

# TRI MO TRIMOTERM

ARCADIA. LIGHTWEAR.

FAÇADE SYSTEM **TRIMOTERM FTV INVISIO**

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# 1 Technical description of the facade system with hidden fixing – FTV INVISIO

## 1.1 General

Invisio is predominantly designed as a vertically applied, secret fix, mineral wool façade panel that can be produced in lengths, up to 14 m. Providing a minimal, clean, homogenous aesthetic, Invisio is extremely fast and economical to install, but the rewards are an appealing flat, architecturally sensitive façade.

The intermediate fixing details have a high level of load-bearing capacity and utilises the integral strength of the panel, to the fullest, without compromising the panel flatness.

The system is primarily intended for vertical orientation although, horizontal installation is also practical (Fig. 1 and 2). Trimoterm panels FTV HL (referred as FTV INVISIO) are fixed to the intermediate supports of steel or concrete frames, with steel profiles, by means of a purpose-built spreader bar, the purpose of which, is to spread the loading capacity, to a larger bearing area. The longitudinal edge of the adjacent panel covers the spreader bars and screws of the attached panel in such a manner that they are not visible on the completed façade. The fixing point is shown in cross-section in Fig. 6. The spreader bar is attached with a double screw according to the thickness of the sub structure and static calculation.

The Invisio system of façades delivers excellent technical characteristics, and exceptional flexibility in designing the façade. The range of use of the FTV INVISIO facades is extremely wide and is suitable for business, commercial and industrial projects.

Fig. 1: Vertical installation.

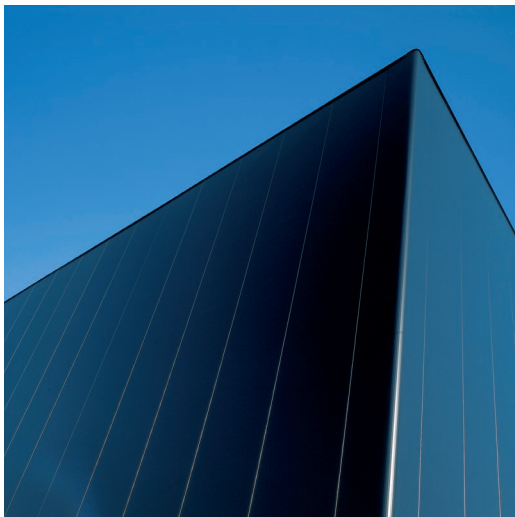


Fig. 2: Horizontal installation.



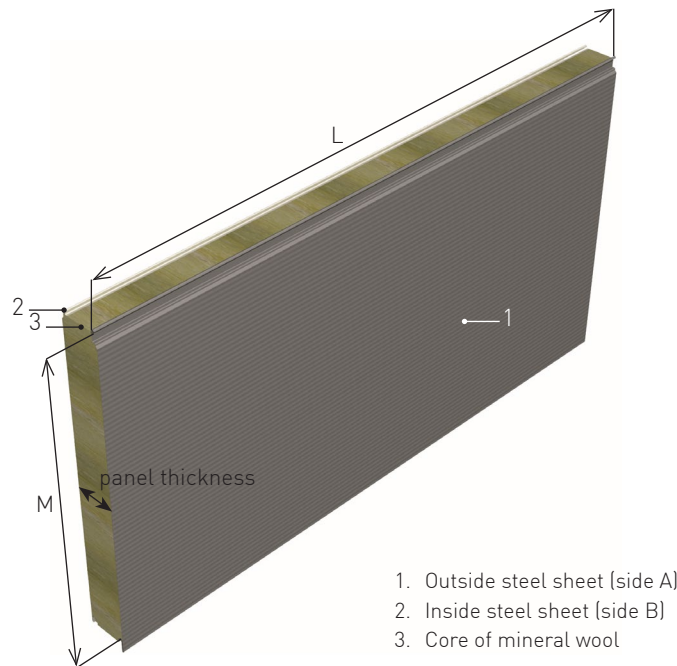
Fig. 4: Fixing in the light steel structure.



1. Panel Trimoterm FTV INVISIO
2. Self-tapping screws
3. Spreader bar

## 1.2 Panel profile

Fig. 5: Shapes of Trimoterm FTV INVISIO panels



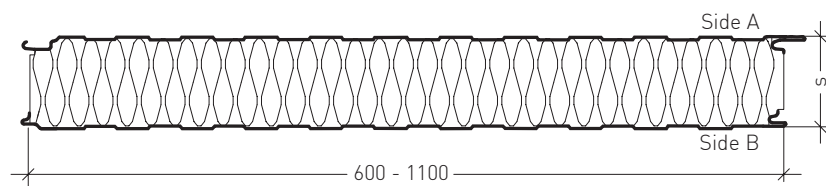
| Profile Type     | Side A | Side B |
|------------------|--------|--------|
| S - profile      | •      | •      |
| V - profile (V)  | •      | •      |
| V - profile (V2) | •      | •      |
| Smooth (G)       | •      | •      |
| Micro lined (M)  | •      |        |
| Micro lined (M2) |        | •      |
| Micro lined (M3) | •      |        |

Side A is usually the external side of a panel.  
Steel sheet thickness for profile v2, v6, G-gladio is 0.7 mm.

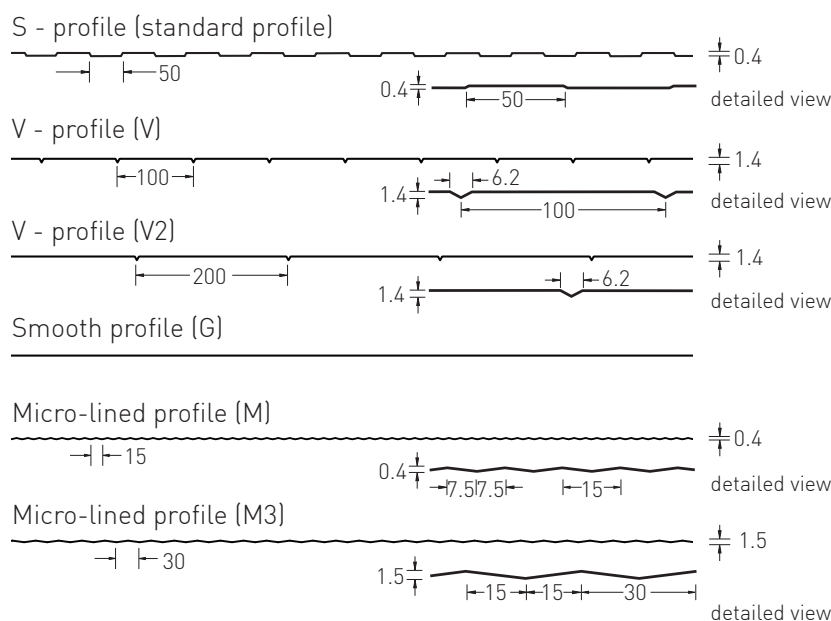
**NOTE:**

Complete panel range can be found in brochure Trimoterm Fireproof panels - Product range.

Section view of Trimoterm FTV INVISIO panel



External Profile Types:



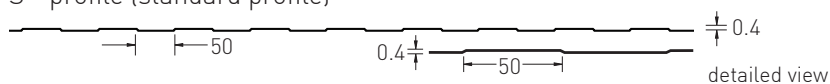
**NOTE:**

The internal and external Trimoterm profiles seen in this document present the main range of profile options. For the approval of the requested profile combination please contact Trimoterm's technical support team. The arrangement of V profile (and all others) typically starts on the middle (centred) of panel steel sheet prior to forming stage. Module end, groove and the distance from the panel edge depends on Trimoterm panel module and may vary. Any other V profile arrangements are declared as non-standard and a subject of individual order. The arrangement of S profile typically starts on the middle (centred) of panel steel sheet prior to forming stage. Module end and the distance from the panel edge depends on Trimoterm panel module and may vary.

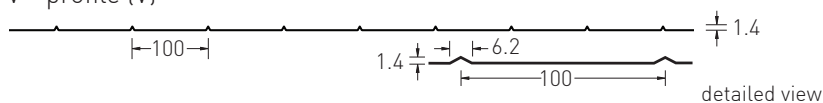


### Internal Profile Types:

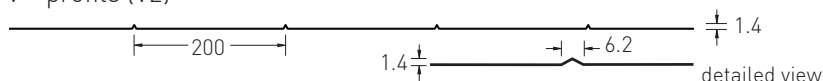
#### S - profile (standard profile)



#### V - profile (V)



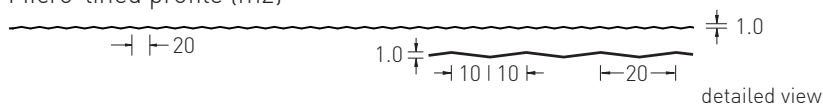
#### V - profile (V2)



#### Smooth profile (G)



#### Micro-lined profile (m2)



## 1.3 Panel Composition

Trimoterm FTV INVISIO panels are composed of two shallow profiled galvanised and colour-coated steel sheets. The sheet metal is bonded to the panel core, made of non-combustible laminated mineral wool, A1 (EN 13501-1), which ensures excellent thermal and sound insulation of panels as well as the requisite, specified fire resistance. All three layers are bonded to form a composite structure (in a thickness of 50 to 240 mm) that provides load-bearing capability, air/water tightness and various construction applications.

A protective foil is glued to the surface of the panels, as protection during handling, transport and mounting. After the installation is completed, the foil is removed. The maximum panel length is 14 m.

## 1.4 Technical data

Table 1: Technical data for Trimoterm FTV INVISIO

| Technical data FTV INVISIO  |               | FTVHL 50 | FTV HL 60 | FTV HL 80 | FTV HL 100 | FTV HL 120 | FTV HL 133 | FTV HL 150 | FTV HL 172 | FTV HL 200 | FTV HL 240 |
|-----------------------------|---------------|----------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|
| Panel thickness [mm]        |               | 50       | 60        | 80        | 100        | 120        | 133        | 150        | 172        | 200        | 240        |
| Weight [kg/m <sup>2</sup> ] | Fe 0,6/Fe 0,6 | 16.5     | 17.7      | 20.1      | 22.5       | 24.9       | 26.5       | 28.5       | 31.2       | 34.5       | 39.3       |
| Panel width [mm]            |               | 1000     |           |           |            |            |            |            |            |            |            |
| Panel length [m]            |               | up to 14 |           |           |            |            |            |            |            |            |            |

Complete Technical data is available in Trimoterm technical specification.

## 1.5 Coatings

Trimo panels consist of a mineral wool core and an internal and external covering made of galvanized, pre-painted, thin gauge, steel sheet metal. The steel is hot galvanised (usually 275 g/m<sup>2</sup>) in compliance with EN 10346 and additionally protected by an organic coating in accordance with the coil-coating process (DIN EN 10169/1).

The following basic types of organic coating protection are applied to steel sheet metal:

- based on SP polyester
- based on PVDF polyvinylidene fluoride
- based on PUR polyurethane
- based on PVC polyvinyl chloride, coating or film

Individual types of organic protection with the basic characteristics are presented in Table 2.

Table 2: Basic characteristics of an individual type of organic coating or protection.

| TYPE OF CORROSION PROTECTION              | SP  | SP   | PVDF | PVDF+ | PUR  | PVC(P)   | PVC+F    |
|---|-----|------|------|-------|------|----------|----------|
| Corrosion classification [DIN 55928-8]    | II  | III  | III  | III   | III  | III      | III      |
| Total organic thickness [my] [EN 13523-1] | 15  | 25   | 25   | 35    | 50   | max. 175 | max. 175 |
| Temperture resistance (°C)                | +70 | +80  | +110 | +110  | +110 | +70      | +70      |
| UV resistance category [EN 13523-10]      | —   | Ruv3 | Ruv4 | Ruv4  | Ruv4 | Ruv2     | —        |
| Flexibility                               | ••  | ••   | •••  | ••••  | •••• | ••••     | ••••     |
| Staining resistance                       | ••  | •••  | •••• | ••••  | •••• | ••       | ••••     |

**NOTE:**

•••• suitable without reservations ••• very suitable •• suitable • suitable with reservations/contact Trimo - unsuitable

**NOTE:**

A detailed explanation of the coating, together with Instructions for the use and maintenance can be found in the Technical instructions for the use and maintenance of Trimo products.

## 2 Design Procedure

### 2.1 Panel Thickness Selection of Trimoterm FTV INVISIO

Based on the designer's requirements the Trimoterm FTV INVISIO panel, fixing and required sub-construction for fixing, is determined in accordance with the local building regulations/standards.

