

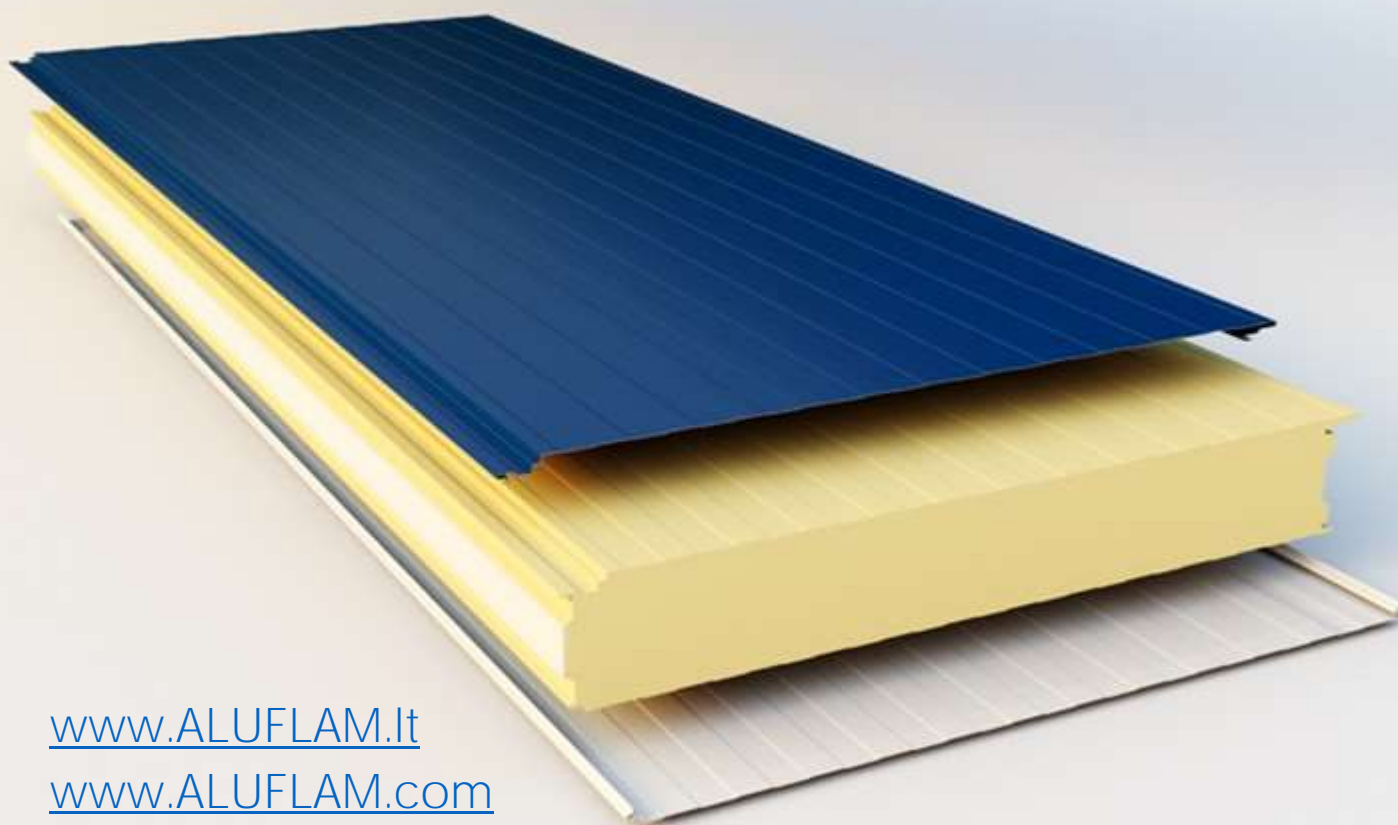


## ALUFLAM MULTI-LAYER SANDWICH PANELS

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POLYISOCYANURATE CORE AND MINERAL WOOL CORE

### INSTALLATION GUIDE



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### Disclaimer

This guide is intended to be used in conjunction with the project's installation drawings. The installation drawings should identify the applicable wall conditions and specify the components and the required arrangement of the elements. Specific building design and construction conditions may require variations from the information in this guide.

ALUFLAM does not guarantee and is not liable for the quality of installation. ALUFLAM is not responsible for defects that may be attributed to improper installation, the negligence of other parties, or for materials not provided by ALUFLAM.

All safety procedures including but not limited to fall protection and material handling are the exclusive responsibility of the installing contractor.

Unless specified in writing, ALUFLAM makes no expressed or implied warranties for the fitness of the wall panels or its components for any particular purpose, and shall not be responsible for any indirect or consequential damages, such as to building contents, nor for any further loss of any kind to the owner or contractor.

ALUFLAM does not warrant any product or material as meeting the ordinances, laws, or regulations of any particular region or local municipality, and ALUFLAM is not responsible for conformance by the owner or contractor to such ordinances, laws, or regulations.

## 1. INTRODUCTION

Welcome to ALUFLAM, the dynamic industry professional dedicated to manufacturing and marketing the highest quality insulated building panel products. ALUFLAM has a significant share in the market of polystyrene foam and sandwich panels, which are successfully sold in markets like Denmark, Norway, Sweden, Finland, Lithuania, Latvia, Estonia, and the Faroe Islands.

Due to the growth potential of the market, the company aims to strengthen its position in the sandwich panels sector and increase its productivity.

Our mission is clearly defined: Deliver the highest quality energy-efficient solutions to insulate and protect our world.

This installation guide is designed to provide step-by-step instructions for PIR and MW sandwich wall and roof panels.

For more information regarding proper panel installation, please contact ALUFLAM Customer Service or your sales representative:

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## 1. INTRODUCTION

### Safety

All safety procedures are the responsibility of the panel installation contractor. If the installer determines that they cannot safely install the panels following the installation drawings or this guide, it is their responsibility to determine appropriate alternative procedures.

### Owner's Responsibilities

"Owner" as used throughout this guide refers to the project's owner and/or his representatives, such as the project's architect, design engineer, and general contractor. These parties are responsible for determining the following:

- ❖ Selection of a competent installer who is qualified and experienced in the proper installation of insulated sandwich panels and related construction.
- ❖ Installer has reviewed and understands the project's installation drawings and this guide **before installation**.
- ❖ Sandwich panels and related components are installed following the project's installation drawings and the applicable portions of this guide.
- ❖ Sandwich panels are suitable for the purpose intended.
- ❖ Project's structural framing is properly designed and in satisfactory condition to accept the erection and design loads imposed by the roof and wall sandwich panels.
- ❖ Location of interior and/or exterior panel joint and perimeter seals are properly specified for the project's moisture and vapour control requirements.
- ❖ Panels and related components are installed in compliance with the applicable codes, regulations, service conditions, and good engineering and construction practices.

## 1. INTRODUCTION

### Installation Drawings

Recommended installation drawings (also known as shop drawings) are provided by ALUFLAM. They may also be prepared by the installation contractor, architect, or some other party depending on preferences or contractual requirements, however, ALUFLAM is not responsible for these drawings which are not provided by ALUFLAM.

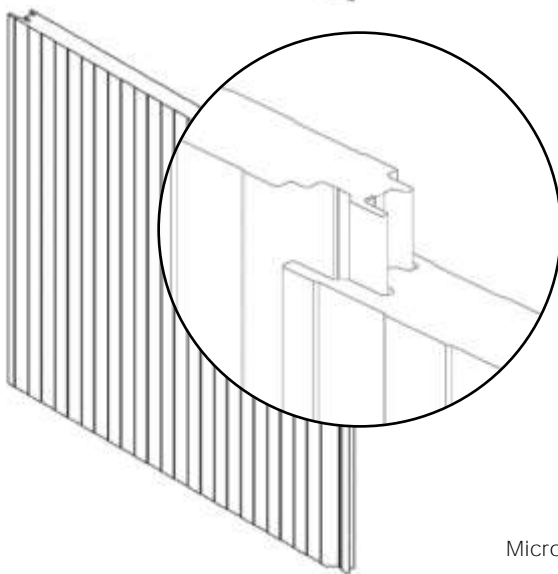
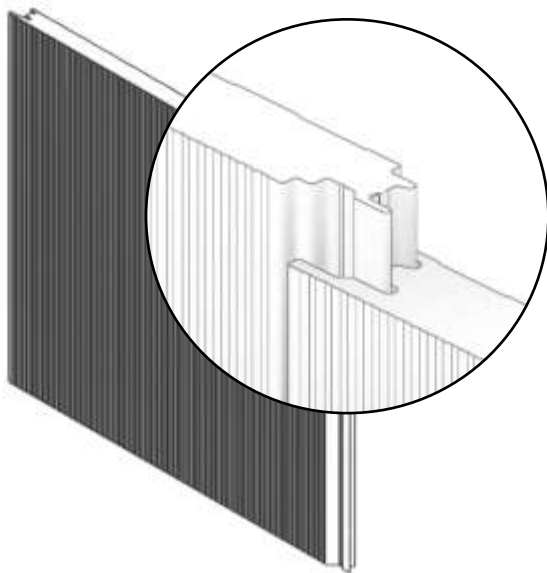
Installation drawings also must be "approved" by the project architect before they are to be used for construction. It is critical that the "approved installation drawings" are in agreement with the final architectural and structural drawings as well as all addenda.

Installation drawings (labelled "for construction" or "for production") must be available at the job site during the preparation, installation, and inspection of the wall support framing, wall panels, flashings, and other related construction.

The installation drawings must be reviewed for differences with field conditions, and discrepancies should be resolved before proceeding with panel installation.

In case of conflict between this guide and "for construction/for production" installation drawings, the drawings govern.

