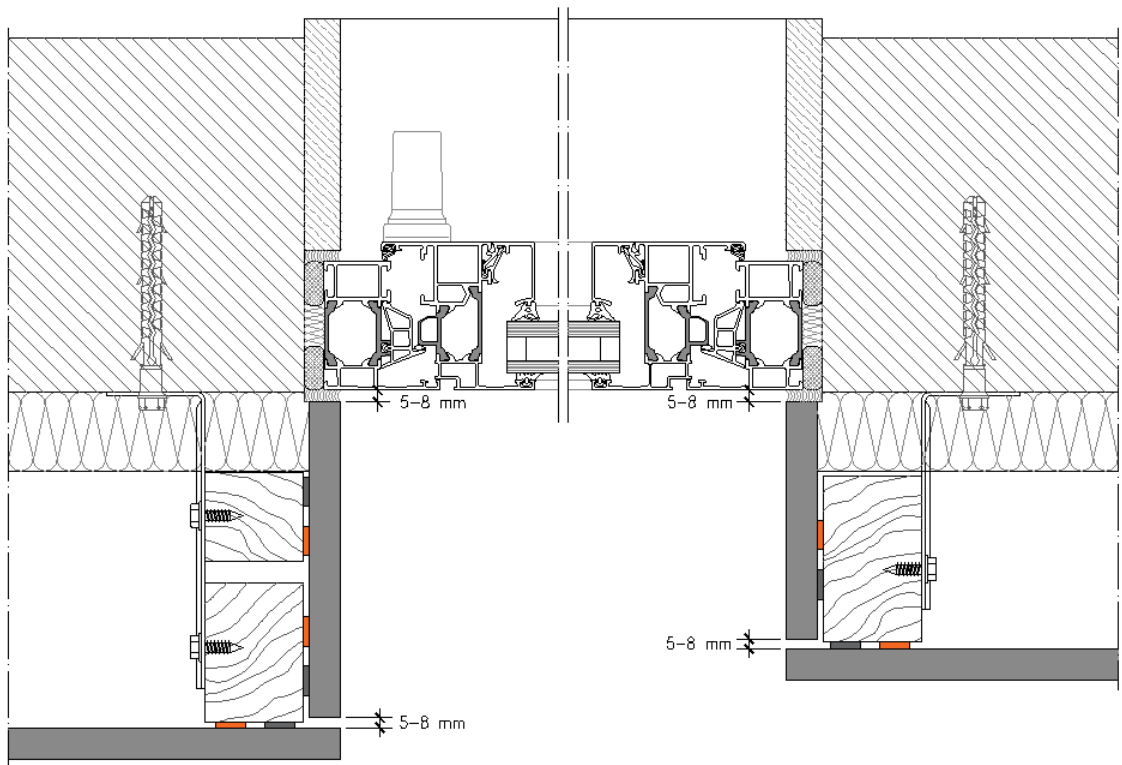


Figure 2.91 - Horizontal section, window span

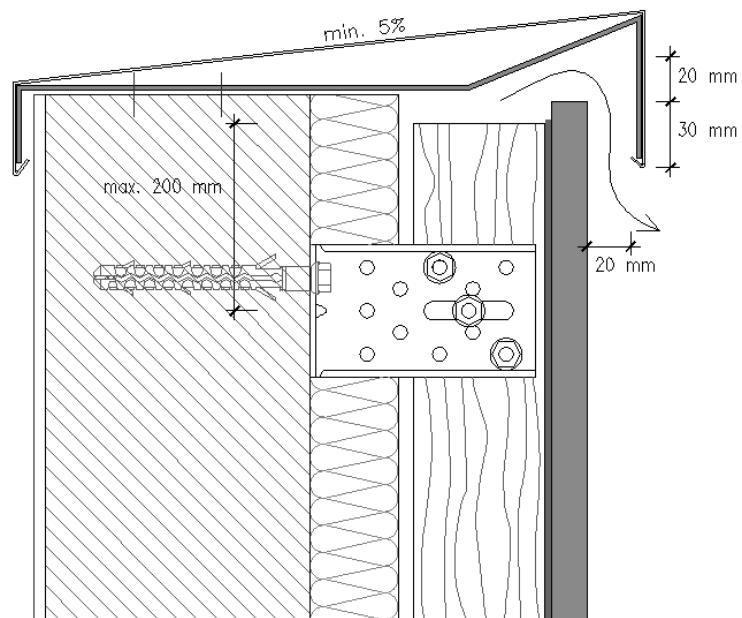


Figure 2.92 - Detail of the top

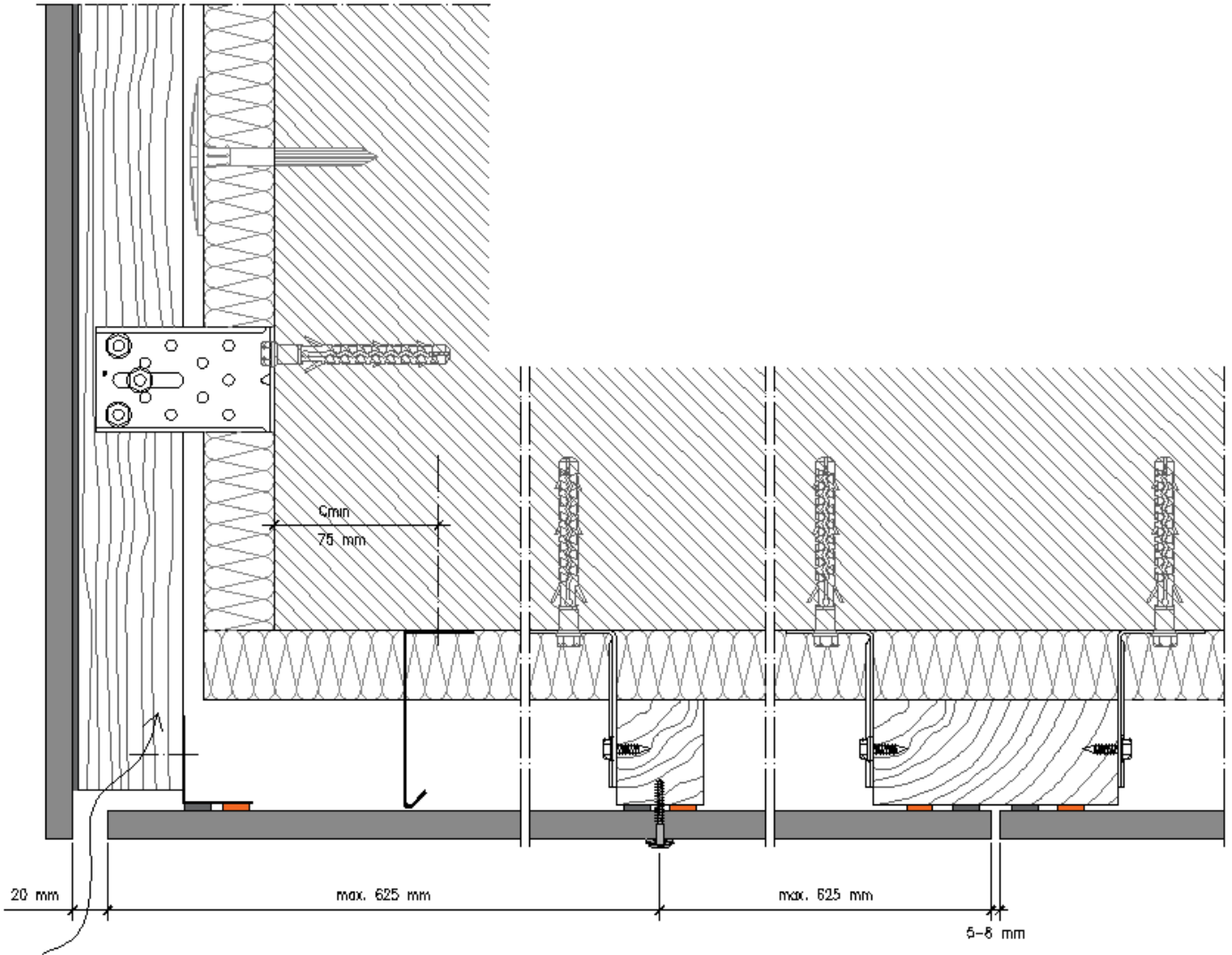


Figure 2.93 - Detail of the facade connection - suspended ceiling

Galvanized Steel Structure

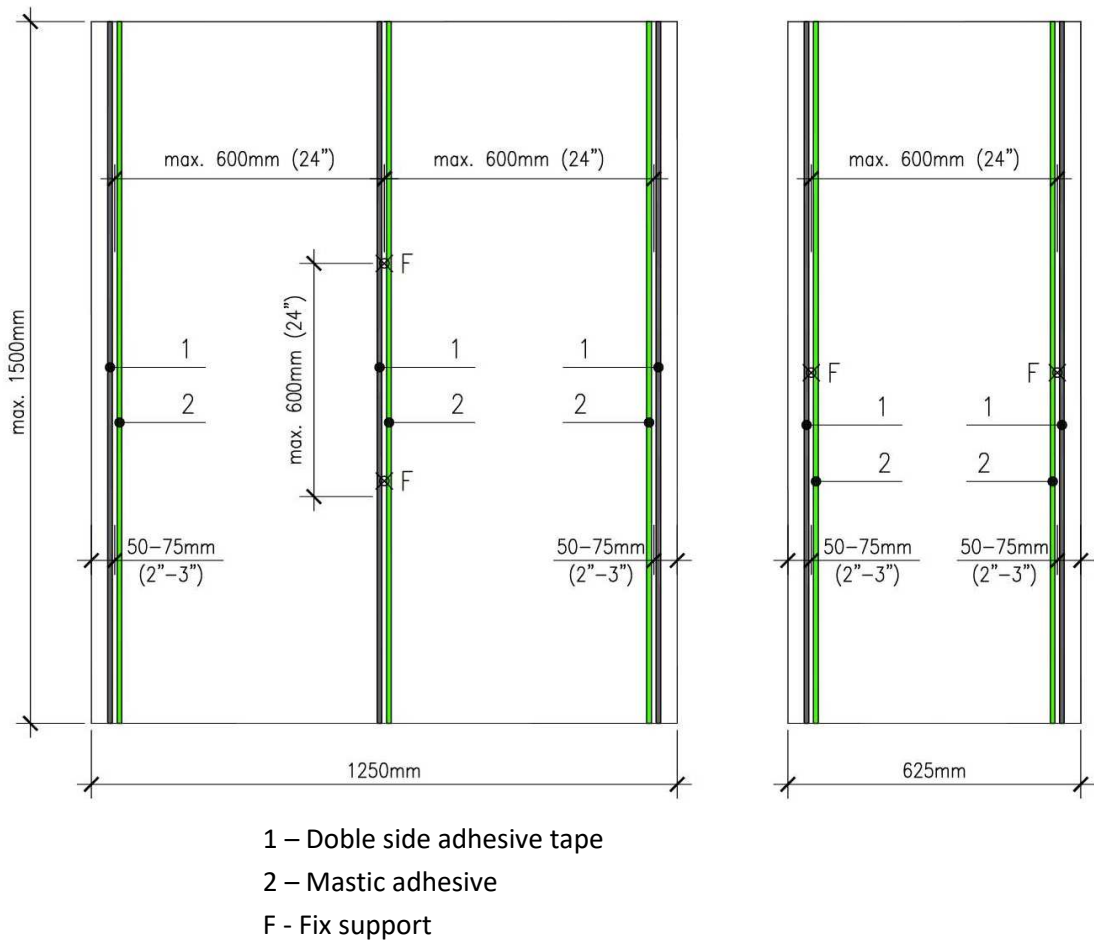
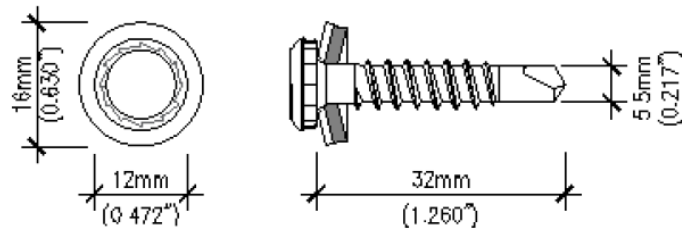


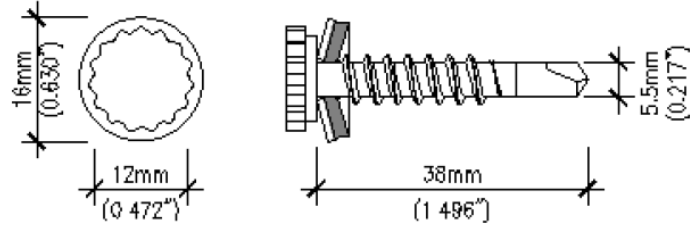
Figure 2.94 - Board Size and Location of the Combined Fastening System

Note: Double-sided adhesive tape is always placed near the end of the board, the mastic adhesive on the inside

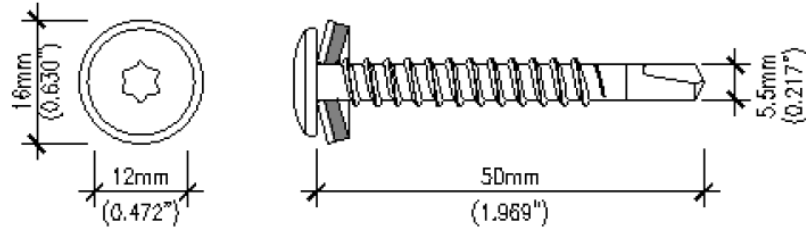
SX3/15-L12-516-5.5x32, SXW-L12-516-5.5x42 (SFS Intec)



STARCOLOR/Zn 5.5x38 A16 (ETANCO)



DRILLNOX STAR 5.5x38 A16, DRILLNOX STAR 5.5x50 A16 (ETANCO)



SCS3/27-7982/PH2-4.8x42 (SFS Intec)
Wingteks/Bi-métal 4.8x45 (ETANCO)

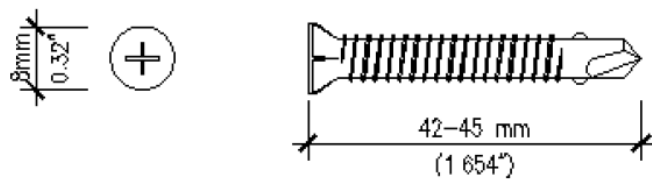
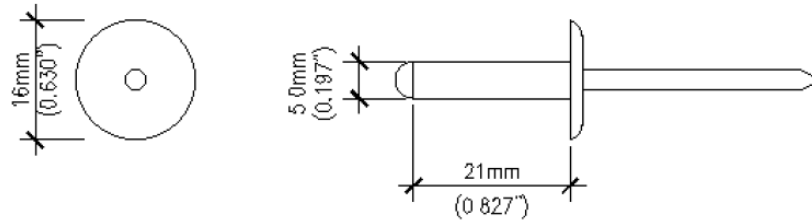


Figure 2.95 - Screws for metal frame

AP16-5.0x21 (SFS Intec)



RIVET N.E. CEL Alu/Inox-4.8x22 (ETANCO)

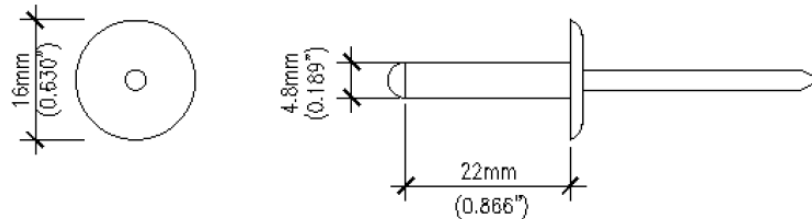


Figure 2.96 - Metal Frame Rivet

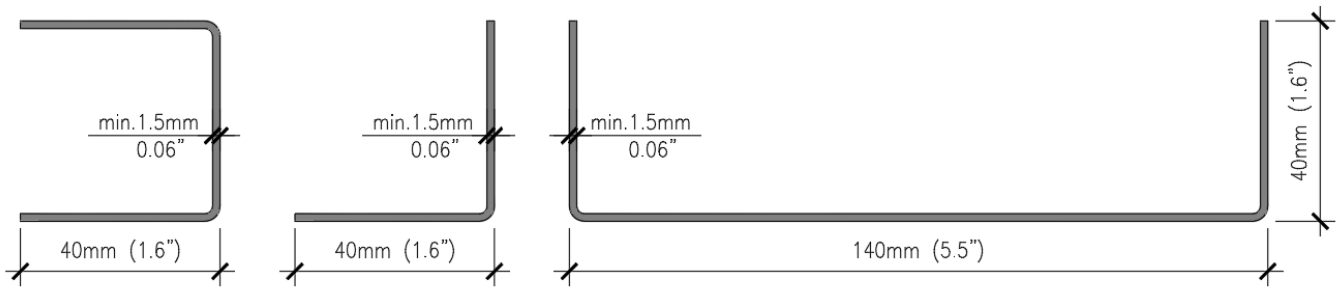


Figure 2.97 - Profiles adapted to the system
Galvanized steel, minimum resistance category S220GD (EN 10346)

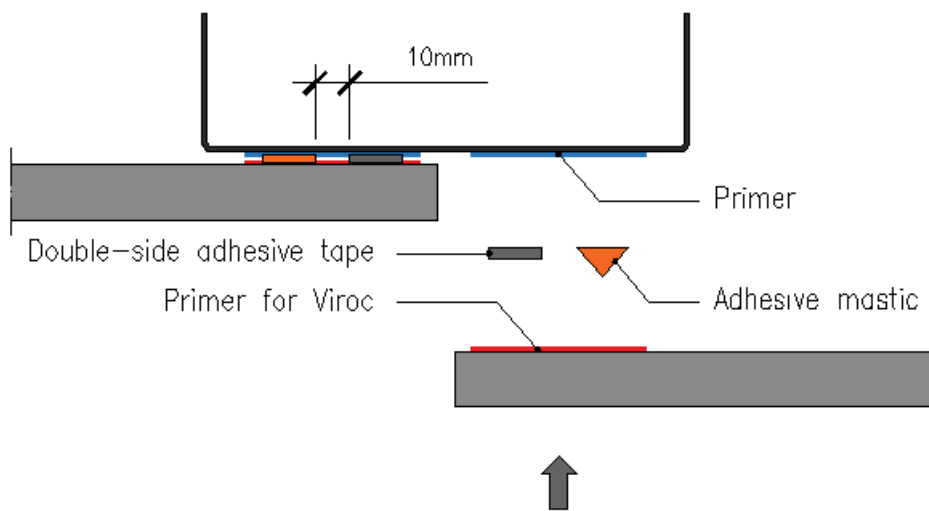


Figure 2.98 - Profiles adapted to the system

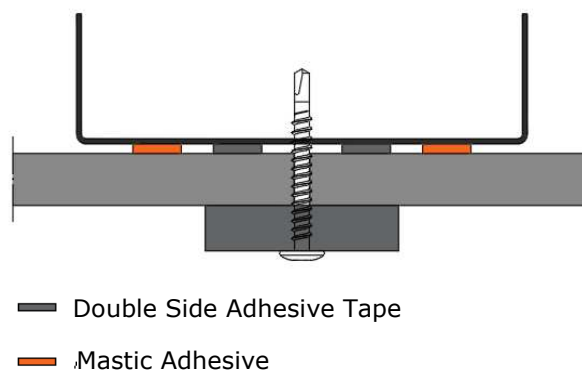
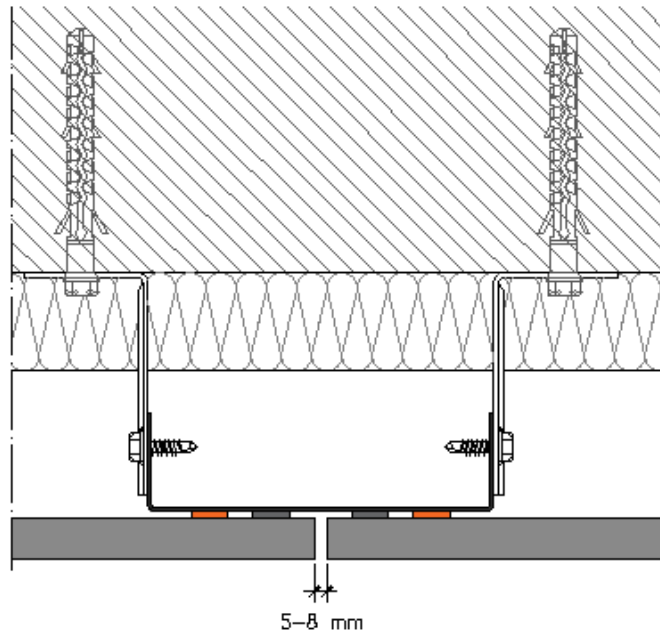