The basic information required for designing is:

**1. Information on the facility (location, type of the facility, purpose of the facility, desired appearance of the facility, thermal insulation, etc.).**

**2. Panel information:**

- Panel thickness
- Type of sheet metal and panel (sheet metal thickness and colour)
- Modular width
- Panel length

**3. The type of detailing is determined on the basis of the available structural data:**

- **The load on the panel and sub-structure.**
- **Sub-structure and type of fixing:**
  - Allowed distances or the range of the panel
  - Minimum bearing area of the panel
  - Fixing

### 2.2 Advised spans and Minimal Bearing Area of the Panel

The panels require static data for the load-bearing capacity, in accordance with EN 14509:2006 or local regulations. The conversion must also be performed for a concrete installation and load requirements. To assist the selection and design of the façade, a table of allowed distances spans has been produced and minimal bearing areas for construction. The advised spans are listed in the annex of the instructions and are intended for information only. The detailed span between supports needs to be calculated individually for each facility. The conversion is available on Trimo d.d. web site.

The main factors for determining the fixing are:

**1. Wind load:**

- Basic wind load
- Height of the façade above the terrain
- Position on the façade (edge areas)

**2. Temperature load:**

- Panel colour (group I, II or III)

**3. Static system of panel laying:**

- Single-span, double-span, multi-field

**4. Panel orientation:**

- Horizontal installation
- Vertical installation

Considering the listed factors, the façade can be subjected to various loads. The allowed spans of the sub-structure and the fixing manner must be adjusted to the loads.

### 2.3 Fixing

Fixing of the FTV INVISION panel is a combination of edge and intermediate fixing. The intermediate fixing is the same for horizontal and vertical installation. Edge fixing depends on the type of installation and comes in various forms.

### 2.3.1 Fixing in Vertical Installations

Fig. 6: Vertical installation with edge fixing.

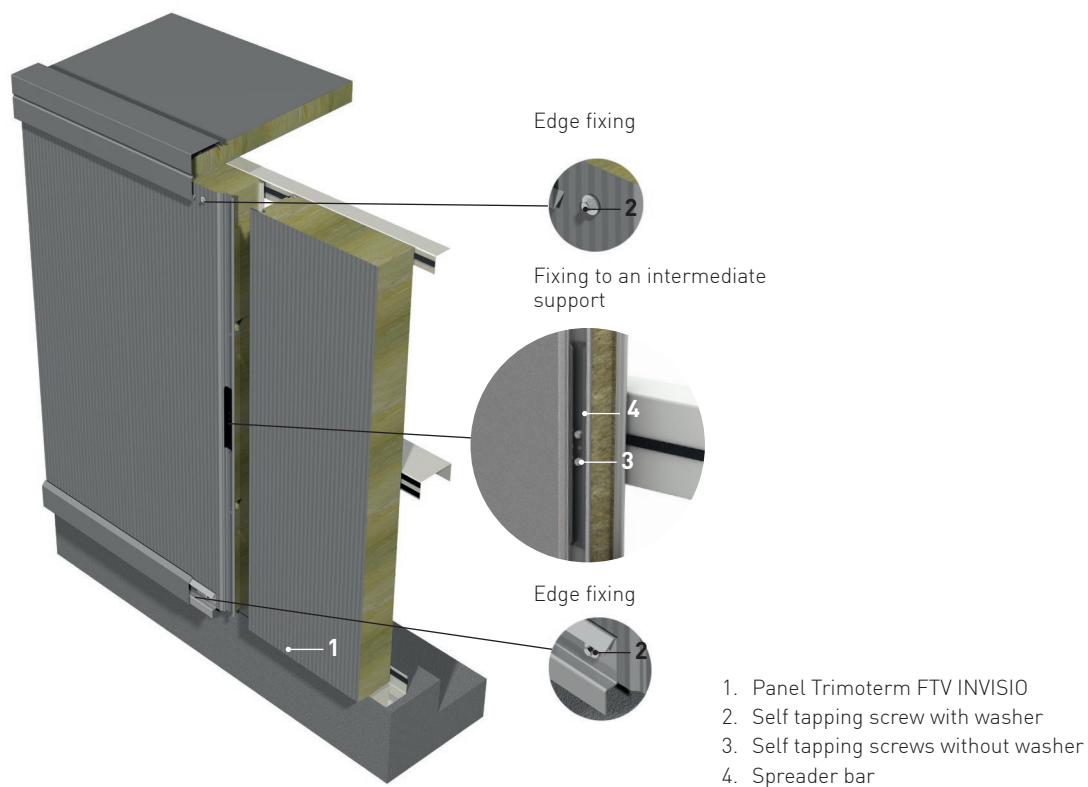
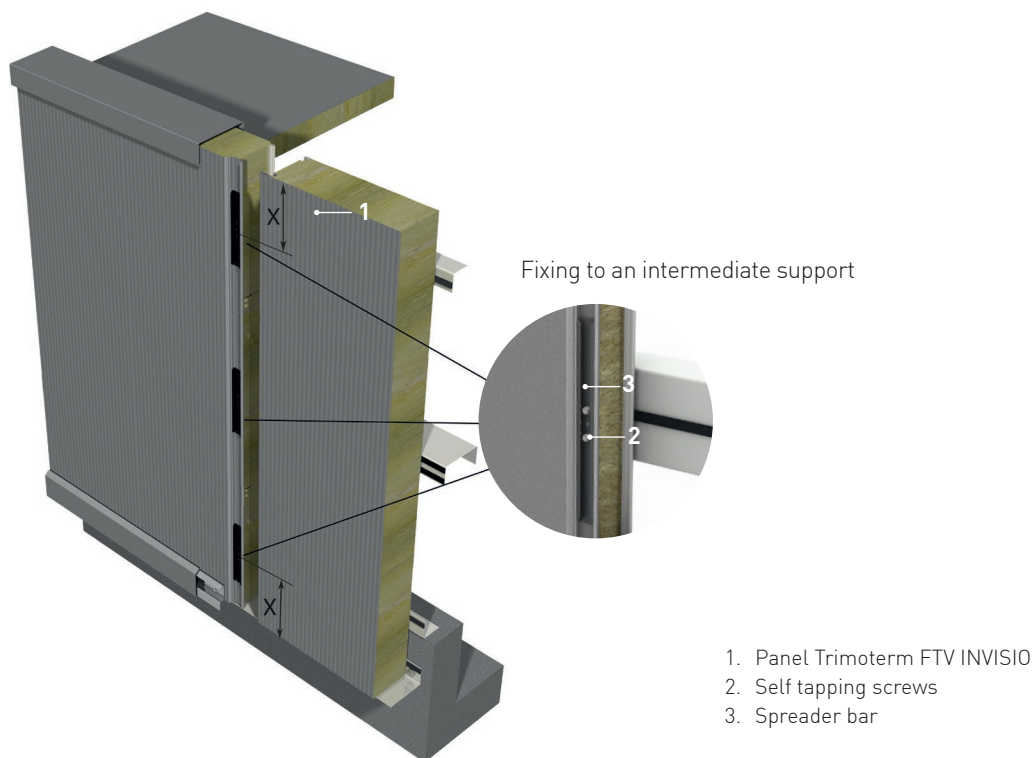


Fig. 7: Vertical installation without edge fixing.

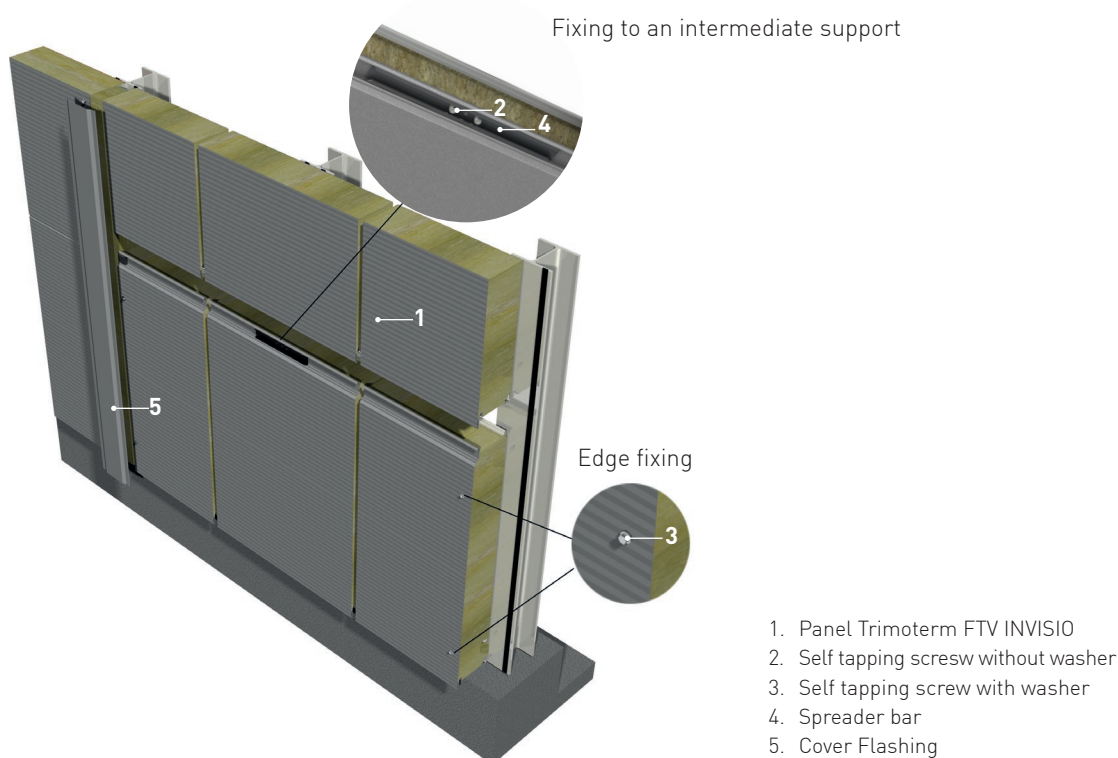




## 2.3.2 Fixing in Horizontal Installations

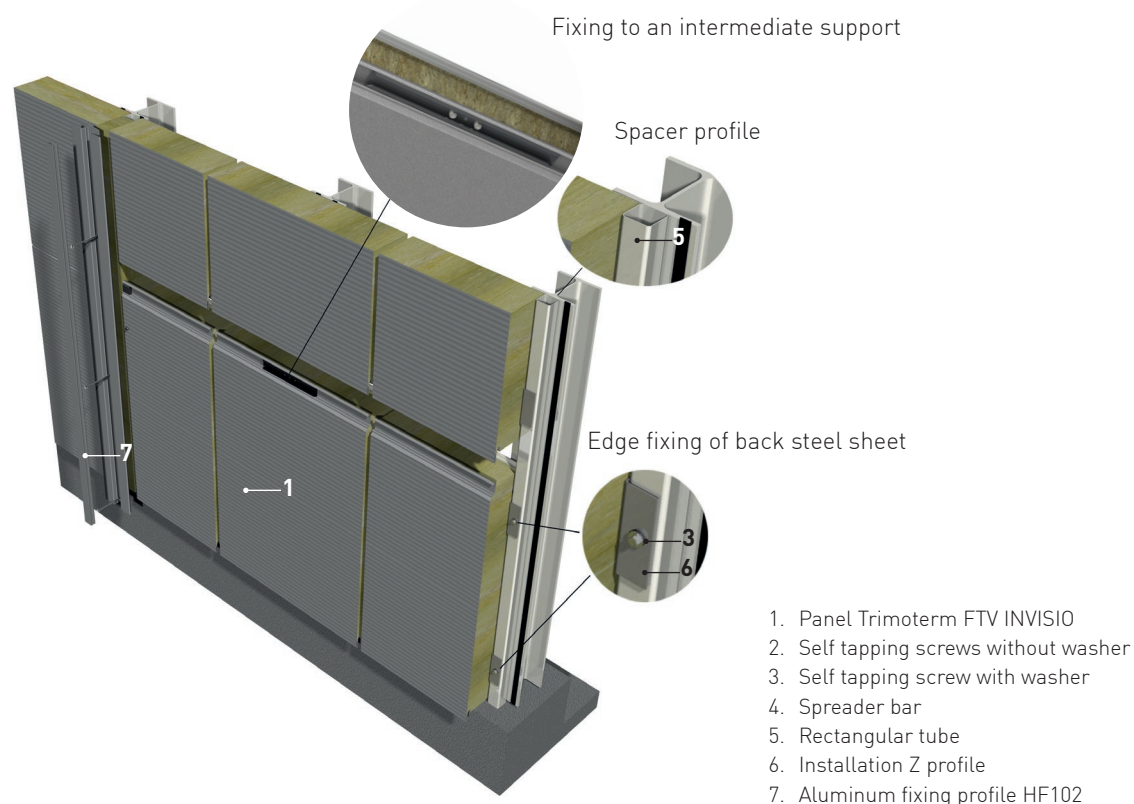
Two basic types of fixing or transversal extension of the façade for horizontal installation are used: horizontal installation with a cover flashing (Fig. 8) and horizontal installation with fixing by means of Aluminium profile with the HF102 label (Fig. 9). In the case of façade extension with a cover flashing, the edge panel is attached with two screws on each side. Edge screws transfer the weight of the panel and wind load.