## 2. ALUFLAM PANEL PROFILES



Micro profiling dimensions



Linear profiling dimensions



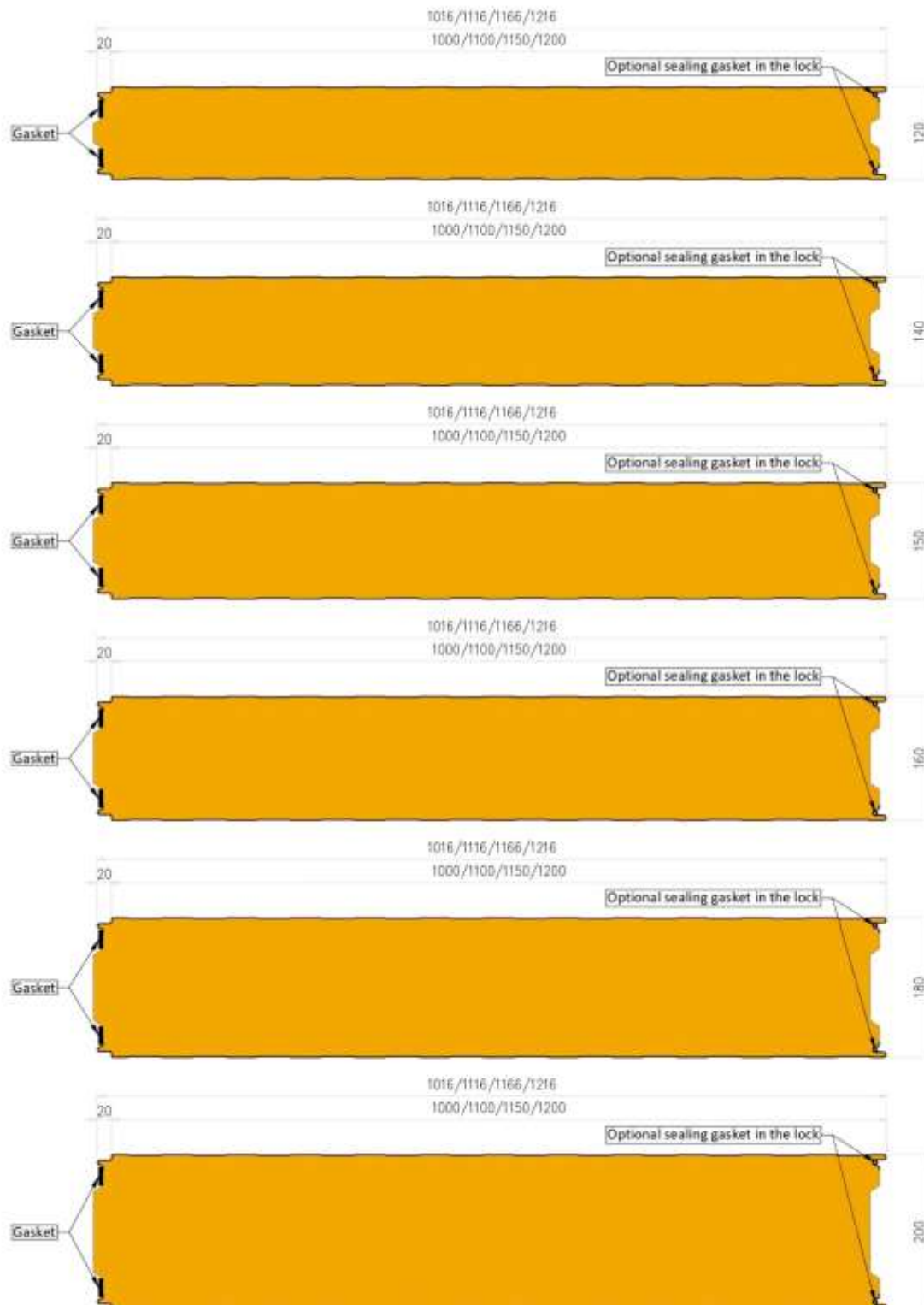
## 2. ALUFLAM PANEL PROFILES

Standard PIR wall sandwich panels



## 2. ALUFLAM PANEL PROFILES

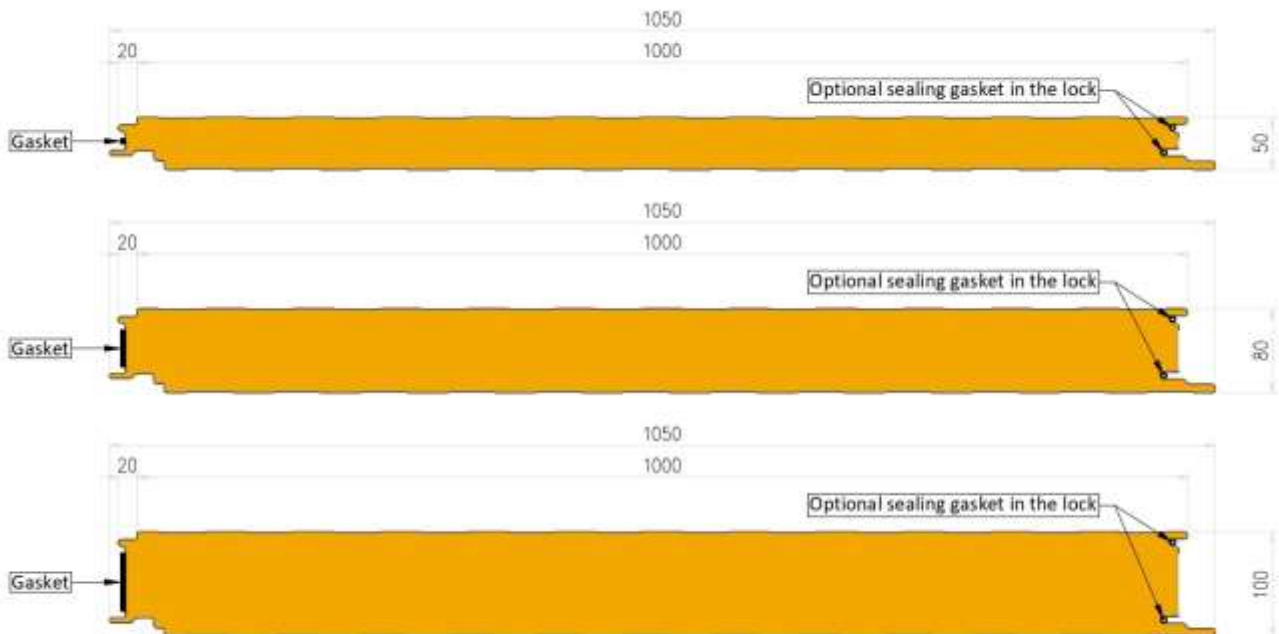
Thermo lock PIR wall sandwich panels





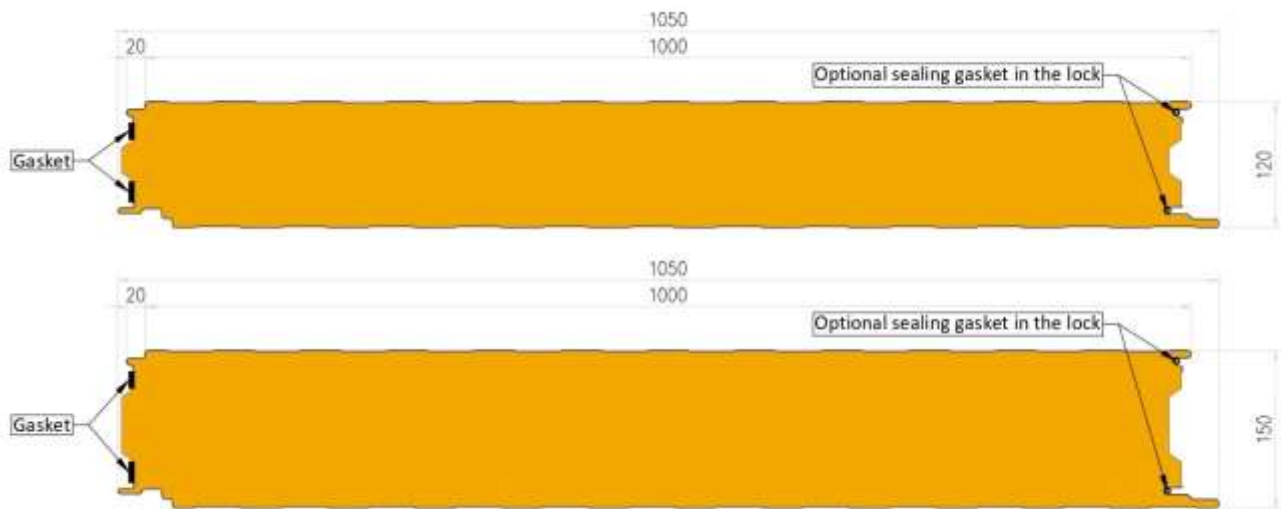
## 2. ALUFLAM PANEL PROFILES

Hidden fix PIR wall sandwich panels



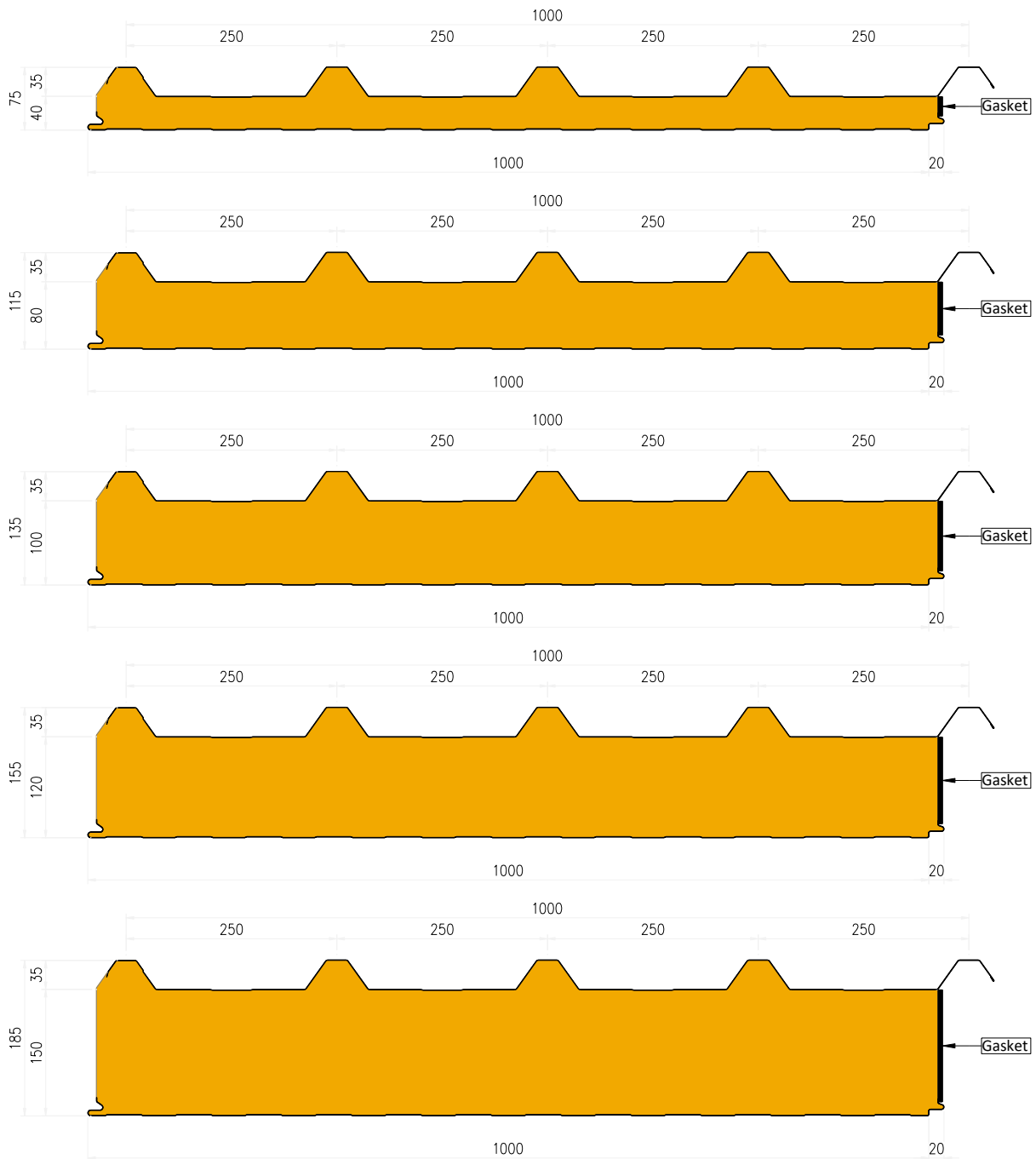
## 2. ALUFLAM PANEL PROFILES

Hidden fix with thermo-lock PIR wall sandwich panels



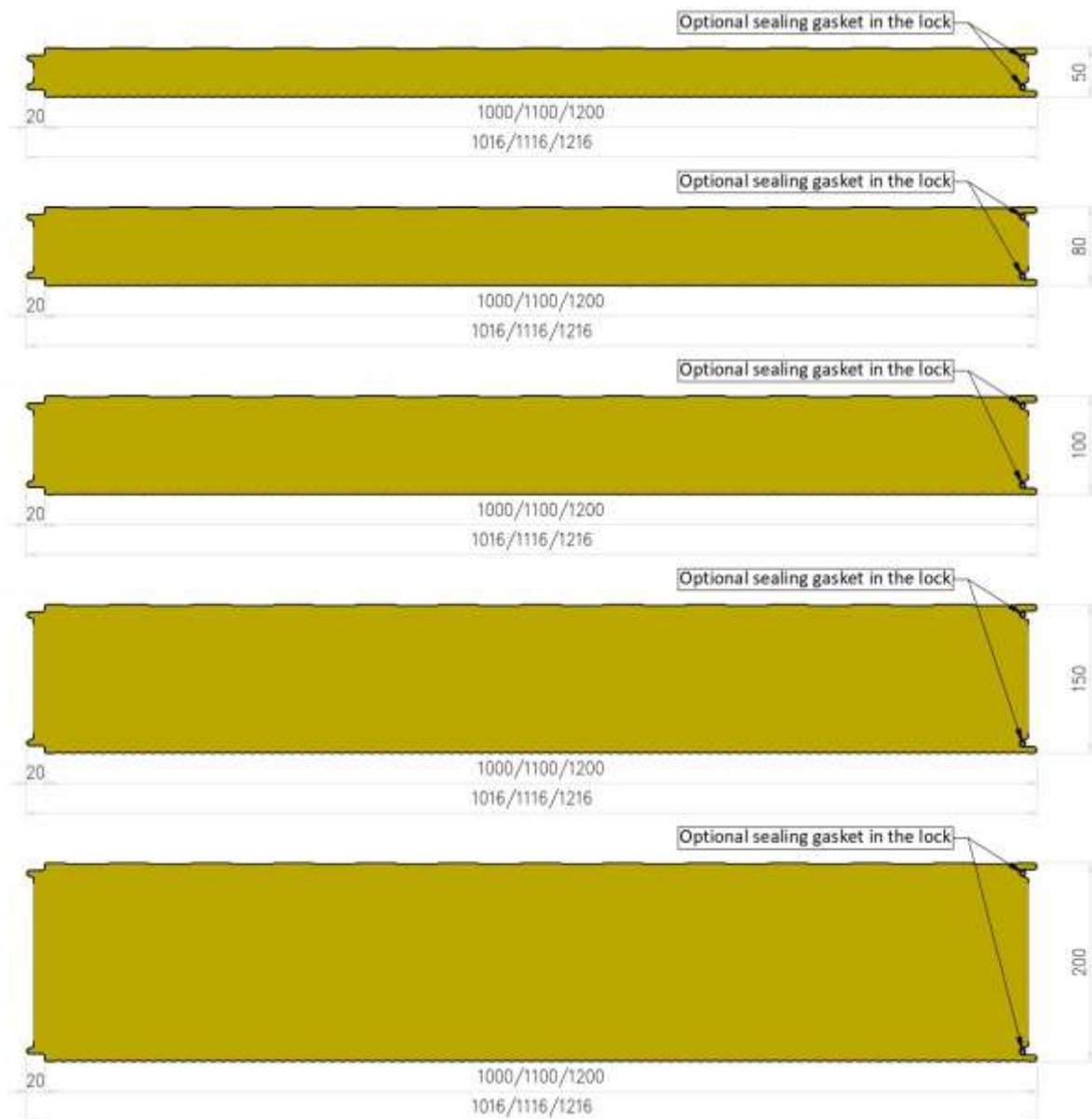
## 2. ALUFLAM PANEL PROFILES

5 rib PIR roof sandwich panels



## 2. ALUFLAM PANEL PROFILES

Standard MW wall sandwich panels



### 3. RECEIVING SANDWICH PANELS

- 3.1 Proper offloading equipment must be on site before the arrival of panels and accessories. All bundles and crates are packaged for side unloading by forklift or by crane. The maximum bundle weight is 1500 kg for 6 meters bundle.
- 3.2 Check all materials immediately upon arrival for freight damage. Inspect for a strap, forklift, or packaging/bundle wrap damage.
- 3.3 Verify that the order number, quantities, and descriptions of all bundles, crates, and pallets on the bill of lading match those on the truck.
- 3.4 List all visible damages and/or shortages on the bill of lading and obtain the signature of the truck driver and an authorized representative of the ALUFLAM customer.
- 3.5 Keep a copy of the marked-up bill of lading and send it with digital photos of the damage to ALUFLAM Customer Service.
- 3.6 All visible deficiencies of panels related to quality and quantity shall be recorded on a delivery note. The deficiencies which the BUYER could not have identified when accepting the Goods should be reported to the SELLER not later than within 5 (five) business days from the moment of transfer of the panels, but before they are assembled.
- 3.7 The panel bundling and accessories report lists the specific contents of each bundle, crate, and pallet listed on the bill of lading.
- 3.8 Every bundle and trim/accessory crate has a shipping label that contains information on the contents.
- 3.9 Standard bundling system is given in the table below:

Wall panels, length – 6000mm.			
Thickness, mm	Pcs.	Packages quantity and height	Quantity in one package
50	168	12 packs – 750mm	13
80	112	8 packs – 1220mm	14
100	88	8 packs - 1200mm	11
120	76	4 packs – 1180mm	9
		4 packs – 1300mm	10
140	64	8 packs – 1220mm	8
150	60	4 packs – 1300mm	8
		4 packs – 1150mm	7
160	56	8 packs – 1220mm	7
180	48	8 packs – 1180mm	6
200	44	4 packs – 1300mm	6
		4 packs – 1100mm	5
Roof panels, length – 6000mm.			
Thickness, mm	Pcs.	Packages quantity and height	Quantity in one package
40	160	8 packs – 1180mm	20
80	88	4 packs – 1100mm	10
		4 packs – 1300mm	12
100	72	4 packs – 1060mm	8
		4 packs – 1300mm	10
120	64	8 packs – 1220mm	8
150	48	8 packs – 1120mm	6

## 4. MATERIAL HANDLING – BUNDLES

### Forklifts

- 4.1 Identify and mark off the unloading area before material delivery.
- 4.2 Verify adequate material handling equipment with the proper reach and capacity is on site. Bundle weights are listed on the bill of lading, and have a maximum weight of 1500 kg for 6 meters bundles.
- 4.3 Pre-determine the panel storage area before material delivery. It must be secure, flat, well-drained, and reasonably level.
- 4.4 Panels are shipped via flatbed trailer and can be off-loaded from the side of the trailer using forklifts.
- 4.5 The recommended loading/unloading method for bundles less than or equal to 6.00 m is to use a single forklift with widely spaced forks placed under the center of the bundle as shown in Figure 4.1a. Panel bundles over 6.00 m in length may be moved by using a forklift with a special wide load stabilizer as shown in Figure 4.1b if there is no possibility to unload with a crane. Wide load stabilizers width min 5 meters. Protective forklift fork sleeves must be used to prevent sandwich panel damage as shown in Figure 4.1c. Inspect travel routes to assure a reasonable level and compacted surface free of ruts and excavations.

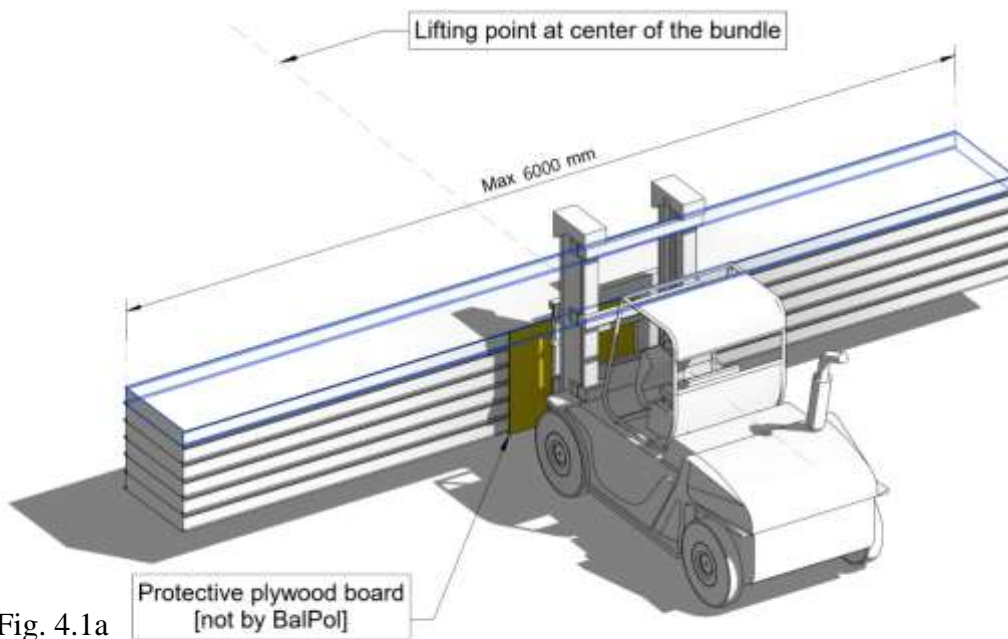


Fig. 4.1a



Fig. 4.1b



Fig. 4.1c

## 4. MATERIAL HANDLING – BUNDLES

### Forklifts

4.6 Tape foam blocks or protective plywood board on forks to prevent over-engagement of panel bundles.



**WARNING: USE PADDING OR BLOCKING ON FORKLIFT MASTS TO PROTECT PANEL EDGES AND PREVENT OVERENGAGEMENT INTO ADJACENT BUNDLES!**



4.7 Forklift blades must be level and centered under the weight of the bundle.

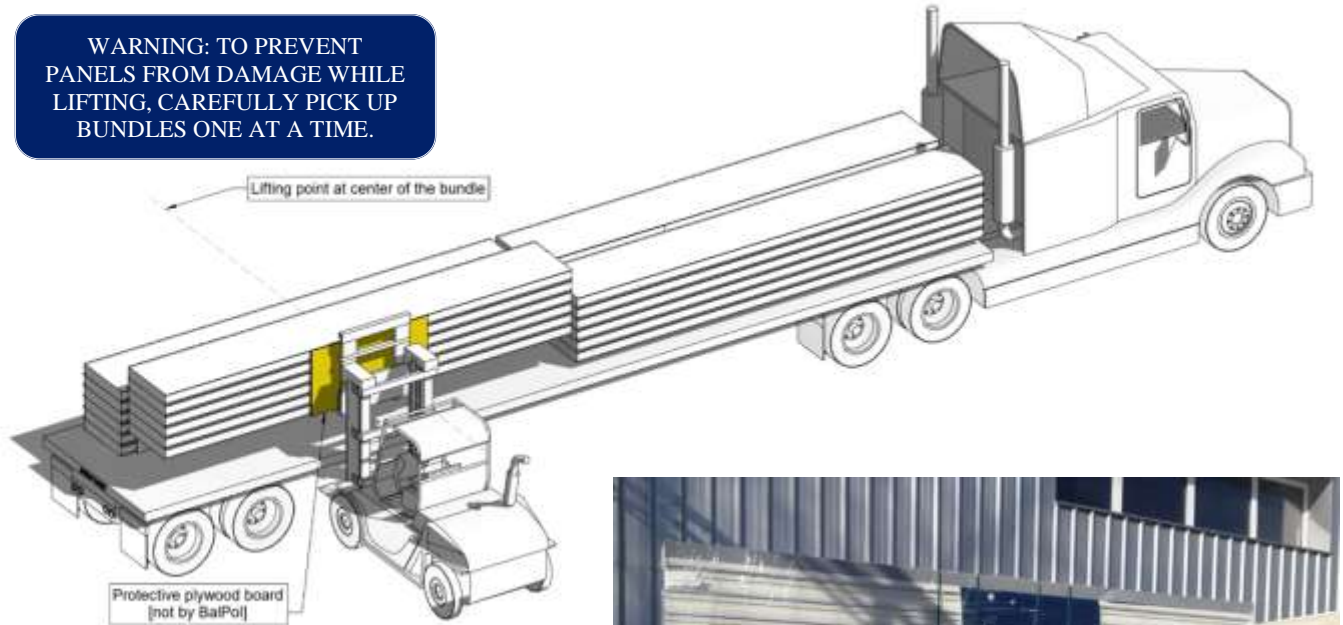


Fig. 4.7

Every bundle has special marked lifting points for forklift forks.