Figure 2.99 - Levelling wedge and temporary support



- Double Side Adhesive Tape
- Mastic Adhesive

Figure 2.100 - Horizontal section, joint between boards

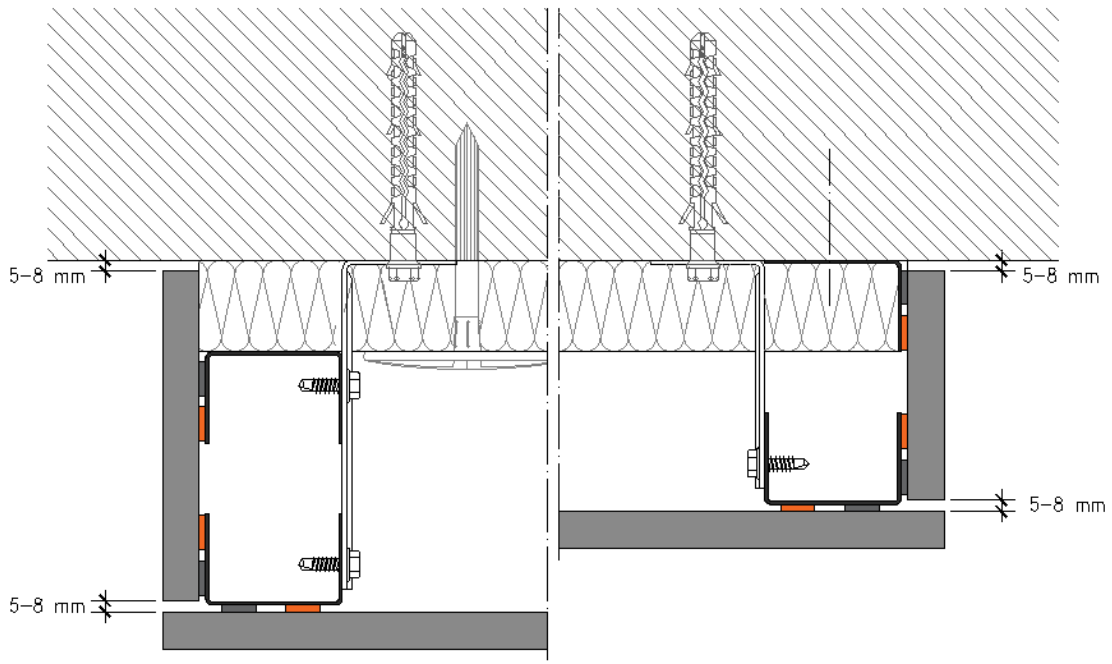


Figure 2.101 - Side Shot

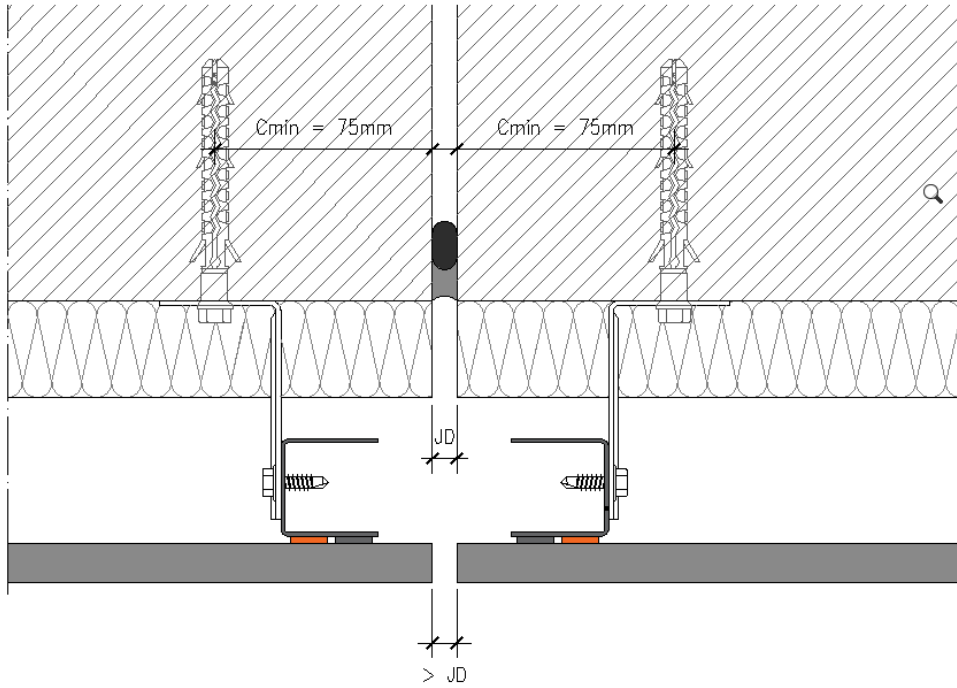


Figure 2.102 - Expansion joint

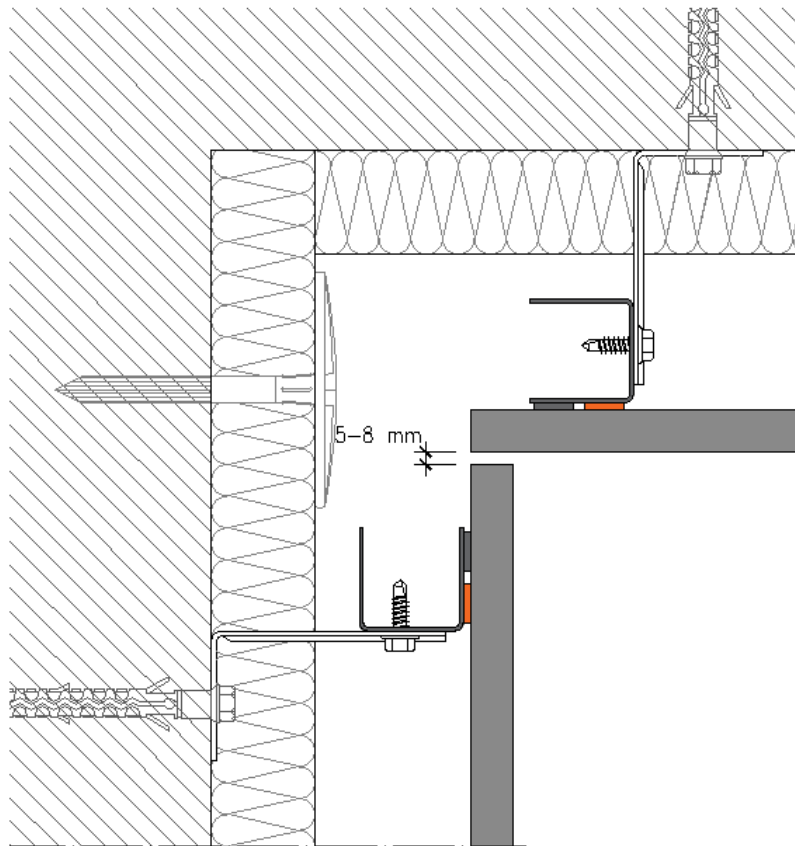


Figure 2.103 - Corner Angle

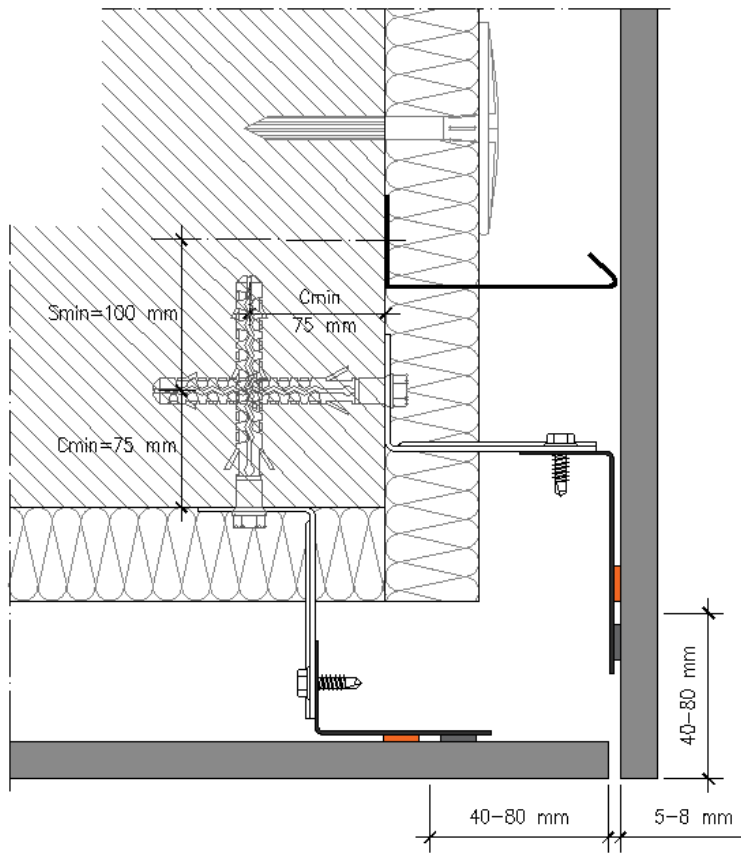


Figure 2.104 - Corner Angle

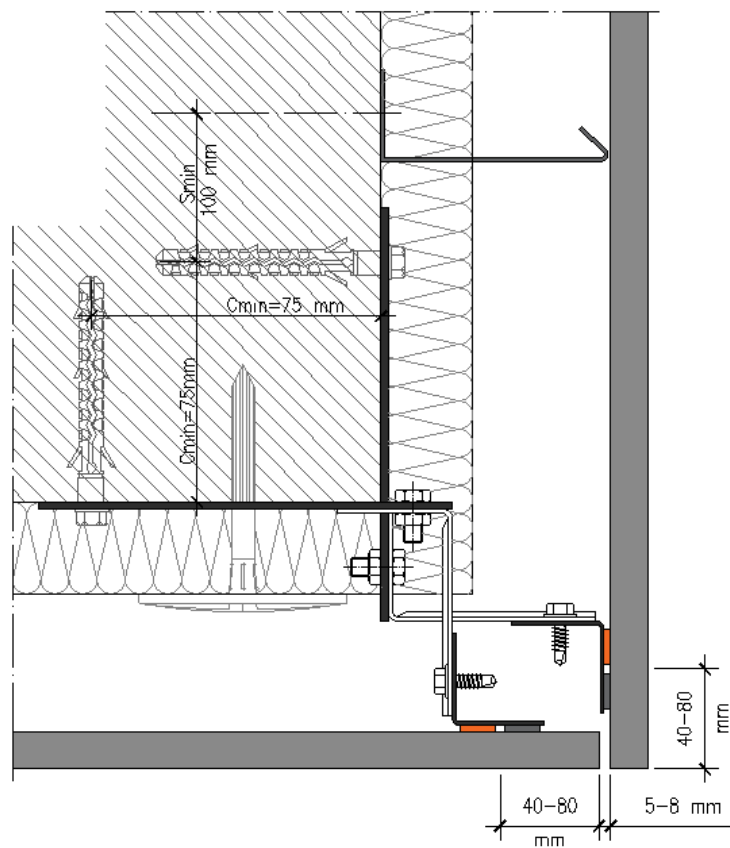


Figure 2.105 - Corner angle, variant

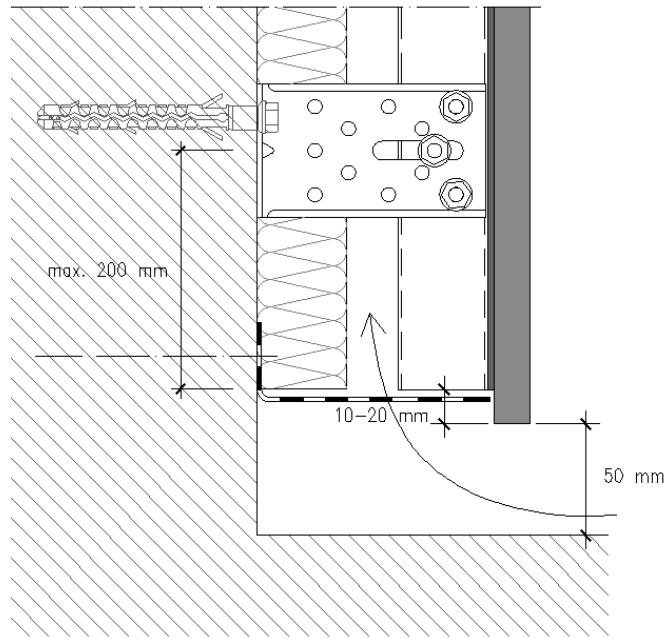


Figure 2.106 - Detail of the base, anti-anti-rodent grill

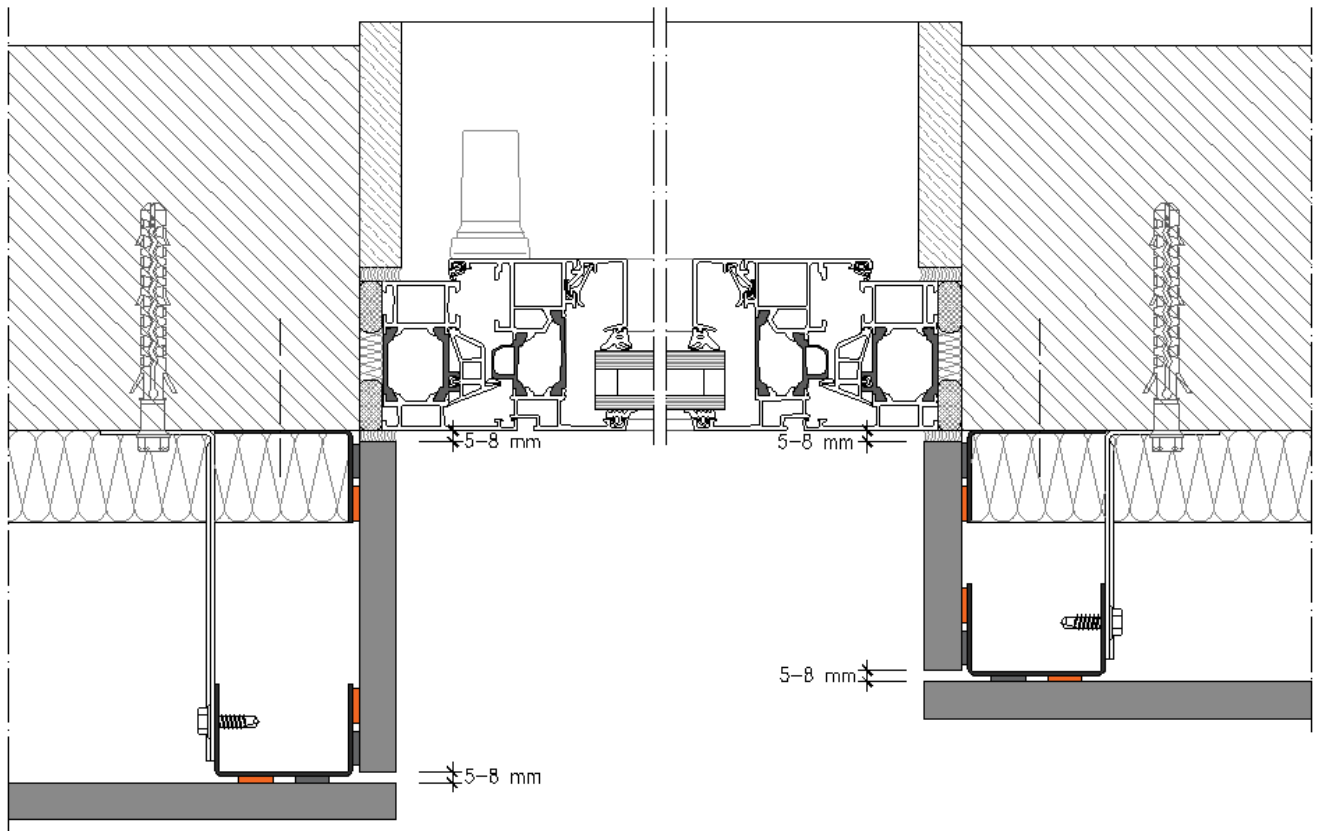


Figure 2.107 - Horizontal section, window span

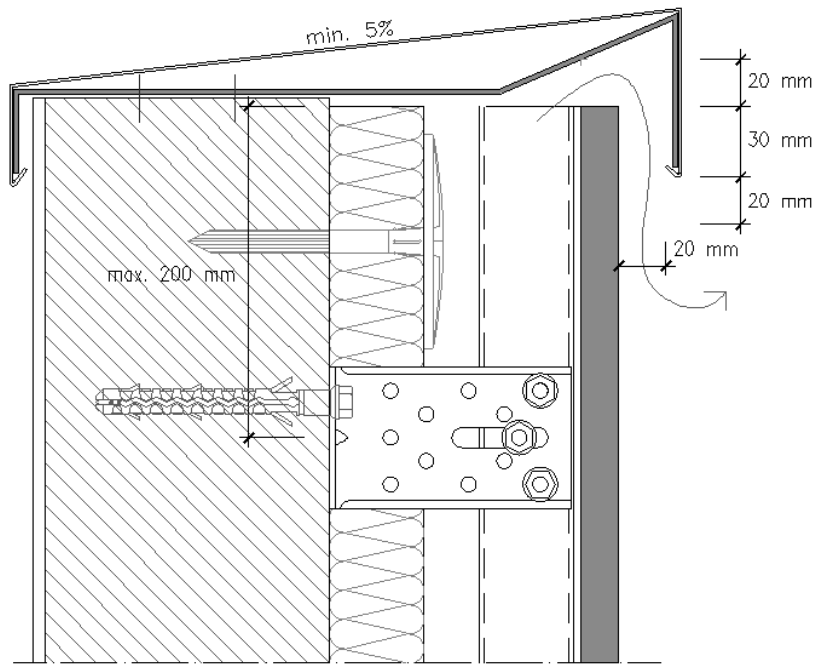


Figure 2.108 - Detail of the top

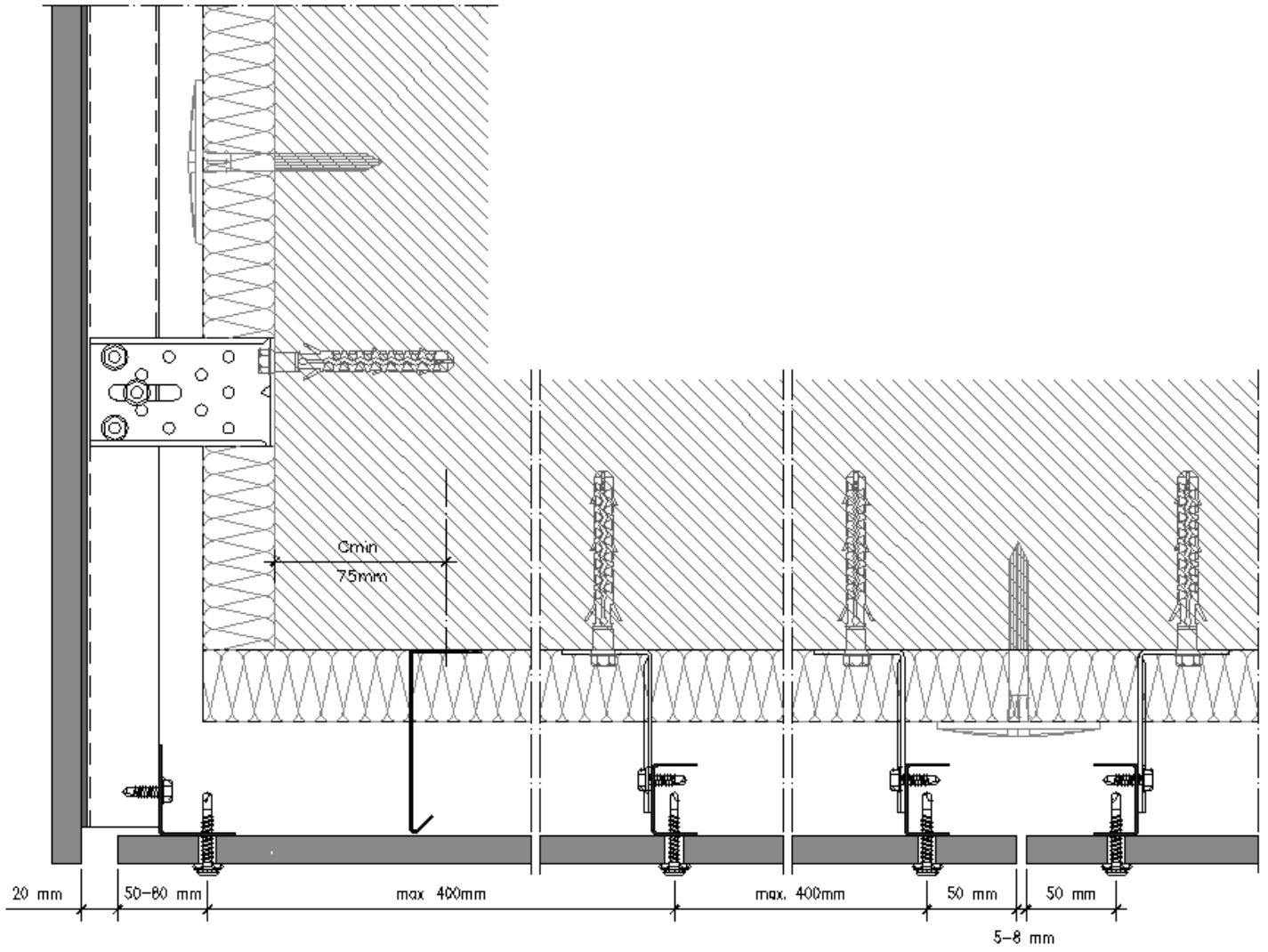


Figure 2.109 - Detail of the facade connection - suspended ceiling

Aluminium Structure

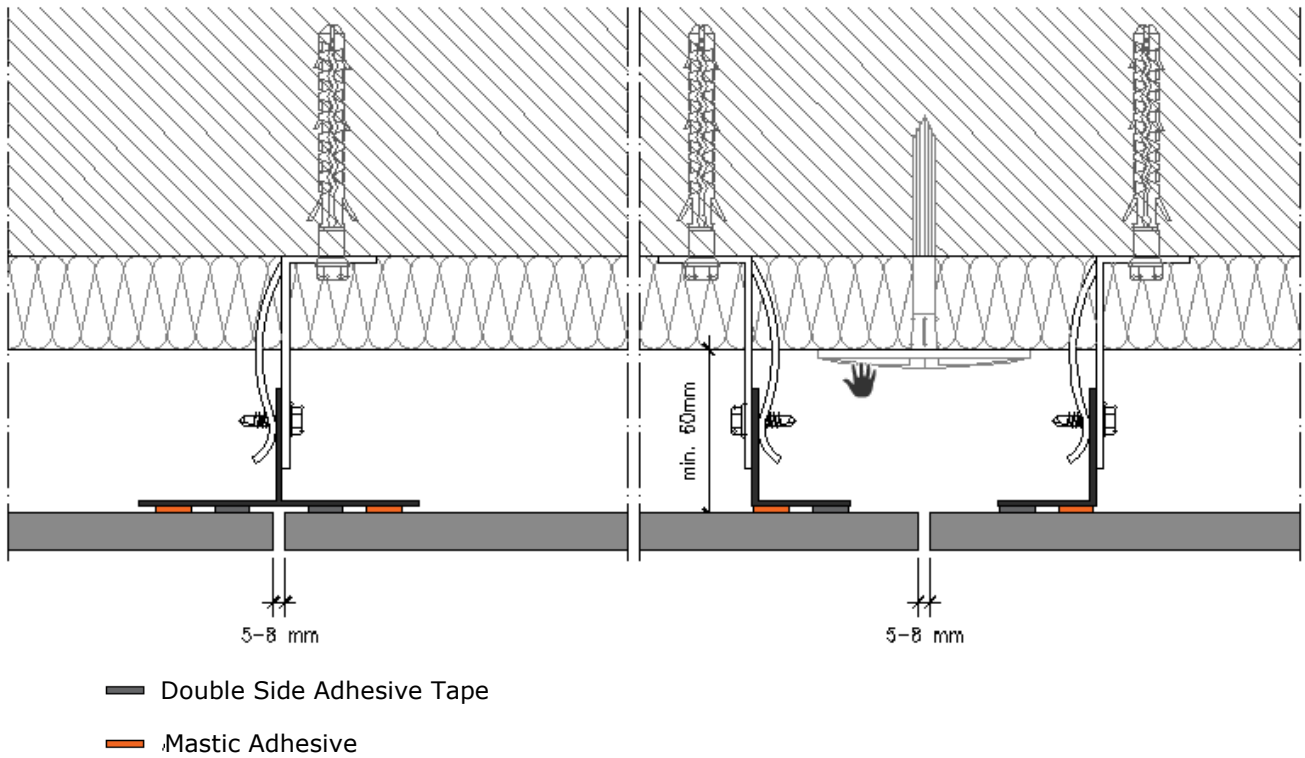


Figure 2.110 - Horizontal section, joint between boards

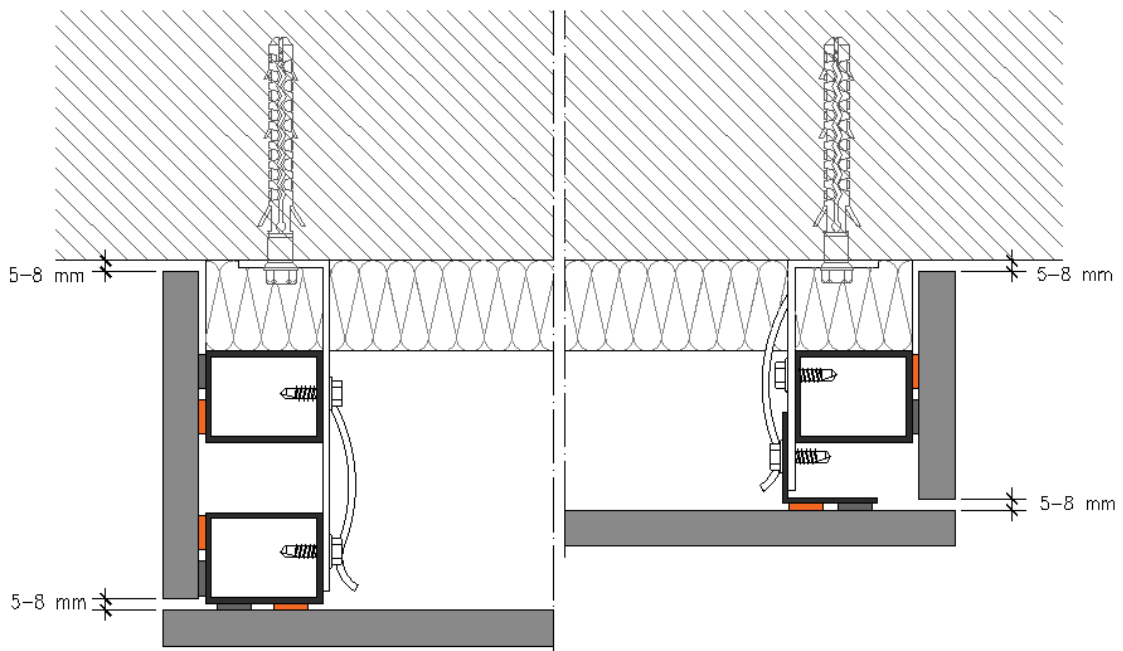


Figure 2.111 - Side Shot Detail

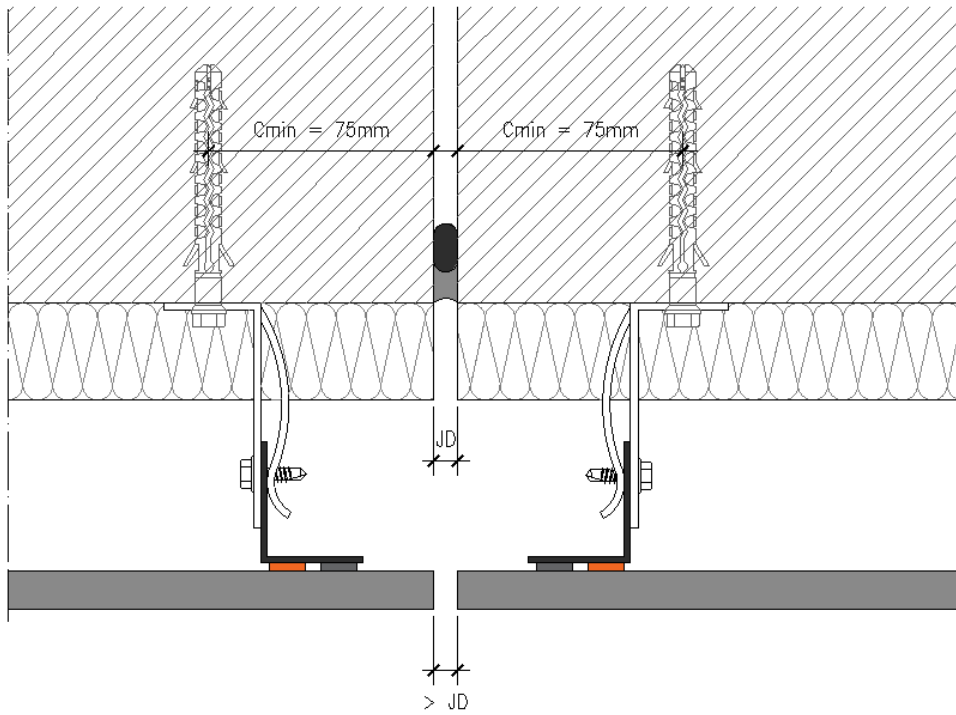


Figure 2.112 - Expansion joint

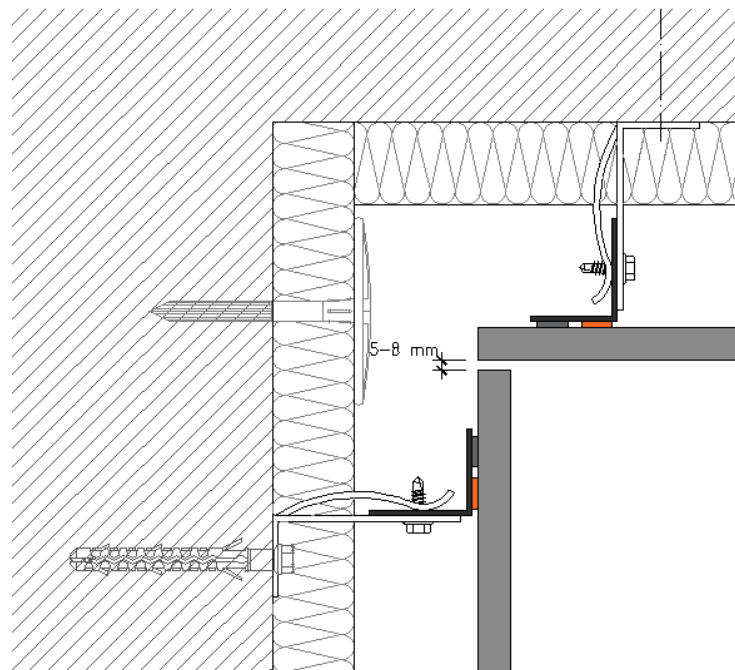


Figure 2.113 - Corner Angle

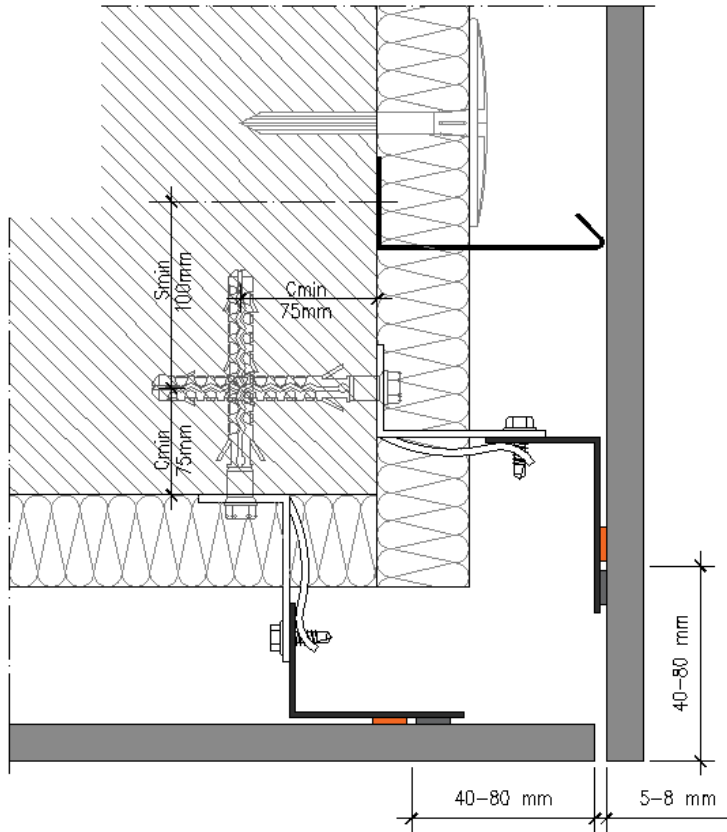


Figure 2.114 - Corner Angle

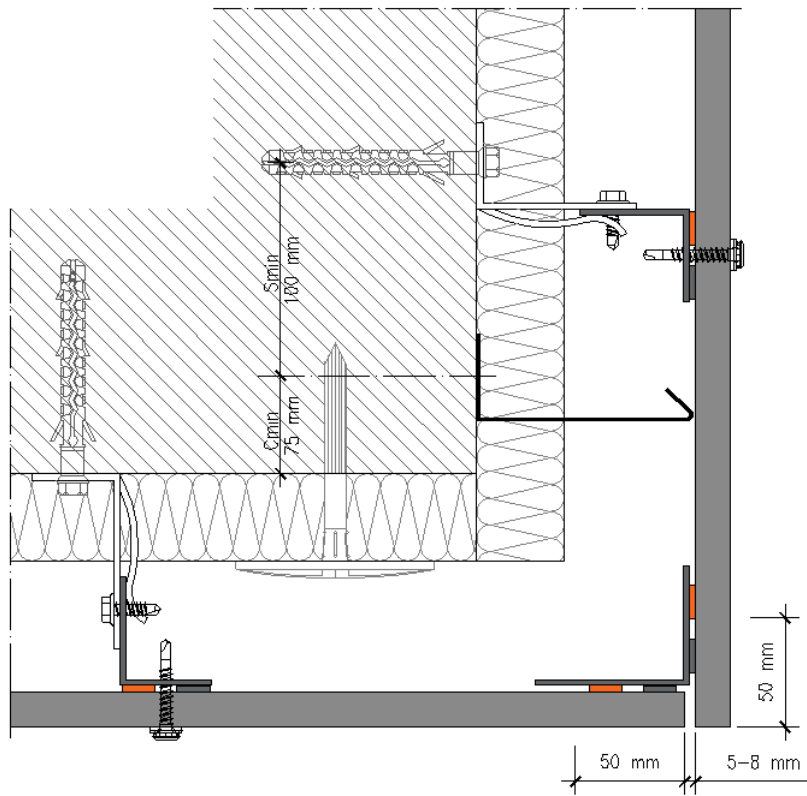


Figure 2.115 - Corner angle, variant

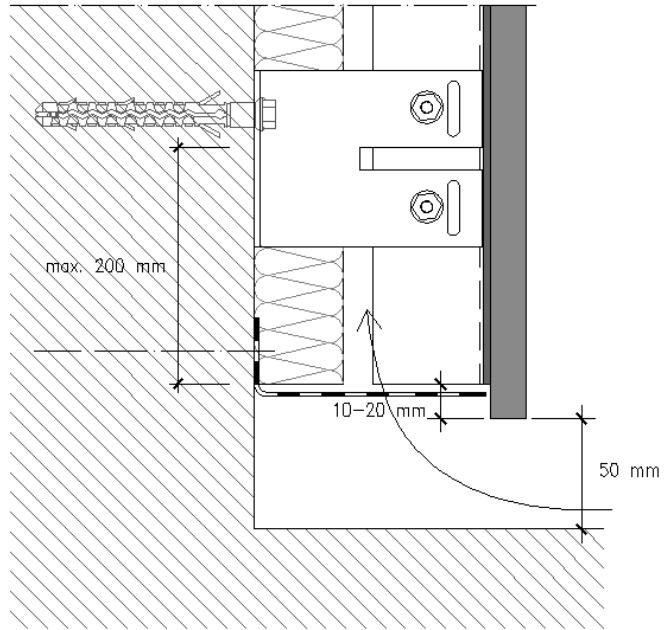


Figure 2.116 - Detail of the base, anti-rodent grill

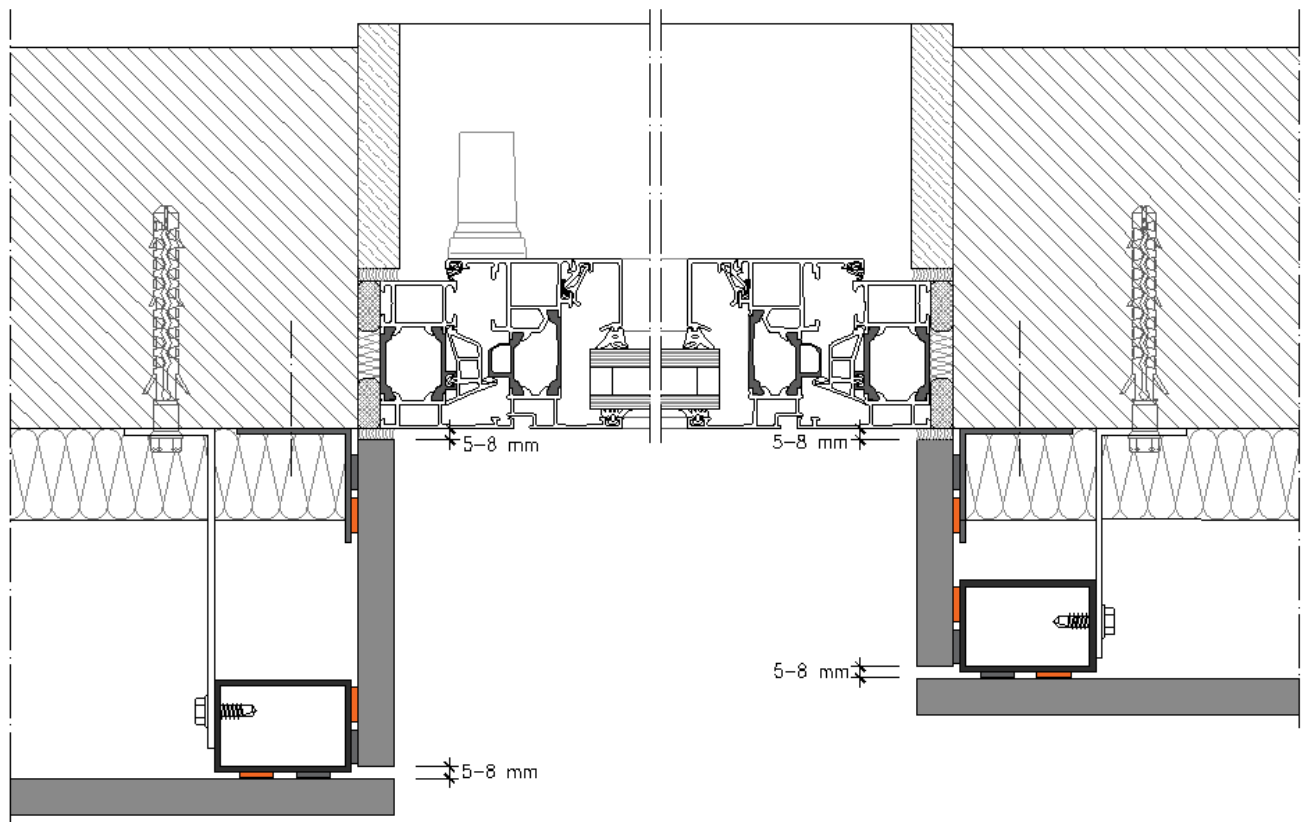