Fig. 8: Horizontal installation cover flashing.



The façade extension is performed with a HF102 fixing profile, which has a function of an edge fixing but only for wind load. In order to transfer the load of the panel's weight, the back sheet metal, of the panel, must also be screwed to prevent settlement of the entire façade. The fixing of the internal sheet metal is performed in various ways described in Chapter 4.3.

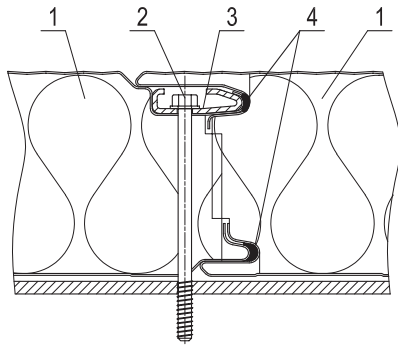
Fig. 9: Horizontal installation with HF102 fixing profile.



### 2.3.3 Intermediate Fixing

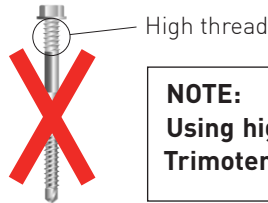
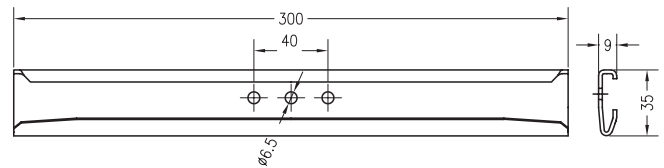
Intermediate fixing is a combination of screw and expansion detail (Fig. 10, 11) and a sub-structure. The line gasket takes over one load direction through the screw and the sub structure takes over the other load direction. Intermediate fixing is fully functional when both panels are in contact (Fig. 10). Non-corroding screws without a washer should be used for fixing.

**Fig. 10: Fixing to an intermediate support detail.**



1. Panel Trimoterm FTV INVISIO
2. Self tapping screw without washer
3. Spreader bar
4. Line gasket

**Fig. 11: Spreader bar detail.**

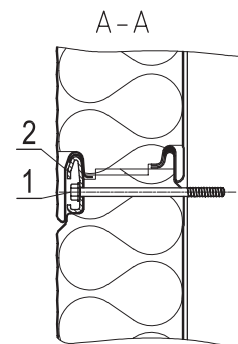
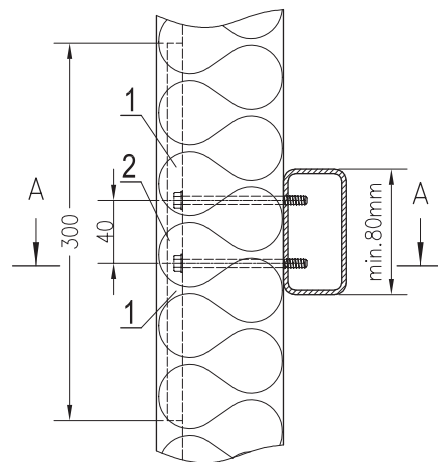


**NOTE:**

**Using high thread screw for intermediate fixing of Trimoterm FTV HL panels is NOT ALLOWED !**

In general the minimum required bearing area on the intermediate support for an appropriate positioning on a sub - structure is 60 mm or is determined by static conversion. Fixing of the panel to steel sub - structure and the line gasket is attached with two screws. Overall number of screws is also determined by Static Calculation. It is dependent of the load and the thickness of the sub - structure.

**Fig. 13: Two screws fixing.**

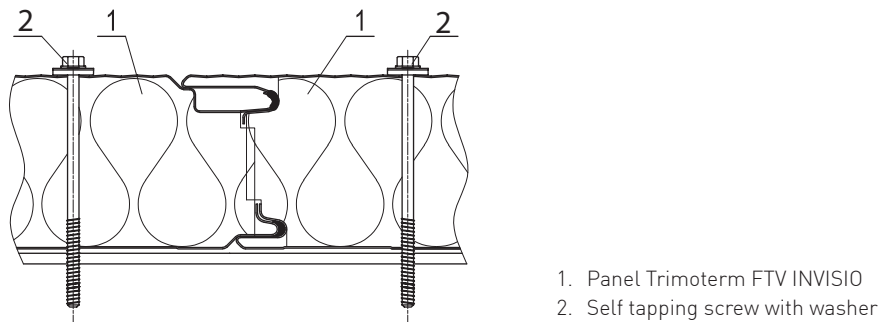


1. Self tapping screw without washer
2. Spreader bar

### 2.3.4 Edge Fixing - Vertical Installation

In the case of fixing through the panel (edge support) stainless steel screws (Fig. 14) with a stainless steel washer (19 mm in diameter) and an EPDM gasket should be used exclusively. The fixing should be performed at least 25 mm from the edge of the panel.

Fig. 14: Edge fixing trough a panel



### 2.3.5 Edge Fixing with an HF102 Aluminium Profile - Horizontal Installation

Edge fixing in a horizontal installation with a purpose-built HF102 profile is performed by means of fixing of the profile to the steel construction. The profile is screwed directly into the flange if it is not thicker than 12 mm (Fig. 15) and is within the prescribed tolerance or through a spacing profile welded to the construction (Fig. 16, 17). Screw lengths according to panel thickness are listed in Table 3.

Fig. 15: Edge fixing with HF102 profile directly into steel construction.

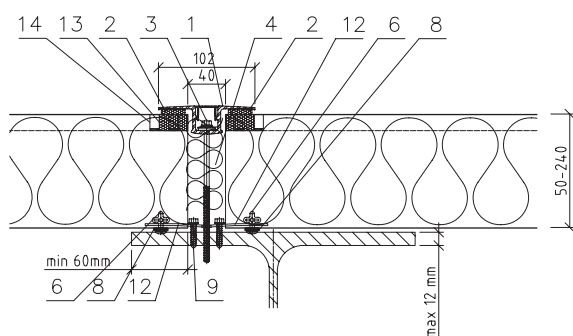


Fig. 16: Edge fixing with HF102 profile indirectly into tube 40 x 40 x 2

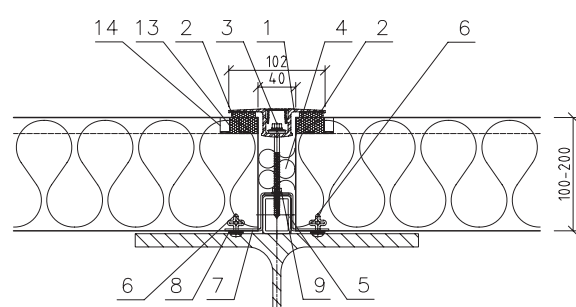
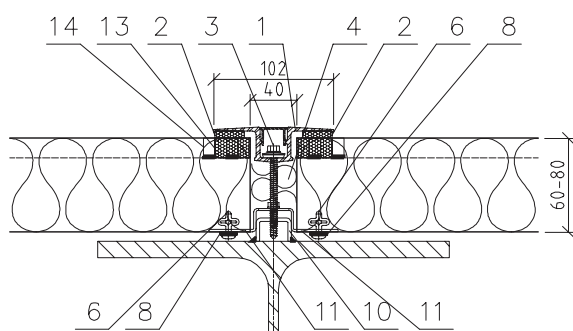
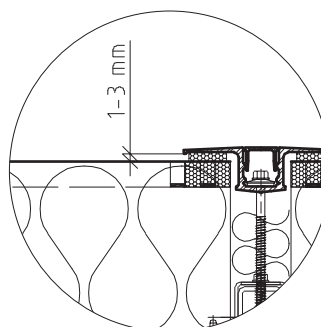


Fig. 17: Edge fixing with HF102 profile indirectly into tube 40x40x2



- |                            |                              |
|----------------------------|------------------------------|
| 1. Aluminium profile HF102 | 8. Sealing tape 3x15         |
| 2. Gasket EPDM 6x30        | 9. Self-tapping screws       |
| 3. Self-tapping screw      | 10. U profile 20x40x20x3     |
| 4. Thermal insulation      | 11. Z profile 40x18x40x120x2 |
| 5. Tube 40x40x2            | 12. Installation sheet metal |
| 6. Bulb tite rivet         | 13. PE gasket                |
| 7. Z profile 40x38x40x2    | 14. Sealing tape             |



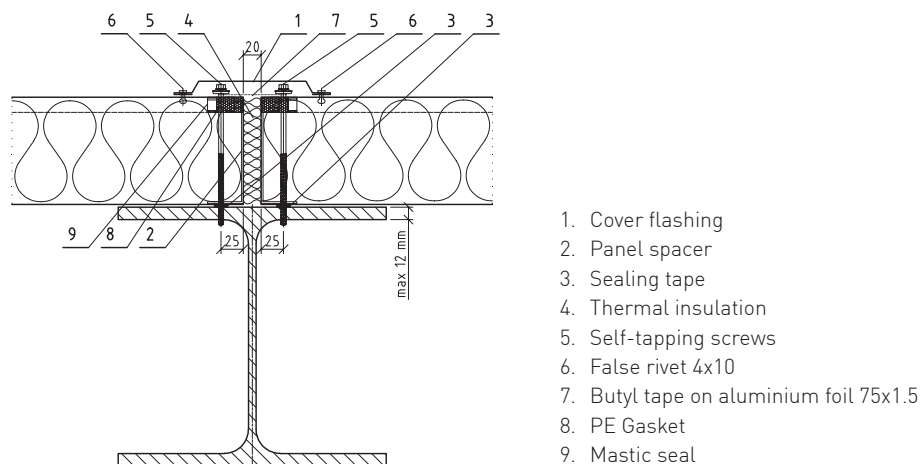
NOTE:

Distance between HF profile and Trimoterm panel needs to be 1-3mm.

### 2.3.6 Edge Fixing with a Panel COVER FLASHING - Horizontal Installation

Edge fixing with a panel extension for horizontal installations is performed through the entire panel (Fig. 18). Screw lengths according to panel thickness are listed in Table 3.

Fig. 18: Detail of edge fixing with panel cover flashing.



### 2.3.7 Fixing Material

The screw length depends on the panel thickness, type of detail and type of sub - construction in accordance with the instructions of the screw producer (Table 3). Special attention is needed when tightening the screws in order to ensure that they are not under- or over-tightened.

Table 3: Screw lengths for attaching Trimoterm FTV panels..

| Thickness FTV<br>INVISIO<br>(mm) | Type of screw used for various of attachment (Type A and B) |   |   |   |
|----------------------------------|---|---|---|---|
|                                  | Attachment in the<br>hidden joint <sup>1)</sup>             | Attachment through<br>the panel <sup>2)</sup> | Attachment through<br>profile HF102 <sup>3)</sup> | Attachment through<br>profile HF102 <sup>4)</sup> |
| 50                               | 6.3/6.5 x 64  | 80  | 6.3/6.5x64  | 6.3/6.5 x 25                                      |
| 60                               | 6.3/6.5 x 64  | 6.3/6.5 x 80                                  | 6.3/6.5 x 64                                      | 6.3/6.5 x 32                                      |
| 80                               | 6.3/6.5 x 80  | 6.3/6.5 x 100                                 | 6.3/6.5 x 80/90                                   | 6.3/6.5 x 50/45                                   |
| 100                              | 6.3/6.5 x 100   | 6.3/6.5 x 125                                 | 6.3/6.5 x 100                                     | 6.3/6.5 x 64                                      |
| 120                              | 6.3/6.5 x 125   | 6.3/6.5 x 150                                 | 6.3/6.5 x 125                                     | 6.3/6.5 x 90                                      |
| 133                              | 175   | 175   | 135/150   | 100   |
| 150                              | 6.3/6.5 x 175   | 6.3/6.5 x 175                                 | 6.3/6.5 x 150                                     | 6.3/6.5 x 115                                     |
| 172                              | 200   | 200   | 175   | 135/150   |
| 200                              | 6.3/6.5 x 230   | 6.3/6.5 x 230                                 | 6.3/6.5 x 200                                     | 6.3/6.5 x 175                                     |
| 240                              | 6.3/6.5 x 270/290   | 6.3/6.5 x 270/290                             | 6.3/6.5 x 270/260                                 | 6.3/6.5 x 230                                     |

NOTE:

<sup>1)</sup> This is true for secondary attachment in the hidden joint.