4.8 Inspect the travel route to make sure the path is reasonably level, compacted, and free of ruts. Move bundles into position as required for efficient installation.

4.9 Secure open bundles with straps before moving with a forklift. Spread forks as far as possible or use a wide load stabilizer as shown in Figure 4.1b and center under the load. Use caution to prevent excessive bending as damage to panels may result. Avoid bumpy terrain.

**WARNING: USE EXTREME CARE WHEN MOVING OPEN BUNDLES, ESPECIALLY THOSE WITH 40-80 mm PANELS LONGER THAN 6 m.**

## 4. MATERIAL HANDLING – BUNDLES

Lifting by crane

4.10 Use wood spreaders (40 mm minimum thickness, width as required for straps) on top and bottom of bundles at all pick points.

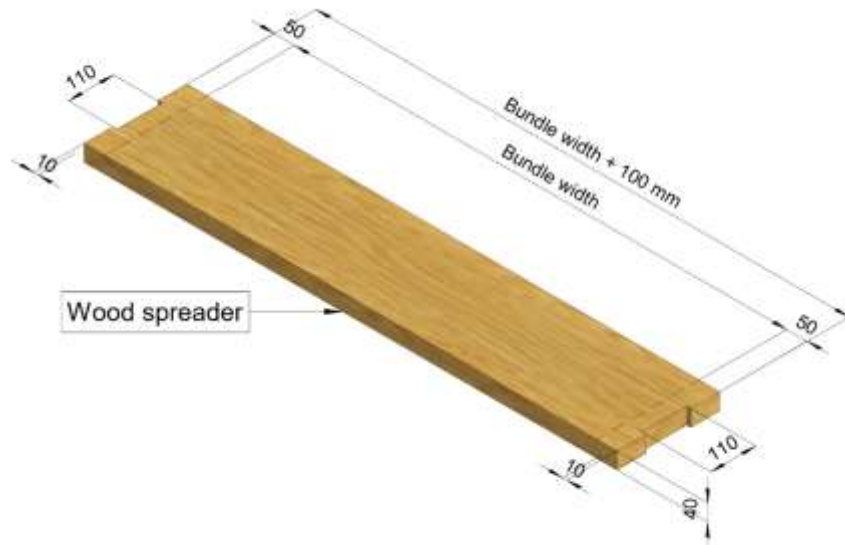


Fig. 4.10

4.11 Place foam blocks on the sides of bundles at all sling locations as shown in figure 4.12.

4.12 Bundles under 1800 kg and less than 13 m may be lifted as shown in figure 4.12.

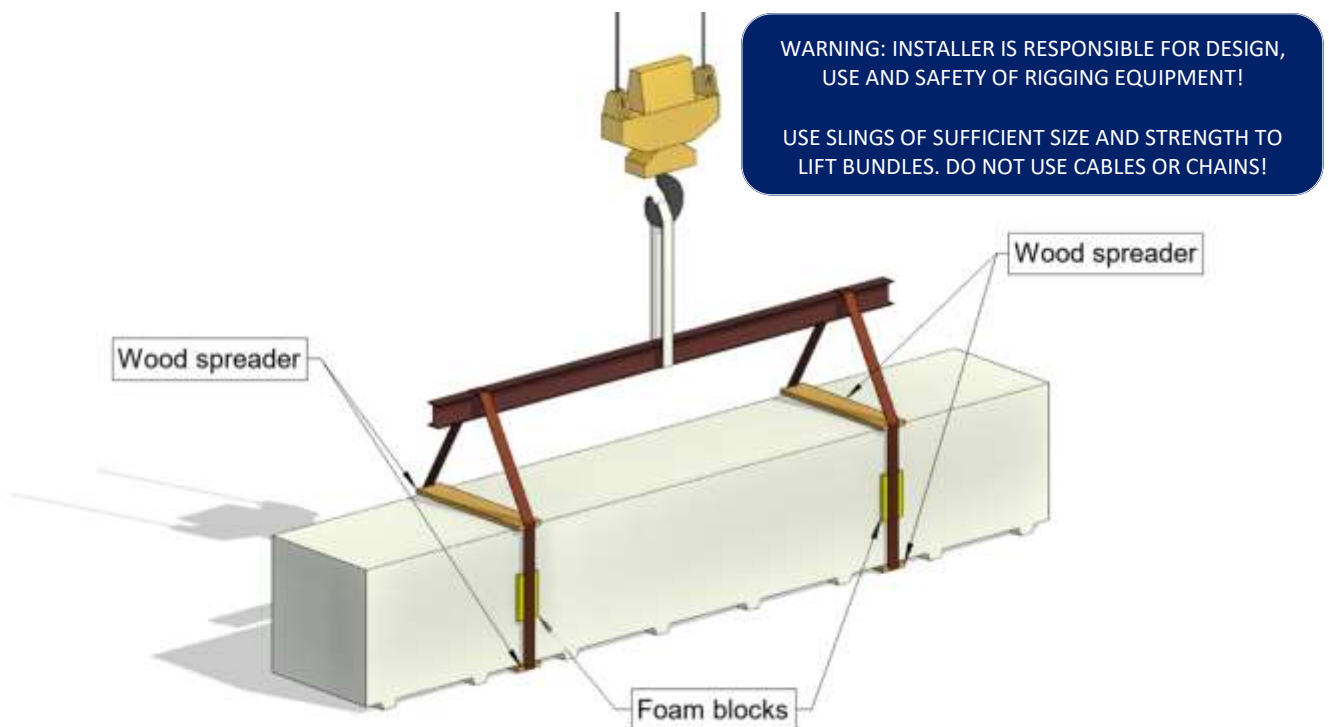


Fig. 4.12



## 4. MATERIAL HANDLING – BUNDLES

Lifting by crane

4.13 Bundles over 1800 kg and less than 13 m may be lifted as shown in figure 4.13

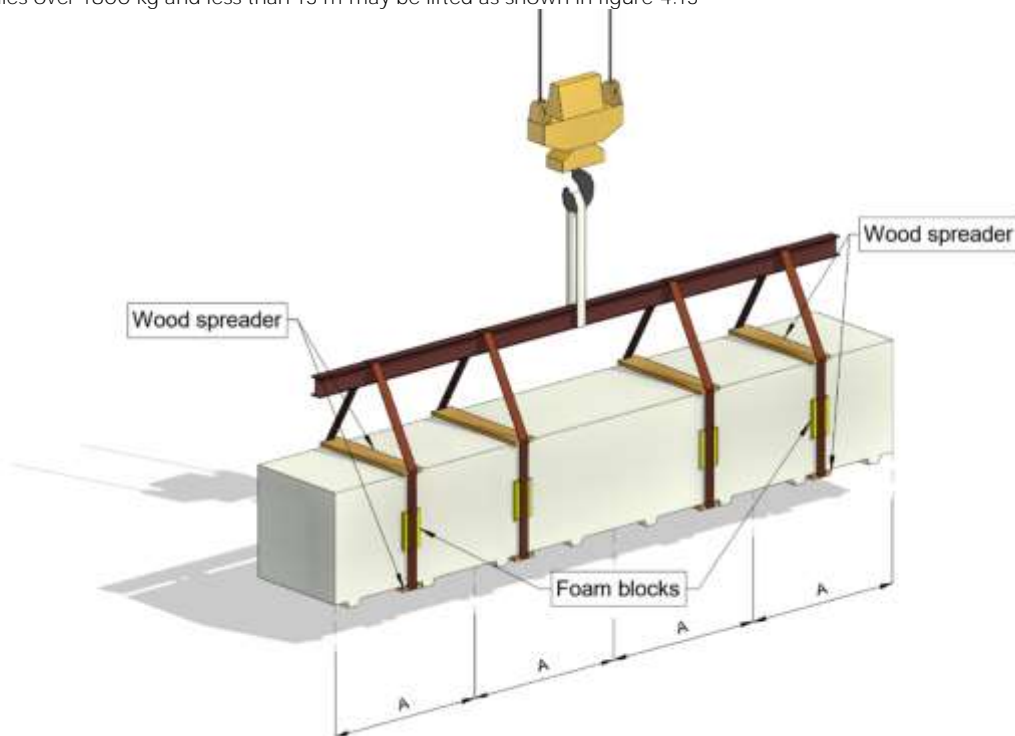


Fig. 4.13

4.14 Bundles over 1800 kg and/or over 13 m may be lifted as shown in figure 4.14

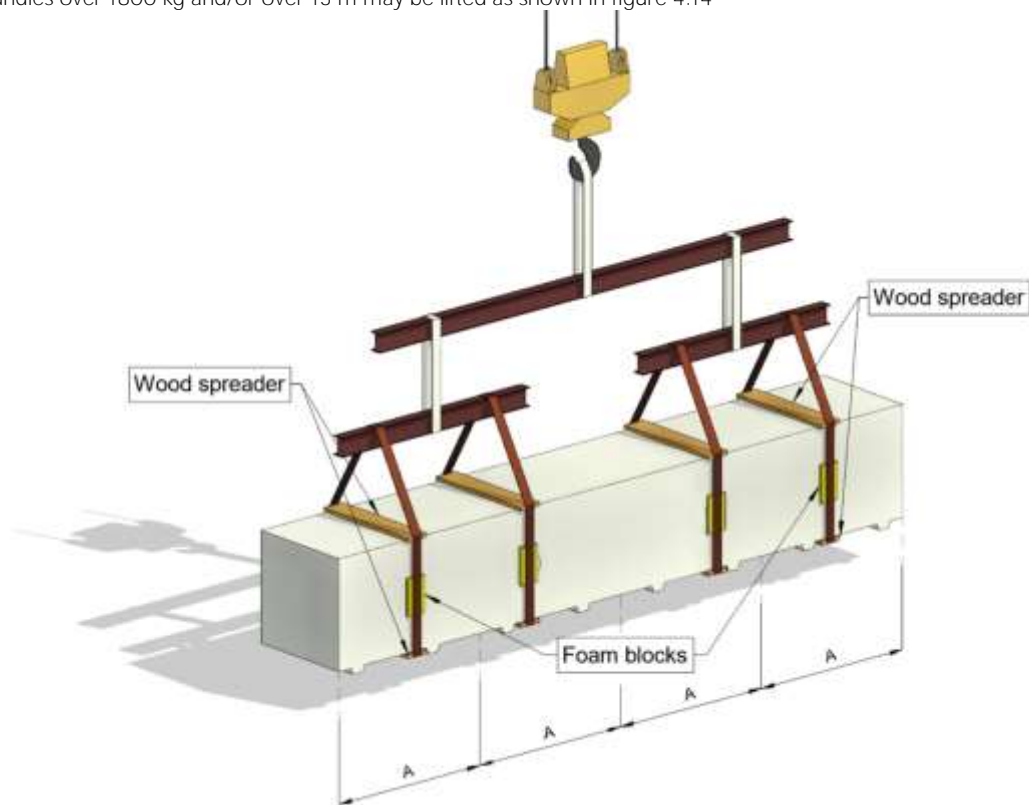
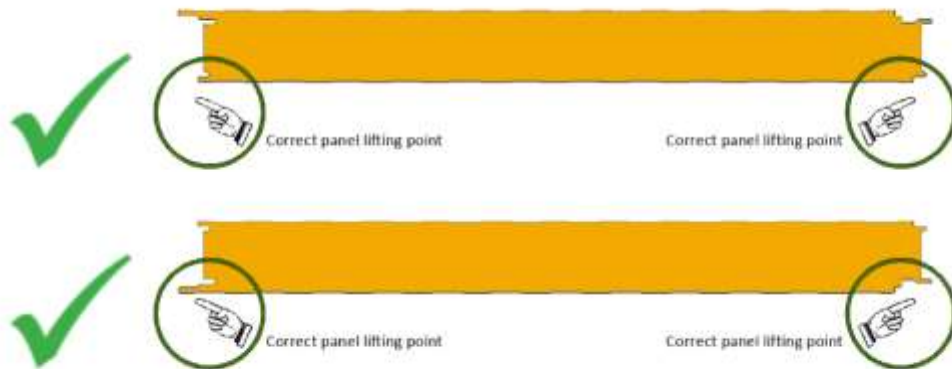


Fig. 4.14

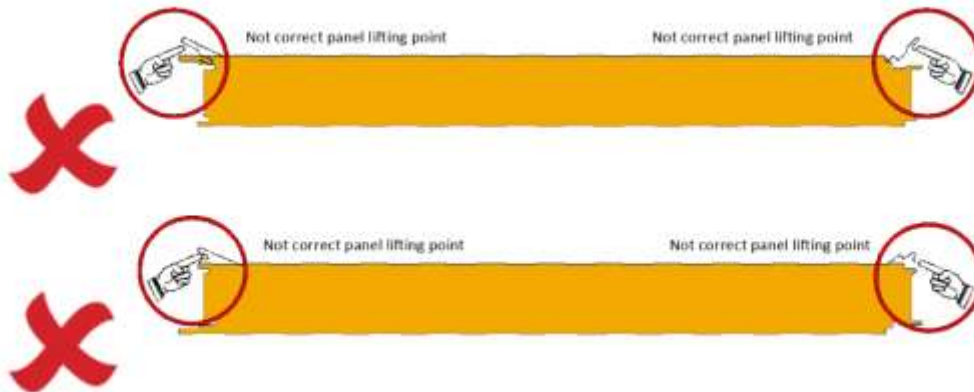
## 4. MATERIAL HANDLING – INDIVIDUAL PANELS

### Manual lifting

#### 4.15 Lift panels from here...



NOT from here...



4.16 Rotate panels onto the leading edge (side with clip shelf) before carrying. Use foam blocks (from bundles) to prevent panel edge damage as shown in Figure 4.16.

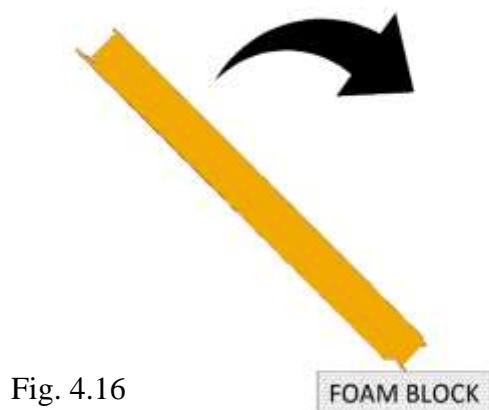


Fig. 4.16

**WARNING: TO AVOID SCRATCHING, DO NOT SLIDE PANELS OFF BUNDLES – ALWAYS LIFT THEM.**

**WARNING: WORKERS MUST WEAR APPROPRIATE PROTECTIVE GEAR AT ALL TIMES WHEN HANDLING PANELS. FAILURE TO DO SO MAY CAUSE INJURY.**

## 4. MATERIAL HANDLING – INDIVIDUAL PANELS

### Manual lifting

4.17 Carry panels on edge with sufficient manpower to prevent straining.

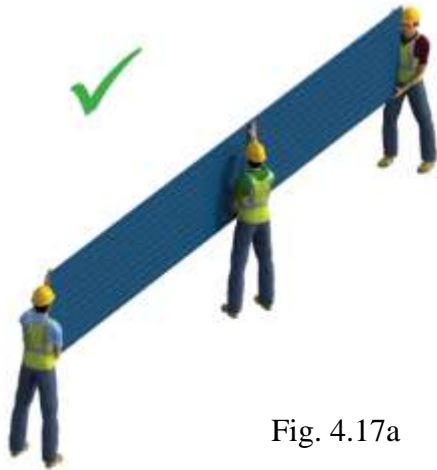


Fig. 4.17a

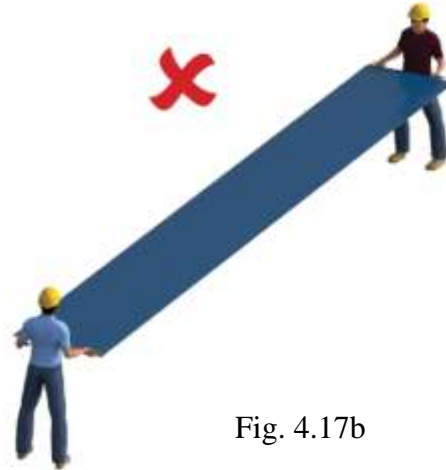
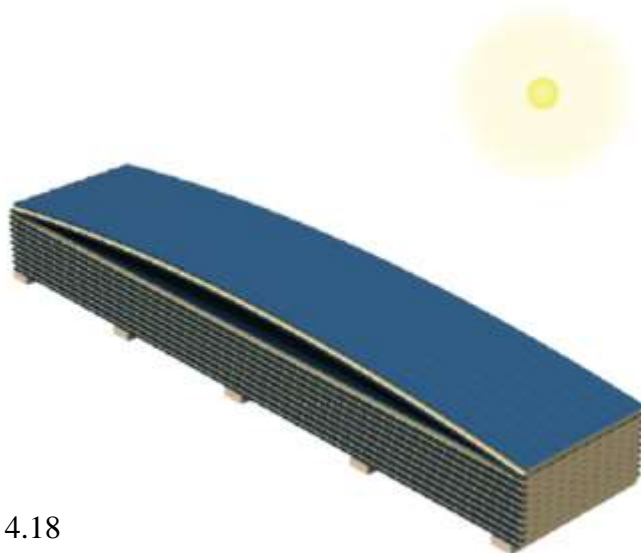


Fig. 4.17b

**WARNING: INDIVIDUAL PANELS SHOULD NEVER BE MOVED IN A FLAT POSITION AS EXCESSIVE FLEXING MAY RESULT. EXCESSIVE FLEXING RUPTURES A PANEL'S CORE, PERMANENTLY DISTORTS THE FACINGS AND MAY LEAD TO THERMAL BLISTERING. WHEN MOVING A PANEL, IT MUST BE TURNED ON ITS EDGE FIRST, THEN SUPPORTED AT EACH END WITH AS MANY MEN AS NECESSARY TO SAFELY HANDLE.**

### Thermal Bowing

4.18 Panels exposed to direct sunlight may exhibit thermal bows which can prevent proper engagement. Move panels to a shaded area or flip them over to expose the cool side to sunlight for approximately 15 minutes.