Figure 2.117 - Horizontal section, window span

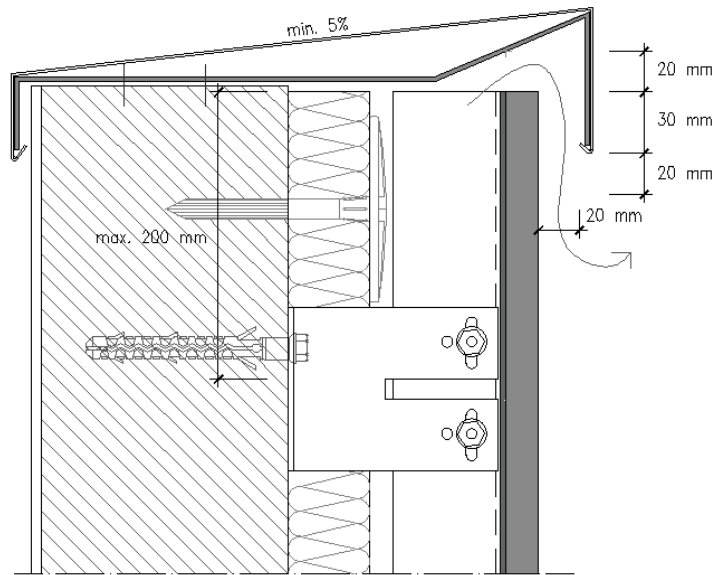


Figure 2.118 - Detail of the top

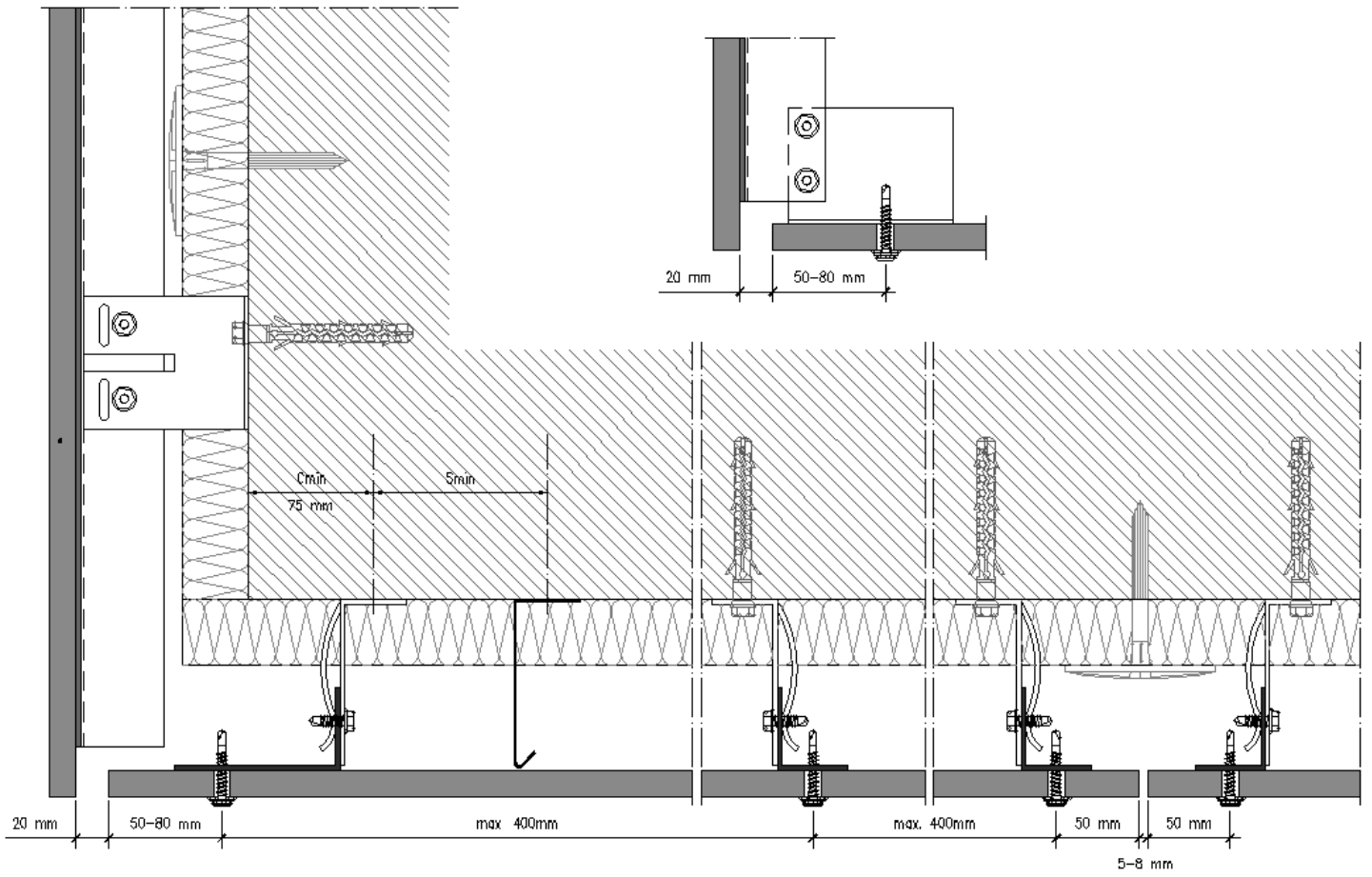


Figure 2.119 - Detail of the facade connection - suspended ceiling

Facade – CLIN System

Board size and fastening location

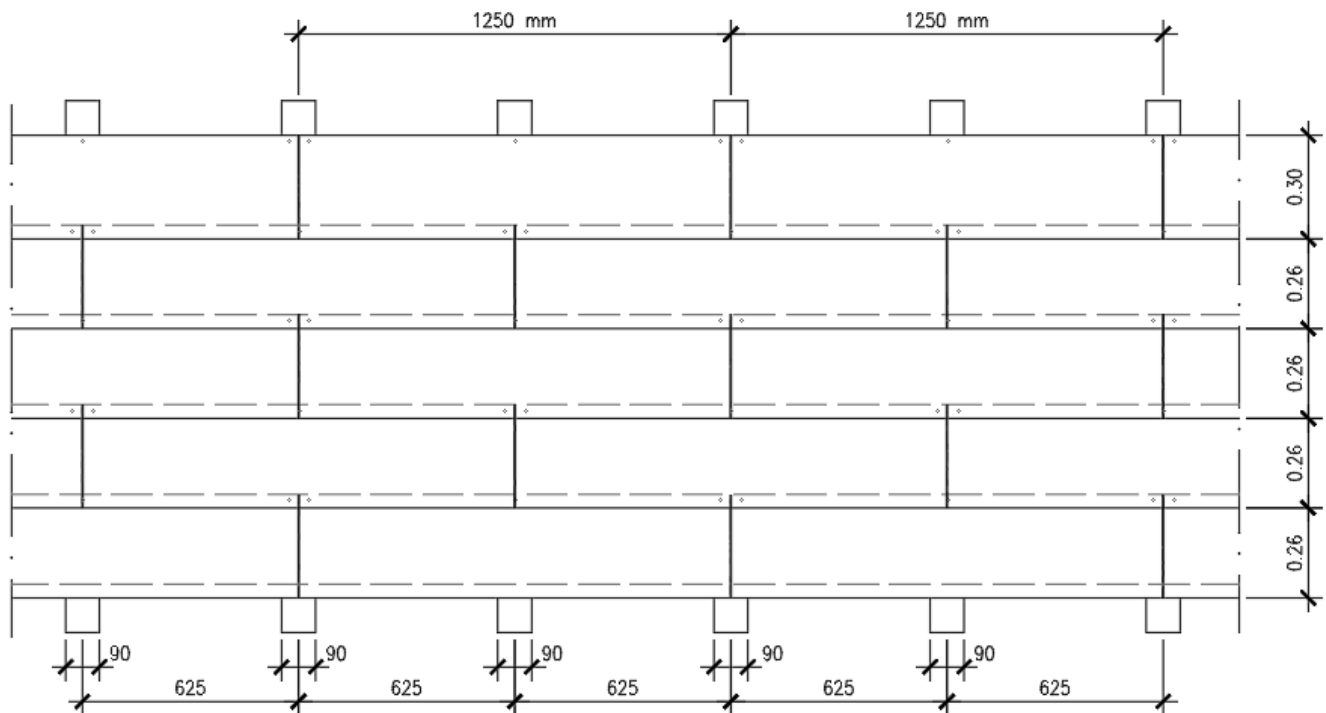


Figure 2.120 – CLIN System view

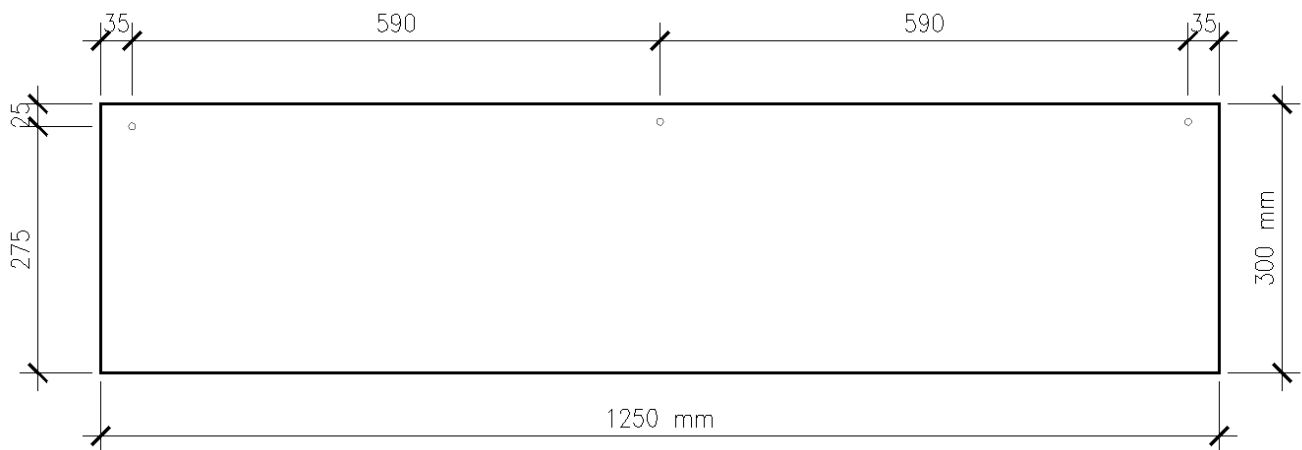


Figure 2.121 – Viroc board dimension, thickness 16mm

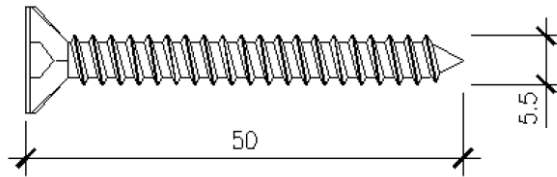


Figure 2.122 – Possible machining Viroc board edges

Wood Structure

Galvanizes stell screw 50x5.5

SWI/40 P-5.5x50 (SFS Intec)



Galvanizes Steel Structure

Galvanized Steel Screw 38x4.8

Sc3/25 PH2-4.8x35 (SFS Intec)

Wingteks/Zn 4.8x35 (ETANCO)

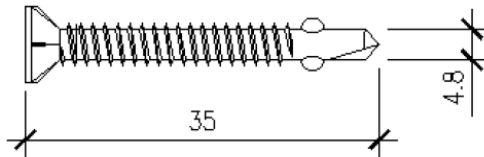


Figure 2.123 - Screws for attaching boards

Timber structure

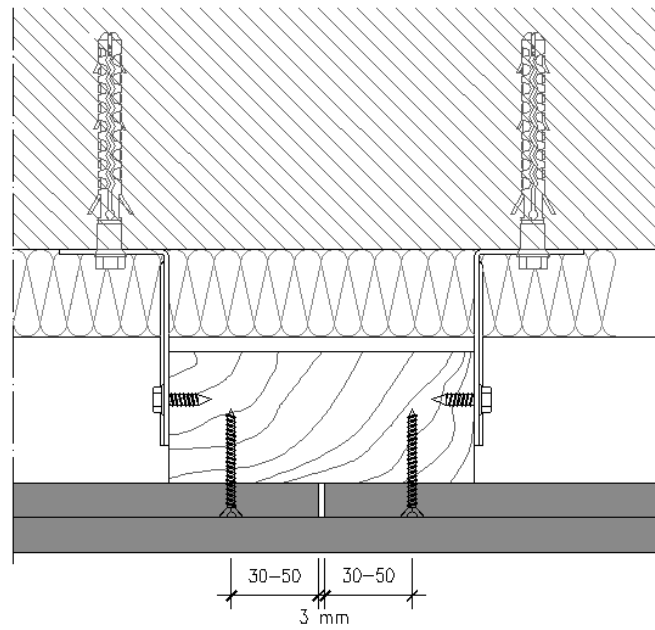


Figure 2.124 - Horizontal Section

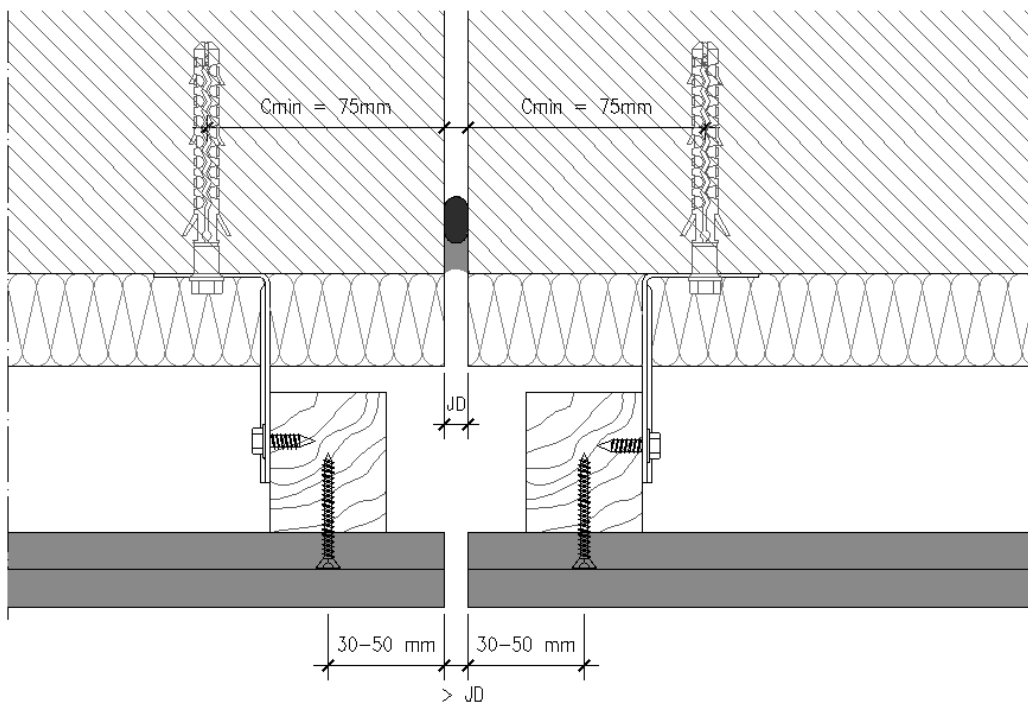


Figure 2.125 - Expansion joint

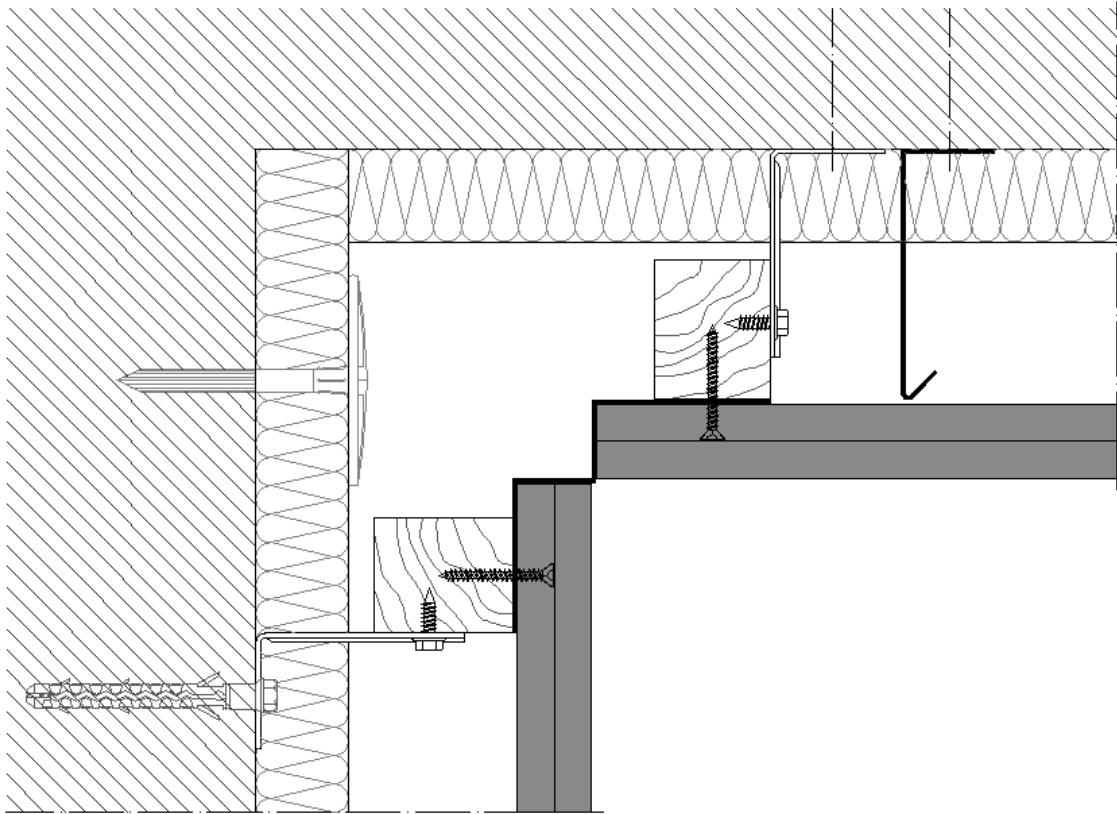


Figure 2.126 - Corner Angle

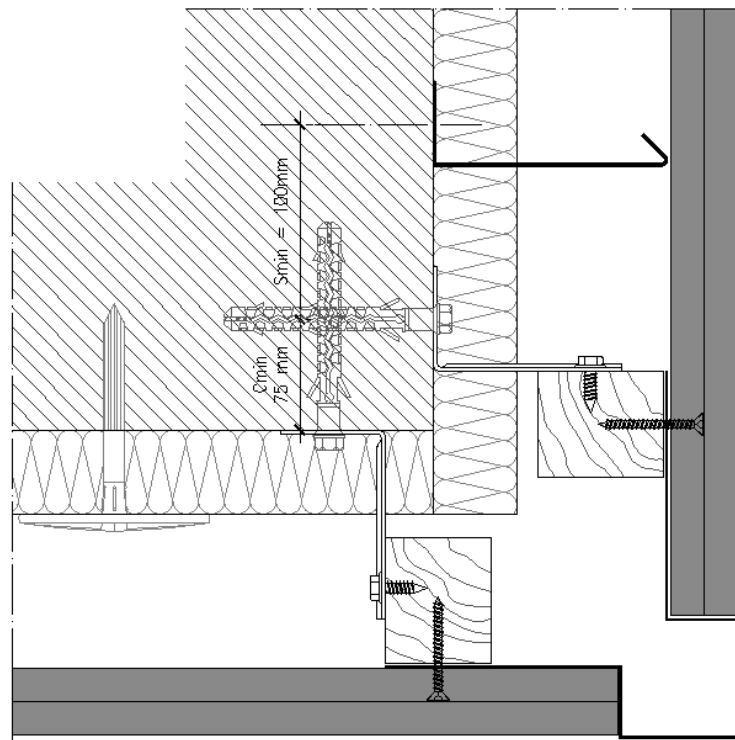
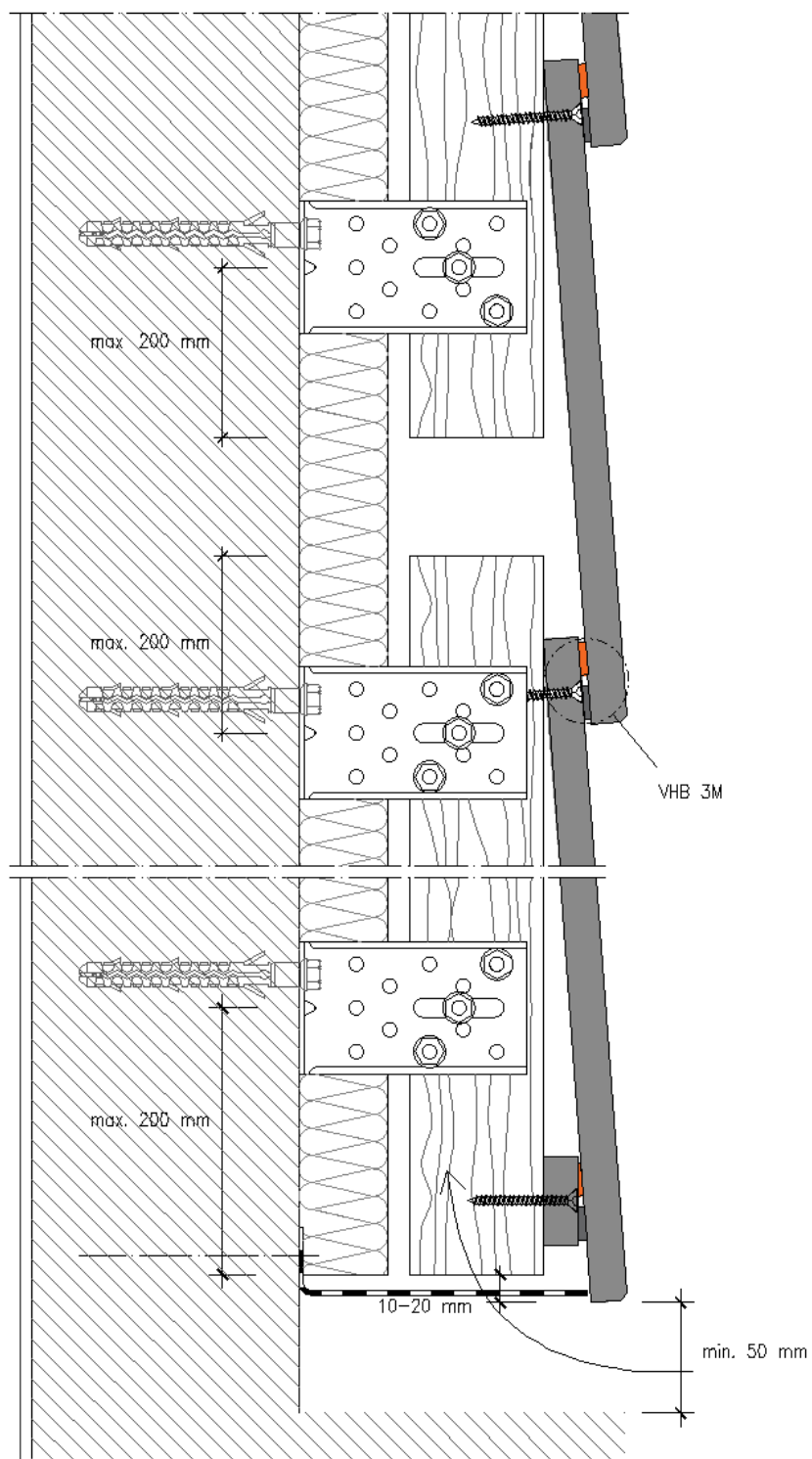


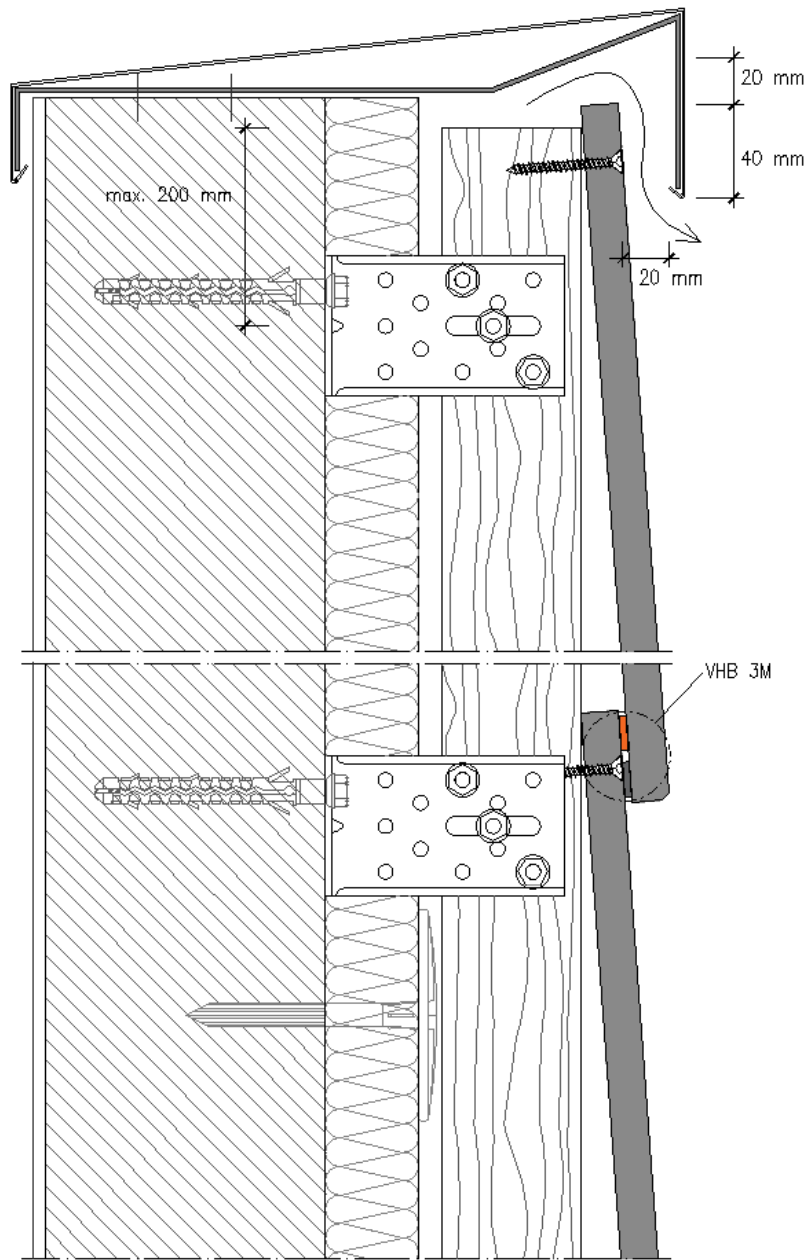
Figure 2.127 - Corner Angle



— Double Side Adhesive Tape

— Mastic Adhesive

Figure 2.128 - Detail of the base, anti-rodent grill



— Double Side Adhesive Tape

— Mastic Adhesive

Figure 2.129 - Detail of the top

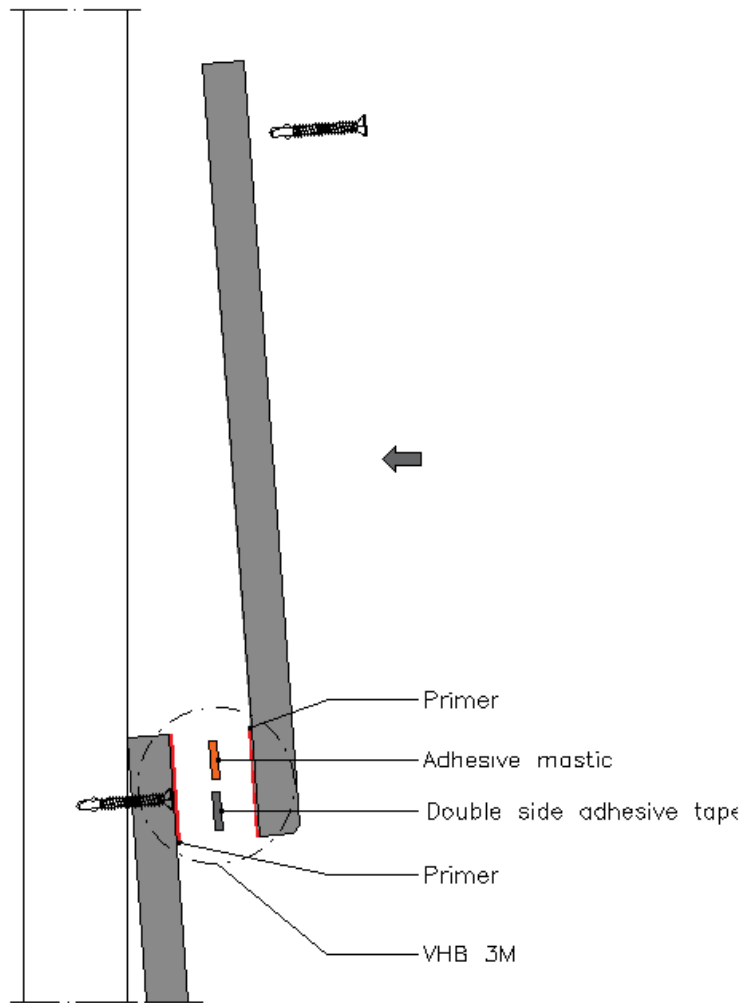


Figure 2.130 - Assembly Sequence
(Assembly is from bottom to top)