<sup>2)</sup> This is true for attachment through the whole panel thickness

<sup>3)</sup> This is true for attachment of panels using the HF102 aluminium profile without the additional square pipe 40x40x22

<sup>4)</sup> This is true for attachment of panels using the HF102 aluminium profile with the additional square pipe 40x40x2

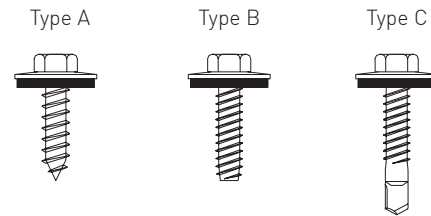
Screws of types A and B are used for fixing to a steel substructure; a hole of a suitable diameter is to be drilled through a panel and substructure in accordance with the instructions of the screw producer. Table 4 presents examples of required hole sizes by the producer SFS Stadler. Preliminary drilling of bore holes is not allowed for screws of type C.



Table 4: Drilling diameter for the screw depending on the substructure.

| Substructure thickness<br>[ mm ] | Drilling diameter<br>[ mm ] |
|----------------------------------|-----------------------------|
| 2.0 - 3.0 (Tip A)                | 5.00                        |
| 3.0 - 3.9                        | 5.05                        |
| 4.0 - 4.9                        | 5.35                        |
| 5.0 - 5.9                        | 5.65                        |
| 6.0 - 10.0                       | 5.80                        |
| > 10.0                           | 5.85                        |

Fig. 19: Fixing screw types.



### 2.3.8 Types of Structure or Sub-structures

The classic steel sub-structure is suitable for fixing FTV INVISIO façade elements within the permissible tolerances. If the sub-structure is not within the permissible tolerances an aligning sub-structure must be used.

The fixing method is selected according to the type of structure. FTV INVISIO façade panels are fixed:

1. Directly onto steel structures (if the structure is within permissible tolerances).
2. If the sub-structure is not within the permissible tolerances an aligned sub-structure must be used.

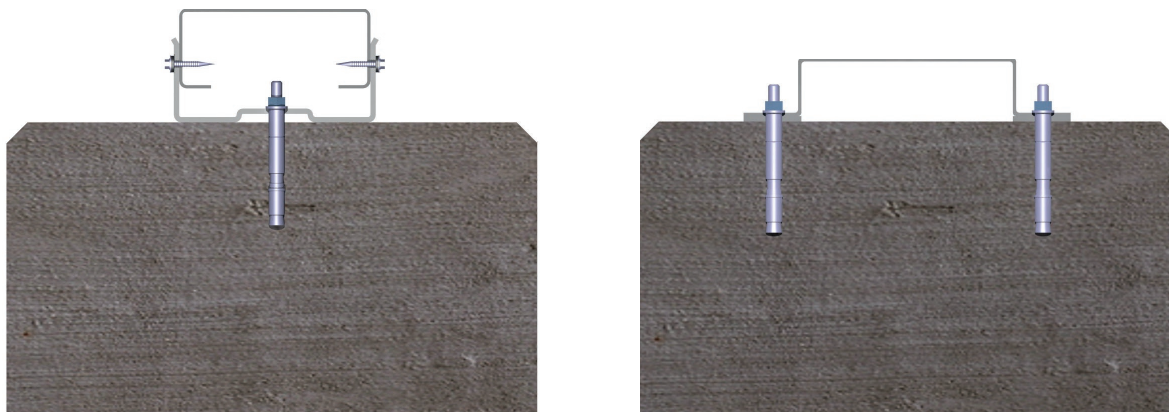
Two methods of fixing are used for concrete structures:

1. Using levelling sub-structures.
2. Using a wide levelling profile.

Fig. 21: Steel structure and steel structure with levelling sub-structure.



Fig. 22: Concrete structure with two types of levelling structure



## 2.4 Panel penetrations

Panel penetrations presents a critical point for a panel to lose its rigidity and structural performance in an installed state.

- The penetration can affect negatively to effective structural cross section
- At the point of penetration (especially when it comes to orthogonal shapes) the concentration of internal stresses can cause local disintegration of a panel.
- Decrease of structural performance can occur with all panel types and installation methods!

With building facade design the special care must be dedicated to elements assembled together with the panel.

- Facade elements like doors, windows, ventilation shaft mesh, etc. must be installed in a way, that they do not interfere the effective structural cross section (do not cut the panes if possible).
- With a single span installation system, the transfer of structural loads from a panel with a penetration to adjacent panels is possible. With that, the current state of sandwich panels technology knowledge must respected.
  - Additional structural calculation for a panel with penetration is needed.
- With a multi span installation system, additional loads due to a intermediate fixing points occur. This presents an additional stress on the panel penetration area.
  - The penetration limitation:  $A_{\text{penetration}} \leq 0,15 * A_{\text{panel}}$
  - In case when the size of penetration exceeds 15% of panel section, a special structural installation detail solution is needed, which defines termination of external steel sheet at a section critical point.
  - At the point of external steel sheet section, water tightness on external surface must be guaranteed.





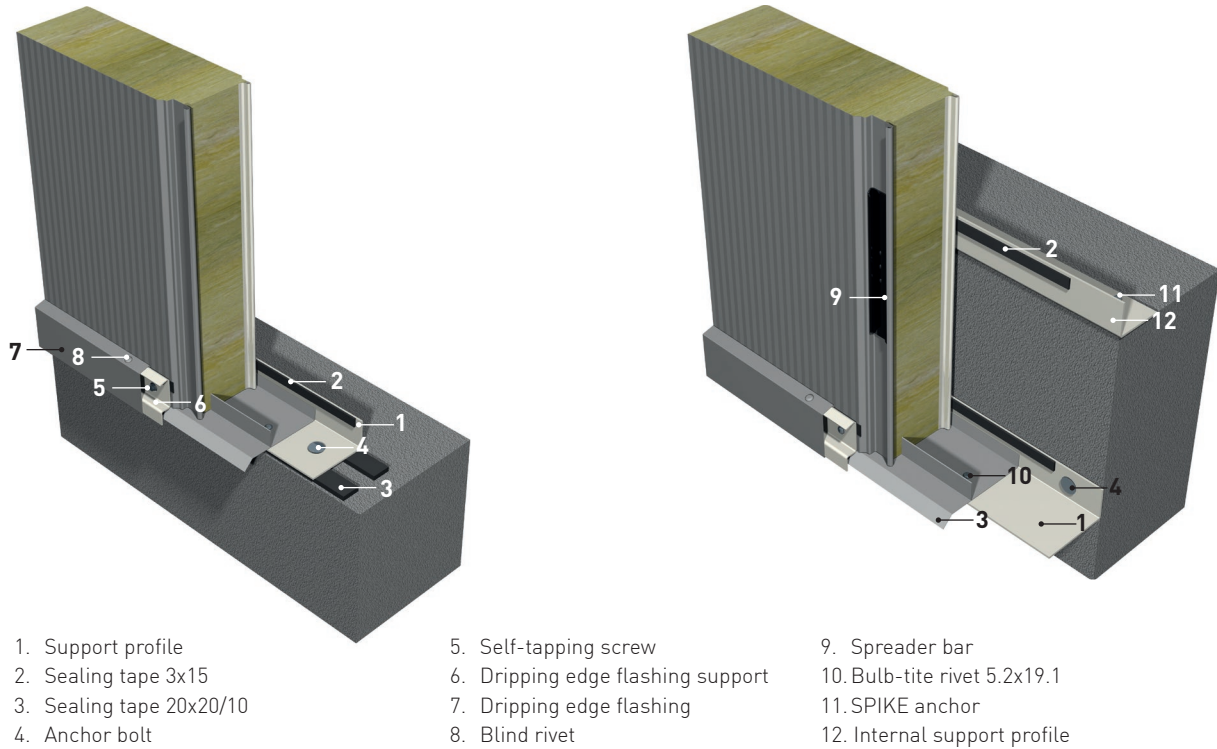
### 3 Typical details of facade system INVISIO

The typical finishing details and detail elements that are used for fixing, sealing, thermal insulation and changing visual appearance are presented below. The details are specific for vertical and horizontal installation. Basic details are presented. A detailed description of the implementation of details is provided in the instructions for installation and drawings of details.

#### 3.1 Vertical Installation

##### 3.1.1 Connection to the base beam

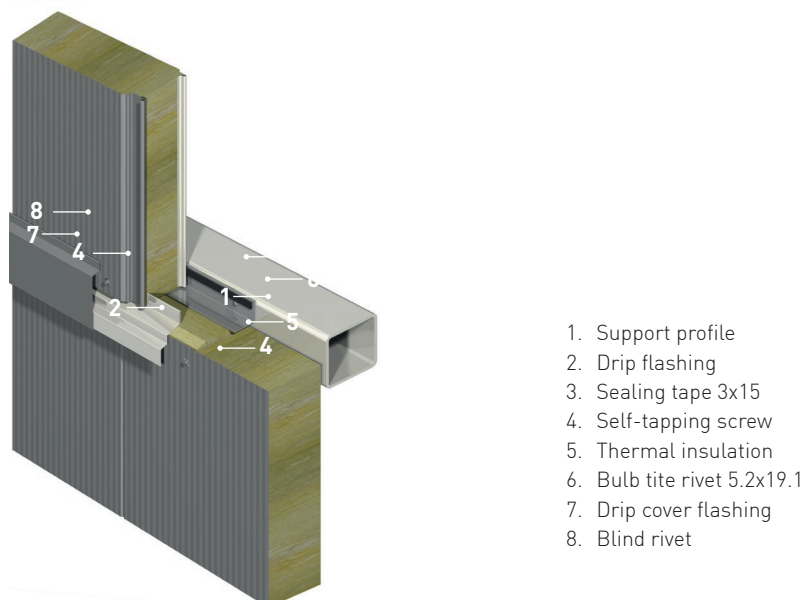
Fig. 23: Detail of a connection to the base beam



##### 3.1.2 Extension of a façade

The vertical extension detail is used in cases when the height of the façade exceeds the maximum panel length which is limited to 14 m. In this case an intermediate fixing to the sub - construction is performed in which a minimum bearing area must be ensured and a finishing cover flashing provided that ensures tightness of the break.

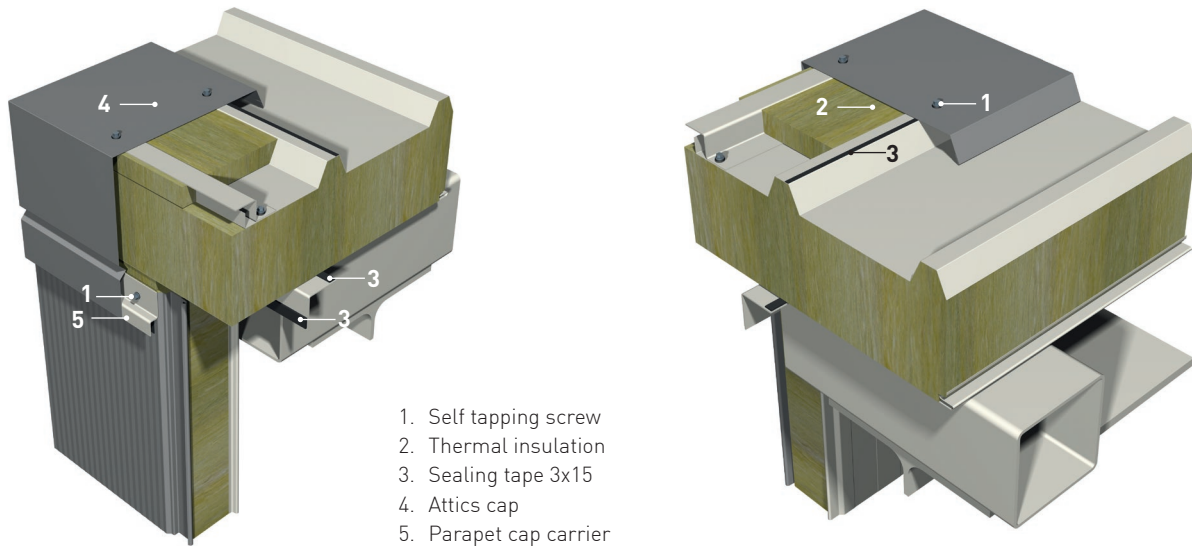
Fig. 24: Detail of façade extension.