**WARNING: TO PREVENT JOINT DAMAGE AND POSSIBLE DELAMINATION, NEVER LIFT A PANEL FROM THE TOP SHEET ONLY. LIFT FROM UNDERNEATH THE ENTIRE PANEL.**

**WARNING: NEVER DRAG A PANEL FROM A BUNDLE OR ACROSS OTHER SURFACES. IT WILL SCRATCH AND DAMAGE THE PANEL COATING/FINISH. ALWAYS LIFT PANELS WHEN REMOVING FROM BUNDLE.**

Fig. 4.18

## 4. MATERIAL HANDLING – INDIVIDUAL PANELS

Vacuum lifting (wall sandwich panels)

4.19 Panel installation time is typically reduced when using vacuum lifting equipment as shown in Figures 4.19 and 4.23. Equipment must be designed for panel lengths, weights and profiles to be lifted – verify the requirements of your specific project with your lifting equipment supplier.

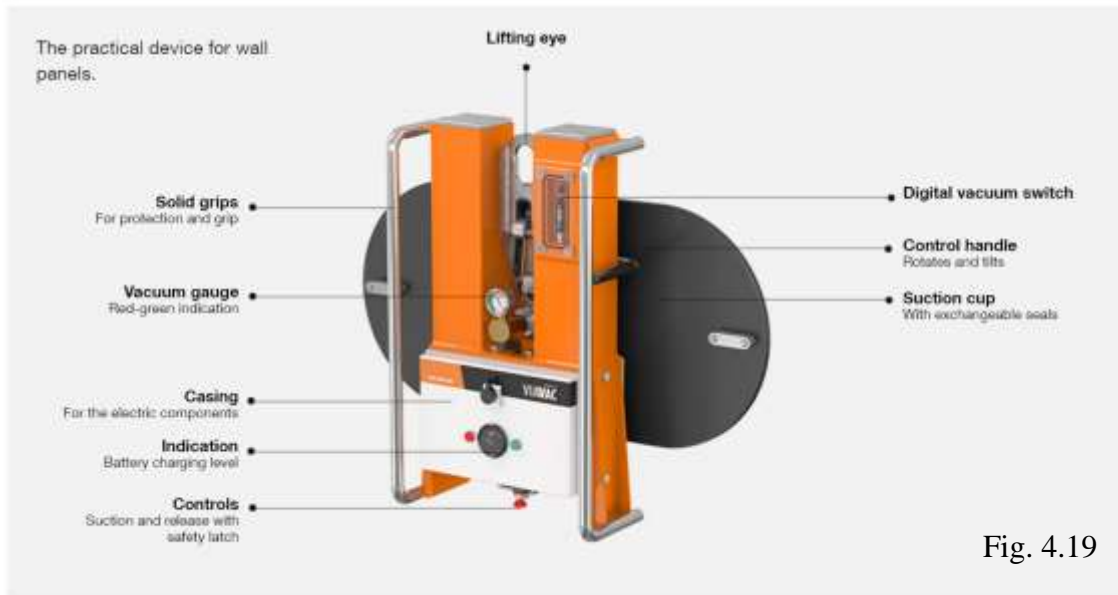


Fig. 4.19

4.20 According to CE directive EN 13155, it is required in all countries of the European Union to use secondary safety devices when a vacuum lifter is used on a construction site. This can be achieved in two different ways:

- 1 (single) vacuum circuit and using secondary safety devices as shown in Figure 4.21.
- 2 (dual) independent vacuum circuits.

1 (single) vacuum circuit

All suction cups are connected in one vacuum circuit. The lifting capacity is the sum of all connected suction cups. The use of a secondary safety device is required, which is achieved with VIAVAC vacuum lifters using safety straps.

2 (dual) independent vacuum circuits

Here, two completely separate vacuum circuits work independently of each other. Each circuit (set of suction cups) is capable of holding the maximum lift capacity with double security. If one circuit fails, the other circuit will hold the load. In this event, both visual and audio alarms will alert the user.

The use of secondary safety devices with a double vacuum circuit is therefore not required.

4.21 Falling safety devices for horizontal and vertical wall sandwich panels.

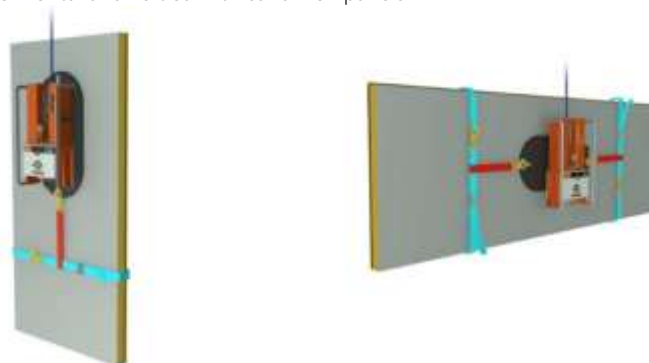


Fig. 4.21

## 4. MATERIAL HANDLING – INDIVIDUAL PANELS









### Vacuum lifting (wall sandwich panels)

The falling safety devices are executed using lifting straps with hooks, which must be hooked to the suction pad. During use, the following must take place.

1. The correct falling safety device is hooked to the, therefore, intended fixing points on the suction pad.
2. Lift the element with the vacuum lifter approx. 0,5 meters free from the ground.
3. Consequently, the strap is put around the element as indicated above.
4. Through the clamp buckle the strip is pulled tight around the element. (No clearance).
5. With the lifting device the whole unit is lifted to the designated place.
6. Just before the element is put in its place, the falling safety device is removed after which the element is placed on its spot.

**WARNING: PROTECT FROM SHARP EDGES OF THE ELEMENTS TO BE LIFTED AT LOCATION OF THE STRAPS.  
IF THERE ARE CRACKS OR TEARS IN THE LIFTING STRAPS, DO NOT USE THEM AND REPLACE THEM IMMEDIATELY.**

### 4.22 Viavac CladBoy compact for wall sandwich panels:

	Vacuum circuit:	Max. capacity:	Suction cups:	Own weight:
	GB-500	 500 kg	80x40 cm	55 kg
	GB-750	 750 kg	100x50 cm	65 kg
	GB2-250	 250 kg	80x40 cm	60 kg
	GB2-375	 375 kg	100x50 cm	70 kg





## 4. MATERIAL HANDLING – INDIVIDUAL PANELS

Vacuum lifting (roof sandwich panels)

4.23 Viavac CladBoy for roof sandwich panels:

Fig. 4.23

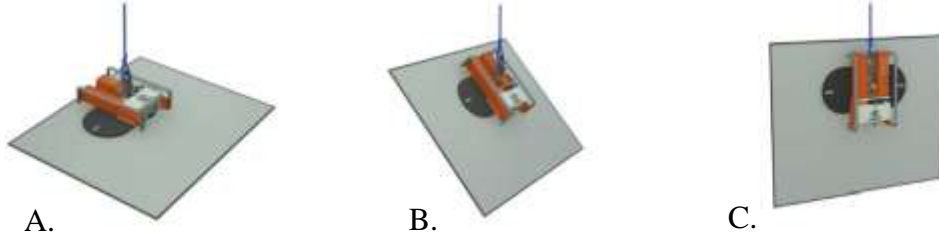


	Vacuum circuit:	Max. weight capacity:	Max. length capacity:	Own weight:
	<b>CB4</b> 	800 kg	roof 25 m / wall 14 m	125 kg
	<b>CB5</b> 	800 kg	roof 25 m / wall 14 m	150 kg

## 4. MATERIAL HANDLING – INDIVIDUAL PANELS

Vacuum lifting (lifting from bundle)

4.24 Tilting from horizontal to vertical position when lifting from the bundle.



- A. Place the suction pad horizontally centered, in or above the middle of the load.
- B. During lifting the load will tilt.
- C. When after lifting the load still hangs in a tilted position, move it manually to the vertical position so the suction pad will fall in the locked position.

**WARNING: SLIGHTLY LIFT ONE CORNER OF THE SANDWICH PANEL WHEN LIFTING IN HORIZONTAL POSITION FROM BUNDLE. VACUUM FORCES CAN CAUSE DELAMINATION OF SANDWICH PANEL IN SOME CASES.**

**WARNING: ANY MOVEMENT OF THE SANDWICH PANELS FROM PLACE TO PLACE ON THE CONSTRUCTION SITE MUST BE CARRIED OUT USING PROTECTIVE MEASURES AGAINST DAMAGE TO THE SANDWICH PANELS BY SCRATCHING.**

## 5. STORAGE AND STAGING

- 5.1 Panels should be stored in a secure location, on level ground that is well drained and free from standing water.
- 5.2 Elevate one end of panel bundles to provide adequate drainage - use graduated blocking under bundle bearing pads as required (figure 5.2).

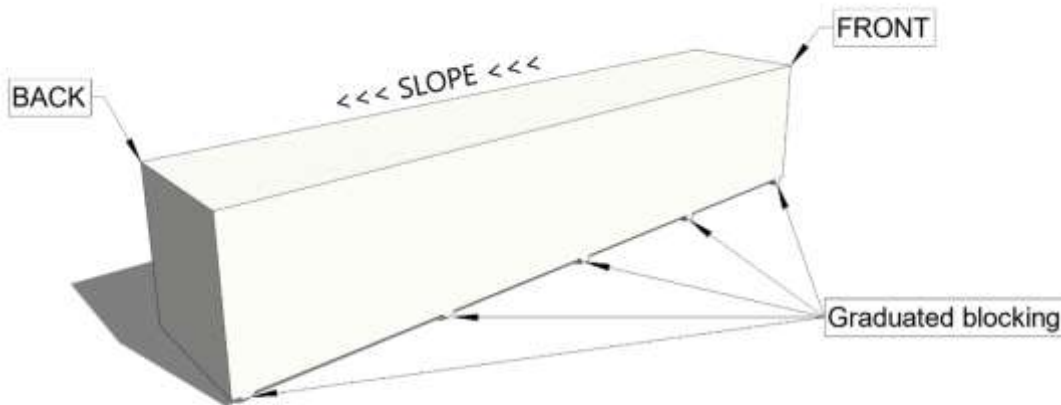


Fig. 5.2

- 5.3 Split bottom wrapping as shown for ventilation (figure 5.3).

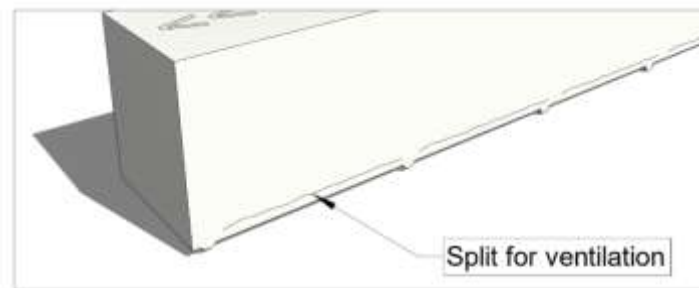


Fig. 5.3

- 5.4 Cover opened bundles at the end of the day with a tarp. Secure the bundle with straps to protect against weather damage as shown in Figure 5.4.



Fig. 5.4



## 6. REMOVAL OF PROTECTIVE FILM

- 6.1 If panels will not be installed within 60 days of receipt, the bundles should be unstacked and protective film removed from each panel. Failure to remove the film within this period may result in excessive film adhesion and breakdown of the plastic, making removal extremely difficult. In addition, failure to remove the film as instructed may result in a buildup of adhesive residue.

ALUFLAM is not responsible for either of these conditions. Film removal and panel cleaning are the responsibility of the installation contractor.

- 6.2 It is recommended to remove the protective film as panels are installed. Film on installed panels should be removed by the end of each day.
- 6.3 Loosen film along the male edge and peel it off and down at approximately 45° angle from both sides of panels (see Fig. 6.1).
- 6.4 If it is not possible to peel the film starting from the corners, then peeling should be started by peeling off the entire short edge of the sandwich panel.

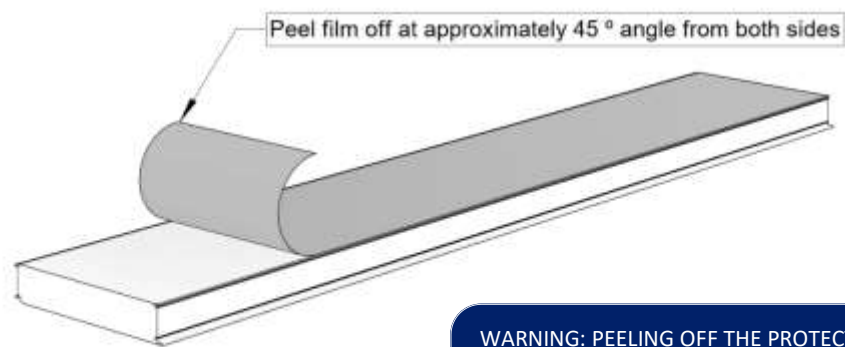


Fig. 6.1

**WARNING: PEELING OFF THE PROTECTIVE FILM FROM THE BOARD CAN CAUSE THE BOARD TO BECOME ELECTRICALLY CHARGED. AFTER REMOVING THE FILM FROM THE BOARD, IT IS STRONGLY RECOMMENDED TO REMOVE THE ELECTRIC CHARGE FIRST.**

## 7. PANEL CUTTING

7.1 Personnel cutting panels should always wear safety glasses, gloves, and long sleeve shirts.

7.2 Panel cutting should take place before installation when possible.

7.3 Use the following cutting tools to avoid panel damage:

- ❖ Circular saw with carbide-tipped metal cutting blade.
- ❖ Insulated metal panel saw.
- ❖ Band saw with metal cutting blade.



7.4 Use care when using reciprocating saws to avoid panel delamination: make sure the blade is sharp and let the saw cut at its own pace - do not force.



7.5 Do NOT use abrasive saws to cut panels.



**WARNING: USE OF ABRASIVE SAWS/  
GRINDER BLADES WILL DAMAGE THE  
PAINT FINISH AND THE METAL FACINGS!**

7.6 For small penetrations, cut each panel face with a portable router, then cut the foam with a serrated knife.



7.7 Metal flashings may be cut with power snips, nibblers, or hand snips.



## 7. PANEL CUTTING

- 7.8 Place the panel on padded sawhorses with the interior side up.
- 7.9 Wipe mud and debris off the panel face to be cut with a clean rag.
- 7.10 Mark the cut line with chalk or washable felt tip marker (figure 7.10).
- 7.11 Masking tape may be applied on both sides of the cut line to minimize panel scratching.
- 7.12 Recheck measurements and cut with the appropriate tool per 7.3, 7.4.
- 7.13 Remove burrs at cut edges with a deburring tool.