Galvanized Steel Structure

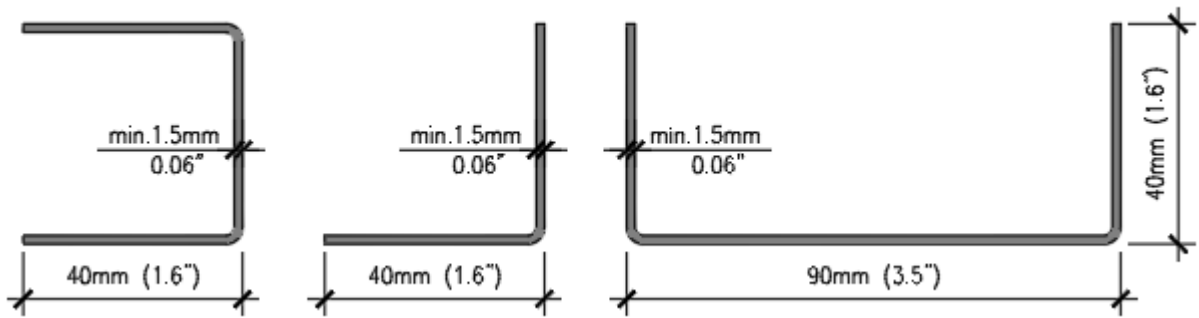


Figure 2.131 - Profiles adapted to the system
Galvanized steel, minimum resistance category S220GD (EN 10346)

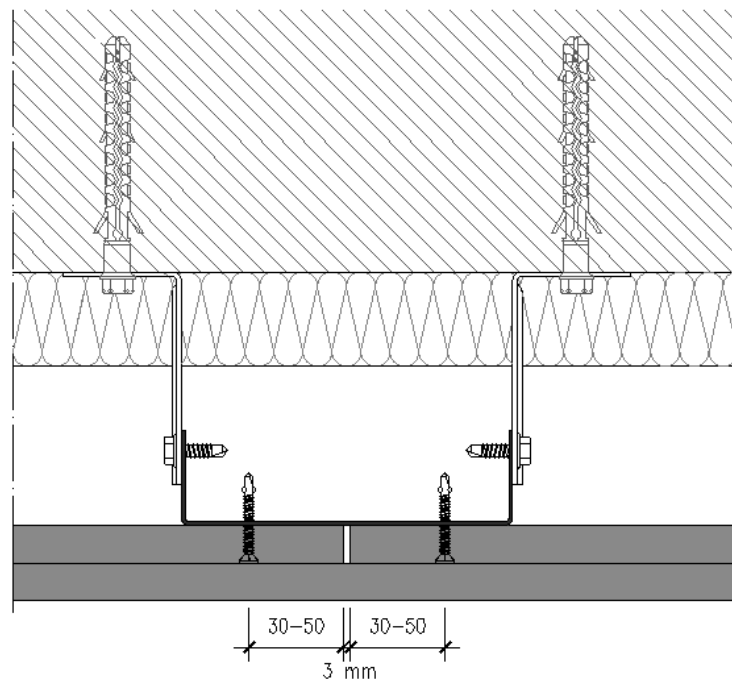


Figure 2.132 - Horizontal section

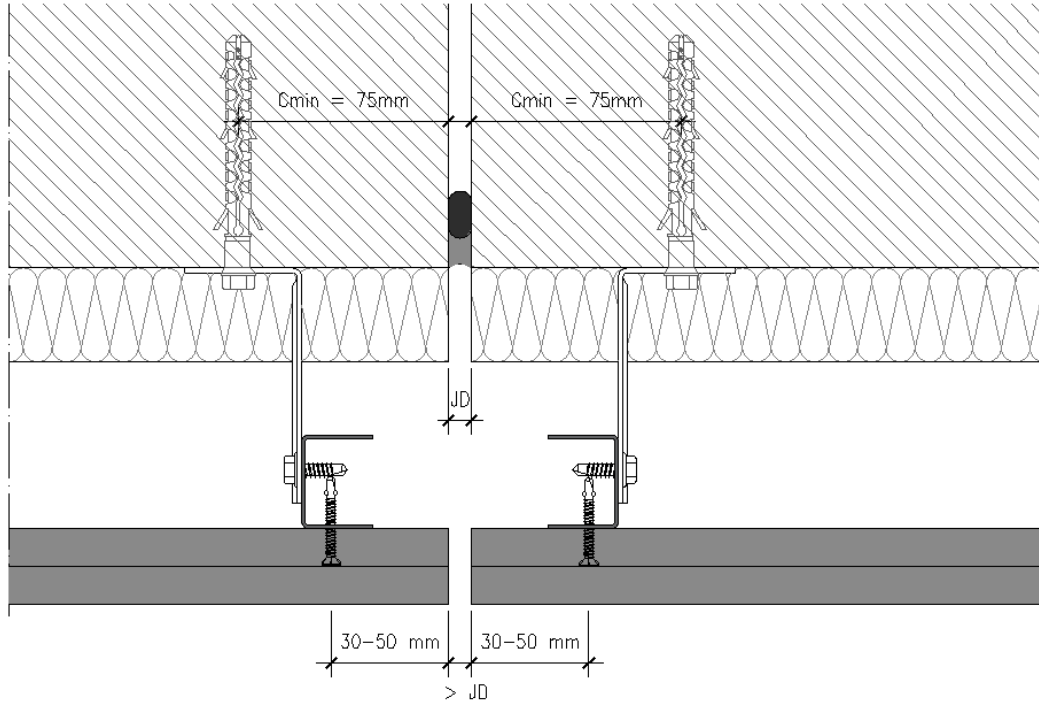


Figure 2.133 - Expansion joint

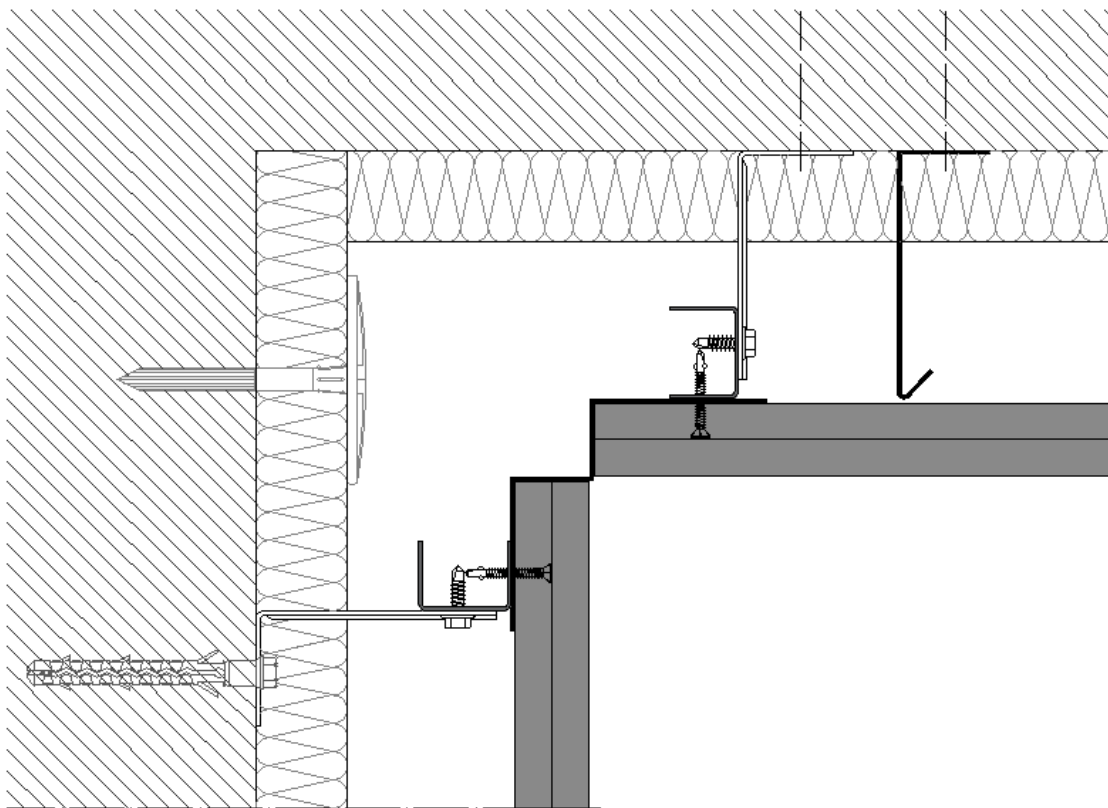


Figure 2.134 - Corner Angle

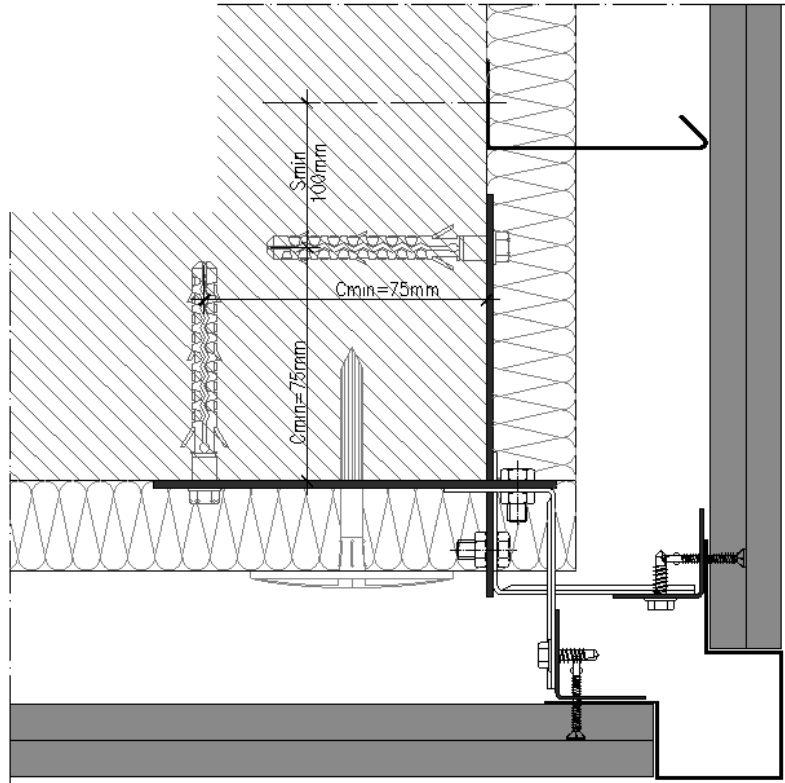


Figure 2.135 - Corner Angle
Angle profile, see figure 2.17

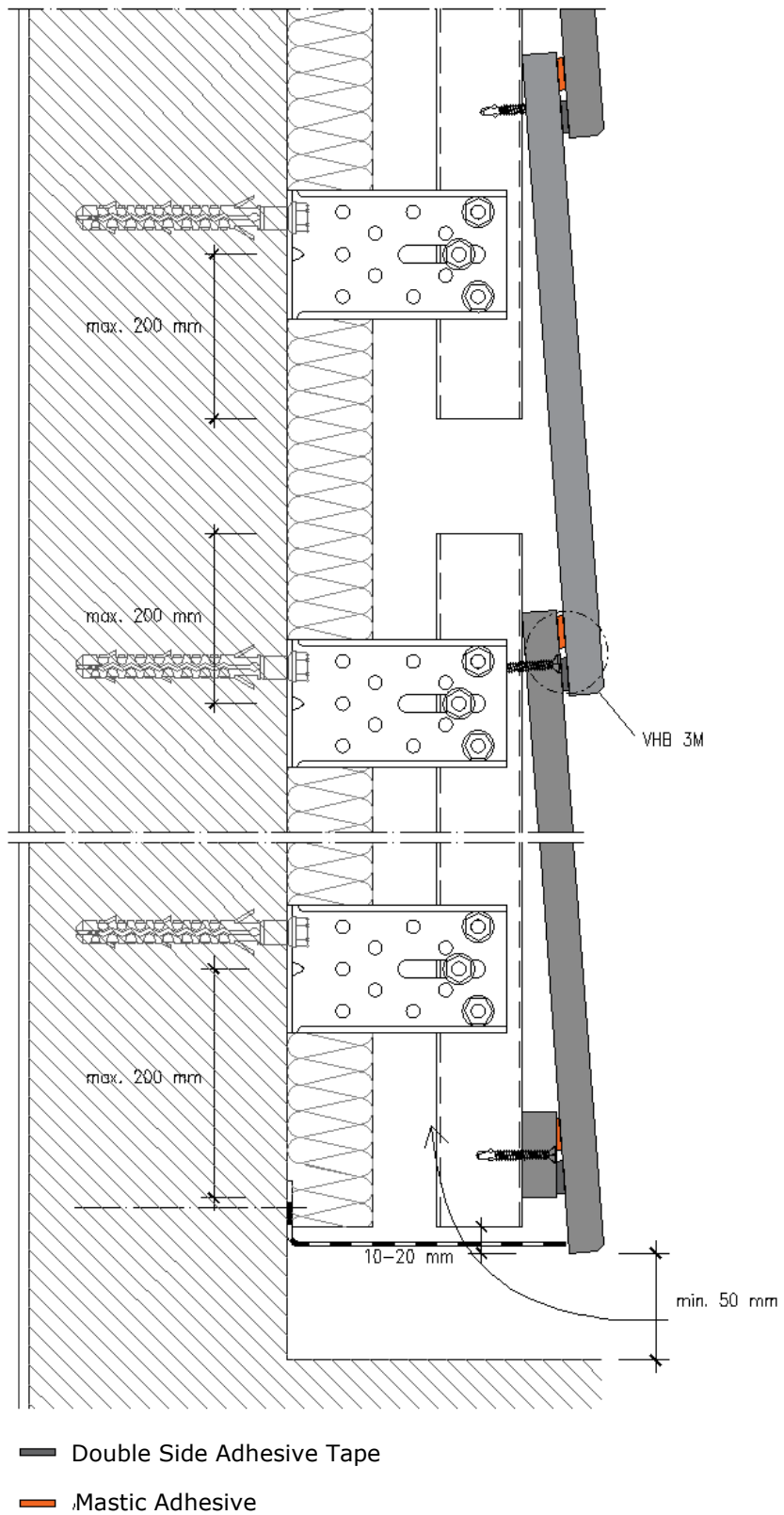


Figure 2.136 - Detail of the base, anti-rodent grill

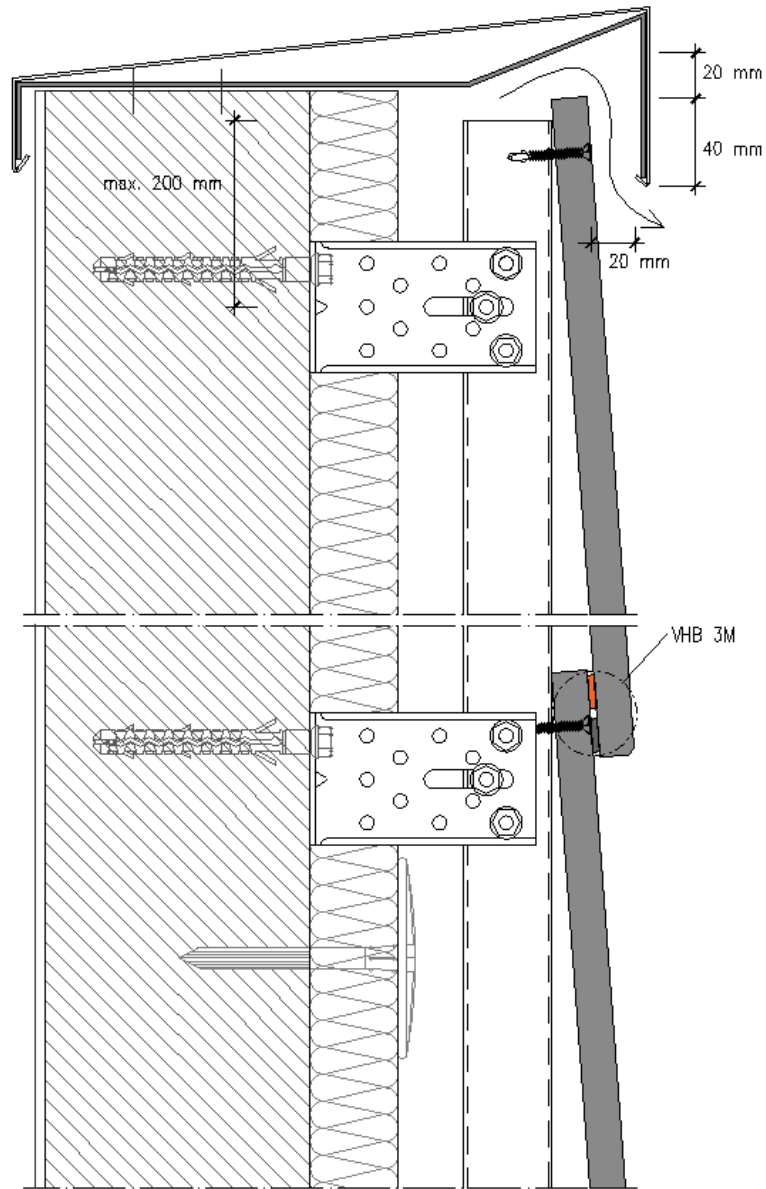


Figure 2.137 - Detail of the top

Aluminium Structure

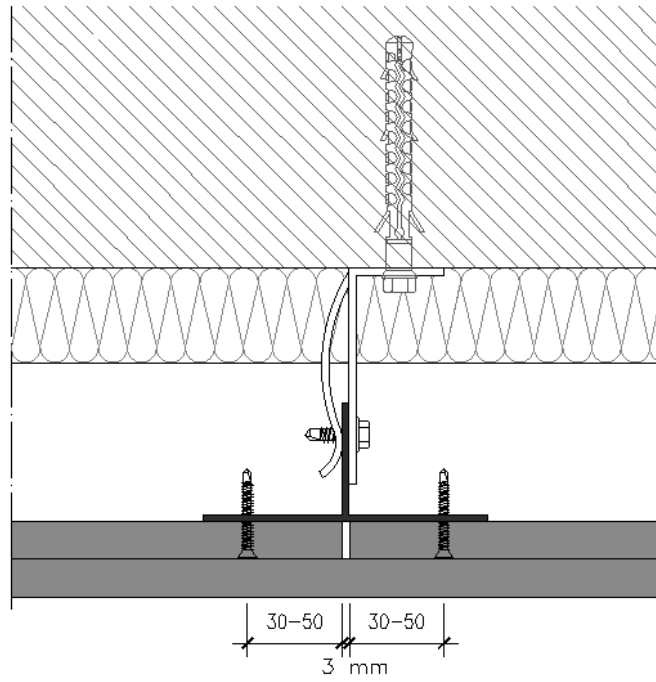


Figure 2.138 - Horizontal cut

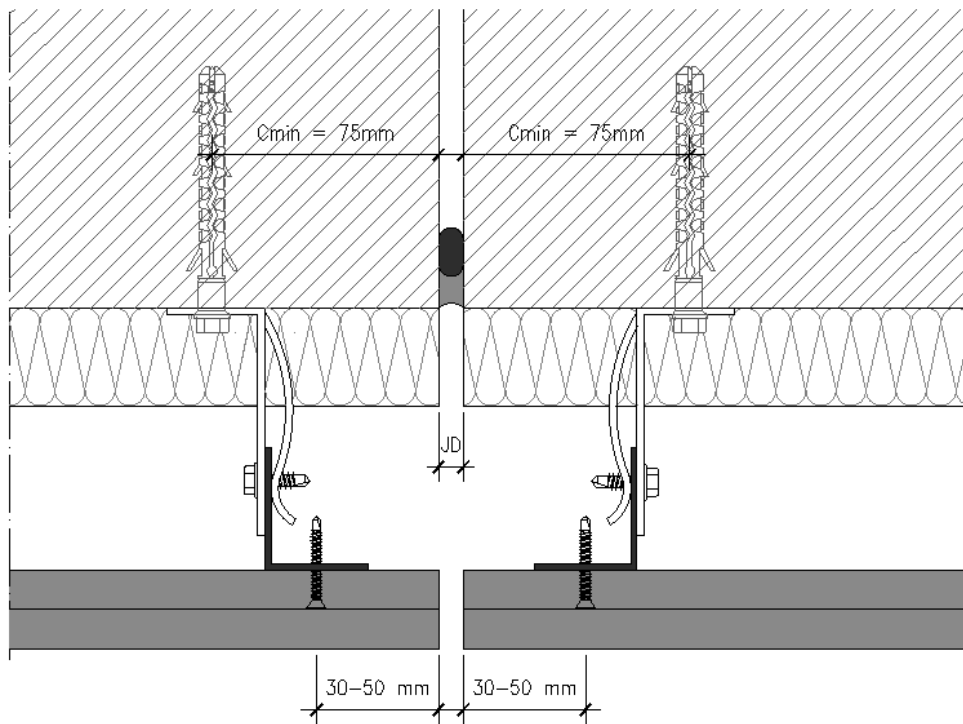


Figure 2.139 - Expansion joint

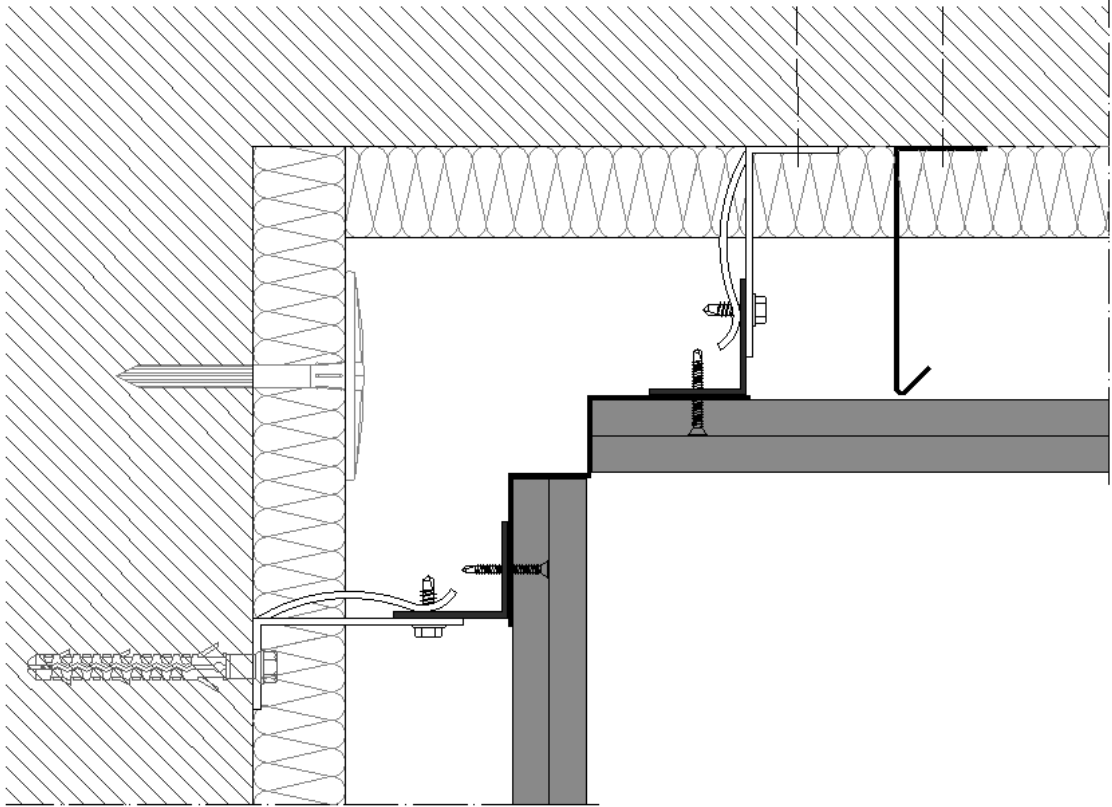


Figure 2.140 - Corner Angle

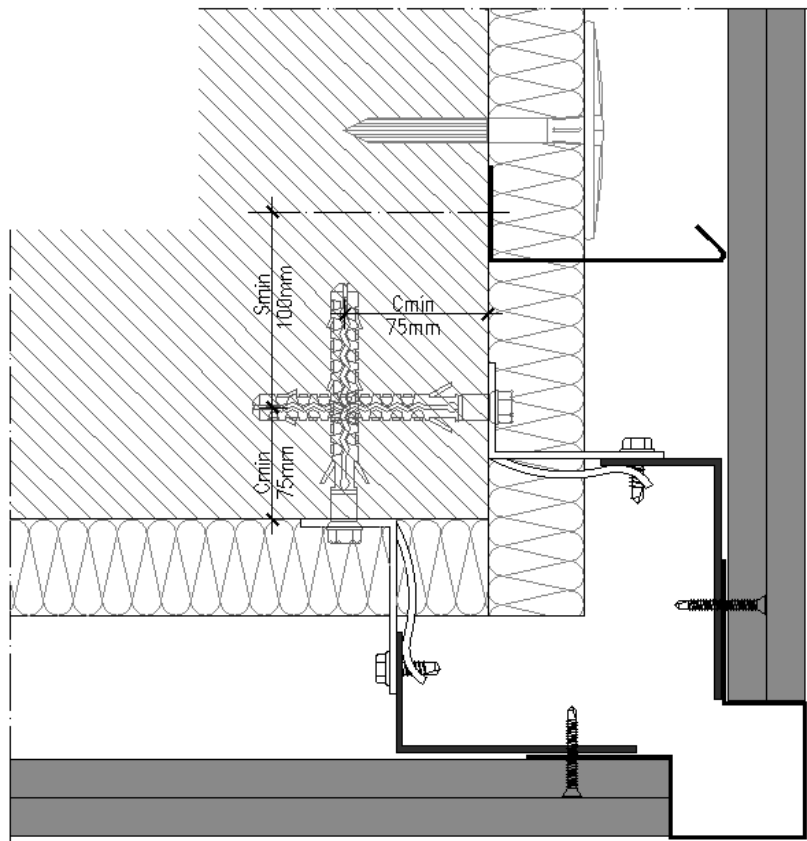
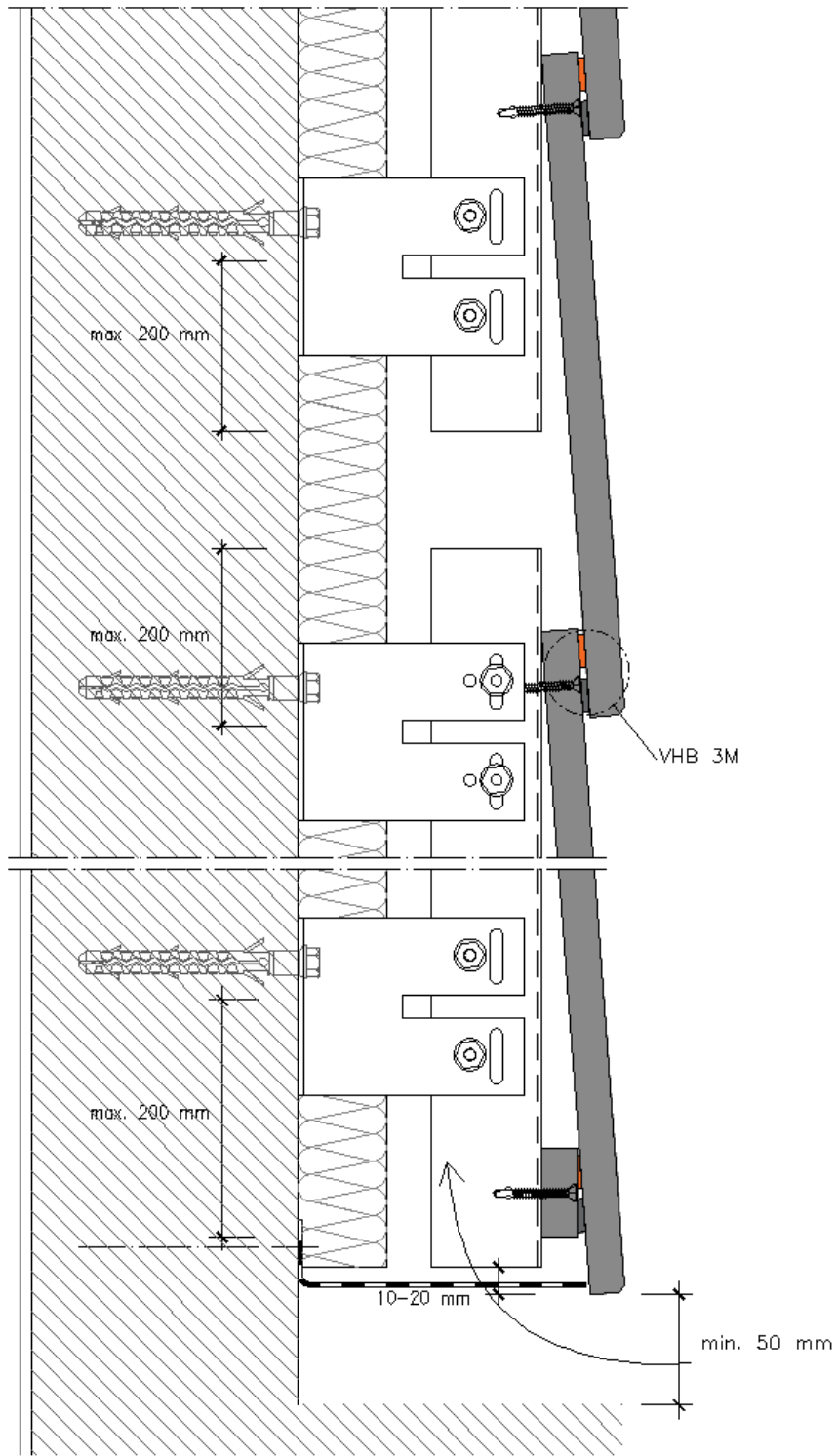