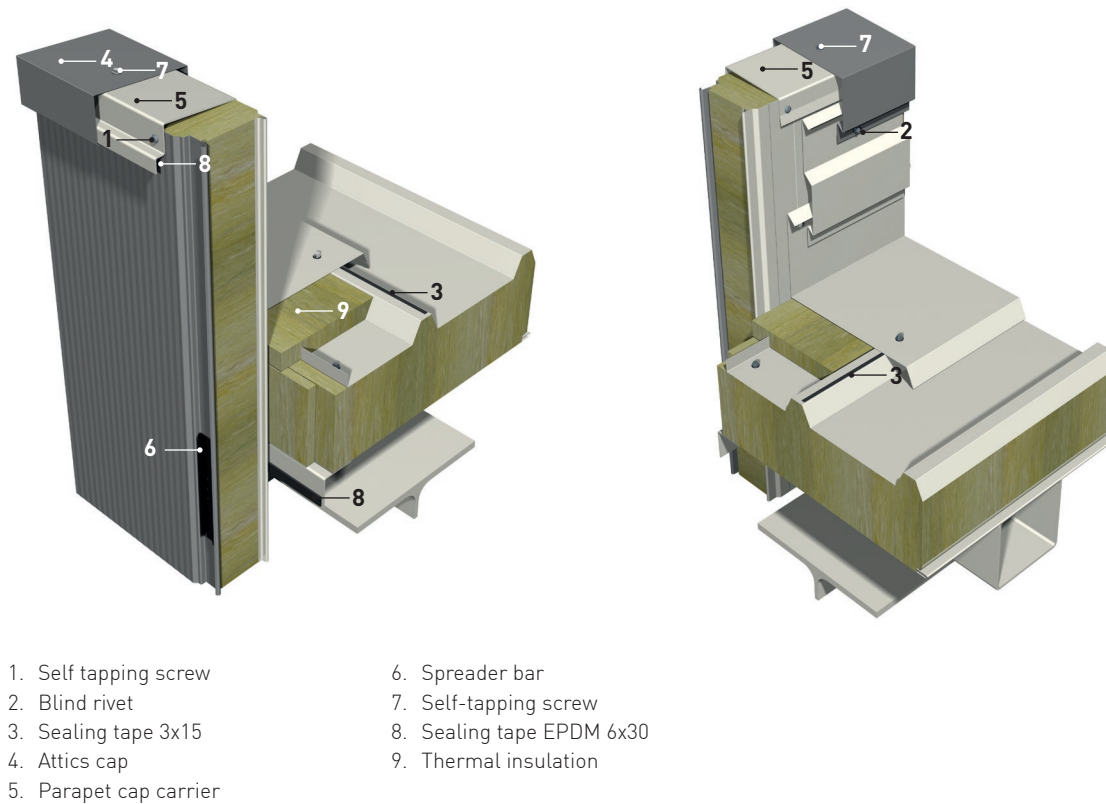
### 3.1.3 Top End Support

Figure 25: Detail of fixing to the top end support.



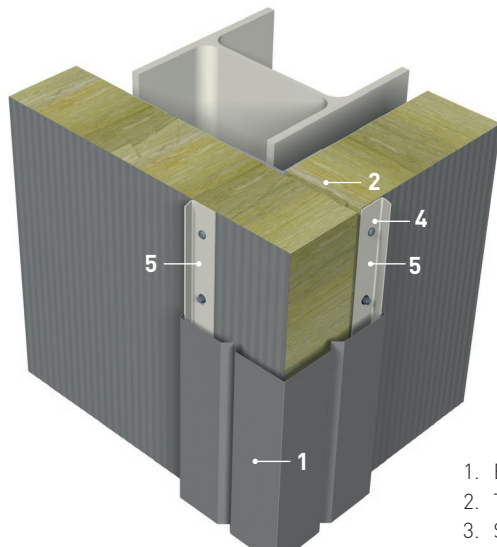
### 3.1.4 Top End Support with attics

Figure 26: Detail of fixing to the top end support with attics.



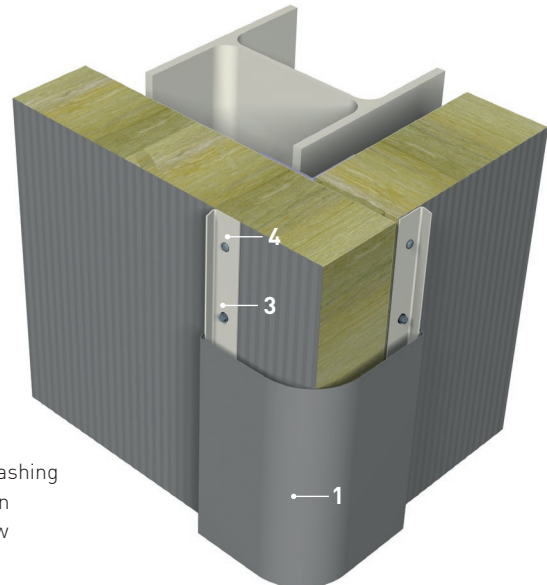
### 3.1.5 External corner with flashing

Fig. 27: Corner finishing with sharp edge flashing.



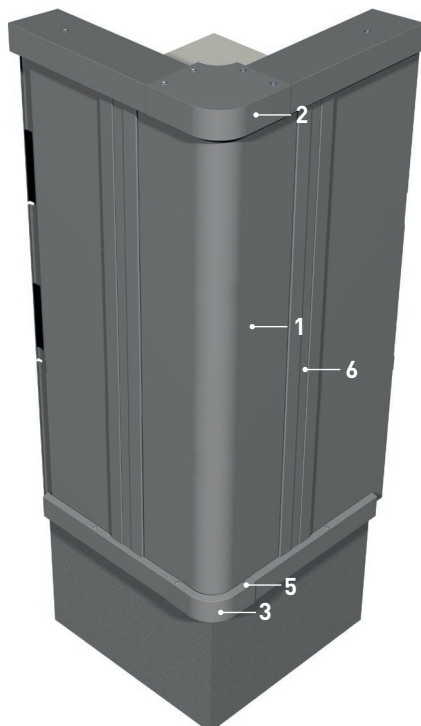
- 1. External corner flashing
- 2. Thermal insulation
- 3. Self-tapping screw
- 4. Blind rivet
- 5. Corner beam

Fig. 28: Corner finishing with rounded flashing.

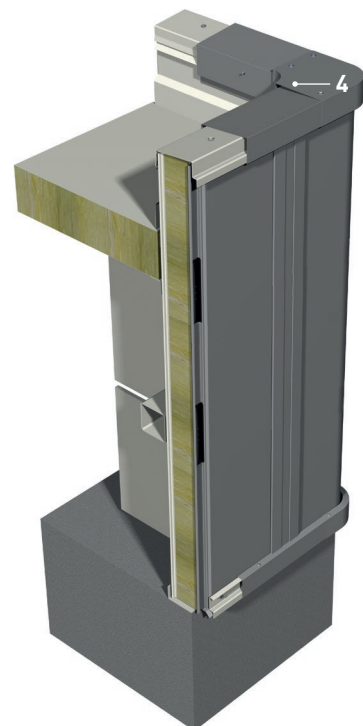


### 3.1.6 Corner with a prefabricated corner panels

Fig. 29: Vertical rounded corner panel.



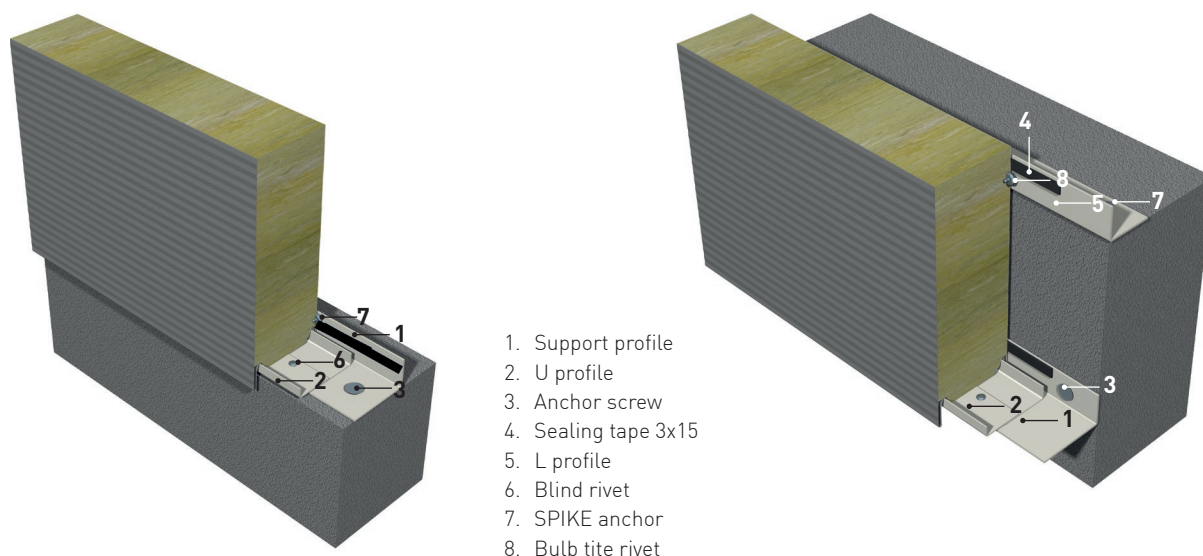
- 1. Vertical rounded corner
- 2. Attic cap of rounded corner
- 3. Parapet of a rounded corner
- 4. Self-tapping screw
- 5. Blind rivet
- 6. HF102 aluminium profile



## 3.2 Horizontal installation

### 3.2.1 Connection to the base beam

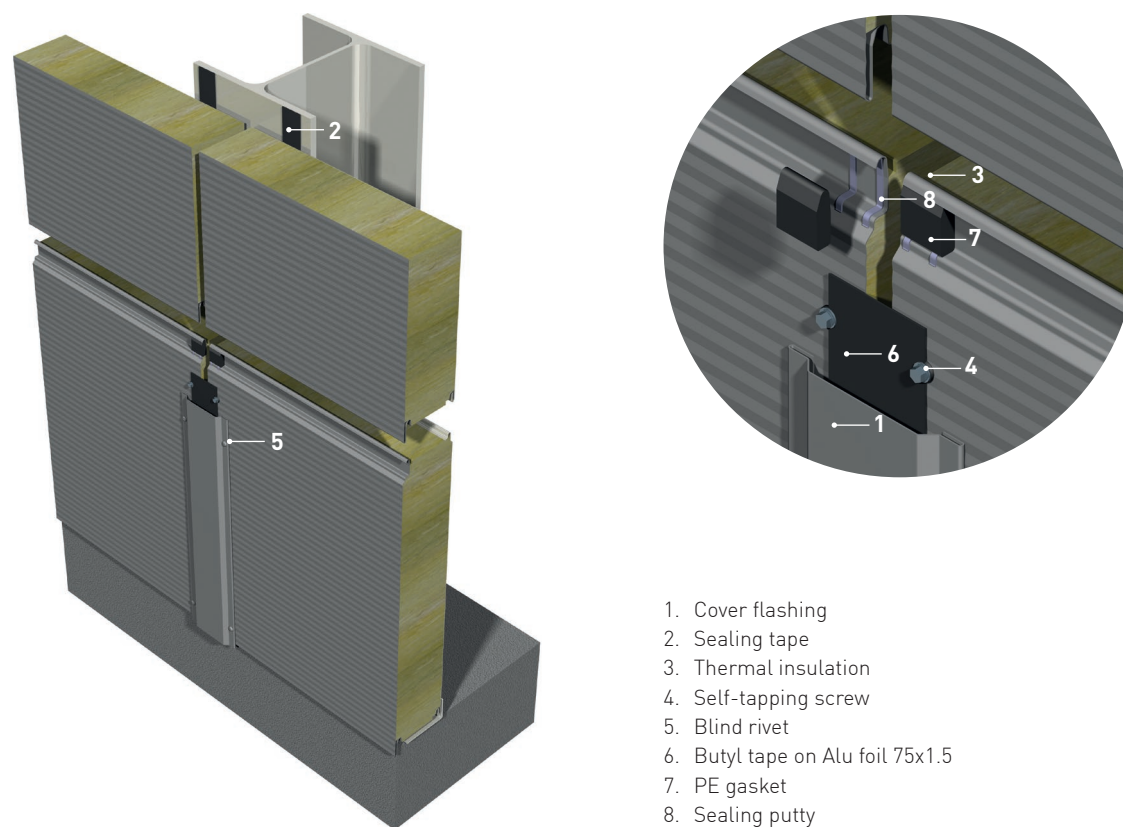
Fig. 30: Detail of attachment to the base beam.