**WARNING: TEST FIT PANEL BEFORE  
INSTALLING JOINT SEALANT!**

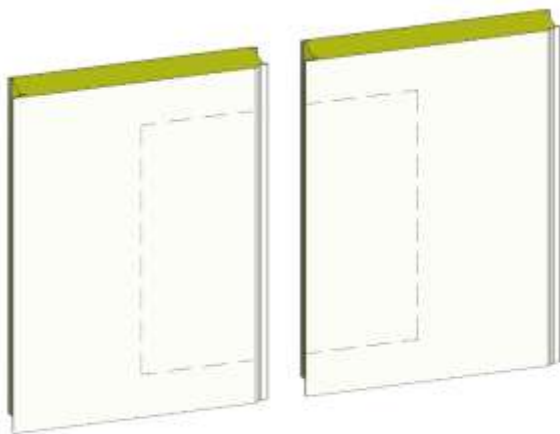
**WARNING: TO PREVENT DAMAGE TO THE PAINT  
FINISH REMOVE ALL METAL SHAVINGS FROM PANEL  
SURFACES AFTER CUTTING!**



Fig. 7.10

7.14 For panels located at framed openings where 50% or more of panel width is removed:

- ❖ mark cut lines on BOTH panels' faces.
- ❖ drill 1/4 holes at corner locations;
- ❖ cut the exterior face to a depth of 1/4;
- ❖ flip the panel over and cut the interior face to a depth of 1/4;
- ❖ cut through panel side joints at the framed opening area;
- ❖ lift the panel into place, and set it on the bottom support.
- ❖ cut foam with a serrated knife and remove the panel section.
- ❖ engage panel and secure it with fasteners.
- ❖ de-bur and remove metal shavings.



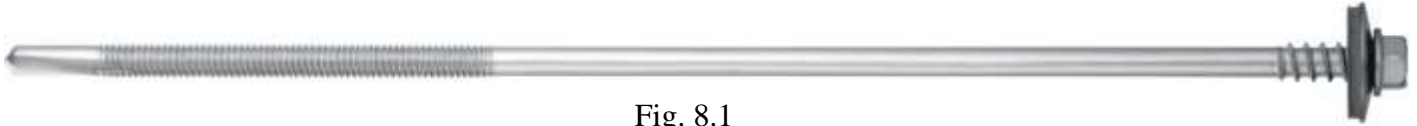
**WARNING: CUT METAL FACINGS ONLY - DO NOT CUT FOAM  
CORE UNTIL PANEL IS LIFTED INTO PLACE!**

Fig. 7.14

## 8. PANEL FASTENERS

**WARNING: REFER TO PROJECT INSTALLATION DRAWINGS FOR FASTENER TYPES AND REQUIRED FASTENING PATTERNS!**

- 8.1 Self-drilling, self-tapping fasteners contain a built-in drill point and do not require pre-drilling. They are the quickest and easiest way to attach insulated metal panels to light-medium gauge supports.



**Fig. 8.1**

- 8.2 Type B point fasteners are used to attach panels to medium-heavy gauge supports that are difficult or not possible to drill with self-drilling type fasteners. They require a two-step operation:

1. pre-drill holes through panels and structure.
2. insert fastener and tighten.



**Fig. 8.2**

- 8.3 Secondary fasteners applied to side overlaps and for flashing attachments. Fasteners for thin materials are required for site installation. Watertight rivets or self-drilling screws should be used.



**Fig. 8.3**

Suggested fastener driving speeds:

Carbon, Zinc Plated and 410 Stainless Steel: 1,800 rpm.

Stainless Steel: 1,000 rpm

## 9. PANEL CLEANING

- 9.1 Cleaning should be carried out when dirt and debris are visibly apparent, not merely out of habit. The presence of dirt and debris not only affects the appearance but may also lead to a breakdown of the coating. Furthermore, over many years, corrosion of the metal substrate may occur if a 'poultice' of debris, dirt, retained water and aggressive chemicals are allowed to build up. Large quantities of debris can also lead to the overflowing or ponding of water, particularly in guttering, which may also lead to corrosion. To avoid this, debris should be swept into a pile, using a soft-bristled brush and removed. Shovels or hard tools should be avoided. All dirty areas should then be washed down using clean water. Do not use salt water or high-pressure jets with a hose. If necessary, use a recommended cleaning product, or a 10% solution of a good household or industrial detergent in water, before applying a final hose down with clean water. A soft-bristled brush can be used for particularly stubborn deposits.

To wash the sandwich panels, it is recommended to use a high-pressure water jet with pressure not exceeding 4 MPa. By using a high-pressure water pump, direct the water jet no closer than 50 cm from the surface of the sandwich panel at a skew angle. When washing the joints of the sandwich panels, make sure that the water is not entering into the joints. The water jet may not be aimed directly at the joints. Water temperature may not exceed +30 °C. If there are fats or grease on the sandwich panels, the water temperature may temporarily be increased to +50 °C.

The surface may be treated with cleaning agents with pH levels from 5 to 10 that are not containing organic solvents. Stubborn stains may be cleaned with isopropyl alcohol or white spirit.

Warning: Environment protection measures must be taken into account when using cleaning agents and solvents.

After the application of cleaning agents, the surface of the sandwich panels immediately must be washed off with clean water. Sandwich panels are cleaned from the bottom towards the top by carefully washing off cleaning agents from the top to bottom. Rainwater pipes and drainage channels have to be rinsed as well.

To make sure that the cleaning method and agents are not damaging the panel, perform a test cleaning on a less visible and smaller area. Evaluate the test cleaning results under a sufficient amount of natural lighting after the panels have dried off.

It is not recommended to clean the sandwich panels with steam. Surfaces may not be washed with water if the ambient air temperature is below or equal to 0 °C.

Surfaces with a coating that is intended for use in contact with food (for example, Food Safe coatings) may be cleaned with cleaning agents not containing solvents with pH values from 5 to 8. To keep the sandwich panels, clean every day, this type of coating may be washed with a soft brush. This type of coating may also be washed with a water jet with a pressure of up to 50 bar. Water temperature may not exceed +60 °C. Coatings that may be used in contact with foodstuffs may not be in an environment where air humidity exceeds 80% RH. These types of coatings may be wet no longer than 6 hours per day. Wet surfaces may be wiped with a soft cloth or dried off with airflow at room temperature. Sandwich panel joints have to be dried off with particular care. Dirt must be sucked off from sandwich panels with an acoustic (for sound damping) facing. Afterwards, the surface may be wiped with a wet cloth.

If it is necessary to wash sandwich panels often, use additional sealing for locks and joints to prevent water from entering into the insulation core. If water enters the insulation core, it not only affects the thermo-dynamic and mechanical properties but also may cause facing corrosion. It is recommended to use sealing that is made from EPDM, silicon, PIB ("butyl"), or polyurethane. Sealing must be inspected frequently and replaced in case of any damage.

- 9.2 Cleaning Snow and Dirt on the Roof. Roof sandwich panels need to be cleaned from any tree leaves and dirt at least once per year. Do it very carefully in order not to damage the sandwich panel surface. Roof sandwich panels should be cleaned with tools that have a soft rubber or polymer coating and that do not have any sharp edges. The worker who is performing cleaning must wear shoes that are not causing damage to sandwich panels and conform to the occupational safety requirements. Damaged sandwich panels deteriorate the appearance of the building but also facilitate corrosion of the steel facing. After cleaning is completed, do not leave any tools or other objects on the panels that may corrode or cause corrosion of the steel facing. Rainwater pipes and drainage channels must be cleaned at least once per year.
- 9.3 Oil can be removed by wiping the area with white spirit before cleaning and rinsing for general dirt and debris. In some areas, birds can be a nuisance. A buildup of bird droppings can occur on roofs and this may significantly alter the pH of the surface water runoff. Buildings used as communal roosts, where an excessive buildup of bird droppings is possible, should be regularly monitored and cleaned down.

## 9. PANEL CLEANING

9.4 Graffiti can be removed with specialist cleaners, and over-paint systems are available. These fall into three categories:

- ❖ Specialist graffiti removals products such as solvents and gels.
- ❖ Waxy sacrificial anti-graffiti treatments can be post-applied to the pre-finished steel. These can be power washed off, removing graffiti and the treatment at the same time. Re-application of the treatment would then be required.
- ❖ Anti-graffiti coatings can also be applied. These render any graffiti easy to clean off, using hot water or cleaning solutions, and do not need re-application after the graffiti is removed.

9.5 Physical damage may occur for several reasons such as impact and abrasion. If there is minor damage, such as scuffing of the paint coating less than the depth of any embosses, then no remedial action is required. If there is more serious damage, such as breaching of the paint coating, then remedial action is suggested. If the coating has been breached, then the metal substrate will be vulnerable to corrosion. The repair of the breaching should be carried out by removing any loose or flaking paint, cleaning the area and, when dry, covering the breach using a recommended touch-up paint. If the metallic coating has been breached, exposing the underlying steel, then the application of an air-curing zinc-rich paint can be used to replenish the sacrificial protection layer. It is important to ensure that any applied paint is no wider than the original scratch. To achieve this, the paint should be applied with a medium-to-fine artist's paintbrush. If the damage is extensive, the panel should be replaced, which is easy to do with pre-finished steel.

9.6 Metallic debris, such as swarf, rivet stems or other debris that may remain after construction or modification to the building will be vulnerable to corrosion, leading to unsightly staining of the cladding. Debris of this nature should simply be removed at as early a stage as possible, carefully so as not to damage the underlying coating. Staining caused by the corrosion of construction debris can be removed using a 5% Hydrochloric acid solution. This should be followed by thorough washing and rinsing as with general dirt and debris. Specialist cleaning products may be required for particularly stubborn marks. Other debris may include expanded foam, bitumen, tar and mastics, all of which require specialist cleaners. Concrete, cement and plaster may also be present as debris and can be removed with a 5% Phosphoric acid solution. This should be followed by thorough washing and rinsing as with general dirt and debris.

9.7 If a removable film is left in place for too long then the adhesive sets and the tack increases to the point where the removal of the film becomes difficult and sometimes impossible. This can also apply to UV-opaque black films if left for long enough. The removal of bonded film or residual adhesive can typically be carried out using WD40, SOLVENT 646 or white spirit, followed by thorough washing and rinsing as with regular dirt and debris. The manufacturer's specific advice on film removal must be always followed.

**WARNING: SCRUBBING THE PANELS WHILE MORTAR IS PRESENT WILL LIKELY RESULT IN SCRATCHES TO THE PAINT.**

**WARNING: DO NOT USE WIRES BRUSHES, STEEL WOOL OR ANY OTHER ABRASIVE METHODS TO CLEAN PANELS.**

## 10. TOUCH – UP (MINOR SCRATCHES ONLY)

10.1 You can find places with paint damage on the surface during building inspections. It is better to leave small patches of surface damage intact. If the damage is deeper and goes deep into the base material (metal), it can be easily solved by applying paint of the appropriate colour. Make sure not to cover the paint on a wider area than the damage. Therefore, be careful when handling, and use soft brushes. Taking into account the fact that the shade of the paint may be slightly different, apply it on as little an area as possible.

10.2 Touch-up painting method is for minor scratches only. For deep scratches, the following procedure is required:

- ❖ degrease the surface.
- ❖ clean with sandpaper.
- ❖ seal with polyester glue.
- ❖ polish according to the metal sheet profiling on the panel
- ❖ apply primer (e.g., Formex S2003).
- ❖ finishing paint coat – sprayed or coated with a roller.
- ❖ the colour of the paint must be chosen at the paint shop according to the sample piece of external or internal metal sheet.

## 11. INSTALLATION

### 11.1 General

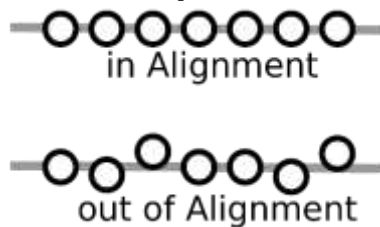
Composite roofing and walling panels must satisfy the requirements of the building envelope concerning stability, air and wind tightness, thermal insulation, fire protection etc.

The industrially produced roof and wall cladding elements must be installed so that the elongation and contraction of the elements are unhindered or can be accommodated with detrimental effects.

Sandwich panels must not penetrate the surrounding ground level. They must neither be sunk into the earth, covered with gravel nor be embedded in asphalt or concrete.

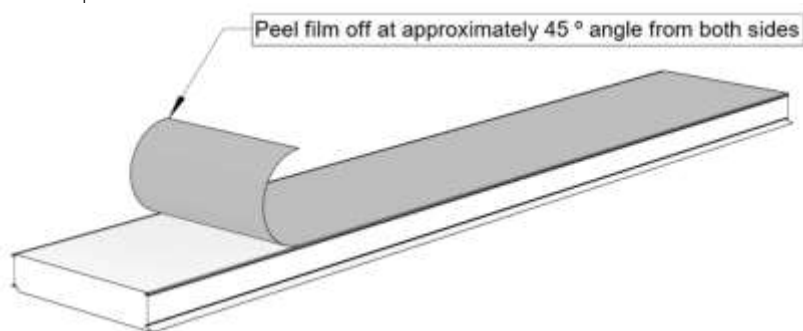


The panels must be installed following the project installation drawings. Panels must be installed plumb and in alignment.



Tolerance compensation is not possible with sandwich panels therefore dimensional deviations are unavoidable. Unless otherwise agreed.

Factory-applied protective films (including seals on sandwich panels) must be removed during the installation process, they should not be exposed to sunlight for an extended period.





## 11. INSTALLATION

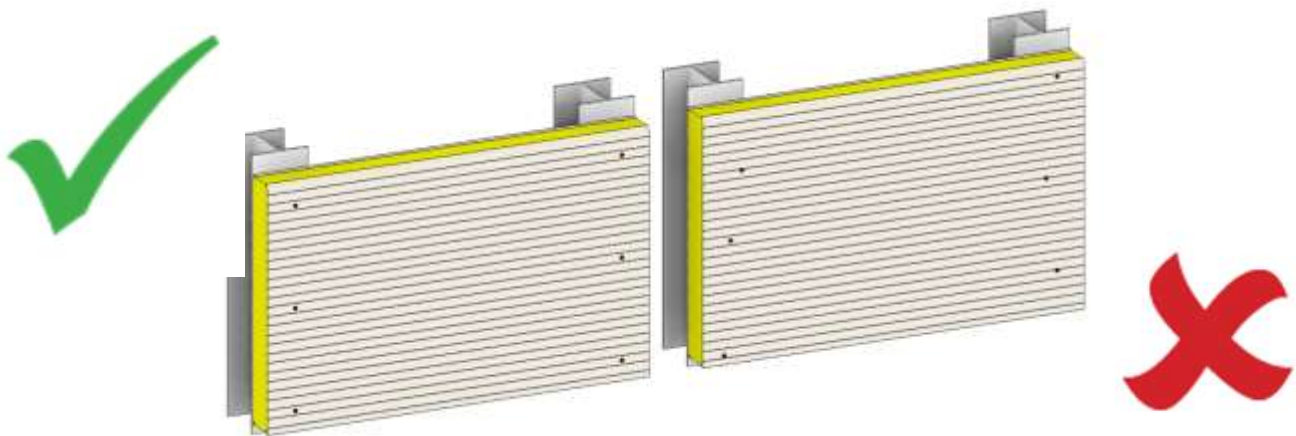
Each sandwich panel must be fixed on the supporting structure before the end of every work session. For safety reasons it is recommended that side lap connections should be formed as soon as possible, particularly on roofs and ceilings.



Due to the risk of falls, cantilevered roof and ceiling panels must be secured against uplift immediately after the installation of each profiled sheet. Panels may only be stored on load-distributing boards. The total load must be no higher than can be supported by the purlins, decking and substructure.

For the horizontal installation of sandwich panels prefabricated cover strips or other galvanized multiple folded and coated sections must be installed. Cover strips are to be attached symmetrically on both sides of the outer panel faces.

Visible screw fixings must be arranged in an orderly geometrical pattern.



The ends of projecting fasteners (screws, cartridge-fired pins) must not be shortened. At roof openings, all layers of the roof construction (airtight membrane, insulation layers, bearings for decking etc.) must be connected to the penetrating in accordance with the 3:1 rule.

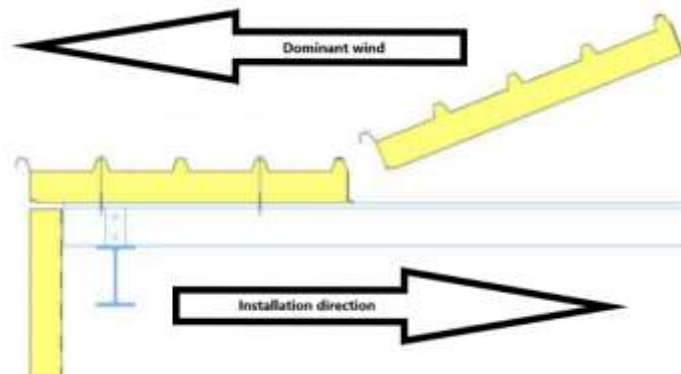
The ends of the roof cladding and the cover tray of composite panels at the eaves level must be tapered in the troughs to drain into the gutter (drip detail).

Cutting with angle grinders or similar tools capable of producing sparks is only permissible in exceptional cases. Use sheet metal nibblers and hand-held circular saws instead. Hot metal chips burn into the paint surface and cause rust spots and can ignite the polyurethane foam. Swarf produced by sawing and drilling must be immediately removed from coated surfaces.



## 11. INSTALLATION

The prevailing wind direction should always be taken into account when installing roof cladding.



Sealing works for wall and roofing systems must be executed with the specified sealing tapes and/or mastic sealants on the side and end laps and other joints.



Facades must be designed so that the sandwich panels do not extend below ground level irrespective of the direction in which they are installed. The embedding in the earth, covering with gravel or similar, and setting in asphalt or concrete is prohibited.