Figure 2.141 - Corner Angle



— Double Side Adhesive Tape

— Mastic Adhesive

Figure 2.142 - Detail of the base, anti-rodent grill

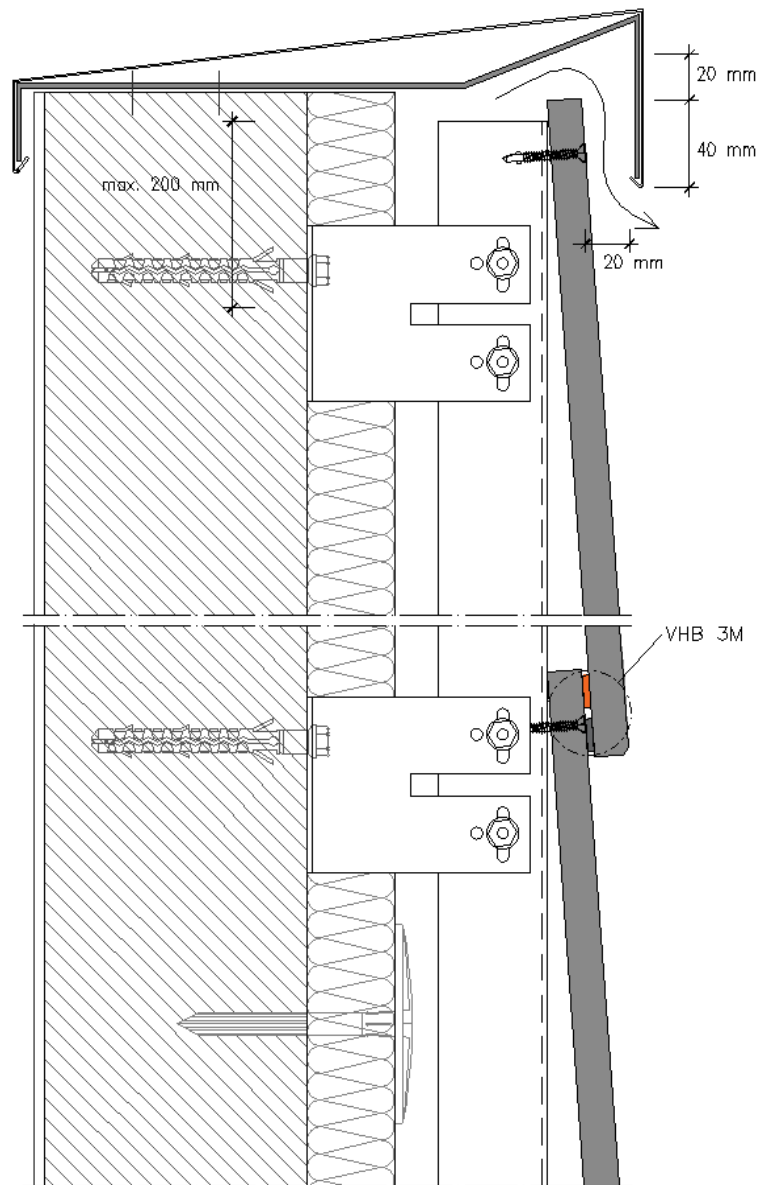


Figure 2.143 - Detail of the top

Unpainted or unvarnished ventilated facade

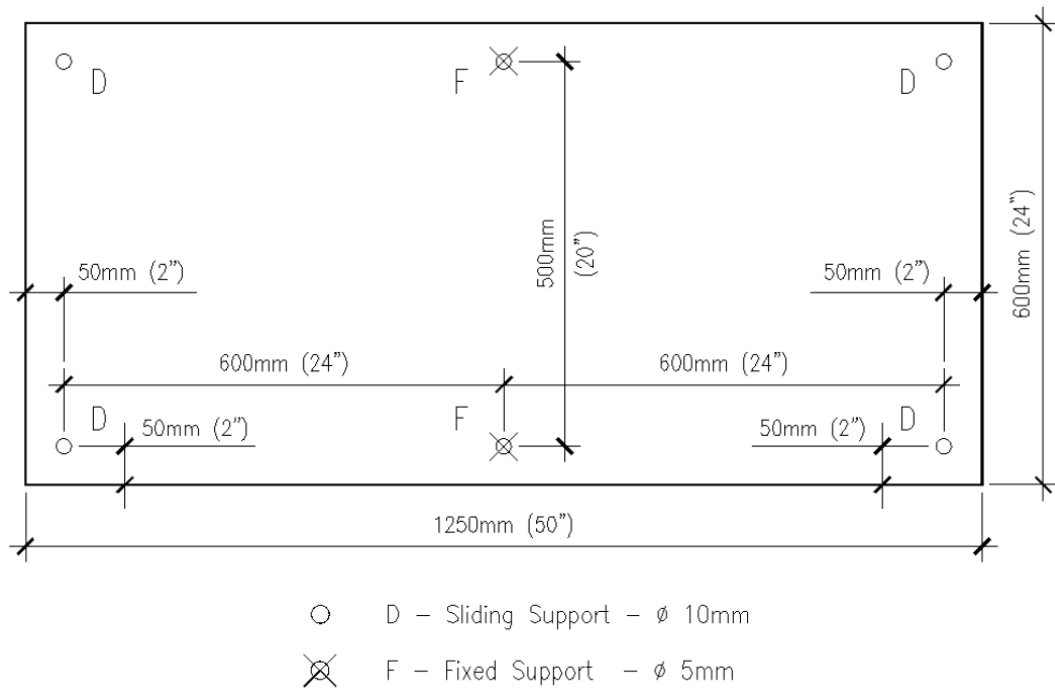
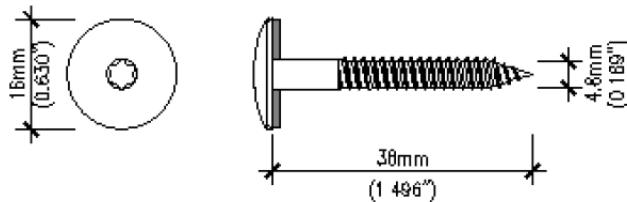


Figure 2.144 - Maximum board size and fastening location

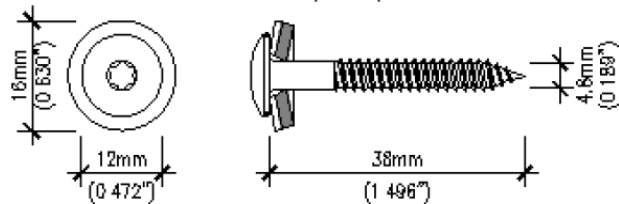
Screws for fastening the boards

Thickness	Maximum dimension of panels	Hole Dimension		Screw	Manufacturer
		Fixed point	Sliding point		
12 (0.472")	3000 x 1250 (118.11" x 49.21")	5 mm (0.20")	10 mm (0.40")	TW-S-D16-4.8x38 + Washer	SFS Intec
				Torx Panel Bois TB16 4.8x38 A16	ETANCO
				TW-S-D12-S16-4.8x38	SFS Intec
				Torx Panel Bois TB12 4.8x38 A16	ETANCO
16 (0.630")	3000 x 1250 (118.11" x 49.21")	5 mm (0.20")	10 mm (0.40")	TW-S-D12-S16-4.8x44	SFS Intec
				TW-S-D12-S16-4.8x60	SFS Intec
				Torx Panel Bois TB12 4.8x60 A16	ETANCO

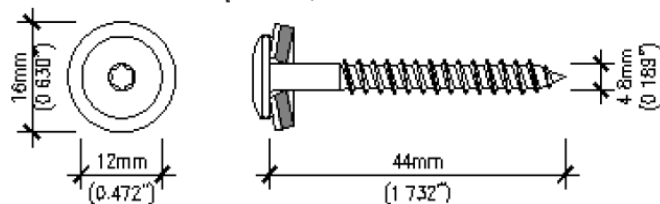
TW-S-D16-4.8x38 + Washer (SFS Intec)
Torx Panel Bois TB16 4.8x38 A16 (ETANCO)



TW-S-D12-S16-4.8x38 (SFS Intec)
Torx Panel Bois TB12 4.8x38 A16 (ETANCO)



TW-S-D12-S16-4.8x44 (SFS Intec)



TW-S-D12-S16-4.8x60 (SFS Intec)
Torx Panel Bois TB12 4.8x60 A16 (ETANCO)

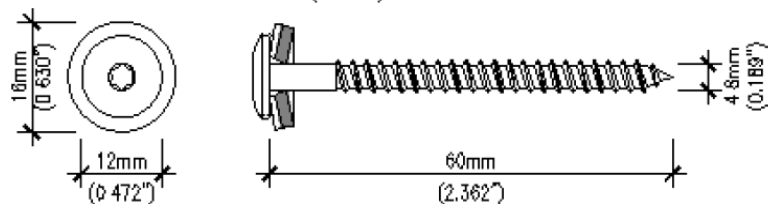
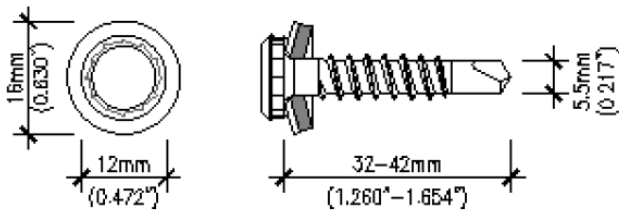


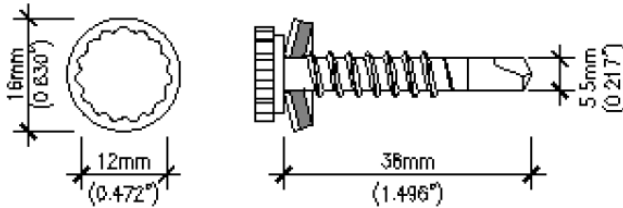
Figure 2.145 - Timber Frame Screws

Thickness	Maximum dimension of panels	Hole Dimension		Screw/Revit	Manufacturer
		Fixed point	Sliding point		
12 mm (0.472")	1500 x 1250 (59.06" x 49.21")	5 mm (0.20")	10 mm (0.40")	SX3/15-L12-S16-5.5x32 STARCOLOR/Zn 5.5x38 A16 DRILLNOX STAR 5.5x38 A16 AP16-5.0x21 RMET N.E. CEL Alu/Inox-4.8x22	SFS Intec ETANCO ETANCO SFS Intec ETANCO
16 mm (0.630")	1500 x 1250 (59.06" x 49.21")	5 mm (0.20")	10 mm (0.40")	SXW-L12-S16-5.5x42 STARCOLOR/Zn 5.5x38 A16 DRILLNOX STAR 5.5x50 A16 AP16-5.0x21 RMET N.E. CEL Alu/Inox-4.8x22	SFS Intec ETANCO ETANCO SFS Intec ETANCO

SX3/15-L12-S16-5.5x32, SXW-L12-S16-5.5x42 (SFS Intec)



STARCOLOR/Zn 5.5x38 A16 (ETANCO)



DRILLNOX STAR 5.5x38 A16, DRILLNOX STAR 5.5x50 A16 (ETANCO)

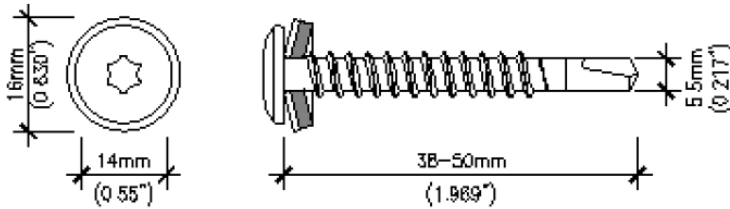


Figure 2.146 - Screws for galvanized steel frame

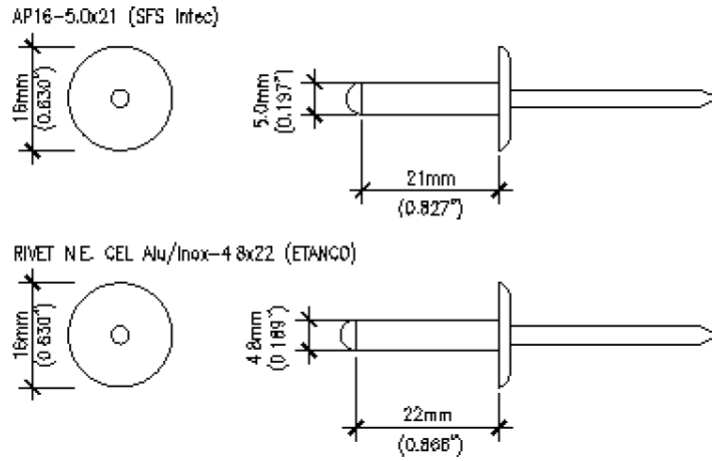


Figure 2.147 - Metal Frame Rivet

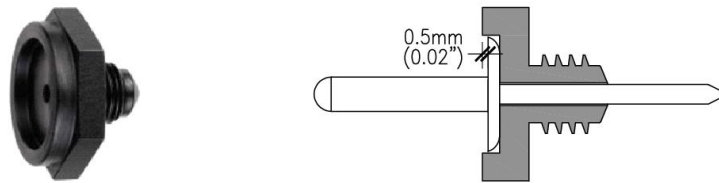


Figure 2.148 - Clamping Limiter, Place on Riveter Head

Mandatory Use

Partition walls and wall cladding

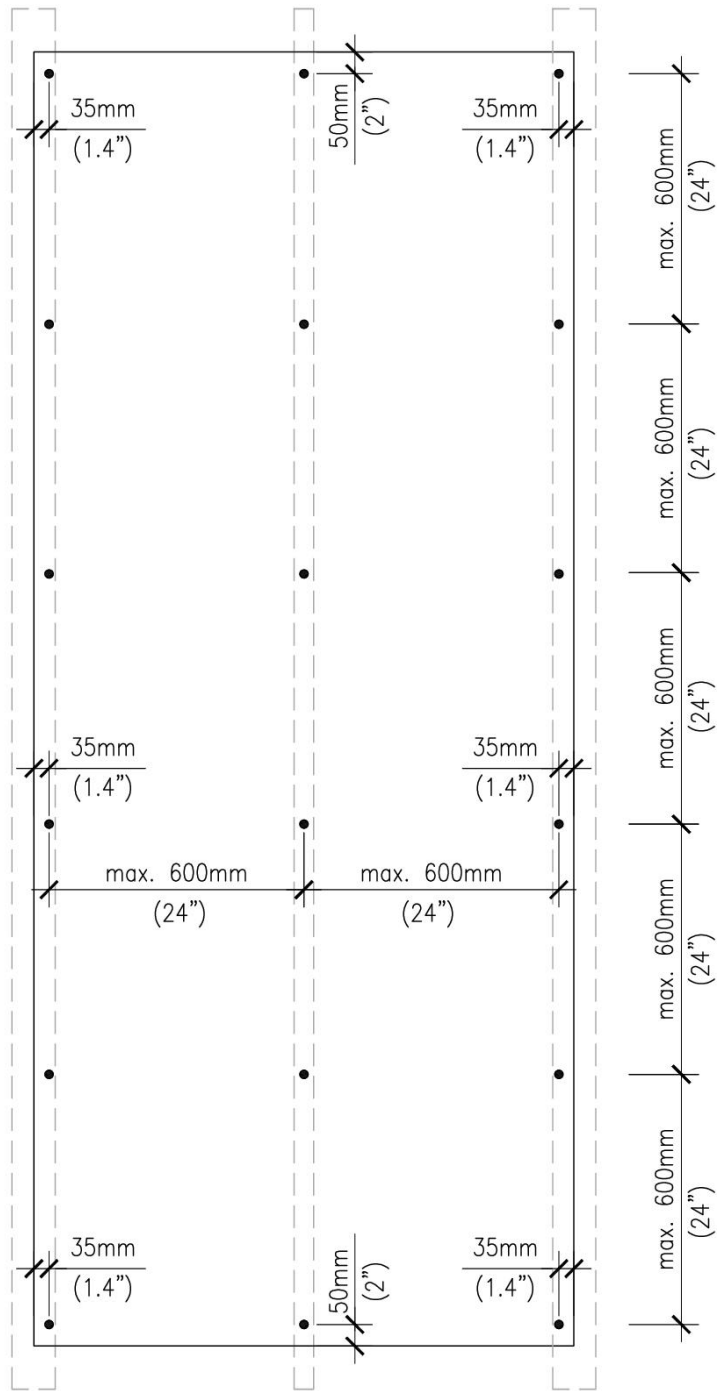


Figure 3.1 - Screw Location



Figure 3.2 - Galvanized steel frame screw
SFS Intec: SWI/30 P-5.5x38



Figure 3.3 - Galvanized steel screw for metallic structure
SFS Intec: SC3/25-PH2-4.8x35; Etanco: Wingteks/Zn 4.8x35



Figure 3.4 - Headless Nail



Figure 3.5 - Air nail gun

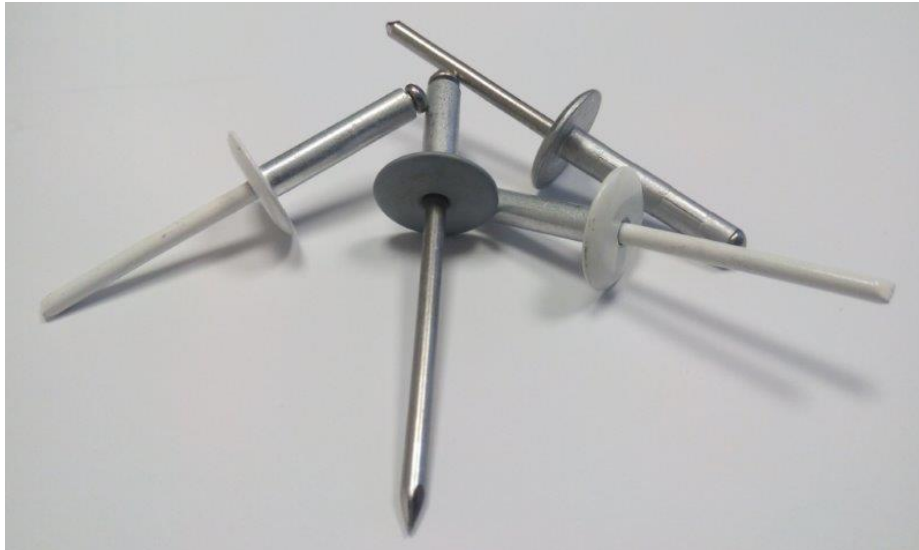


Figure 3.6 - Rivets with aluminium body and stainless-steel nail.
SFS Intec: Rivet AP16-5.0x21; Etanco: Alu / Stainless C16-4.8x22 Rivet



Figure 3.7 - Mastic board bonding system
Sika: Sikatack Panel System; Bostik: Simson PanelTack System



Figure 3.8 - 3M Dual-Lock Tape

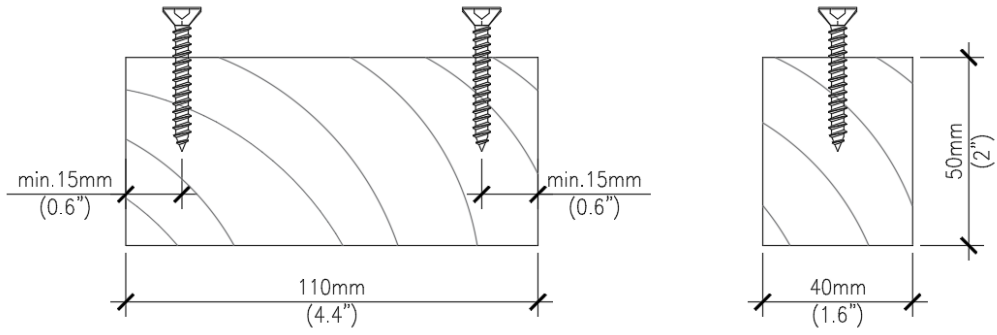


Figure 3.9 - Type of timber frame section

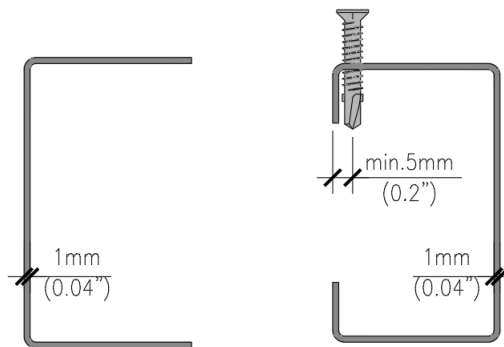


Figure 3.10 - Galvanized steel frame type section

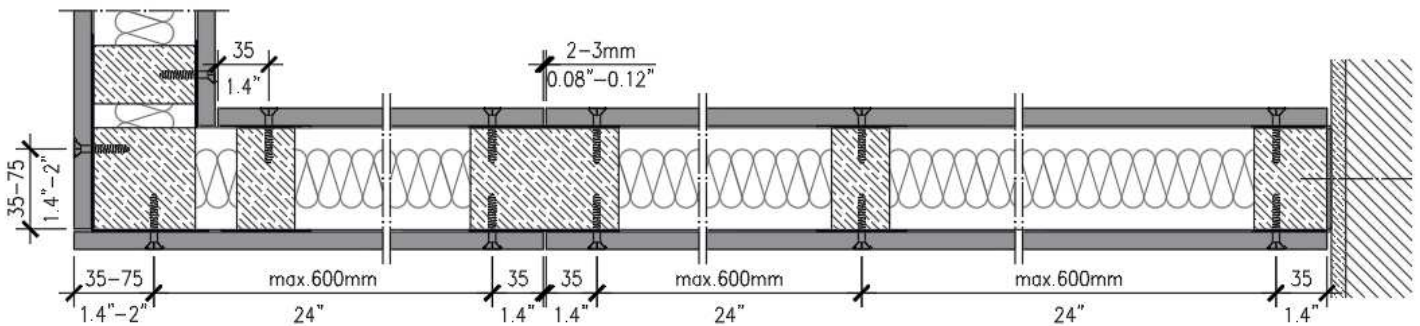


Figure 3.11 - Horizontal section of the wall, timber frame

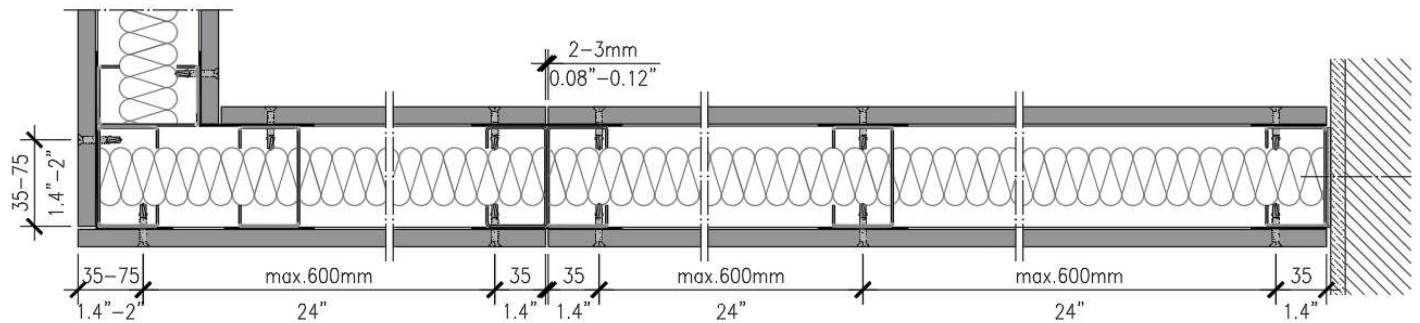


Figure 3.12 - Horizontal section of the wall, galvanized steel frame

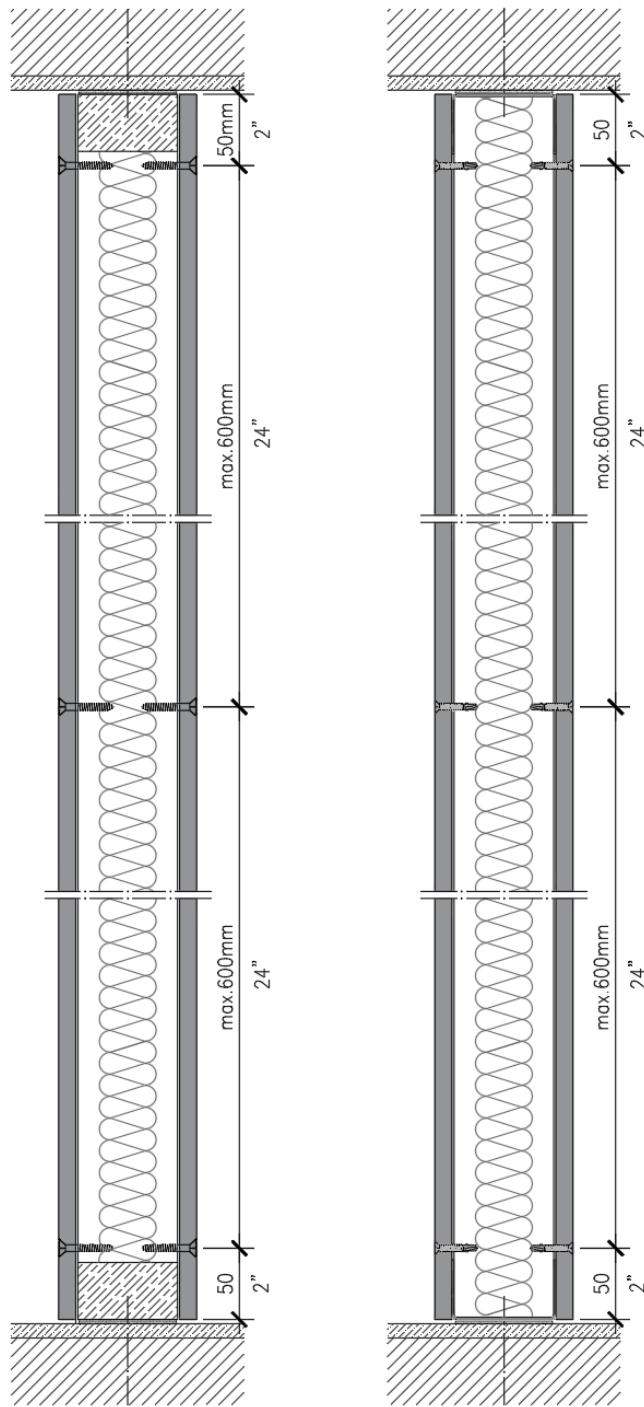


Figure 3.13 - Vertical section of the wall
 Wooden and galvanized steel frame

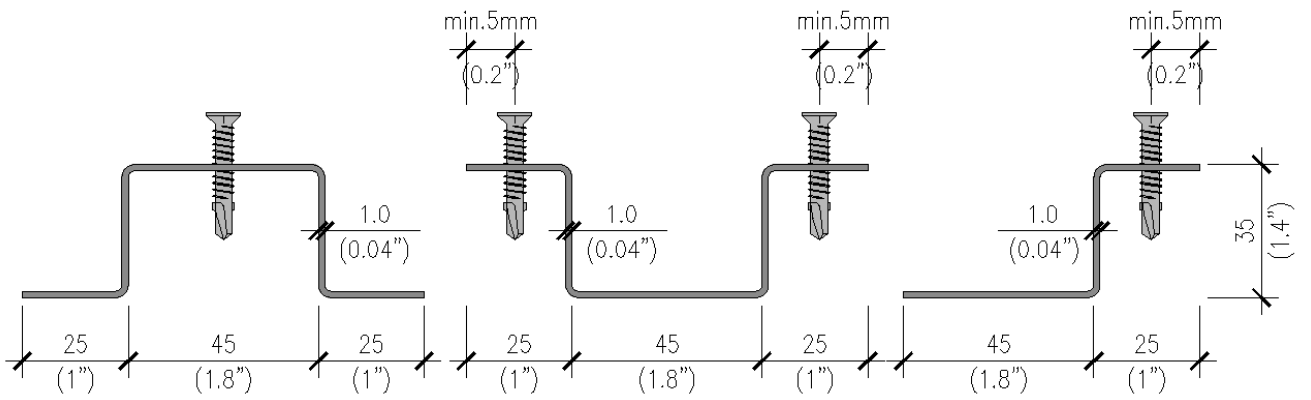


Figure 3.14 - Omega Profile (esp. 1mm minimum), DX51D galvanized steel (Z +)