### 3.2.2 Panel Extension with a cover flashing

Classic extension is performed by fixing through the panels at both edges with at least two screws or in accordance with the static conversion. The joints are sealed with sealing tape and a cover flashing which is fixed to the exterior sheet metal of the panel (Fig. 31). The channel of the exterior joint is sealed with sealing putty and PE gasket.

Fig. 31: Detail of horizontal facade installation with panel mask at edge support.

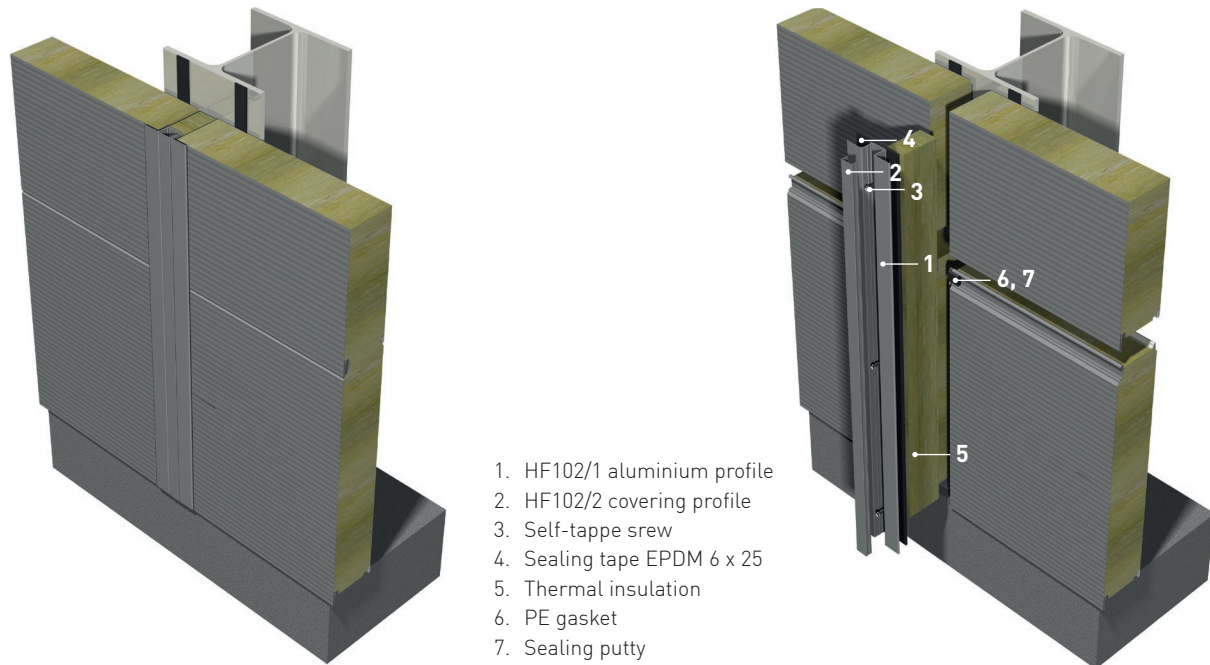




### 3.2.3 Edge Fixing with an HF102 Aluminium Profile

For fixing the horizontal façade a purpose-built extruded HF102 aluminium profile is used which is composed of a load-bearing section (HF102/1) and a cover (HF102/2). The loads are transferred from the panel through the gaskets (pos. 4 in Fig. 32) to the profile which is fixed to the load-bearing construction of the facility by means of self-tapping screws (Fig. 32). In order to transfer the weight of the panel the back sheet metal of the panel must be additionally fixed. The additional fixing can be performed in various methods according to the sub - construction and thickness of the panel (Fig. 16, 17, 18, 31). The channel of the exterior joint is sealed with sealing putty and a PE gasket.

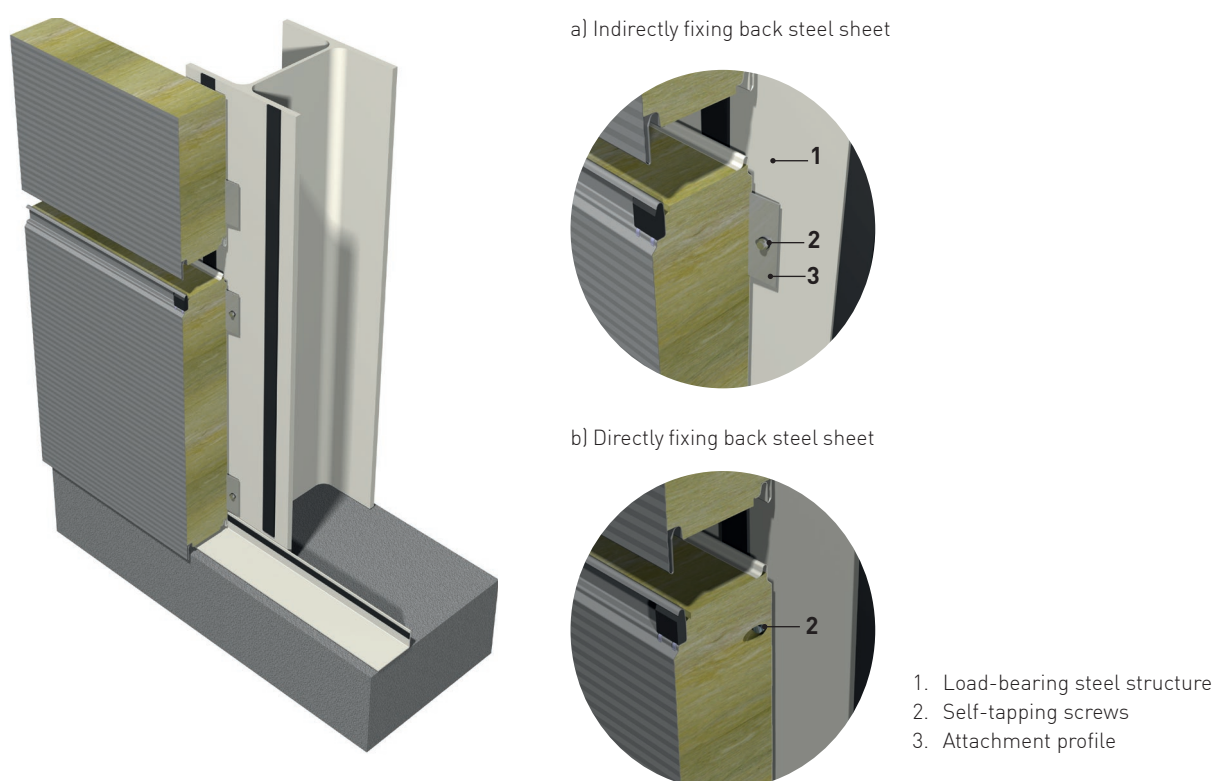
Fig. 32: Edge fixing with HF102 profile.



Installation or temporary fixing of the panel can be performed using the following methods:

1. directly into the construction wall thickness up to 12 mm or
2. on the spacer profile. For direct fixing into the construction the back sheet metal can be fixed indirectly through a fixing sheet metal that is riveted to the back sheet metal of the panel (Fig. 33a) or the sheet metal is screwed on directly (Fig. 33b).

Fig. 33: Temporary fixing directly into the construction.





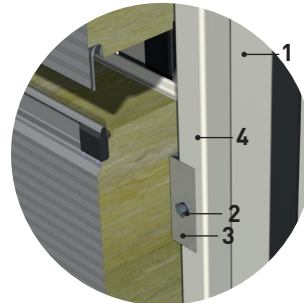
In the case of Installation fixing in thick constructions a spacer profile with the dimensions of 40x40x2 or 40x20x2 (depending on the thickness of the panel appropriate for fixing) is welded to the basic construction (Fig. 34). In this case, the back sheet metal is fixed directly through the Z-profile (Fig. 35) which is riveted to the interior sheet metal of the panel.

The shape of the Z-profile depends on the thickness of the panel or spacer profile (Fig. 35).

Fig. 34: Indirectly fixing back steel sheet into spacer



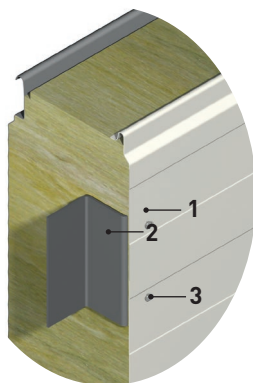
Indirectly fixing back steel sheet into spacer



- 1. Load-bearing steel structure
- 2. Self-tapping screws
- 3. Attachment profile
- 4. Welded tube 40x40

Fig. 35: Installation attachment.

a) FTV HL 100 - FTV HL 240 / Z profile 40/40/40/2



- 1. Panel Trimoterm FTV INVISIO
- 2. Z profile 40/40/40/2
- 3. Blind rivet

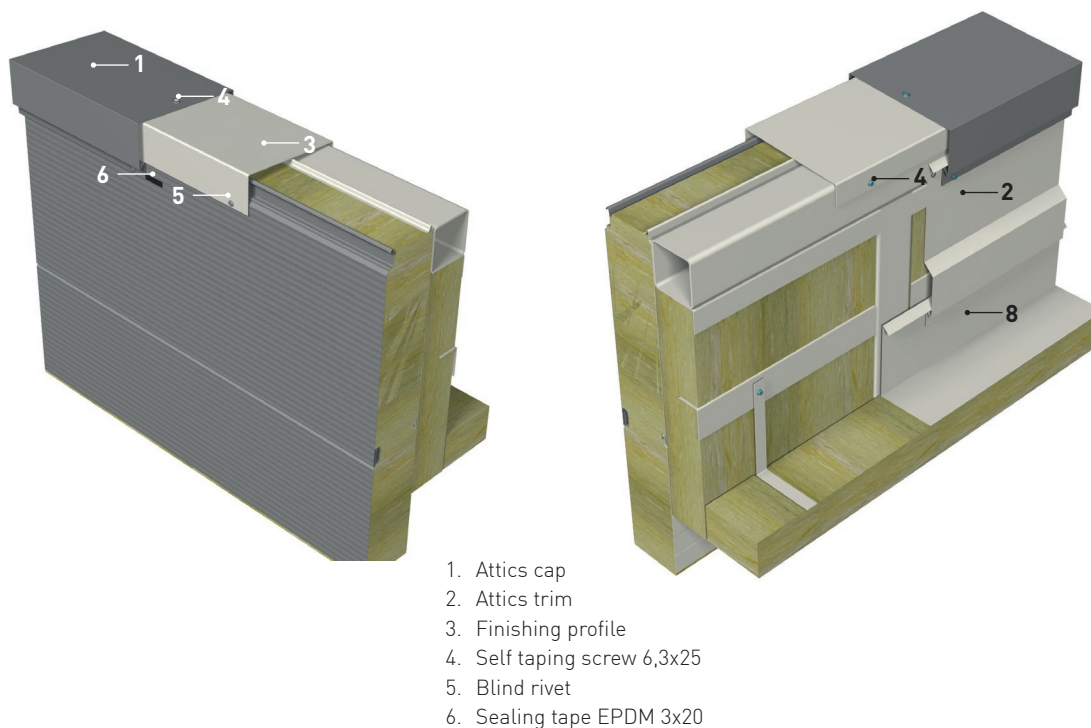
b) FTV HL 60 - FTV HL 80 / Z profile 40/30/40/2

c) fastening without spacers profile (b < 12 mm)

### 3.2.4 Parapets

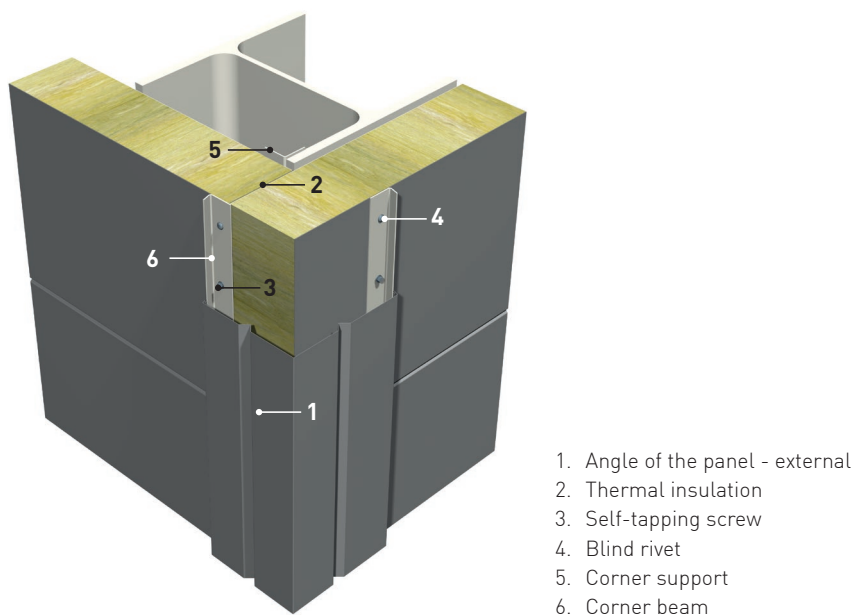
Parapets used with horizontally laid panels need to have additional attachments on the middle support. (Fig. 36). The closure is carried out by a combination of final borders that offer a more aesthetically pleasing finish on the completed facade.