### 11.2 Division into the colour groups

Division of the colours into the groups is related to the impact of thermal loads on the enclosures made from sandwich panels. In the case of darker colours, the steel external cladding at the time of exposure to the sun heats up more extensively. Mechanical characteristics of the sandwich panels fastened to the structure are affected by the temperature difference ( $\Delta t$ ) between the external and internal cladding resulting in thermal stress. Effects of the stress can be waving off the area, damage to the steel claddings or broken panels at the intermediate support. The standard EN 14509:2014 describing the requirements for the sandwich panels regulates also the division into 3 colour groups: very bright, bright and dark. The value of the temperature for the external cladding depends on a colour group to which a particular colour is assigned and it equals:

- +55°C for very bright colours - 1st group.
- +65°C for bright colours - 2nd group.
- +80°C for dark colours - 3rd group.

### 11.3 Division into the colour groups

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## 11. INSTALLATION

- +55°C for very bright colours - 1st group,
- +65°C for bright colours - 2nd group,
- +80°C for dark colours - 3rd group,

For calculation, the indoor temp. equal 20°C was used. In the summer season, for the external cladding, the temperature was accepted based on a proper colour group, and in turn, in the winter the accepted temp was equalled -20°C. Hence, the calculations are based on the following temperature differences:

- 1st group –  $\Delta t = 40^{\circ}\text{C}$ ,
- 2nd group –  $\Delta t = 45^{\circ}\text{C}$ ,
- 3rd group –  $\Delta t = 60^{\circ}\text{C}$ .

It meets the requirements stipulated in the standard EN 14509:2014 for our geographical location.

### 11.4 Guidelines to use the panels with a dark colour cladding.

In case of improper design of the light cladding systems, dark colour external claddings (3rd colour group) because of much higher thermal loads compared to bright colours, may become deformed. During the designing process, the object designer must take this fact into account to avoid damage to the panels and to apply a proper solution to meet 3 conditions at the same time:

1. Select a proper system of the panel installation and a static system acc. to load-span tables;
2. Limit the maximal length of the sandwich panels.
3. Take the installation temperature for the sandwich panels into account.

### 11.5 Static diagram and the installation way

Irrespective of the selection of the panels acc. to load-span tables it is recommended that dark colour wall sandwich panels are installed exclusively at single-span systems. In the case of multi-span systems, at the intermediate support, certain slight waves may occur affecting higher thermal loads. Formally permissible (by the text of the standard) waves may cause potential aesthetic objections. ALUFLAM does not give a guarantee for flatness of the dark colour sandwich panels applied in multi-span systems unless it has been agreed in writing with an authorized representative of ALUFLAM.

#### Maximal lengths of panels

Wall sandwich panels with claddings from the 3rd colour group must not exceed 7,0m and in the case of the roof-sandwich panels 13,5m. ALUFLAM does not give a guarantee for the dark colour sandwich panels longer than the aforementioned ones unless it has been agreed in writing with an authorized representative of ALUFLAM.

### 11.6 Installation temperature

It is recommended to install dark-coloured sandwich panels according to the specific weather conditions on the construction site and to follow the principle of prudence, as installation at very low temperatures during the summer season increases the thermal loads. ALUFLAM does not give a guarantee for the dark colour sandwich panels installed in poor weather conditions unless it has been agreed in writing with an authorized representative of ALUFLAM.

### 11.7 Guidelines to use the panels with smooth or lightly profiled (micro) claddings

Installation of wall sandwich panels with smooth or lightly profiled (micro) claddings or micro profiling may take place exclusively in a single-span system, after previous consultation and approval by an ALUFLAM representative. Application of such panels in two-span or multi-span systems may result in the waving of the claddings. This effect may be temporary only and it occurs under certain weather conditions, e.g., in case of serious sun exposition of a facade. However, it does not affect load carrying properties of a panel. ALUFLAM does not give a guarantee for sandwich panels with smooth or lightly profiled (micro) cladding applied in two-span or multi-span systems unless it has been agreed in writing with an authorized representative of ALUFLAM. ALUFLAM shall not be responsible for damages to sandwich panels with smooth or lightly profiled (micro) claddings arising from non-observance of guidelines by the designer.

### 11.8 Framing alignment should be checked before panels are delivered to the site.

### 11.9 Compare structural and panel shop drawings to ensure wall supports are in the correct location. Field measure support spacing and overall building dimensions.

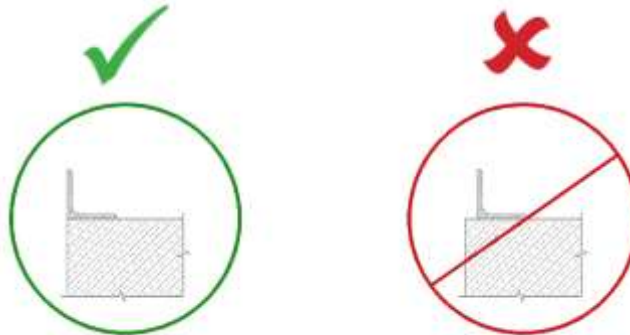
## 11. INSTALLATION



**WARNING: RESOLVE ALL DIMENSIONAL DIFFERENCES WITH SHOP DRAWINGS BEFORE PANEL INSTALLATION BEGINS!**

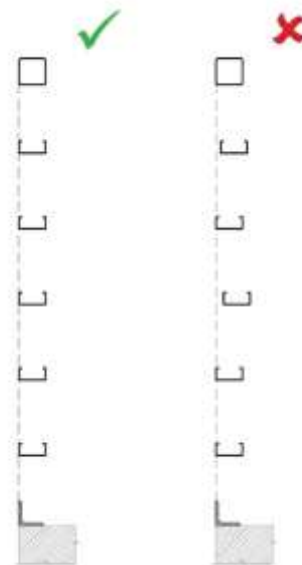


11.10 If base support is installed, verify it is aligned with the slab edge/notch.



11.11 Check alignment at mid-span and column lines with a laser or plumb bob from the top wall support to the base support or slab edge.

**WARNING: IMPROPER FRAMING ALIGNMENT CAN CAUSE DIFFICULTY WITH PANEL ENGAGEMENT AND RIPPLING OR BUCKLING OF THE PANEL FACES.**



11.12 All supports not in alignment must be corrected by the responsible party before panel installation begins.

## 11. INSTALLATION

### 11.13 Correct sandwich panel assembly

To achieve the correct degree of compression of the factory-installed seam seals (60% of the original sealant thickness) it may be necessary to compress the panels before fixing them to the substructure.

This requires the use of dimensional lumber (2 pcs.), steel angle (size according to sandwich panels thickness, 2 pcs.), self-drilling screws to fix steel angle to the column and two simple hydraulic jacks in situations where the elements' weight is insufficient to press together the element locking into the correct position.

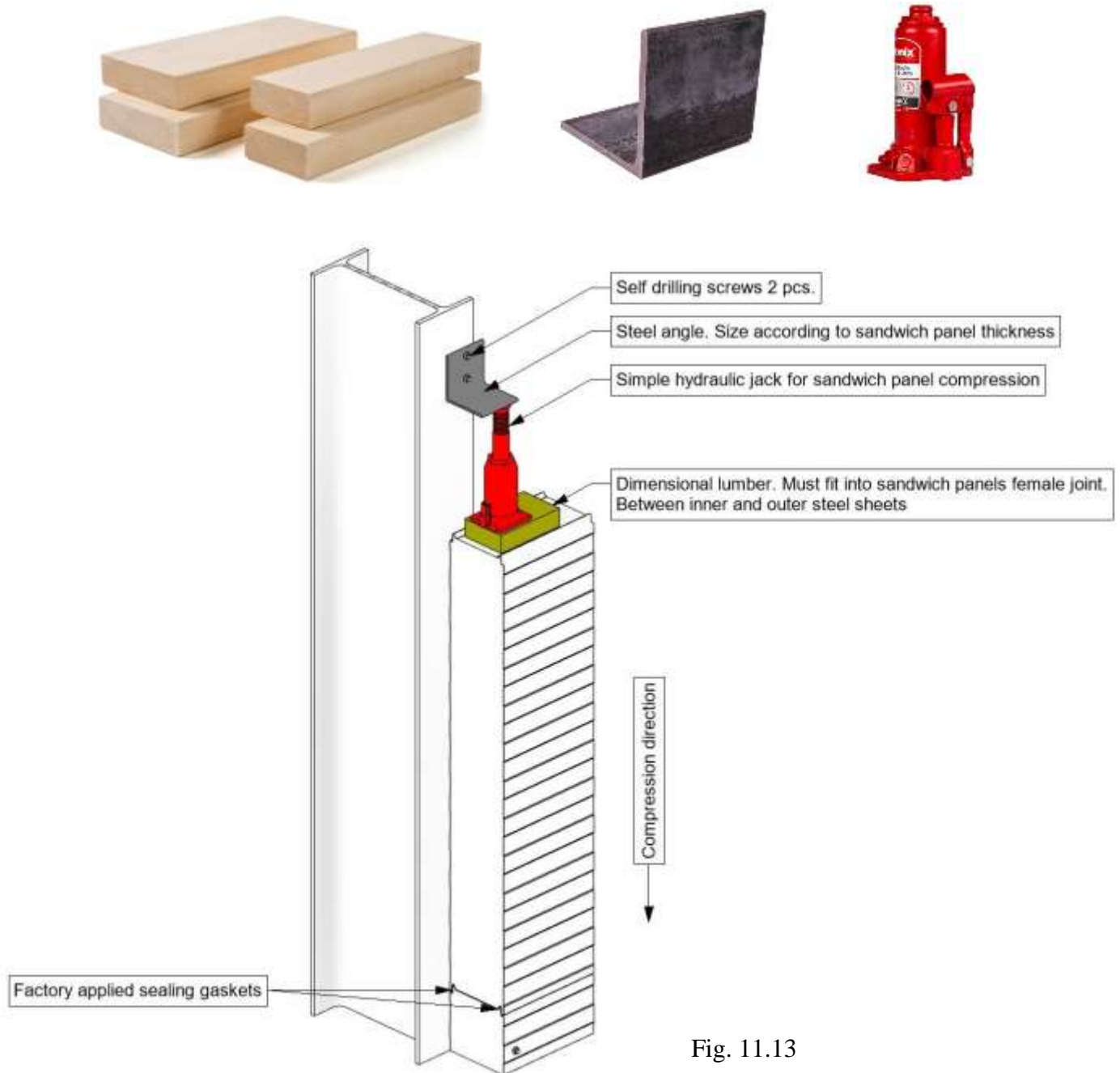


Fig. 11.13

## 11. INSTALLATION

### 11.14 Thermally induced sandwich panel bowing.

Thermally-induced variation in length can cause the bowing of the panels during the assembly phase. This makes it more difficult to assemble the panels thus requiring the use of mechanical compression aids where necessary.

### 11.15 Installation of roof sandwich panels

Lifting devices are available on the market that can be used with a crane including vacuum pumps and suction plates and mechanical lifting tackle such as lifting clamps. On no account should the panels be lifted with slings on the unprotected corners. The seams will be deformed and damaged. Make sure the attachment points and center of gravity are correctly selected to ensure safe lifting. It is also important that the lifting points are correctly spaced, otherwise, the panel might buckle. Suction cups have rubber plates that protect the paint surface. Suitable protection measures must be adopted when using mechanical devices. Make sure each panel fits precisely in the joint area. It is not possible to adjust the panels after the roof installation has been completed. The incorrect joint formation can lead to large gaps and thus vapour diffusion and condensation due to faulty compression of the factory-installed seals. During the roof installation, it is therefore important to post a specialist installer inside the space to spot any gaps and take action immediately.

### 11.16 Vertical installation of wall sandwich panels

If the panels are installed vertically a suitable substructure of steel, concrete or timber sections must be provided. Care must be required bearing width and the span of the horizontal rails. The rails must be visually inspected to check that they are properly sized and fixed (duty to check and warn). A stable, thermally separated cill detail must be constructed. Care must be taken to ensure the panels fit together exactly so the thermal expansion of the outer facing occurs in the vertical direction. The expansion path for the sheet must be unobstructed and on no account be restricted. The bottom edge of the panel must be terminated neatly. Attention must be given to ensure water can drain freely through the space between the panel and that the outer facing can expand. When panels are installed vertically it is unlikely that water can penetrate the vertical joints, provided any water leaking into the vertical seam is properly channelled to the outside. Where attachments or extensions are required to vertically installed sandwich PIR panels, a one-sided 45° upward cut must be made with a hand-held circular saw to allow for the insertion of a flashing. It should be noted that due to the weakening of the panel, it may be necessary to insert an additional horizontal sheeting rail.

### 11.17 Horizontal installation of wall sandwich panels

If properly organized, this type of installation is essentially quicker. Often this involves spans up to 6.00 m wide, with the panels installed as a continuously supported double-span system. With this type of installation, the full extent of the bimetallic effect or thermal bowing becomes apparent, depending on the colour group of the outer facing. There are constructional measures that must be taken to ensure the panels are properly fixed to the building structure and at the same time enable free movement where necessary. Only narrow windows < 1.20 m wide may be directly inserted in the wall cladding (i.e., without a trimming frame construction). Furthermore, care must be taken to ensure that at the ends of the panels, behind the cover strips, the horizontal joints are sealed with sealant up to the end of the edge of the top hat section cover strip. Experience shows that run-off rainwater and driving rain are sucked into the vertical butt joint behind the cover strip by capillary action. There is either drain away or are absorbed by the mineral wool. This can cause irreparable damage to mineral wool panels. Water then often runs down the inside of the masonry plinth wall and forms puddles.

## 11. PRODUCTION TOLERANCES ACCORDING TO EN 14509

Presented possible deviations of the geometrical dimensions of multilayer panels and determination methods according to the requirements of the standard EN 14509. The mechanical properties of the panels, the flammability classes and the fire resistance classes are given in the declaration of performance together with the product. All results obtained during the measurements are evaluated according to the tolerances of the standard (Table 1).

Table 1. Dimensional tolerances for EN 14509 are allowed.

Dimension	Tolerance allowed
The thickness of the panel when $d \leq 100$ mm	$< \pm 2$ mm
The thickness of the panel when $d > 100$ mm	$< \pm 2$ %
Deviation from flatness, L 400 mm (according to the length of measurement L)	$\leq 1$ mm
Profile height $5 \text{ mm} < h \leq 50$ mm For roof panels	$\leq \pm 1$ mm
Microprofile height	$\leq \pm 30\%$ from $ds^*$
Length of the panel when $L \leq 3000$ mm $L > 3000$ mm	$\leq \pm 5$ mm $\leq \pm 10$ mm
Cover width of the panel	$\leq \pm 2$ mm
Deviation from squareness	$\leq 0,6$ % from nominal cover width**
Deviation from straightness (on length)	$\leq 1,0$ mm/m
Bowing by length	$\leq 20$ mm
Bowing by width (wall sandwich panel)	$\leq 8,5$ mm
Bowing by width (roof sandwich panel)	$\leq 10$ mm
The pitch of the profile when $h \leq 50$ mm	$\leq \pm 2$ mm
The pitch of the profile, when $h > 50$ mm	$\leq \pm 3$ mm
Width of the ribs for roof sandwich panels	$\leq \pm 1$ mm
Width of the valleys for roof sandwich panels	$\leq \pm 2$ mm
Distance between micro profile centers	$\leq \pm 2$ mm

Here: \*  $ds$  – micro profile height specified in the technology card.

\*\* actual measured width.

All measurements shall be made with the sample to be measured on four equal parallel supports placed on a flat horizontal surface. Measurements shall be made following the measurement instructions below.

## 12. PRODUCTION TOLERANCES ACCORDING TO EN 14509

### Thickness of panel

The measured thickness (D) of the panel shall be the nominal distance between the external flat surfaces of the faces excluding from the measurement any trapezoidal profiles or stiffeners and including the thickness of both metal faces (see Figure D.1). These measurements shall be taken at each end of the panel on lines 200 mm from the ends of the panel and at a minimum distance of 100 mm from the longitudinal edge. Two of these measurements shall be at the opposite edges of the panel and one at the center. In the case of panels that have profiled faces, the measurement shall be made at the position of predominant thickness. FPC records shall indicate where, within the geometry of the panel, this measurement is to be made and a consistent measurement location shall be used.

Tolerances:  $D \leq 100 \text{ mm} \pm 2 \text{ mm}$ ,  
 $D > 100 \text{ mm} \pm 2 \%$ .