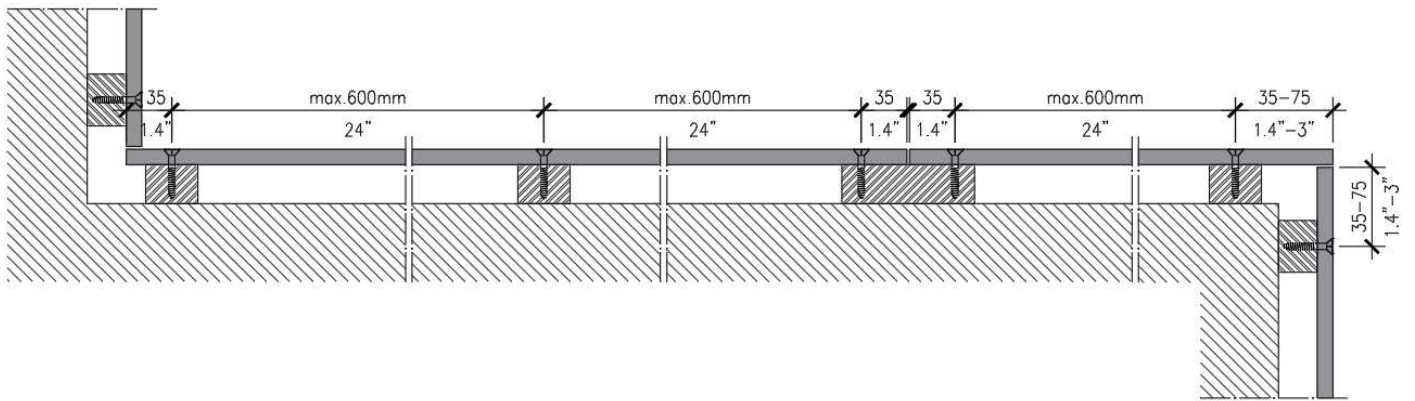


Figure 3.15 - Horizontal section of wall covering, timber frame

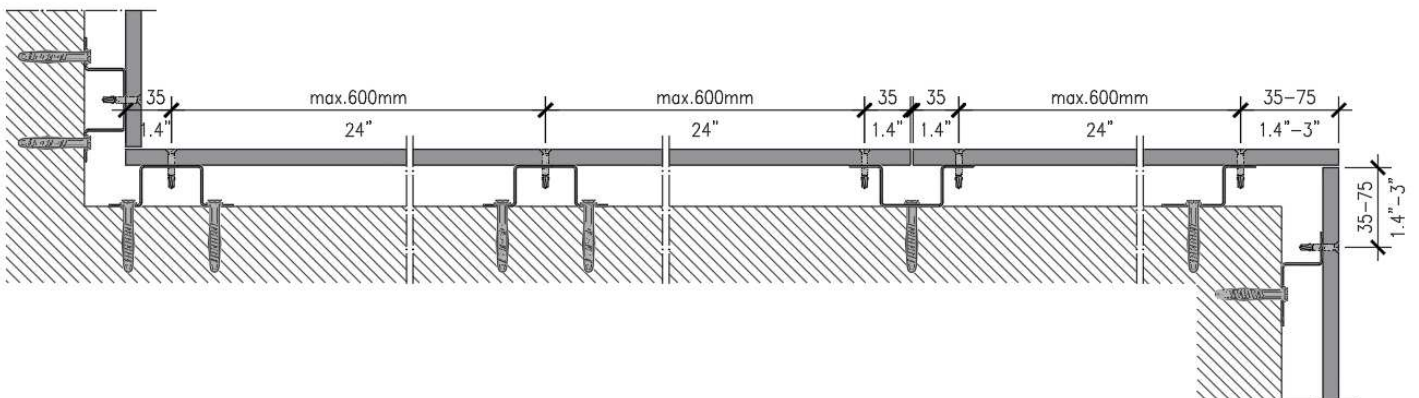


Figure 3.16 - Horizontal section of wall cladding, galvanized steel frame

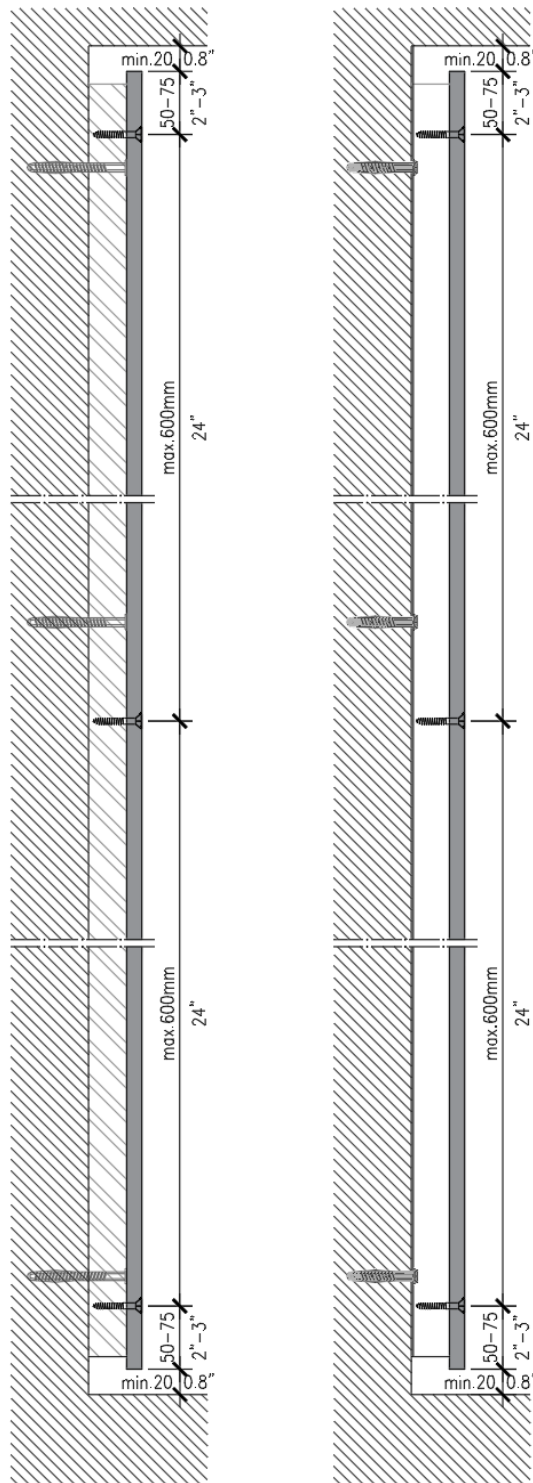


Figure 3.17 - Vertical section of wall covering
 Wooden structure and galvanized steel

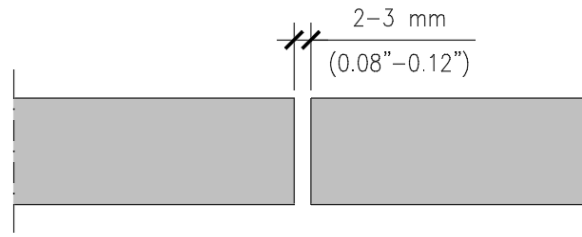


Figure 3.18 - Joints between boards

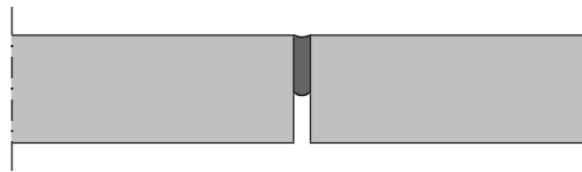


Figure 3.19 - Joints between boards with mastic cord

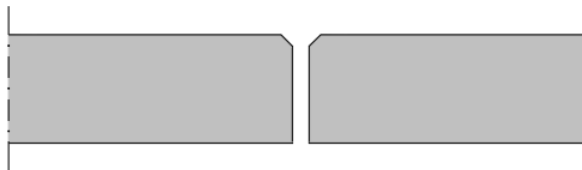
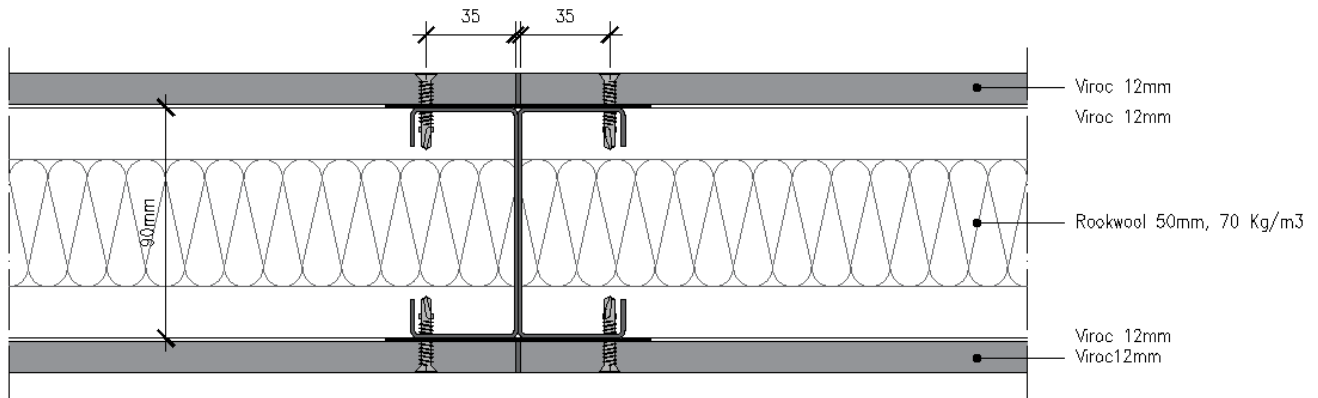


Figure 3.20 - Bevel Machined Edges

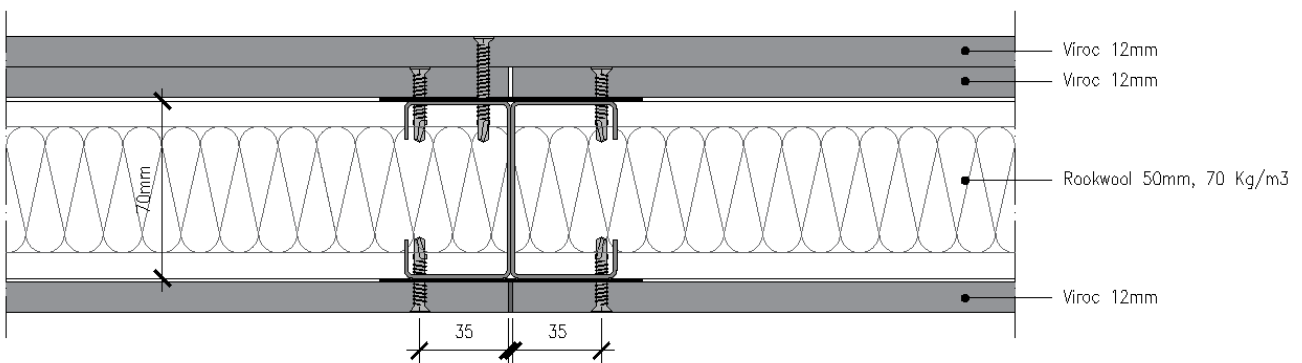
Acoustic performance of Viroc panelled partition walls



$R_w(C;Ctr) = 47(-4;-11)$ dB; EN ISO 140-3

f (Hz)	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	17.5	25.3	36.2	39.7	39.3	39.9	45.4	47.0	48.0	49.7	51.2	49.7	49.1	47.5	49.1	56.7	58.8	58.5

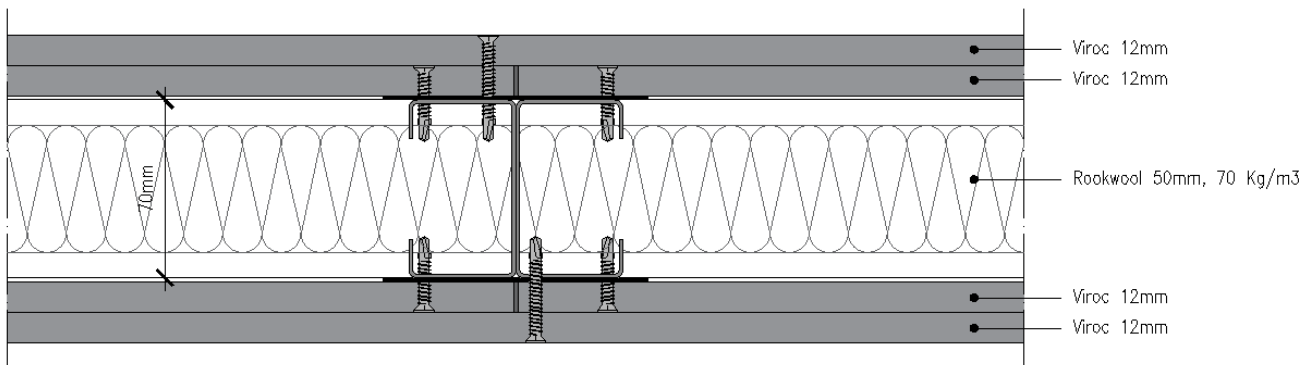
Figure 3.21 - Simple structure 1+1 wall



$R_w(C;Ctr) = 47(-1;-1)$ dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	27.5	18.9	25.5	31.1	39.8	43.0	44.2	44.9	48.6	49.2	49.9	51.3	50.8	49.0	45.3	45.7	45.6	44.9	47.5	48.1	50.8

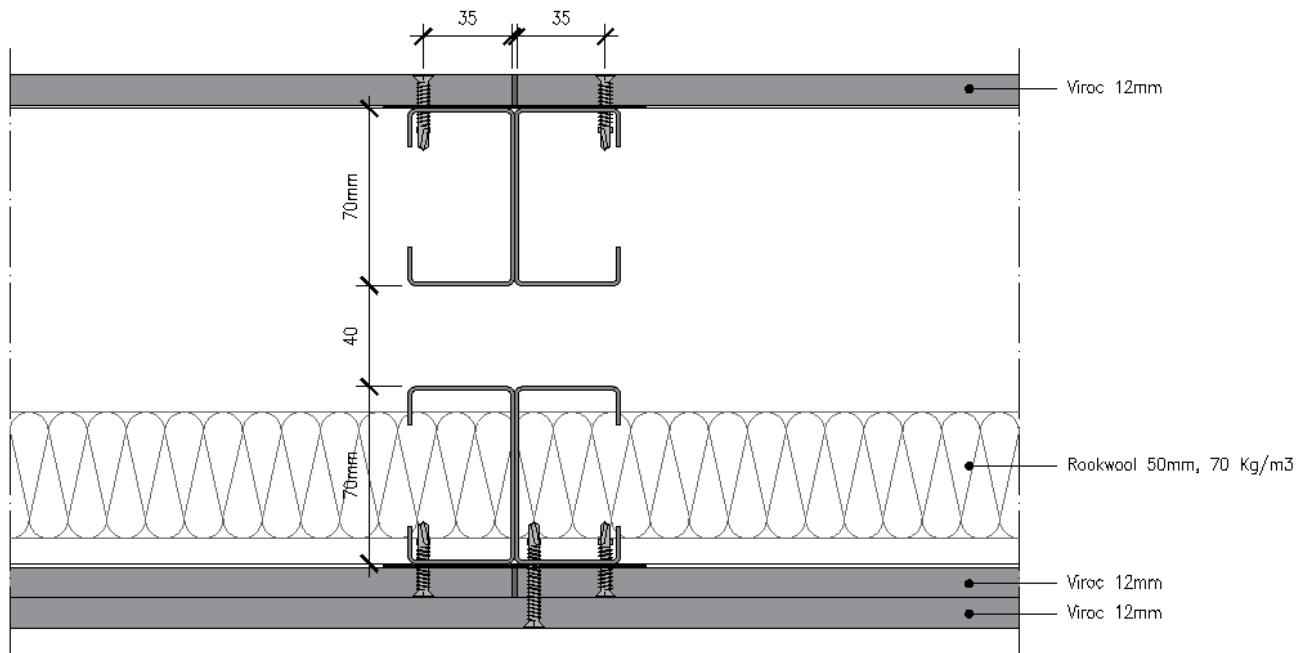
Figure 3.22 - Simple structure 2+1 wall



$R_w(C;Ctr) = 55(-1;-5)$ dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	27.5	20.6	24.0	34.6	42.5	44.5	46.8	48.1	50.6	51.8	51.1	53.0	54.4	55.2	55.8	56.6	56.2	54.1	57.0	56.4	56.2

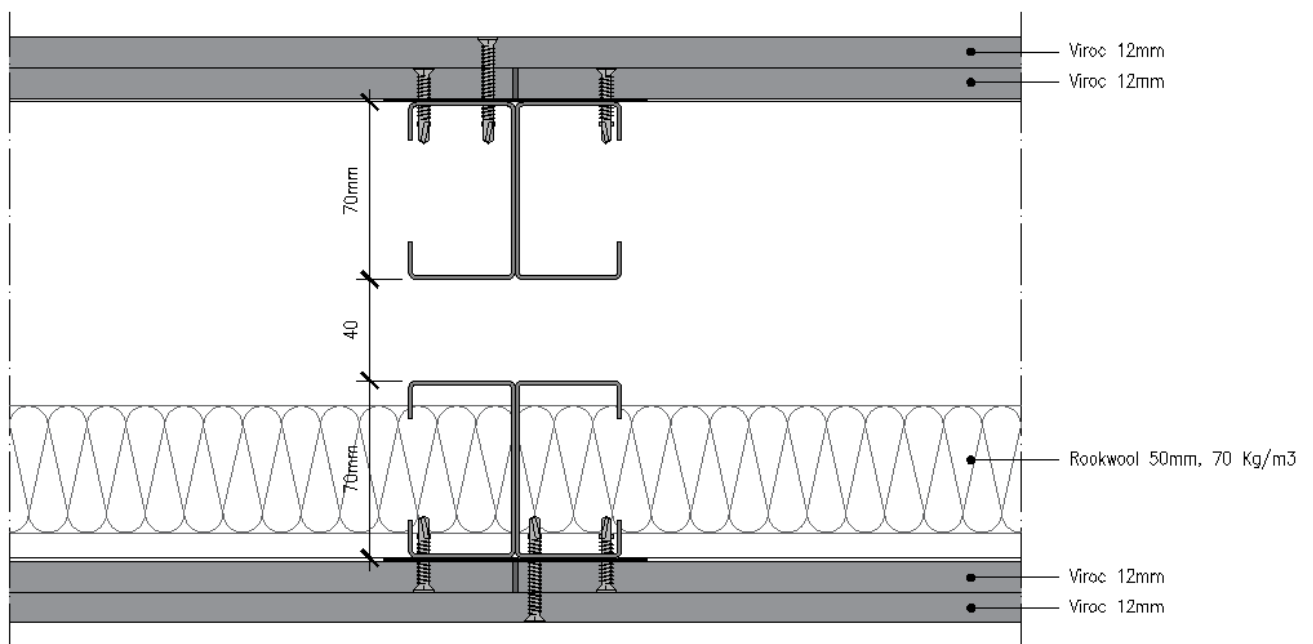
Figure 3.23 - Simple structure 2+2 wall



Rw(C;Ctr) = 59(-3;-11) dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	28.2	22.9	33.1	29.1	40.7	43.7	46.4	50.7	53.3	56.8	57.3	60.3	63.4	66.5	68.8	69.2	67.2	62.4	64.2	65.4	65.2

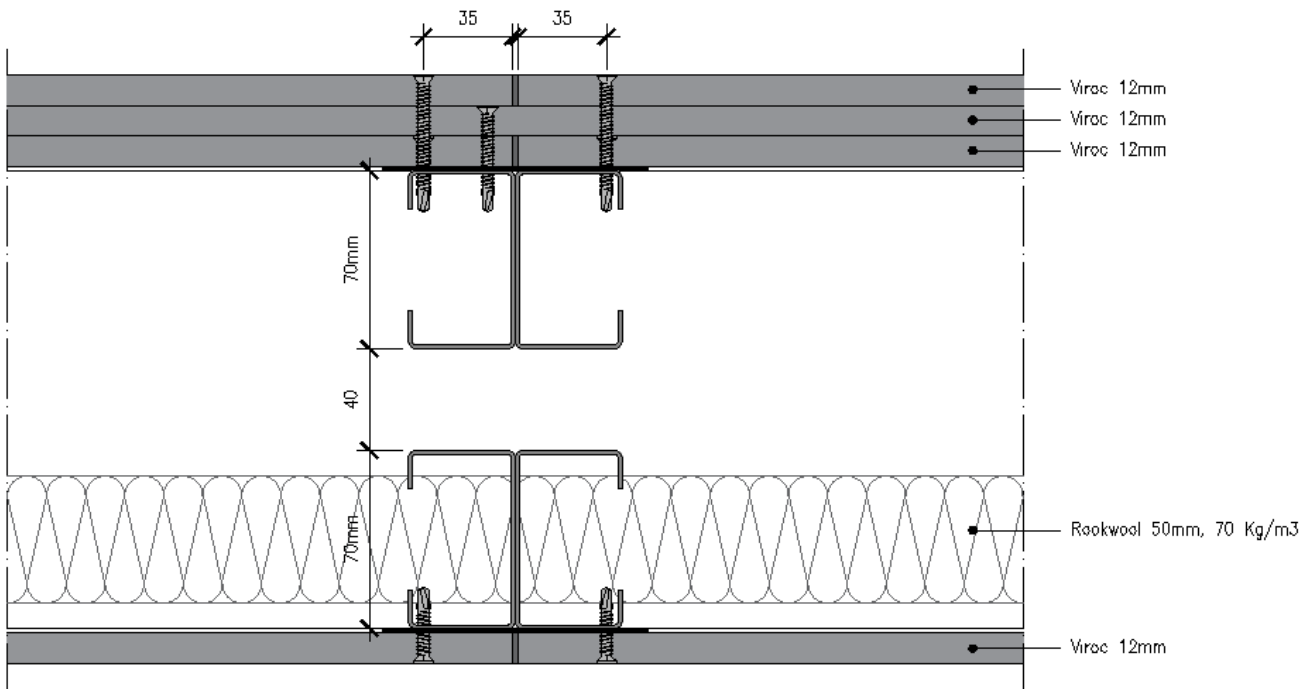
Figure 3.24 - Double structure 2+1 wall



Rw(C;Ctr) = 62(-2;-7) dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	26.6	27.6	33.4	36.9	45.1	47.5	50.8	52.9	55.9	58.8	57.6	60.4	63.9	66.7	70.7	71.7	71.9	68.6	70.4	71.2	68.7

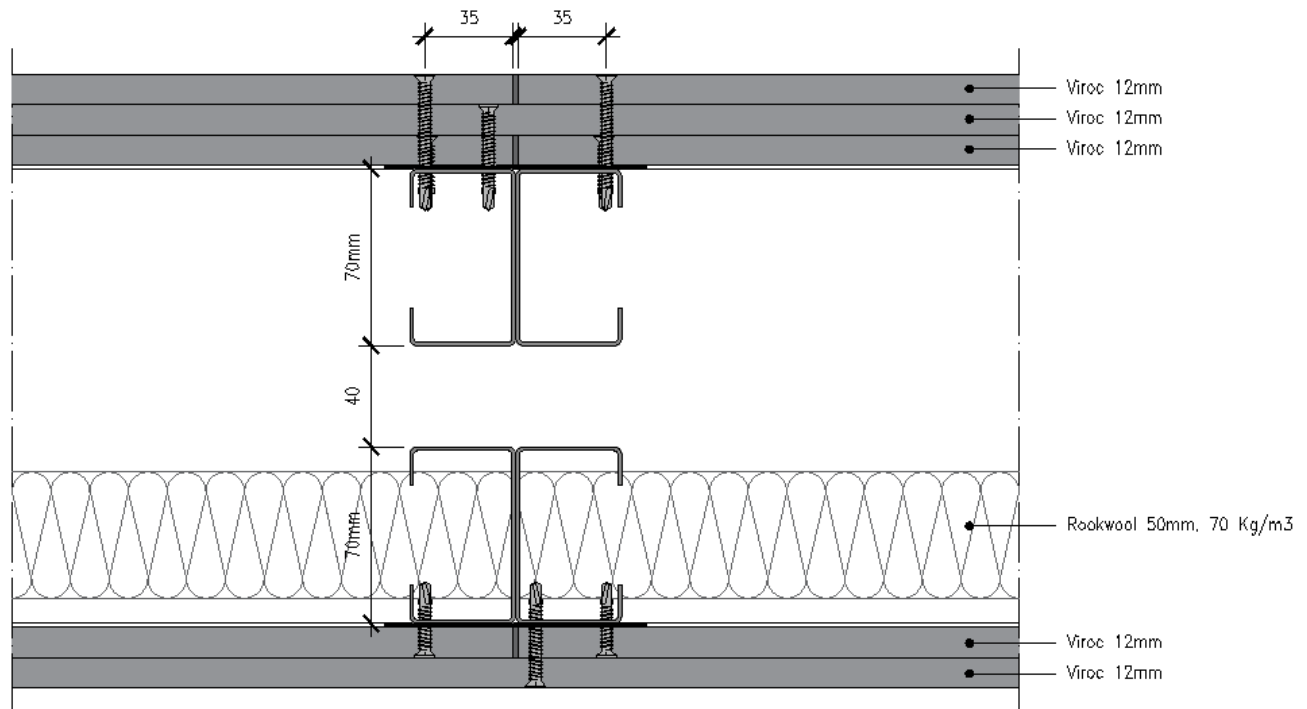
Figure 3.25 - Double structure 2+2 wall



Rw(C;Ctr) = 61(-4;-11) dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	29.2	26.9	34.9	31.6	41.3	48.0	49.6	52.0	54.3	56.9	57.4	60.5	63.6	66.8	70.3	70.9	70.1	65.1	66.9	67.2	65.5