Fig. 36: Detail attics.



### 3.2.5 Corner finish with corner lining

Fig. 37: Detail of corner finish with corner lining.



### 3.2.6 Corner finish

Fig. 38: Detail of a sharp edge corner.

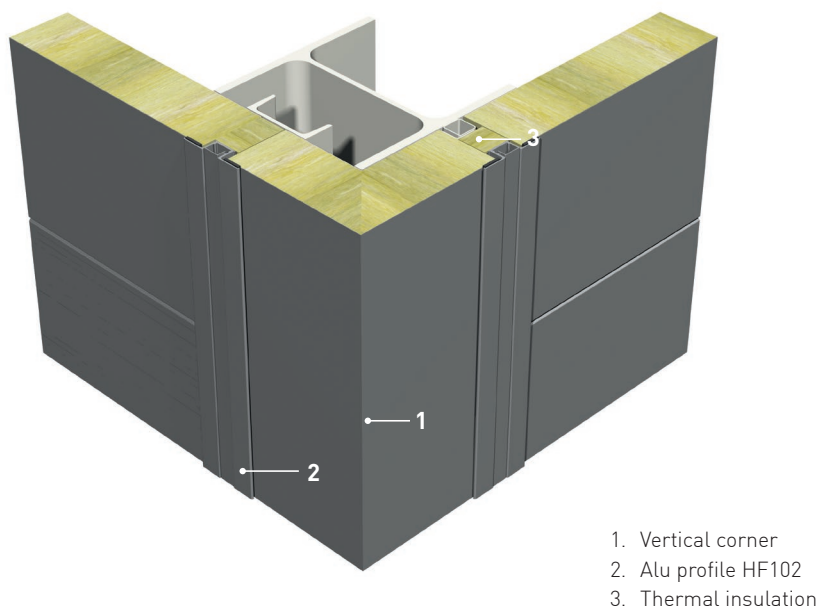
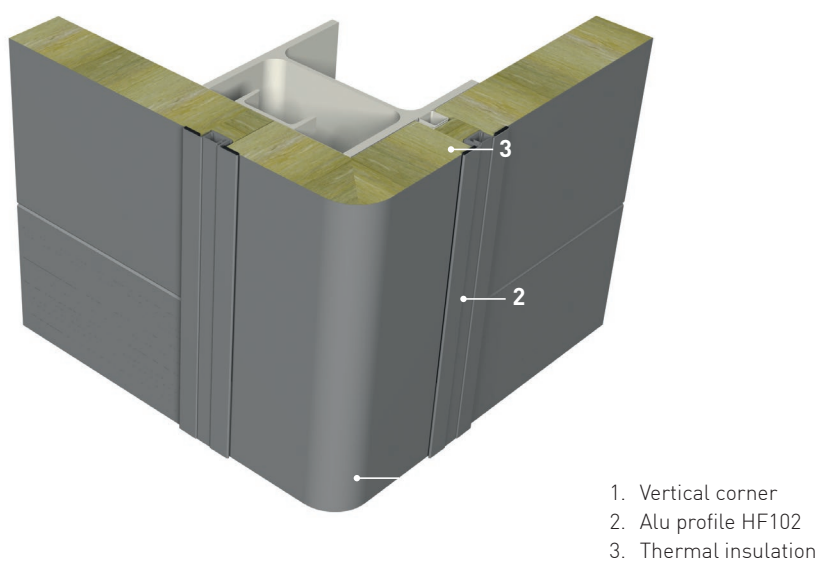


Fig. 39: Detail of a round edge corner.



### 3.2.7 Window and other openings

The openings for installation of windows, doors and penetrations to the INVISIO façade system are finished with a classic cover flashing (Fig. 40) or with a prefabricated aluminium profile with integrated thermal bridge separation (Fig. 41).

Fig. 40: Performance of window dripping edges and flashing.

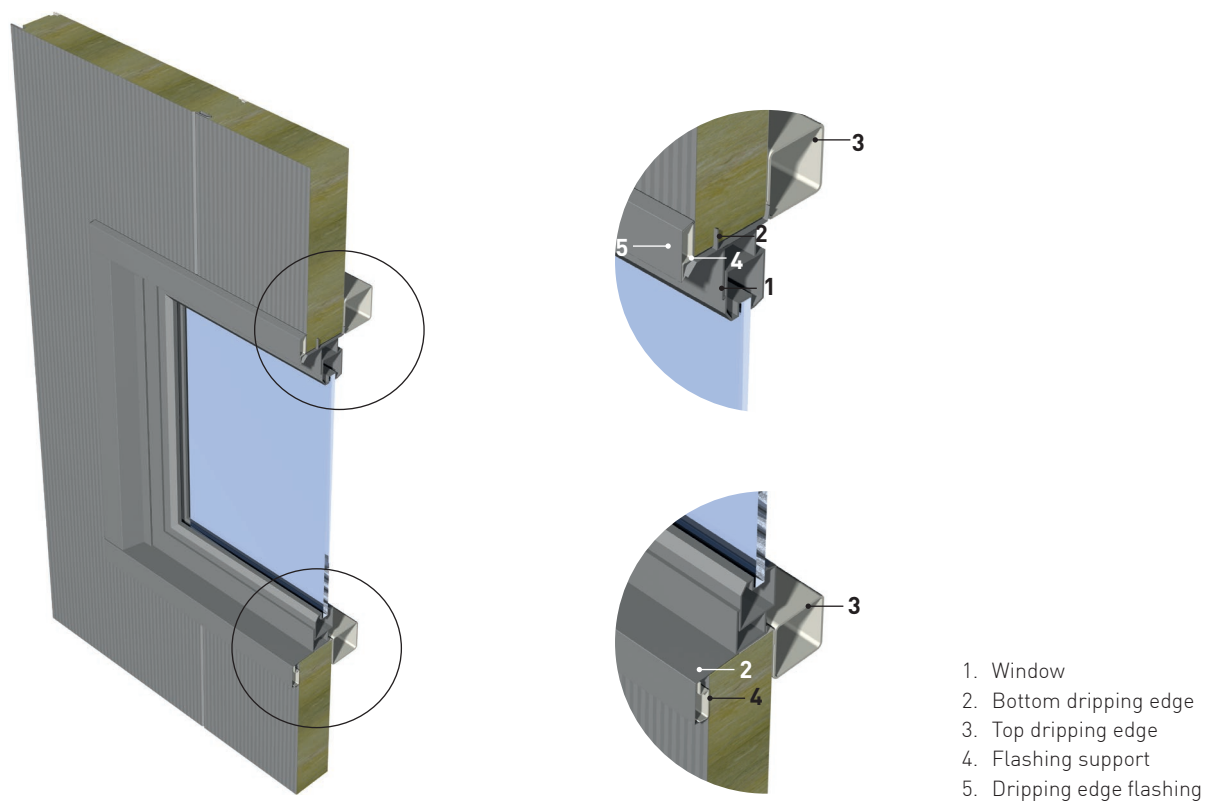
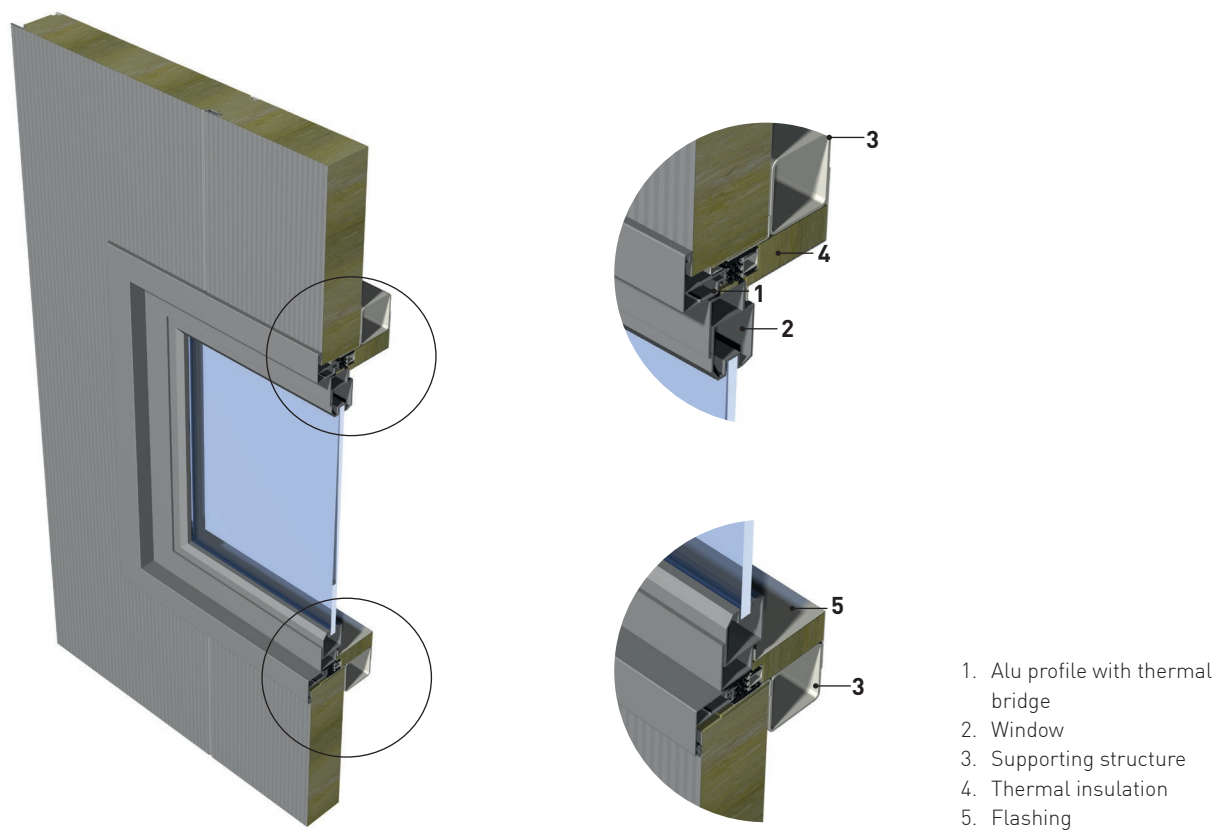


Fig. 41: Installation of window in to Aluminium profile frame.



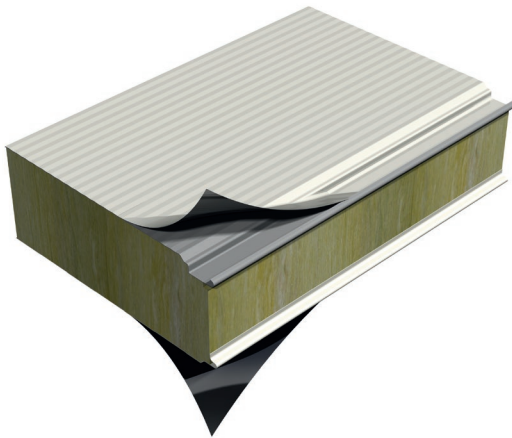
## 4 Recommendations for installation

### 4.1 Preparing Panels Prior to Installation

#### 4.1.1 Removing Protective Foil

A protective foil for the protection of colour coated surfaces against any possible damage caused during transport, handling and assembly is applied to Trimoterm FTV panels on both sides. The foil is to be removed from the internal side before the assembly of an individual panel. The foil on the external side is removed directly before the completion of works; it should be removed during the assembly on places where it is necessary, (e.g. in a longitudinal joint of two panels, under screws, flashing ...) (Fig. 42). If panels are to be stored for a long period of time the foil should be removed after three months. If panels are to be stored in the open air they should be protected against the sun otherwise the removal of the foil may be difficult.

Fig 42: Removal of the protective foil



**NOTE:**

- **Every day, after ending of the installation, the protective foil must be completely removed from each facade element / facade.**
- **If the façade panels are to be stored in the open they should be protected against the sun; otherwise the complete removal of foil is no longer possible.**
- **During installation the foil must be removed from all joints of the façade panel.**
- **Façade elements must be protected from water and other liquids seeping into insulation during unloading right through to the end of the installation. Panels should not be installed during snow, rain falls or during dense fog.**

#### 4.1.2 Elements Cutting

When cutting panels during assembly only scissors and saws that do not heat the cutting edge to a high temperature should be used (Fig. 43). High temperatures can destroy the anticorrosive protection in the immediate surrounding of a cut. Therefore, the use of any grinding machines is prohibited for such purposes! All small metal particles that appear as a result of cutting and drilling should be immediately removed from the surface of panels, but certainly when the daily work has been completed.