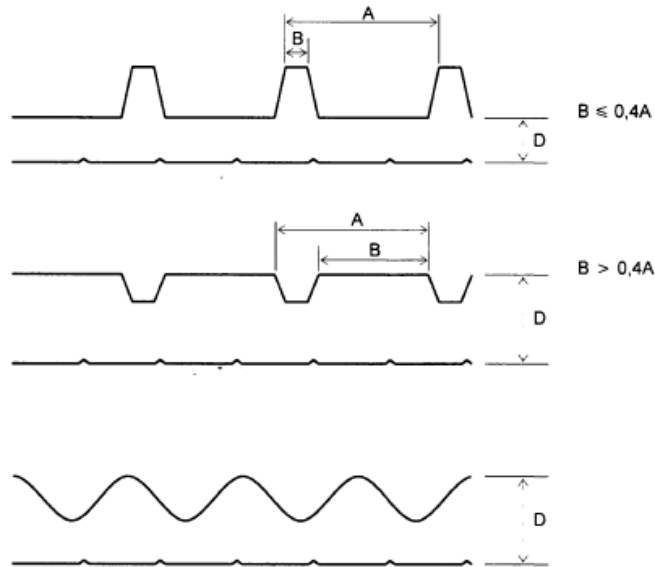


Fig. D.1

### Deviation from flatness

This measurement is only relevant in the case of panels with nominally flat or lightly profiled facings. Deviation from flatness (I) shall be defined as the distance between any point in the surface and the theoretical flat plane as shown in Figure D.2. Flatness shall be measured in both the longitudinal and transverse directions over a minimum distance of  $L = 200 \text{ mm}$ . The location of the measured distance L shall be at least 100 mm from the edge of the panel and 200 mm from the end of the panel. A straight metal bar shall be placed on the surface of the panel and the maximum gap between the bar and the panel measured with a precision gauge.

Tolerance: For  $L = 200 \text{ mm}$   $I = 0,6 \text{ mm}$ ;  
 For  $L = 400 \text{ mm}$   $I = 1,0 \text{ mm}$ ;  
 For  $L > 700 \text{ mm}$   $I = 1,5 \text{ mm}$ .

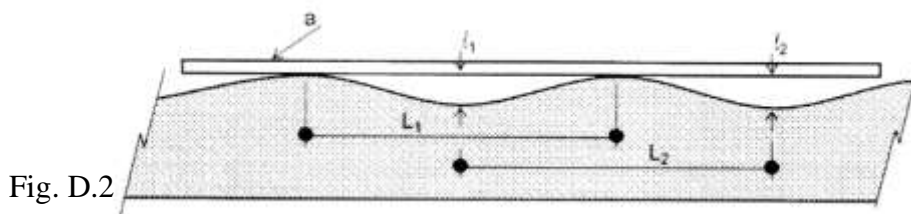


Fig. D.2

Key  
 L measured distance on a flat plane  
 I deviation from flatness  
 a straight metal bar.



## 12. PRODUCTION TOLERANCES ACCORDING TO EN 14509

### Depth of metal profile

The depth of the profile ( $h$ ) shall be the distance between the crown and valley measured on the same side of the sheet (see Figure D.3), at 200 mm from the sheet end. This measurement shall only be taken for panels that have at least one lightly profiled or profiled face.

Tolerances:  $5 \text{ mm} < h \leq 50 \text{ mm} \pm 1 \text{ mm}$ ;  
 $50 \text{ mm} < h \leq 100 \text{ mm} \pm 2,5 \text{ mm}$ .

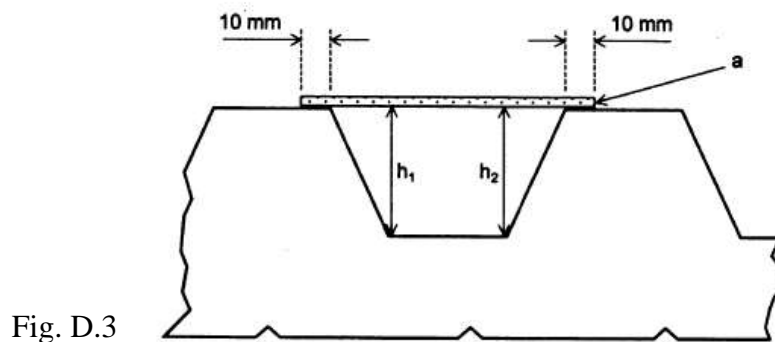


Fig. D.3

Key  
a straight metal bar.

The depth of each valley across the sheet shall be measured using a template or a measuring rule at both sides of the valley (see Figure D.3). The tolerances shall apply to the average value for each valley:

$$h = \frac{h_1 + h_2}{2} \text{ mm}$$

### Depth of stiffeners on lightly profiled facings

The depth of any stiffeners ( $d_s$ , see Figure D.4), on the crown, valley or web, or the depth of light profiling, shall be measured across the sheet on a line at 200 mm from the end using a template or measuring rule and a precision gauge. The average depth obtained in ITT tests shall be the value used for the depth of stiffeners ( $d_s$ ).

Tolerances:  $d_s \leq 1 \text{ mm} \pm 30 \% \text{ of } d_s$ ;  
 $1 \text{ mm} < d_s \leq 3 \text{ mm} \pm 0,3 \text{ mm}$ ;  
 $3 \text{ mm} < d_s \leq 5 \text{ mm} \pm 10 \% \text{ of } d_s$ .



Fig. D.4

Where flat-faced panel properties are used as the basis of design for mechanical resistance, the tolerance of the stiffeners or light profiling need not be considered.

### Length

The length ( $L$ ) shall be measured along the center axis of the panel (see Figure D.5) with the panel continuously supported on a flat surface. The panel length shall be verified at least once during each shift (6 h or 8 h). If the length of the foam is different from the length of the steel sheet, the tolerance shall be based on the length of the metal sheet. A separate tolerance shall be applied to the overlap.

Tolerances:  $L \leq 3\,000 \text{ mm} \pm 5 \text{ mm}$ ;  
 $L > 3\,000 \text{ mm} \pm 10 \text{ mm}$ .

## 12. PRODUCTION TOLERANCES ACCORDING TO EN 14509

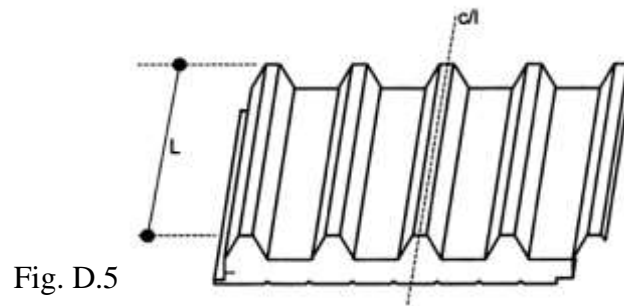


Fig. D.5

Key  
c/l center line of the panel

### Cover width

The cover width,  $w$ , shall be stated by the manufacturer. For profiled panels with a side lap, the cover width is the distance between the center lines of the two outer profiles as shown in Figure D.6.

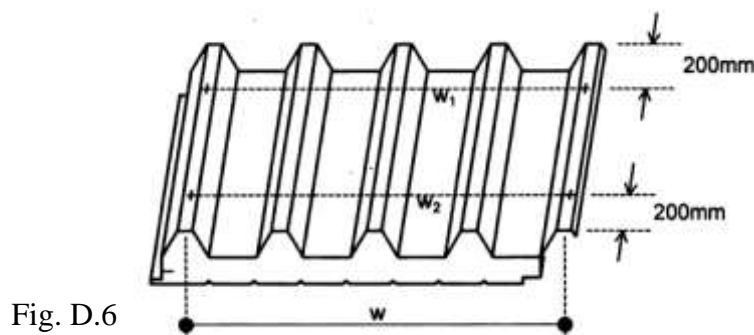


Fig. D.6

Measurements of cover width  $w_1$  and  $w_2$  shall be taken at a distance of 200 mm from the panel ends (see Figure D.6). Both measurements shall be within the specified tolerance. A third measurement of  $w_3$  of cover width shall be made across the center line of the sheet to determine the contraction or bulging of the panel. This  $w_3$  measurement shall be within the stated tolerance referred to as the average value for  $w_1$  and  $w_2$ :

$$w_3 = \frac{w_1 + w_2}{2}$$

Tolerances:  $\pm 2$  mm for all profiles.

For flat panels or panels with a male and female joint, the cover width is the distance between visible panel edges. The manufacturer shall clearly define the measurement points and the same points shall be used every time a measurement is made (see examples in Figure D.7).

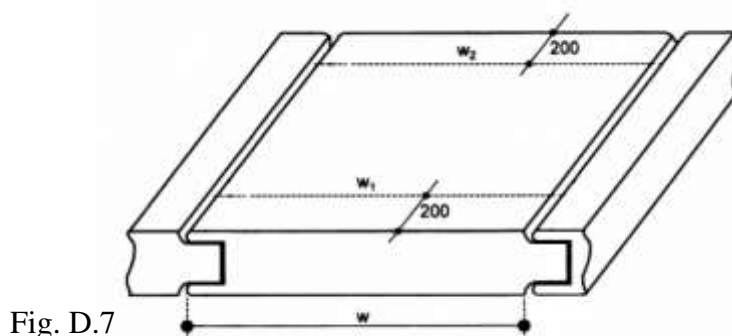


Fig. D.7

## 12. PRODUCTION TOLERANCES ACCORDING TO EN 14509

### Deviation from squareness

The deviation from the squareness of the profiled sheet end is defined as the dimensions in Figure D.8.

Tolerance:  $s \leq 0,6 \%$  of the nominal cover width  $w$ .

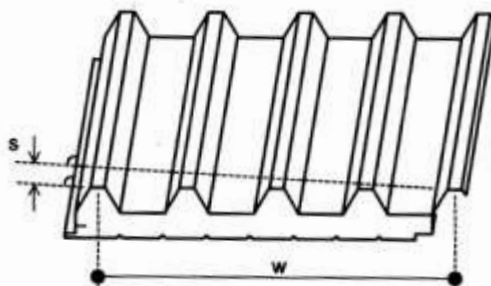


Fig. D.8

The measurement is performed with an angle of at least 1 m. The angle is placed across the sample at a freely chosen distance from the end of the plate or by aligning one of its ends with the rear edge of the sample, its handle being aligned or evenly aligned with the side edge of the sample. The distances at the edges from both corners of the sample to the corner to the corner are then measured. The difference between these distances is considered to be the deviation from the squareness of the angles.

### Deviation from straightness

The deviation of straightness from the theoretical straight line is defined as the dimension  $\delta$  in Figure D.9. The straightness of a panel shall be measured from a thin steel wire tightly stretched between two points on the same edge at 200 mm from each end of the panel. The measurement shall be made at the center of the panel.

Tolerance: 1,0 mm/m, not exceeding 5 mm.

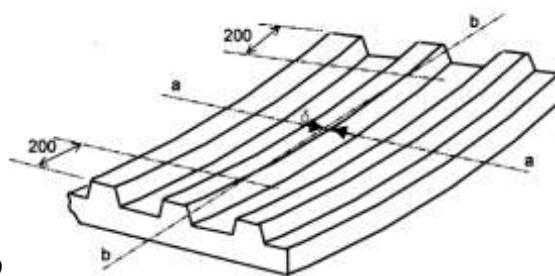


Fig. D.9

### Length bowing

The measurement is performed with a brightly coloured wire not thinner than 0.45 mm thick. The line shall be stretched along the center line of the specimen and pressed 200 mm from the end of the specimen on both sides. Length is the dimension obtained by measuring the distance from the net to the surface of the sample at the midpoint of the line in Figure D.10.

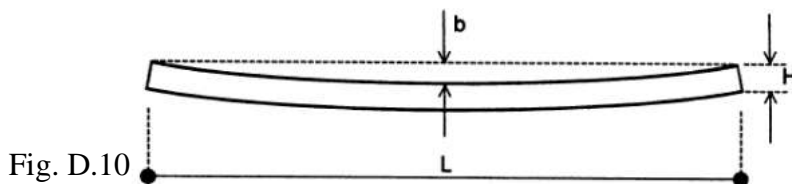


Fig. D.10

## 12. PRODUCTION TOLERANCES ACCORDING TO EN 14509

### Width bowing

The measurement is performed with a brightly coloured wire not thinner than 0.45 mm thick. The line is extended across the sample 200 mm from the end and pressed against the edges of the sample. The distance from the clean to the surface of the sample at the midpoint of the line is measured. The resulting dimension is considered to be curved in width in Figure D.10.

### Pitch of profile

The pitch  $p$  of the profile (see Figure D.11) shall be the distance between the centers of adjacent ribs, measured at 200 mm from the sheet ends.

Tolerances: where  $h \leq 50 \text{ mm} \pm 2 \text{ mm}$ ;  
 $h > 50 \text{ mm} \pm 3 \text{ mm}$ .

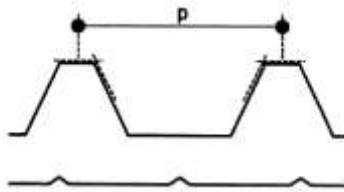


Fig. D.11

### Widths of rib and valley

The widths of a rib ( $b_1$ ) and valley ( $b_2$ ) (see Figure D.12) shall be measured at 200 mm from the sheet ends. The widths of ribs and valleys shall be measured on a line across the sheet using a template.

Tolerances: ribs  $\pm 1 \text{ mm}$ ,  
 valleys  $\pm 2 \text{ mm}$ .

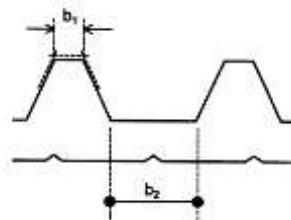


Fig. D.12

## 13. REPLACING PANELS. HORIZONTAL INSTALLATION

If a sandwich panel is significantly damaged and it may decrease its functional properties, i.e., mechanical durability, fire resistance, environmental resistance, or thermal insulation (for example, unacceptably large curve, steel sheet deformation, surface coating damage covering a large area, etc.), the damaged sandwich panel must be replaced with a new one. The following procedure for the replacement of a damaged horizontal wall sandwich panel (let's assume that sandwich panel 2 is damaged) may be applied (Figure 13.1):

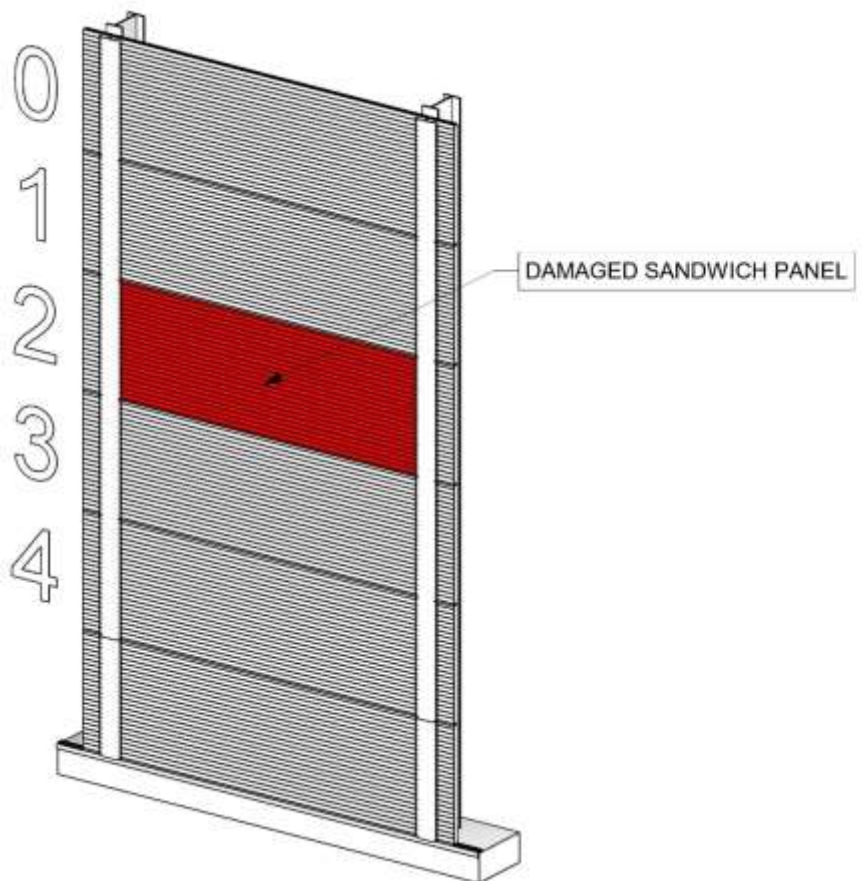


Fig. 13.1

### 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 1. Unscrew flashings that are covering panels 0, 1, 2, 3 and 4 (Figure 13.2).