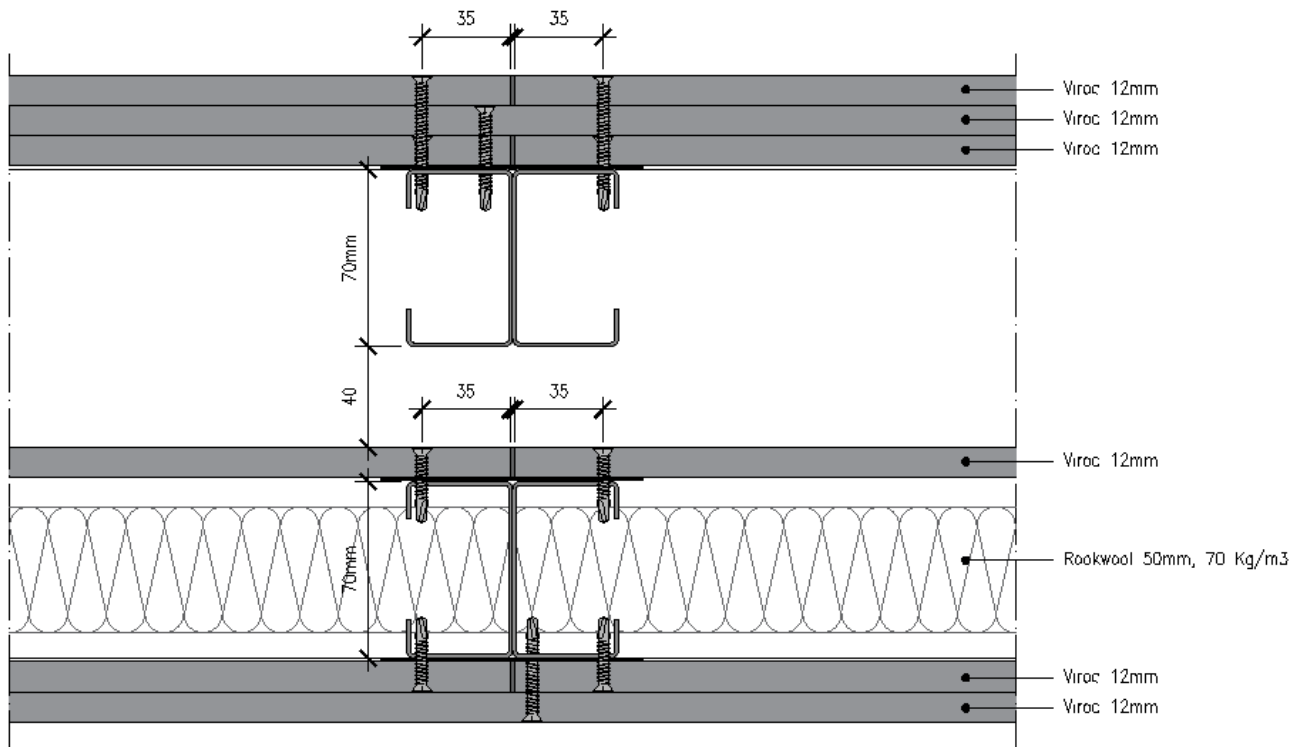
Figure 3.26 - Double structure 3+1 wall



Rw(C;Ctr) = 64(-2;-7) dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	36.0	34.8	40.9	40.6	46.9	50.4	52.9	53.7	55.9	59.3	58.4	61.1	64.1	67.2	71.8	73.0	73.9	70.8	72.2	71.9	69.4

Figure 3.27 - Double structure 3+2 wall



$R_w(C;Ctr) = 65(-2;-7)$ dB; EN ISO 140-3

f (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R (dB)	32.8	28.8	32.6	41.7	46.5	51.0	54.6	55.4	57.6	59.5	58.4	61.8	64.8	67.2	71.8	73.0	73.3	73.5	73.6	71.3	68.2

Figure 3.28 - Double structure 3+1+2 wall

Viroc panelled partition walls fire resistance

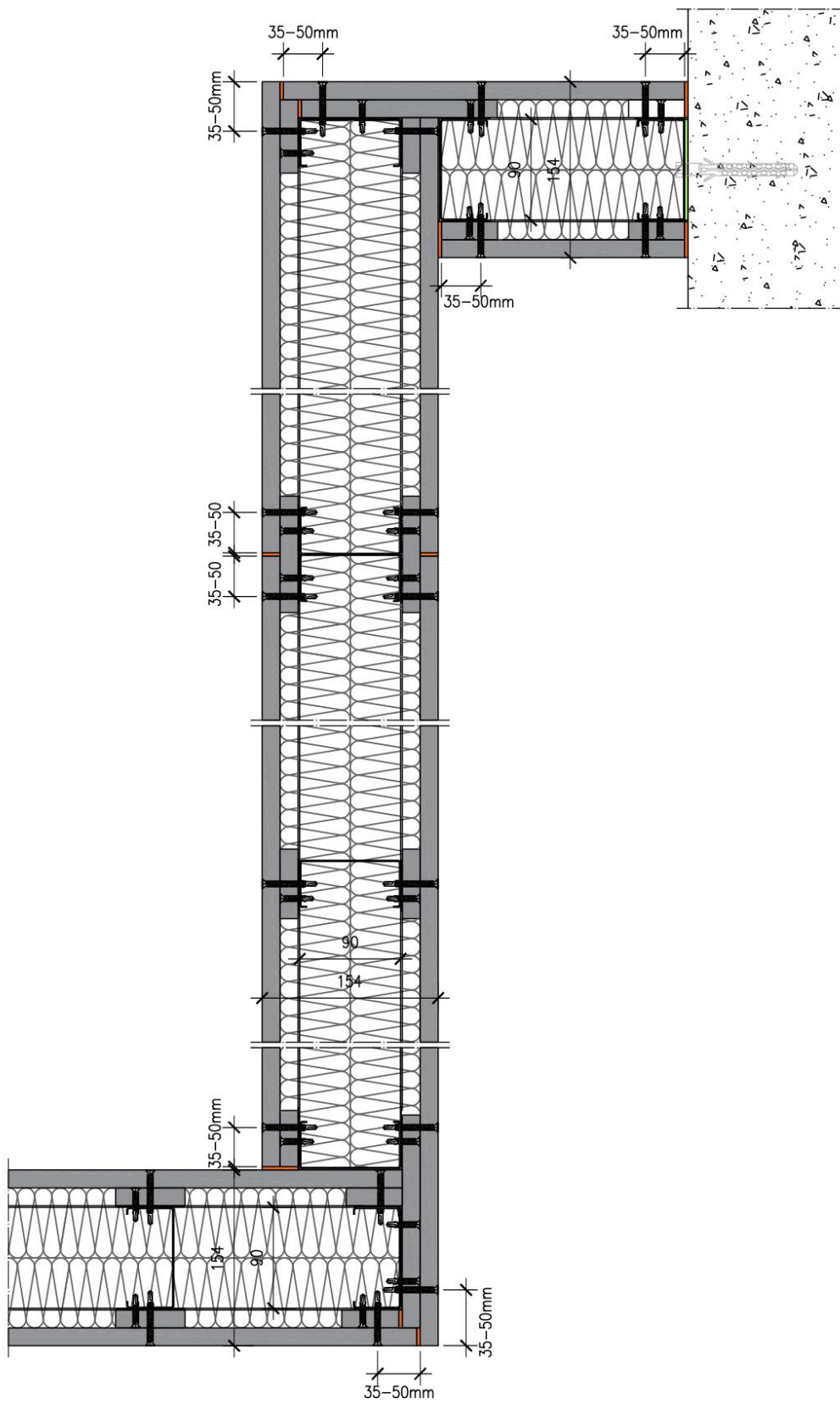


Figure 3.30 - Wall EI90, Horizontal Section

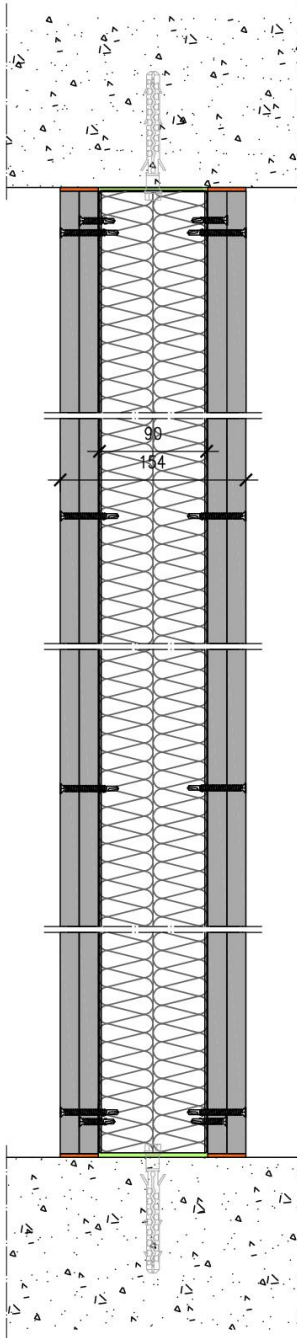


Figure 3.31 - Wall EI90, Vertical Section

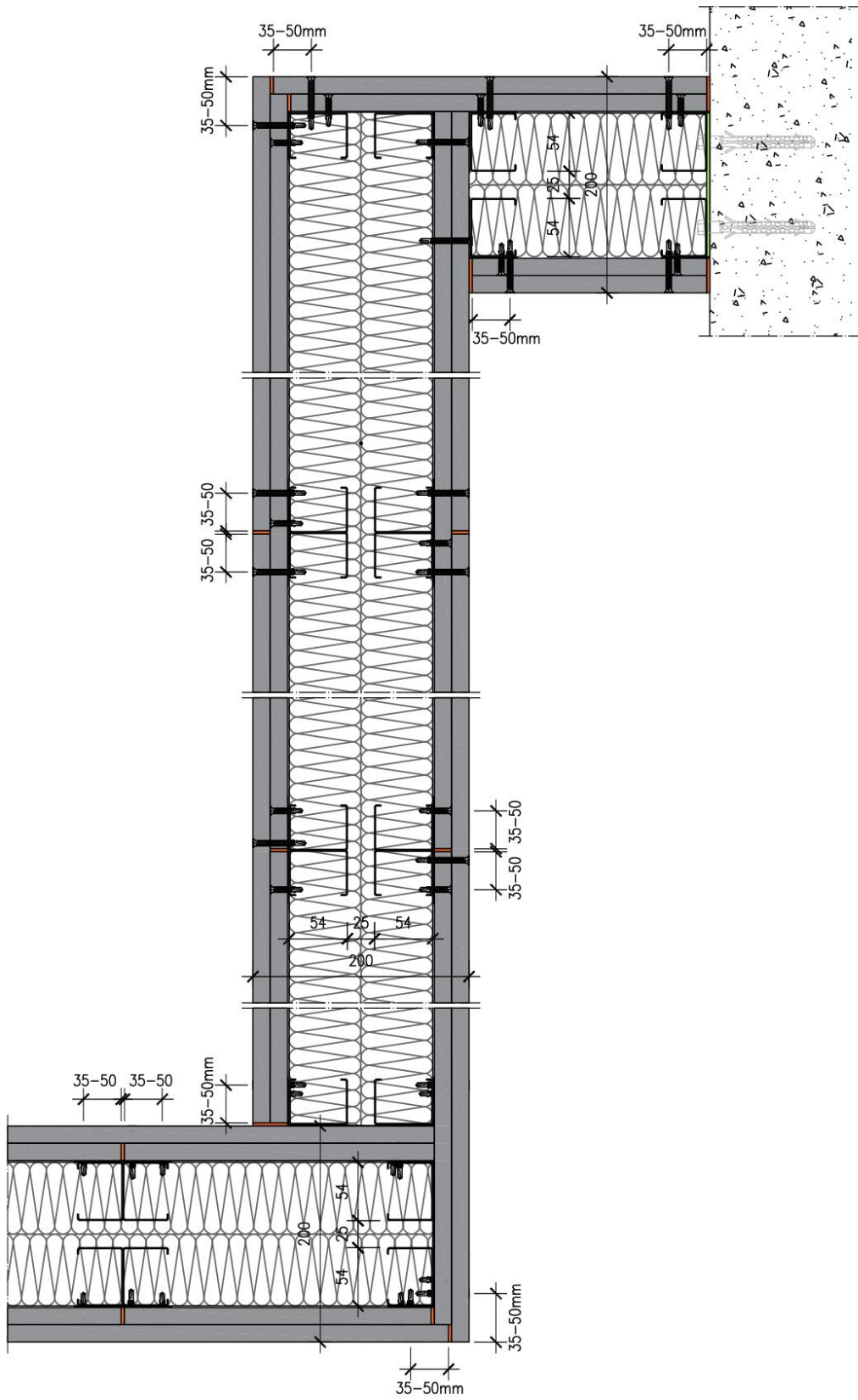


Figure 3.32 - Wall EI120, Horizontal Section

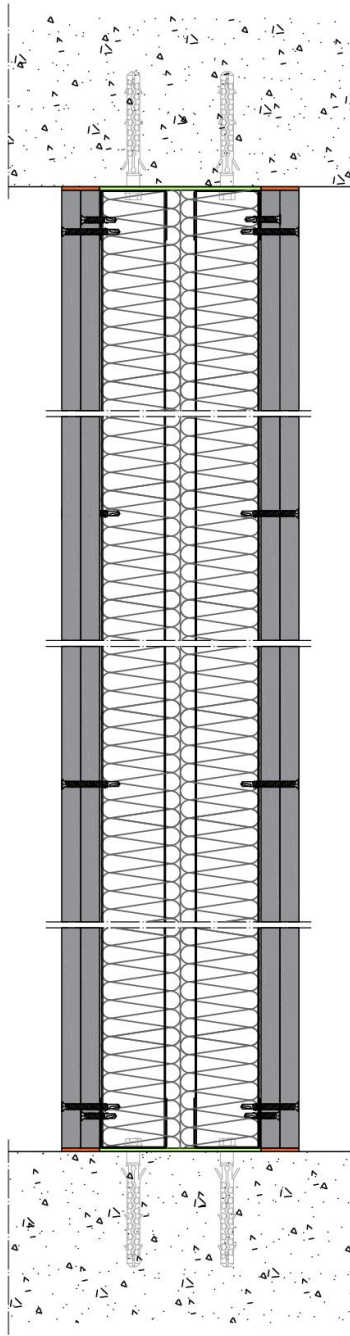


Figure 3.33 - Wall EI120, Vertical Section

Flooring

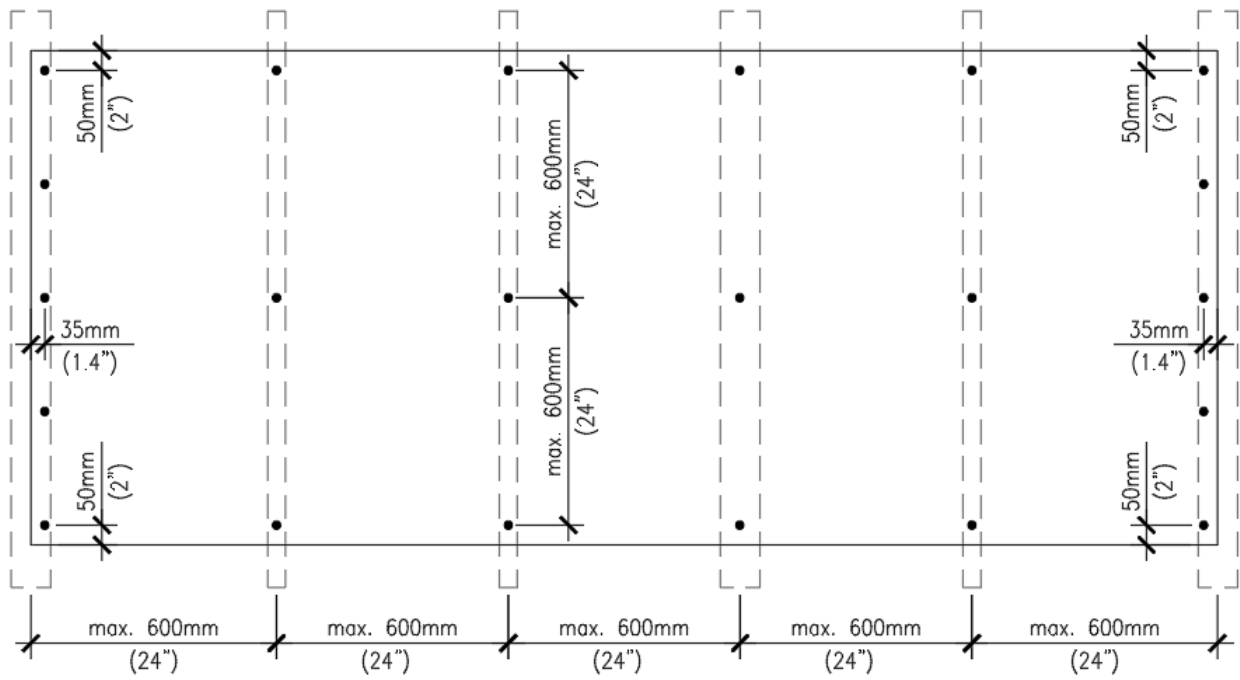


Figure 4.1 – Fixing location

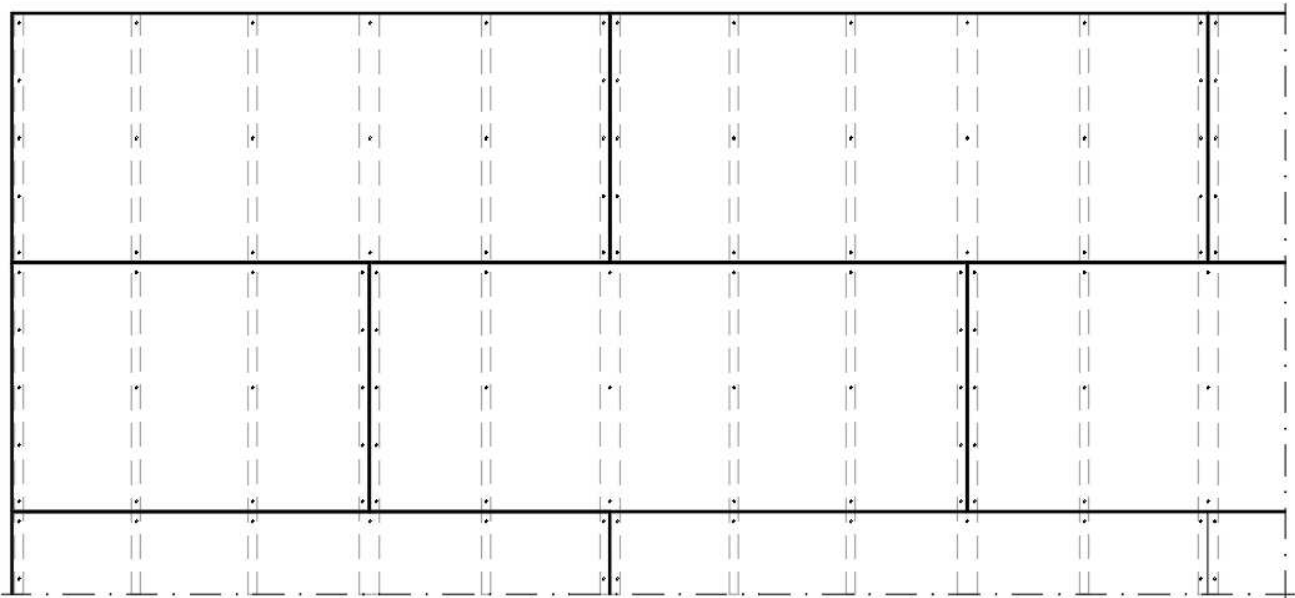


Figure 4.2 - Overview of a beam-supported floor



Figure 4.3 - Galvanized steel frame screw
SFS Intec: SWI/30 P-5.5x38



Figure 4.4 - Galvanized steel screw for metallic structure
SFS Intec: SC3/25-PH2-4.8x35; Etanco: Wingteks/Zn 4.8x35



Figure 4.5 - Mastic board bonding system
Sika: Sikatack Panel System; Bostik: Simson PanelTack System

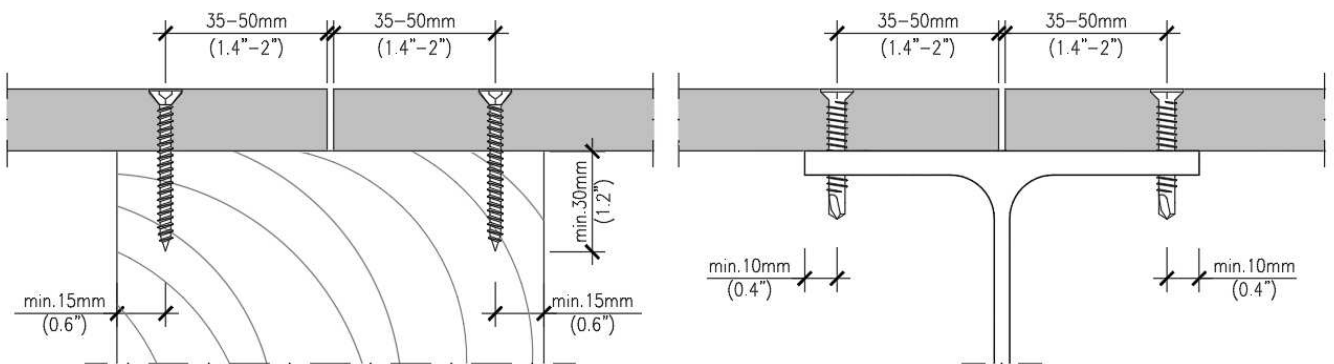


Figure 4.6 - Joint between boards

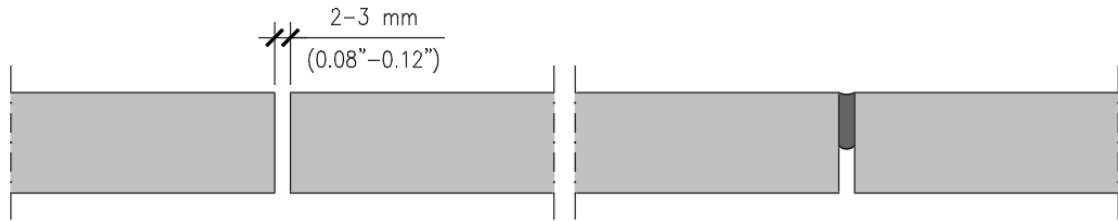


Figure 4.7 - Joints between boards filled with sealant

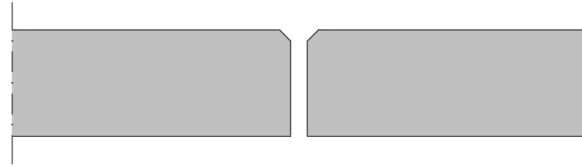


Figure 4.8 - Joints between boards filled with bevel machining

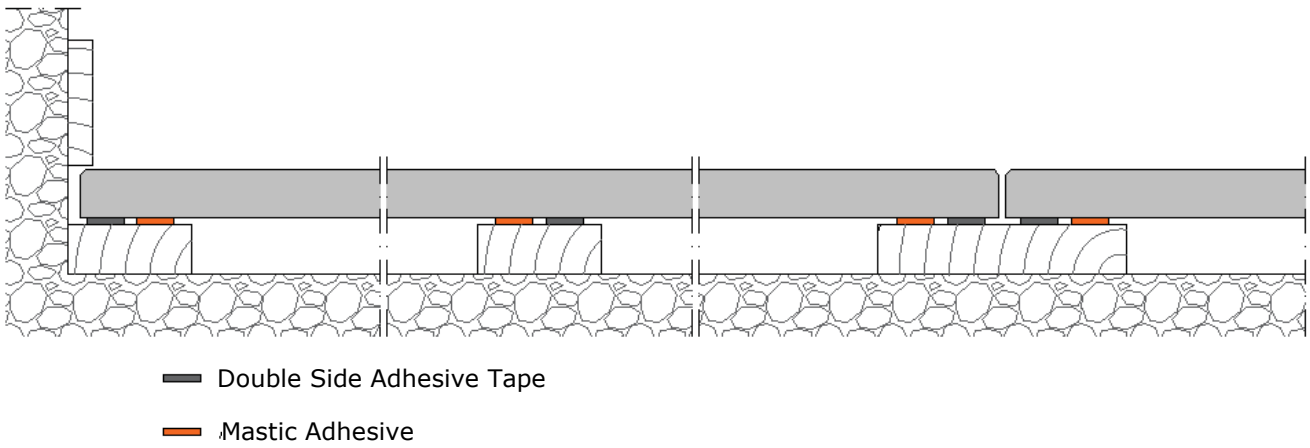


Figure 4.9 - Longitudinal section

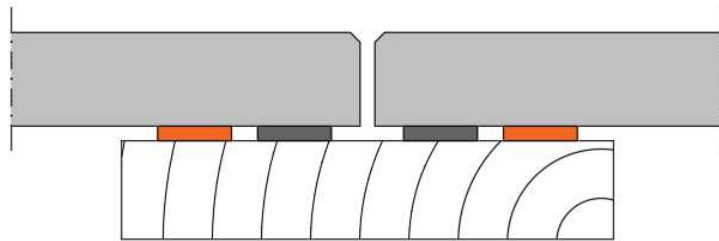


Figure 4.10 - Joint detail, bevelled edges

Example of checking flooring

Dimensioning a floor of a dwelling consisting of Viroc boards, 25mm thickness, 2.40m in length, supports every 60 cm.

Actions

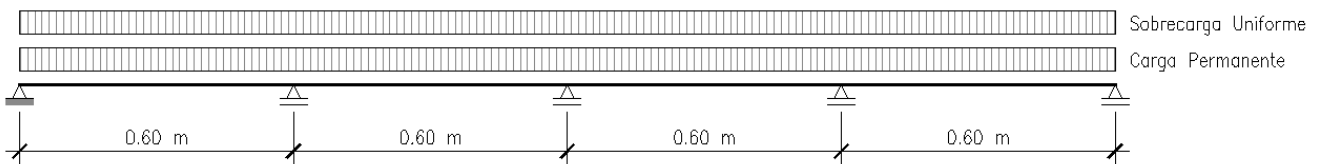
Permanent loads

Own weight (Pp)	0.34 kN/m ²
Remaining permanent loads (RCp)	2.00 kN/m ²

Overloads

Housing (Sc)	2.00 kN/m ²
Concentrated load (evenly distributed load)	1.50 kN/m

Evenly Distributed Loads



Verification of Safety of Ultimate Limit States

Combination of overloaded actions as base variable action

$$S_{sd} = 1.35 Pp + 1.50 RCp + 1.50 Sc$$

$$k_{mod} = 0.65 \text{ Medium duration actions}$$

Maximum efforts

$$M_{Sd,m\acute{a}x} = 0.24 \text{ kNm/m}$$

$$M_{Rd} = k_{mod} \cdot w \cdot f_{m,k} / \gamma_M = 0.65 \times (25/1000)^2 / 6 \times 9000 / 1.3 = 0.47 \text{ kN/m} > 0.24 \text{ kNm/m}$$

$$V_{Sd,m\acute{a}x} = 2.35 \text{ kN/m}$$

$$V_{Rd} = k_{mod} \cdot A_v \cdot f_{v,k} / \gamma_M = 0.65 \times 5 / 6 \times (25/1000) \times 1000 / 1.3 = 10.4 \text{ kN/m} > 2.35 \text{ kN/m}$$

Verification of Safety of Ultimate Limit States

Quasi-permanent combination of actions

Long term deformation

$$\delta_{\infty} = \delta_{inst} \times (1 + k_{Def})$$

$$\delta_{inst} = 1.0 \delta_{Pp} + 1.0 \delta_{RCp} + \psi_2 \delta_{Sc} ; (\psi_2 = 0.2)$$

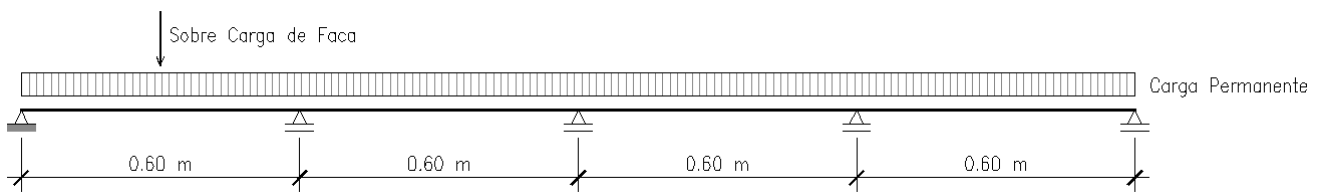
$$\text{Maximum deformation } L/250, 600/250 = 2.4 \text{ mm}$$

$$\text{Instantaneous maximum deformation } \delta_{inst} = 0.4 \text{ mm}$$

$$\text{Long term deformation, } \delta_{fin} = \delta_{inst} \times (1 + 2.25) = 1.3 \text{ mm} < 2.4 \text{ mm}$$

Figure 4.11 - Example of Safety Check, Uniform Distributed Loads

Concentrated Overload (evenly distributed load)



Verification of Safety of Ultimate Limit States

Combination of overloaded actions as base variable action

$$S_{sd} = 1.35 P_p + 1.5 RC_p + 1.5 S_c$$

$$k_{mod} = 0.85 - \text{Short Actions}$$

Maximum efforts

$$M_{Sd,max} = 0.37 \text{ kNm/m}$$

$$M_{Rd} = k_{mod} \cdot W \cdot f_{m,k} / \gamma_M = 0.85 \times (25/1000)^2 / 6 \cdot 9000 / 1.3 = 0.61 \text{ kNm/m} > 0.37 \text{ kNm/m}$$

$$V_{sd,max} = 2.36 \text{ kN/m}$$

$$V_{Rd} = k_{mod} \cdot A_v \cdot f_{v,k} / \gamma_M = 0.85 \times 5 / 6 \times (25/1000) \times 1000 / 1.3 = 13.62 \text{ kN/m} > 2.36 \text{ kN/m}$$

Verification of Safety of Ultimate Limit States

Characteristic combination of actions

Instantaneous deformation

$$\delta_{inst} = 1.0 \delta_{Pp} + 1.0 \delta_{RCp} + \psi_0 \delta_{Sc} ; (\psi_0 = 0.4)$$