Marking and scratching with nails or similar sharp objects can damage the protective coating.

Fig. 43: Elements cutting is allowed sheet metal shears and saws

Recommended use:



Restricted use:



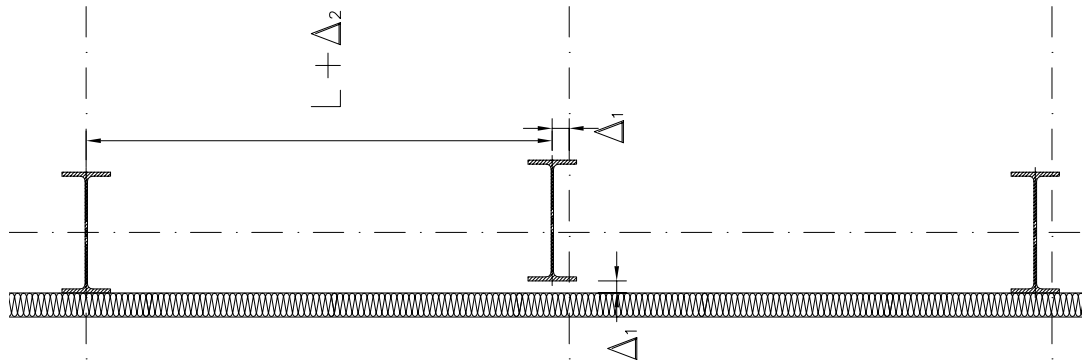


## 4.2 Base requirements and tolerances for Trimoterm FTV INVISIO

The base onto which the panel can be attached is a concrete wall, skeletal concrete structure, steel structure or brick wall. Trimoterm FTV INVISIO panels can be attached directly to steel if substructure accuracy is sufficient and the substructure is less than 12 mm thick.

Before installation, check the measurements of the sub-structure to which panels Trimoterm FTV INVISIO are attached. The structure must be within a  $\pm$  mm tolerance of the two extreme edges of the panel by length (Fig. 44). The steel structure to which the panels are attached must adhere to ENV 1090-1 or internal Trimo requirements. This means that the construction can deviate from ideal project lines by no more than  $\pm$  1 mm and  $\pm$  5 mm as absolute maximum when  $L > 5$  m.

Fig. 44: Structure tolerances based on distances between two fields.

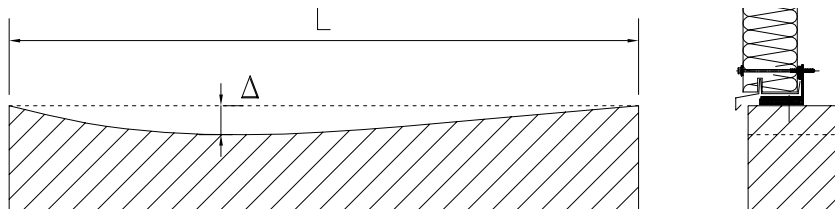


The most important aspect when designing and beginning installation, is in addition to the above mentioned variation of the base beam.

The base beam must be aligned and can vary by a maximum of 5 mm at a distance of a single multi-field panel (Fig. 45).

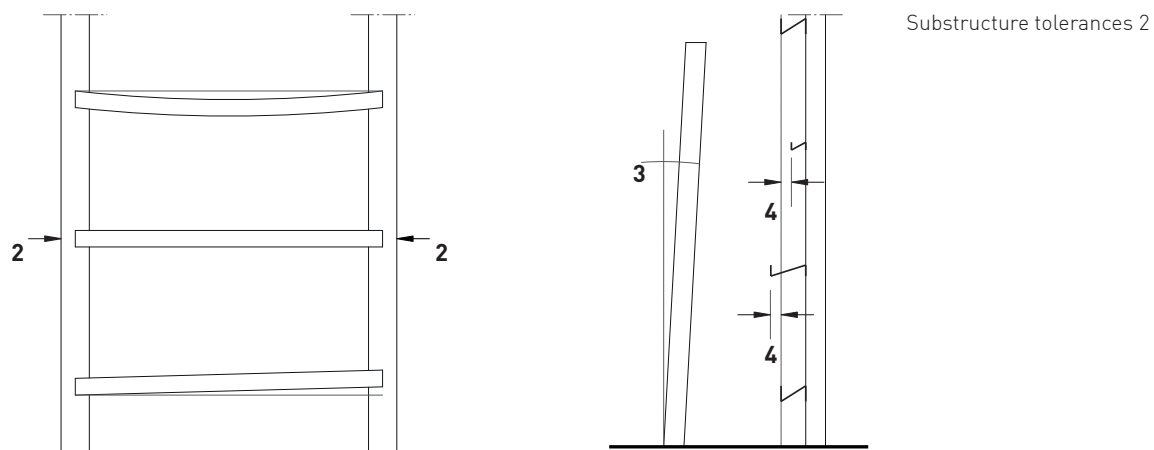
Otherwise, the panel will not be horizontal, which will cause deformation of the bottom joint. The load bearing profile of the base beam must be levelled, using a spirit level.

Fig. 45: Tolerances of the concrete base beam.



Additional tolerances (follow picture substructure tolerances 2)

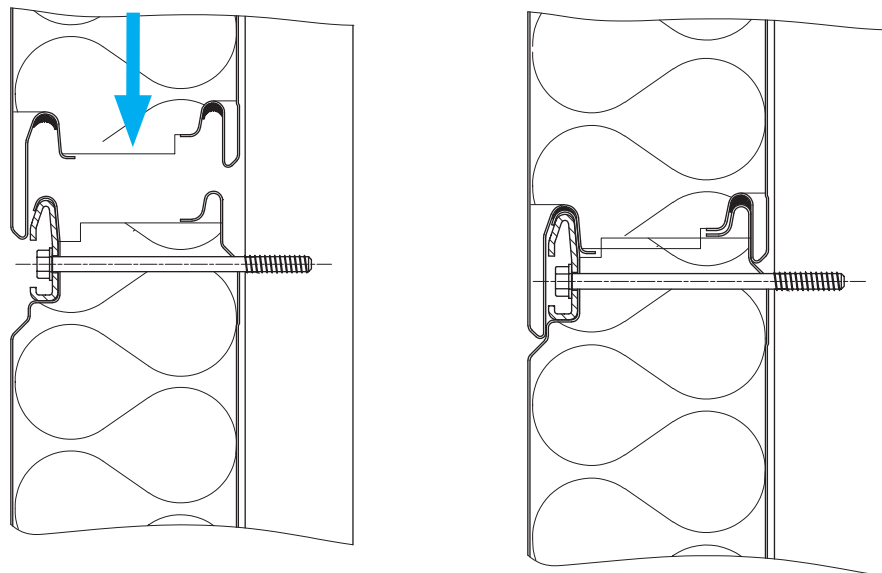
- [2] Alignment of the beams in the longitudinal direction  $\pm$  5 mm / 10 m distance
- [3] Slope tolerance over the height  $\pm$  1°/max 16 mm
- [4] beam offsets tolerance of multispan system:  $\pm$  1,0 mm/ 1 m of beam span, max 5,0 mm



### 4.3 The Installation of Intermediate Support

Intermediate fixing is a specific feature of the Trimoterm FTV INVISIO panel. Intermediate fixing enables the installation of extremely long panels which would not bear the load in the case of classic installation with edge fixing only, causing the panel to collapse. Fixing of the FTV INVISIO panel is always a combination of edge fixing (the same as with the regular panel) and intermediate fixing which additionally holds the panel. The proper manner of fixing is shown in the figure below (Fig. 46).

Fig. 46: The proper manner of fixing.



Intermediate fixing requires special attention as the fitting should not be over-tightened, which causes a pre-deformation of the exterior visible surface and impairment of the exterior appearance of the facade (Fig. 52) or disables the assembly. A minimum inlet of air at the intermediate supports is recommended (Fig. 47).

Figure 47: Recommended fixing of intermediate support.

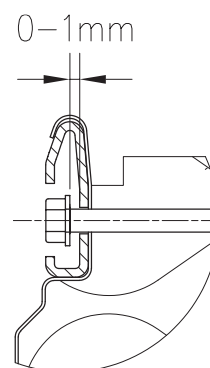
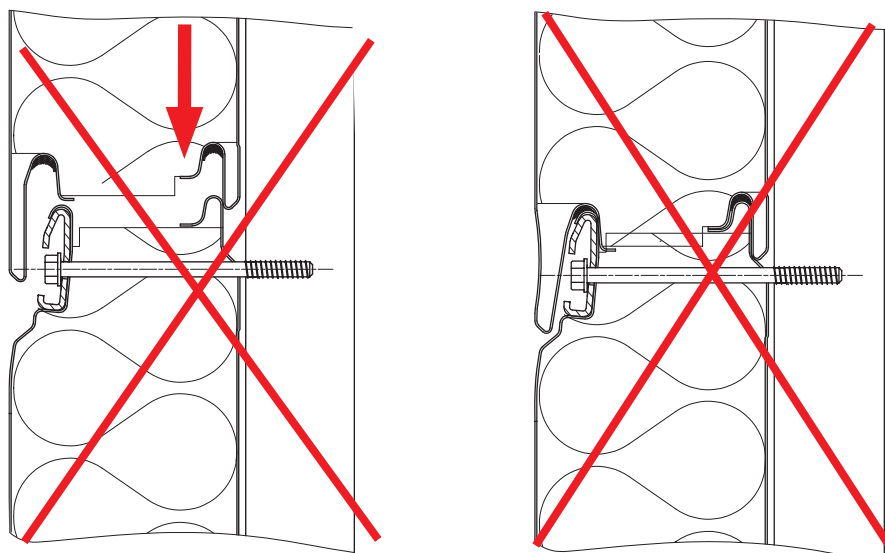


Fig. 48: Inconret manner of fixing.



## 4.4 Lifting Methodes

The installation begins in the edge axis of the individual façade. Prior to the commencement of the installation of panels it is necessary to check the geometric correctness of the sub – structure which is a prerequisite for a quality execution. Any possible geometric irregularities must be corrected by a suitable cutting of initial and end panels. The panels are leant against the base frame which partially bears the vertical loads. For lifting and positioning the panel to the installation spots in the event of vertical or horizontal façade the use of vacuum grips is recommended (Fig. 49). Prior to lifting the protective foil must be removed from the spots where the panel is sucked by the vacuum grip. A special gripper is also designed for vertical or horizontal installation (Fig. 50). The dimensions of the grip and pins must be determined statically according to the thickness and weight of the panels.

### 4.4.1 Vertical Installation

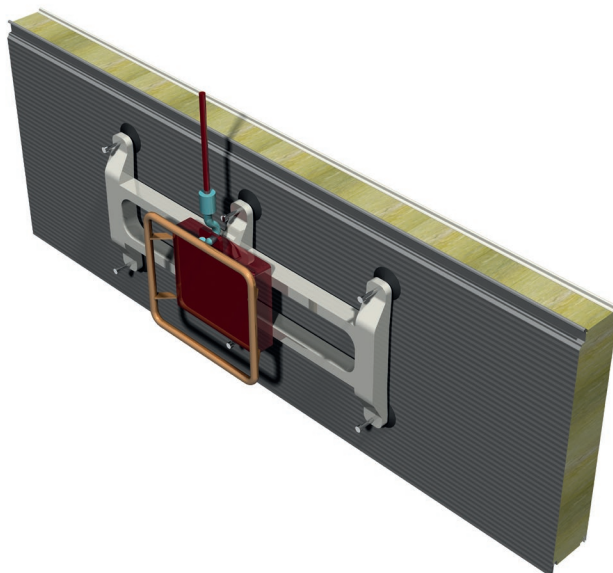
Fig. 49: Vertical lifting with mechanical gripper; Vertical lifting with vacuum gripper.



### 4.4.2 Horizontal Installation

For horizontal lifting of panel FTV INVISIO only vacuum gripper can be used (Fig. 50).

Fig. 50: Horizontal lifting with vacuum gripper.







**TRIMO D.O.O.**

PRIJATELJEVA CESTA 12,  
8210 TREBNJE, SLOVENIA

T: +386 (0)7 34 60 137

F: +386 (0)7 34 60 127

TRIMO@TRIMO-GROUP.COM

WWW.TRIMO-GROUP.COM

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