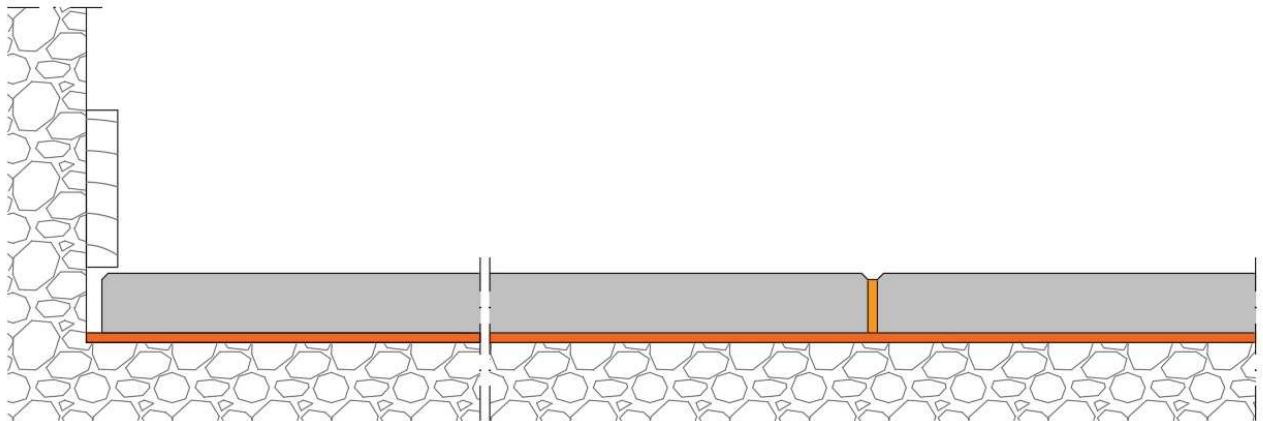
Maximum deformation $L/250$, $600/250 = 2.4 \text{ mm}$

Instantaneous maximum deformation $\delta_{inst} = 0.7 \text{ mm} < 2.4 \text{ mm}$

Figure 4.12 - Example of Safety Check, Evenly Distributed Load



Figure 4.13 - Notched trowel to apply polyurethane mortar




 Polyurethane mortar

Figure 4.14 - Longitudinal section, Viroc laid with polyurethane mortar

Suspended ceilings

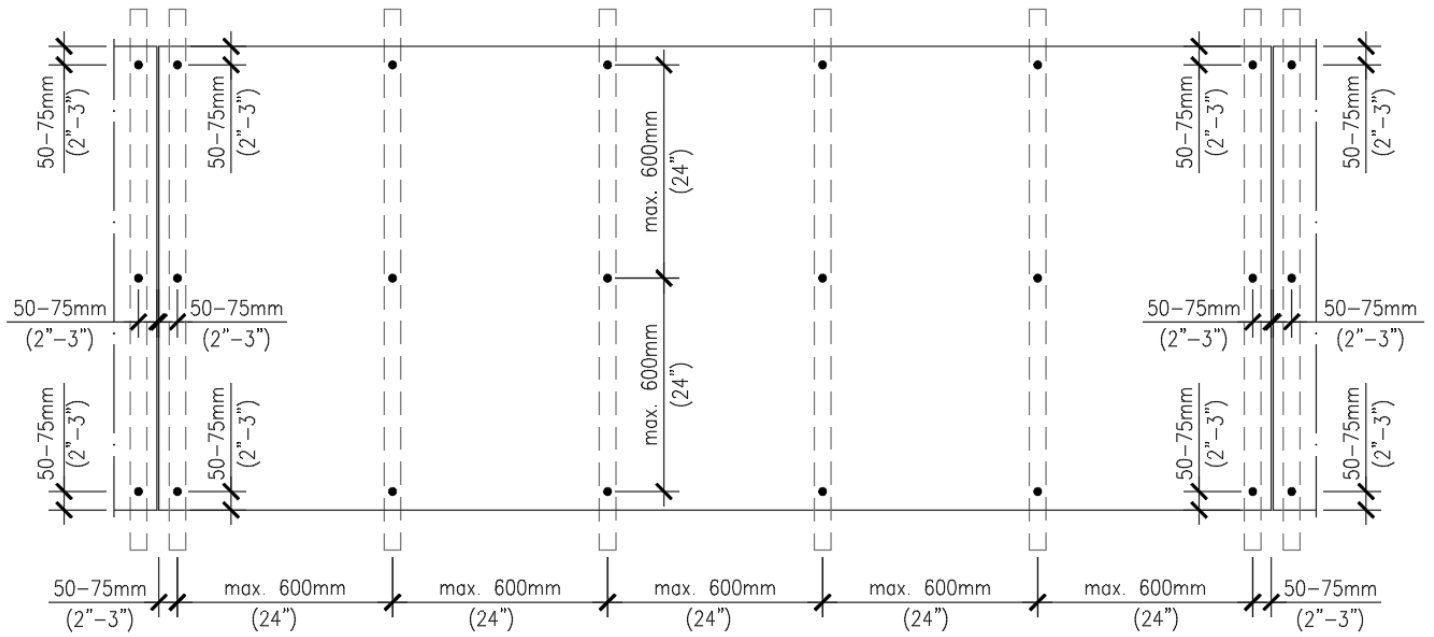


Figure 5.1 - Fix location



Figure 5.2 - Screws and rivets to fix Viroc boards to metallic structures
(See figure 2.42 and 2.43)



Figure 5.3 - Screws to fix Viroc boards to timber structures
(See figure 2.22)

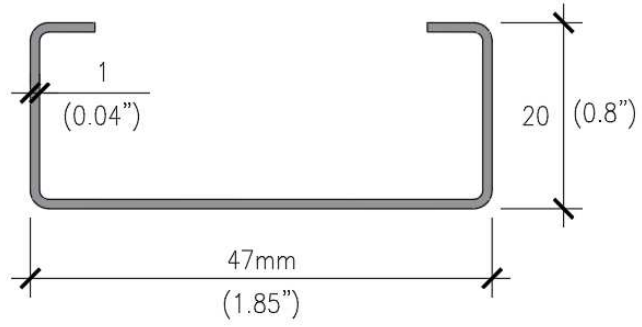


Figure 5.4 - Profile C (Esp. 1mm), DX51D galvanized steel (Z +)



Figure 5.5 - Pivot

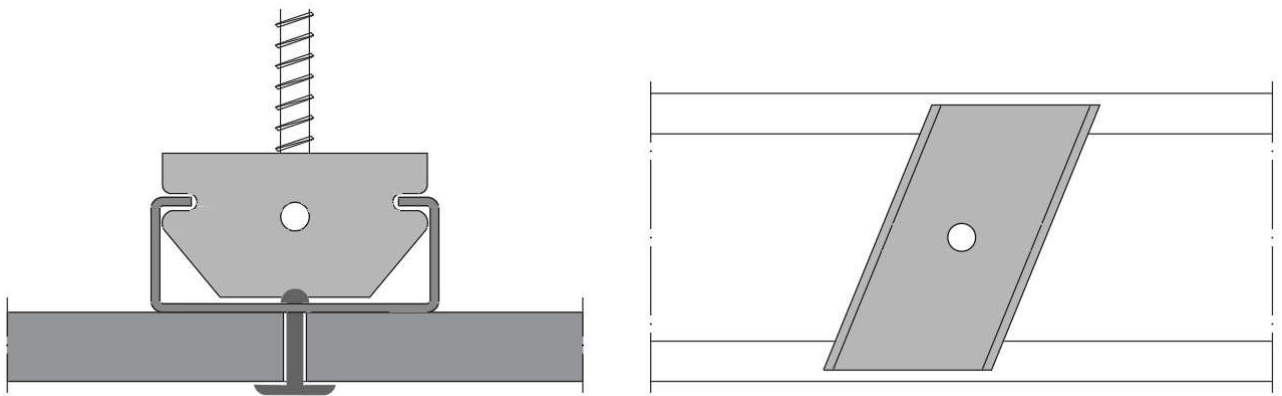


Figure 5.6 - Detail of fastening the board to the support profile

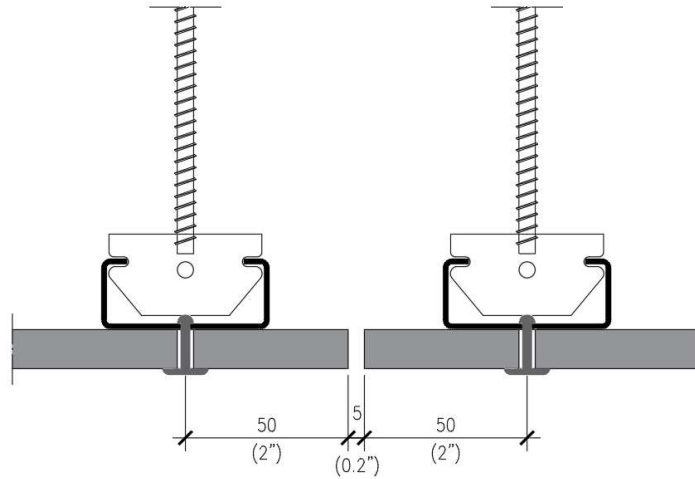


Figure 5.7 - Joint between boards

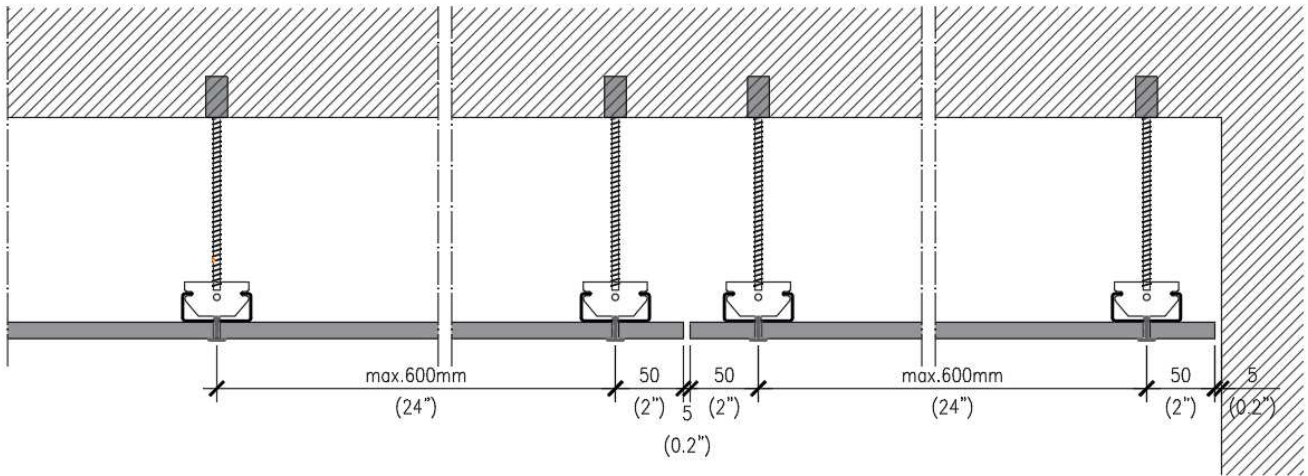


Figure 5.8 - Longitudinal section to board direction

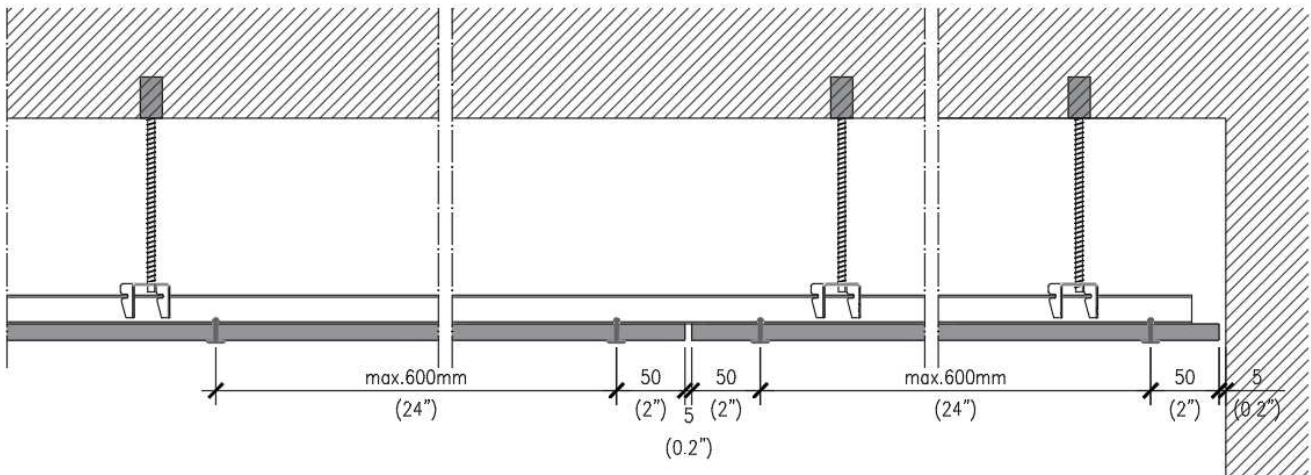


Figure 5.9 - Cross section to board direction

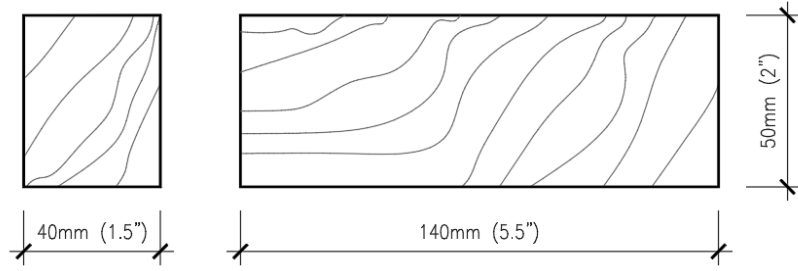


Figure 5.10 - Wooden beams
Minimum resistance C18 (EN 338)

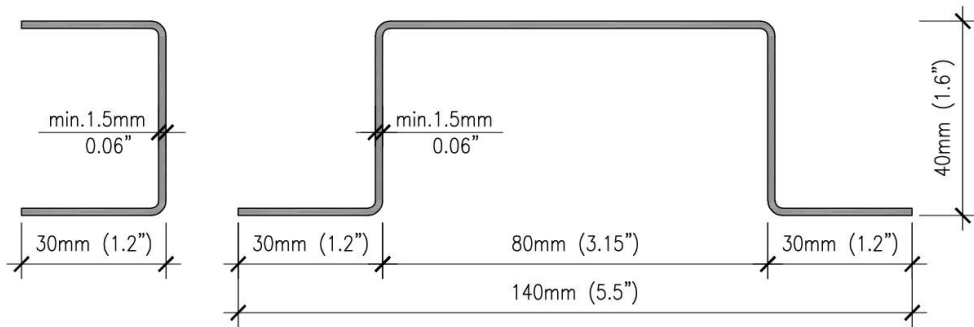


Figure 5.11 - Galvanized Steel Profiles
Minimum resistance S220GD (EN 10346)

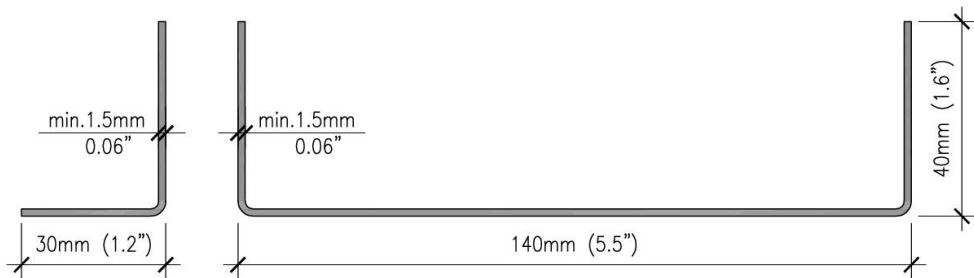


Figure 5.12 - Galvanized Steel Profiles (Alternative)
Minimum resistance S220GD (EN 10346)

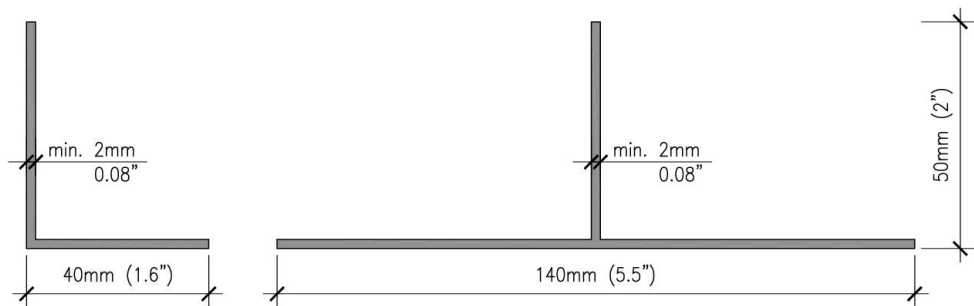
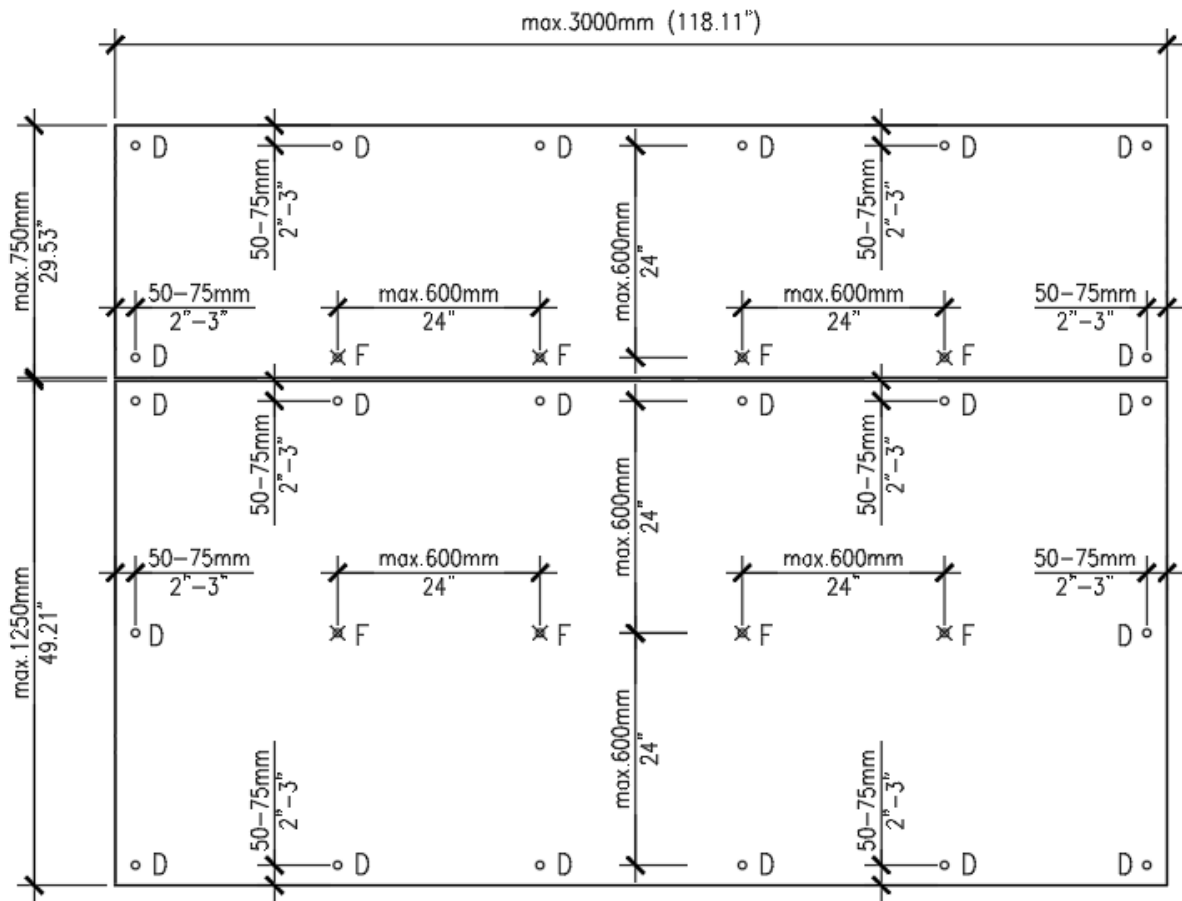


Figure 5.13 - Aluminium Structure
6000 Series Alloy with $R_{p0.2} \geq 180$ MPa



D - Sliding Support - ϕ 10 mm; F - Fix Support - ϕ 5 mm

Figure 5.14 - Type and location of fastenings

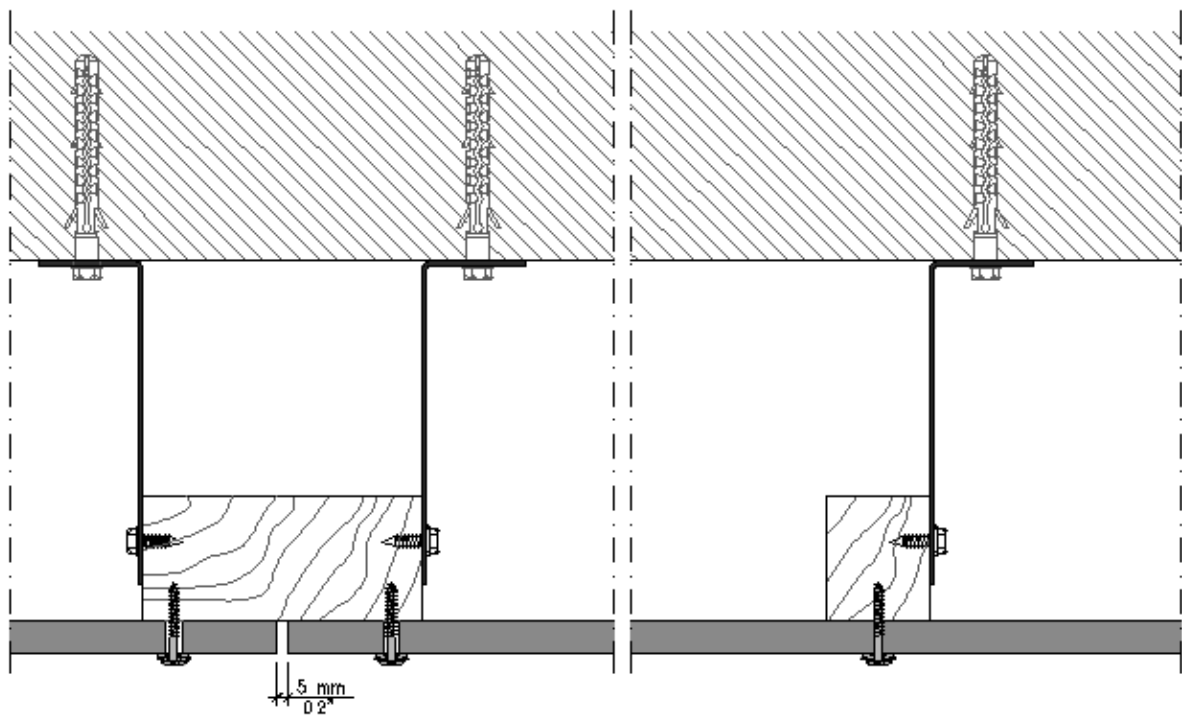


Figure 5.15 - Rigid wooden structure

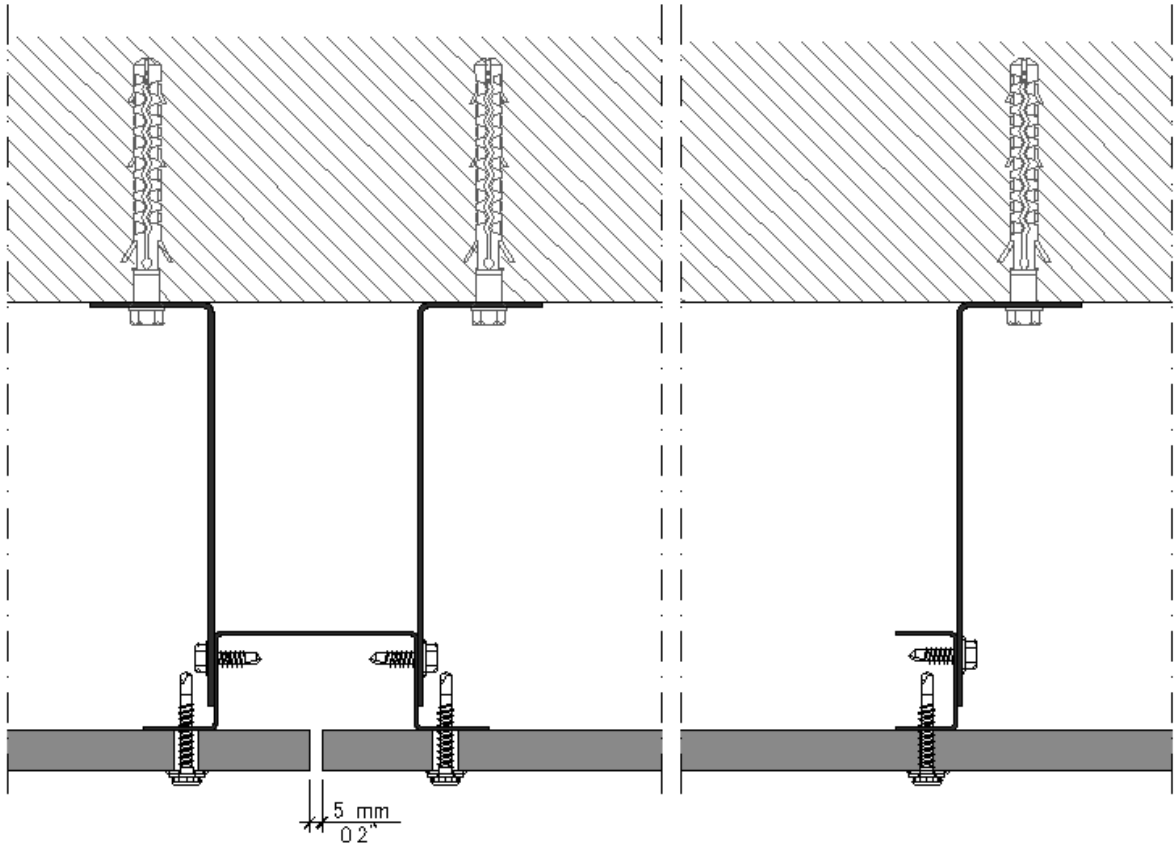


Figure 5.16 - Rigid galvanized steel structure

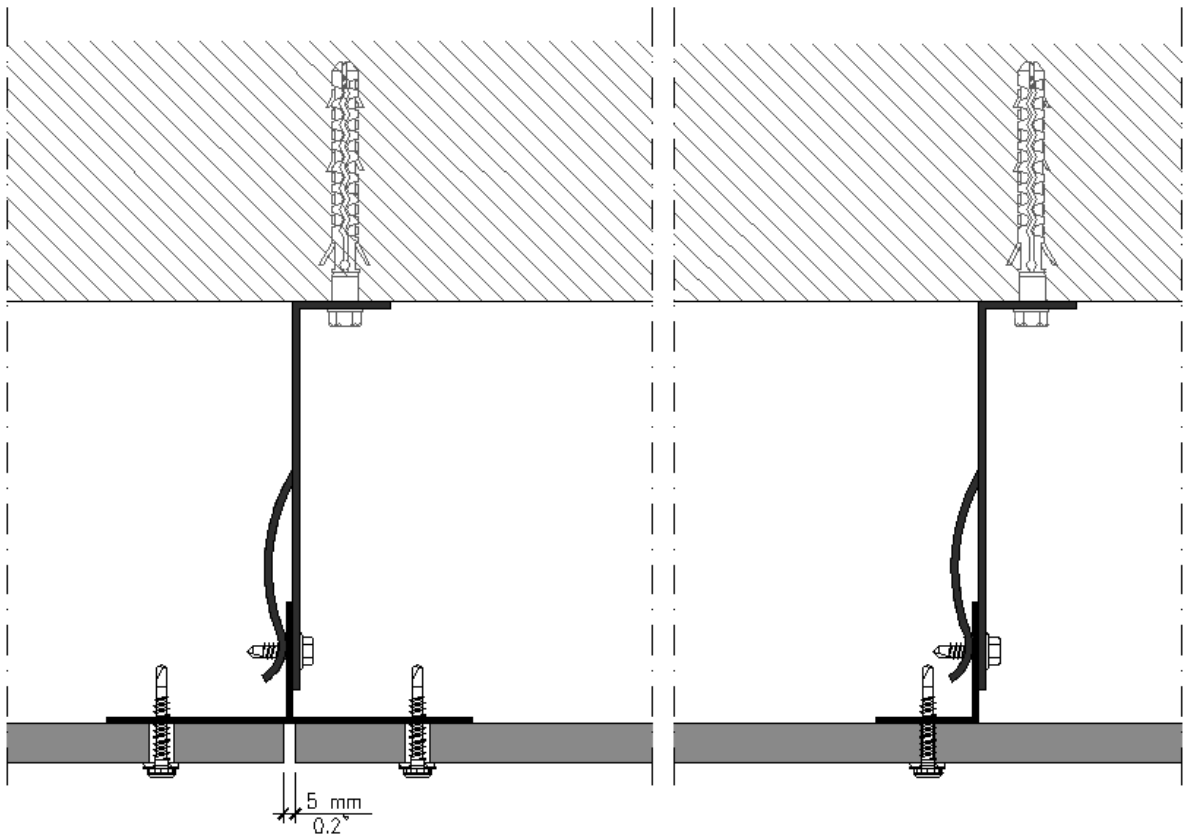


Figure 5.17 - Rigid Aluminium Frame