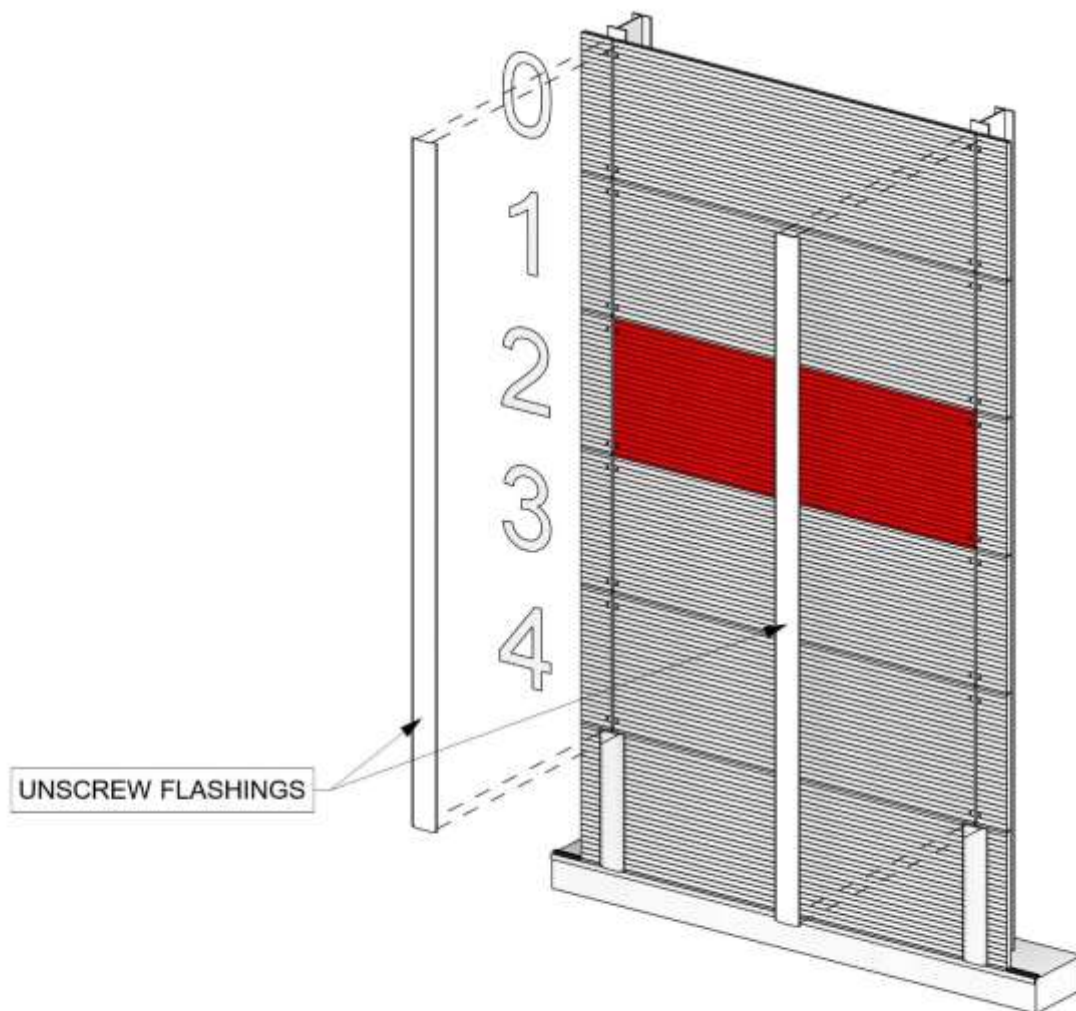


Fig. 13.2

### 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 2. Screw in additional fixation screws in panels 0 and 4.

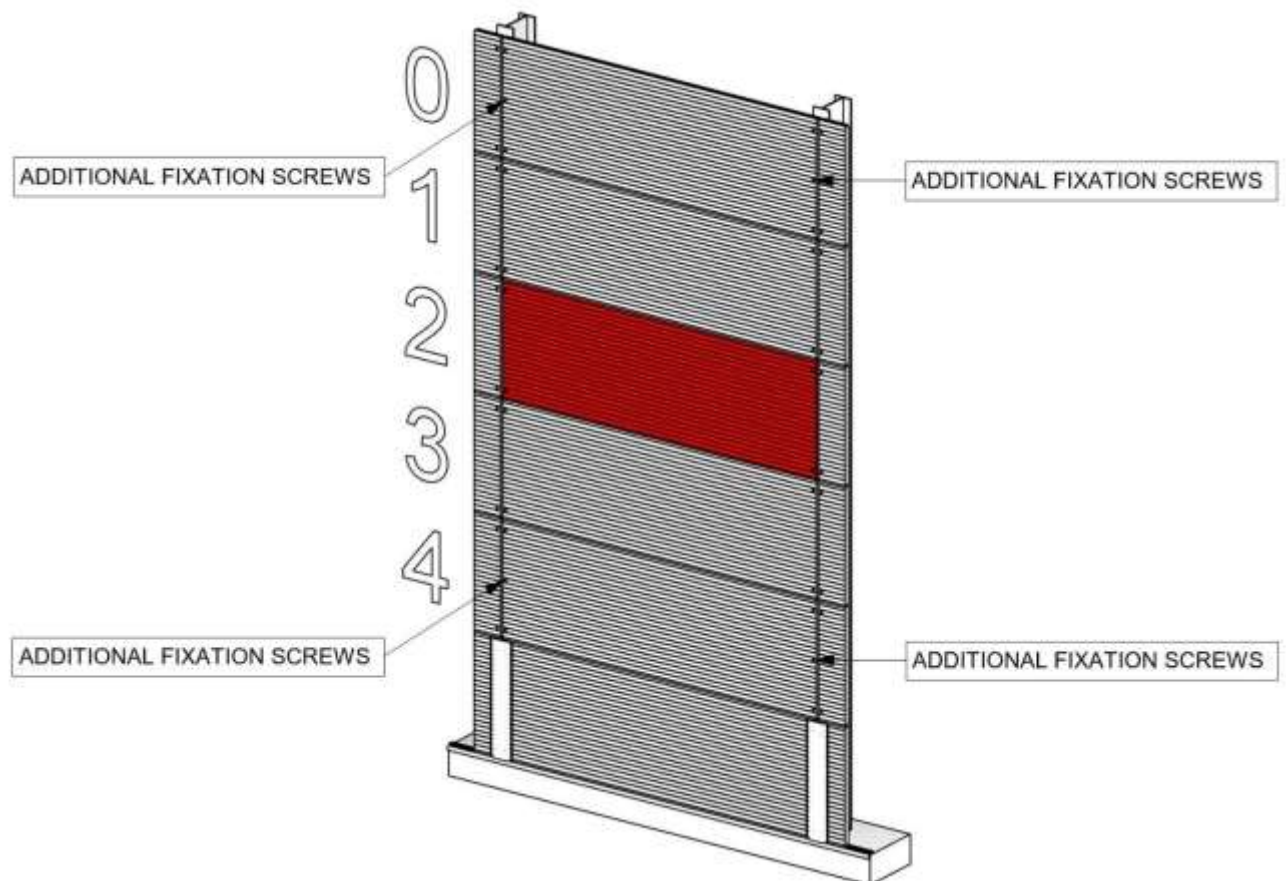


Fig. 13.3



## 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 3. Connect panels 0 and 1, 3 and 4 with sheet steel in both corners at the far end (Figure 13.4). Choose binding points in a way that eventually it is possible to cover them with flashings. The maximum permissible load per screw is 25 kg.

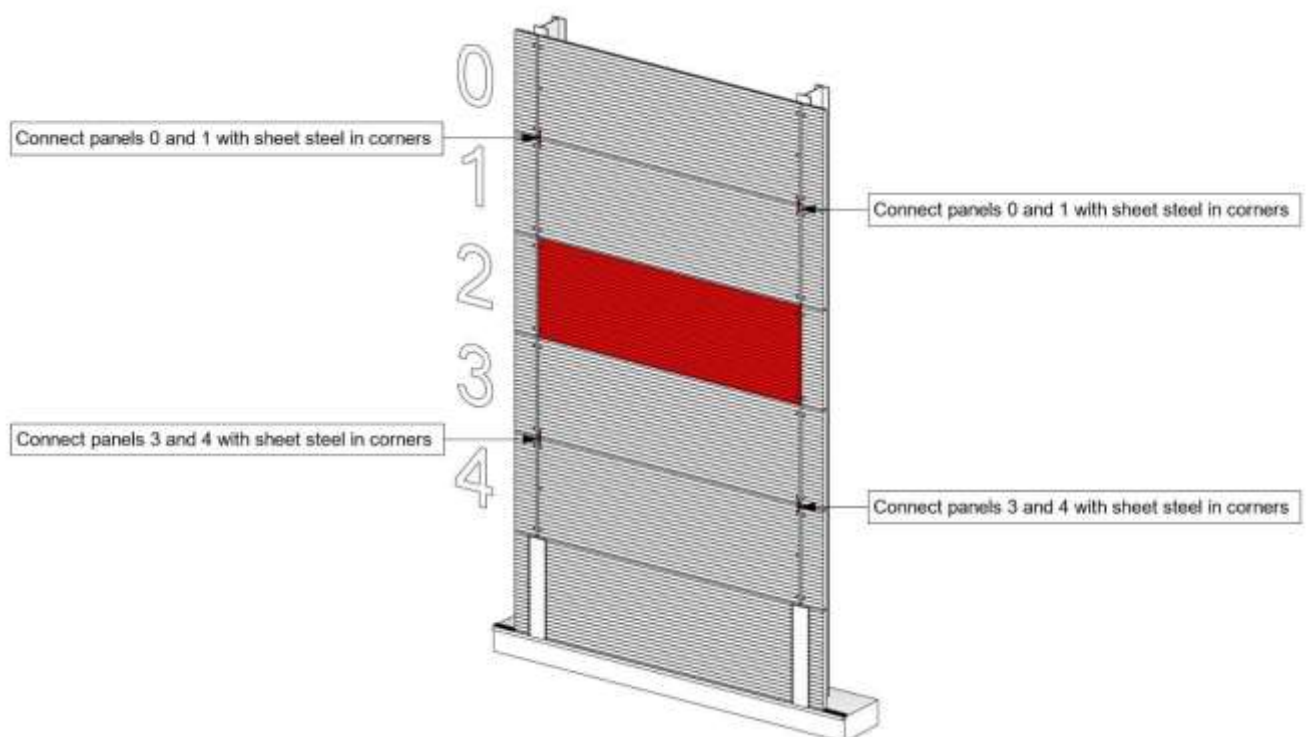


Fig. 13.4



### 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 4. Remove the lower fixation screws from panel 2. After removing the screws, panel 2 is only holding on to panel 1.

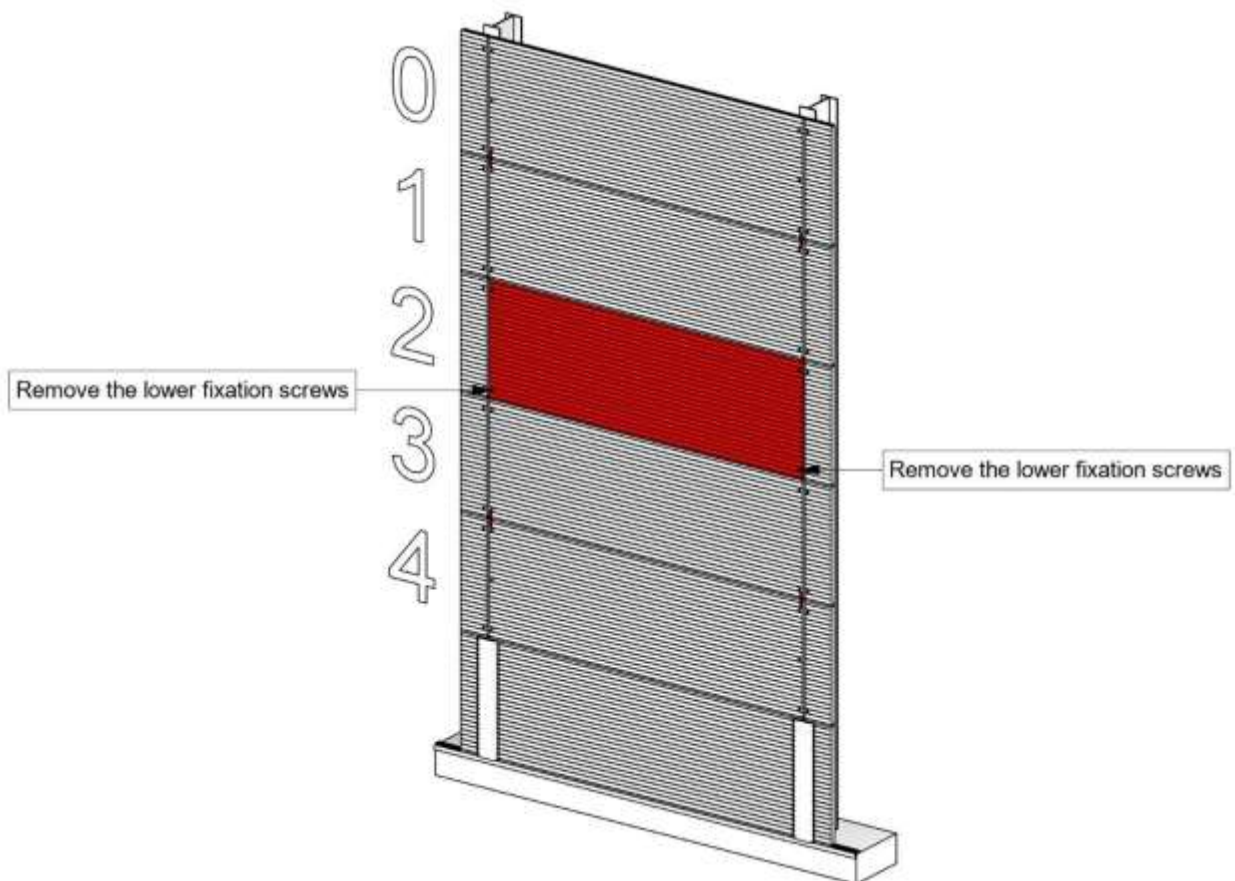


Fig. 13.5

## 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 5. Fix safety ties or stopper profiles (Figure 13.6) at both ends of panel 3 to make sure that when panel 2 is removed, the inner surface of panel 3 would be around 5 cm away from the wall surface. Length of the tie or profile = panel width + 15 cm. Remove fixation screws from panel 3 and panel 1.

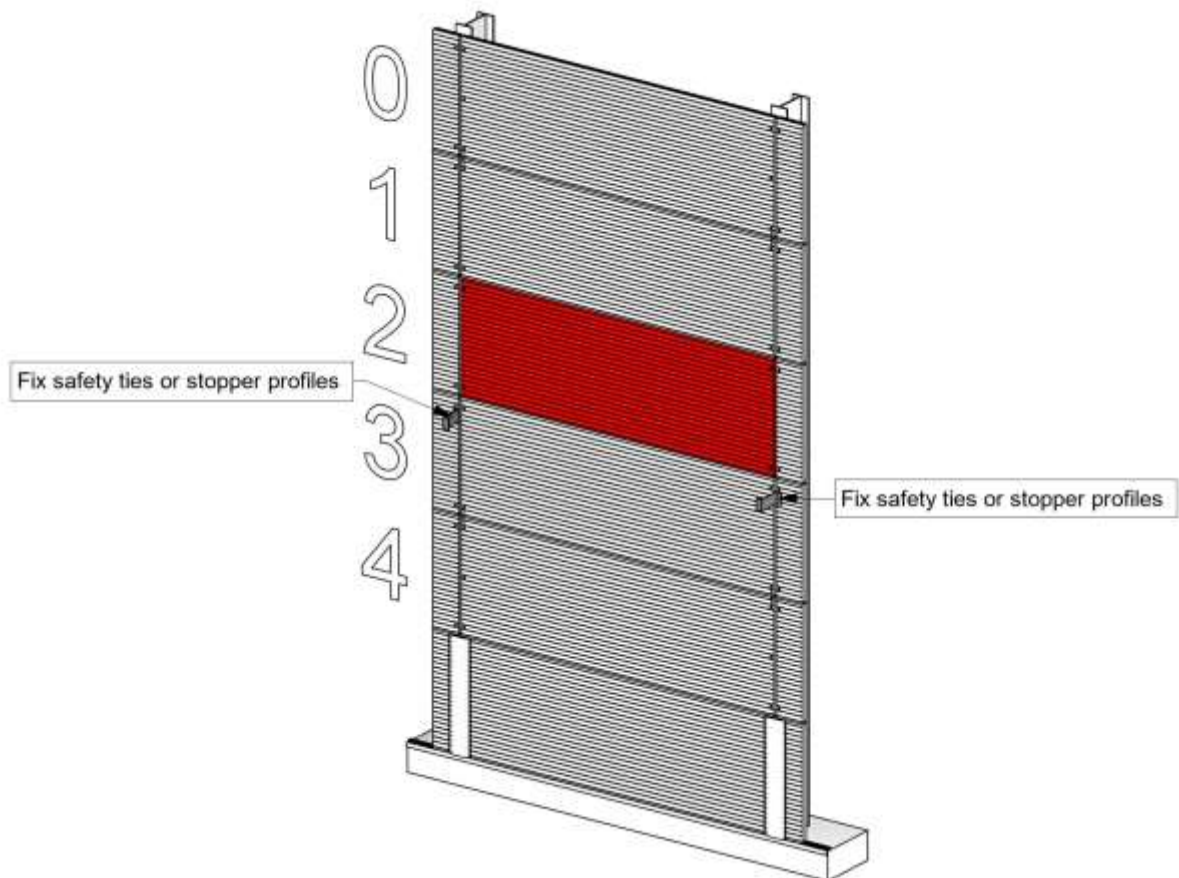


Fig. 13.6

## 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 6. Remove the upper fixation screws from panel 2 (Figure 13.7) and pull the panel outwards (Figure 13.8). Fix the special gripping mechanism to panel 2 and remove it.

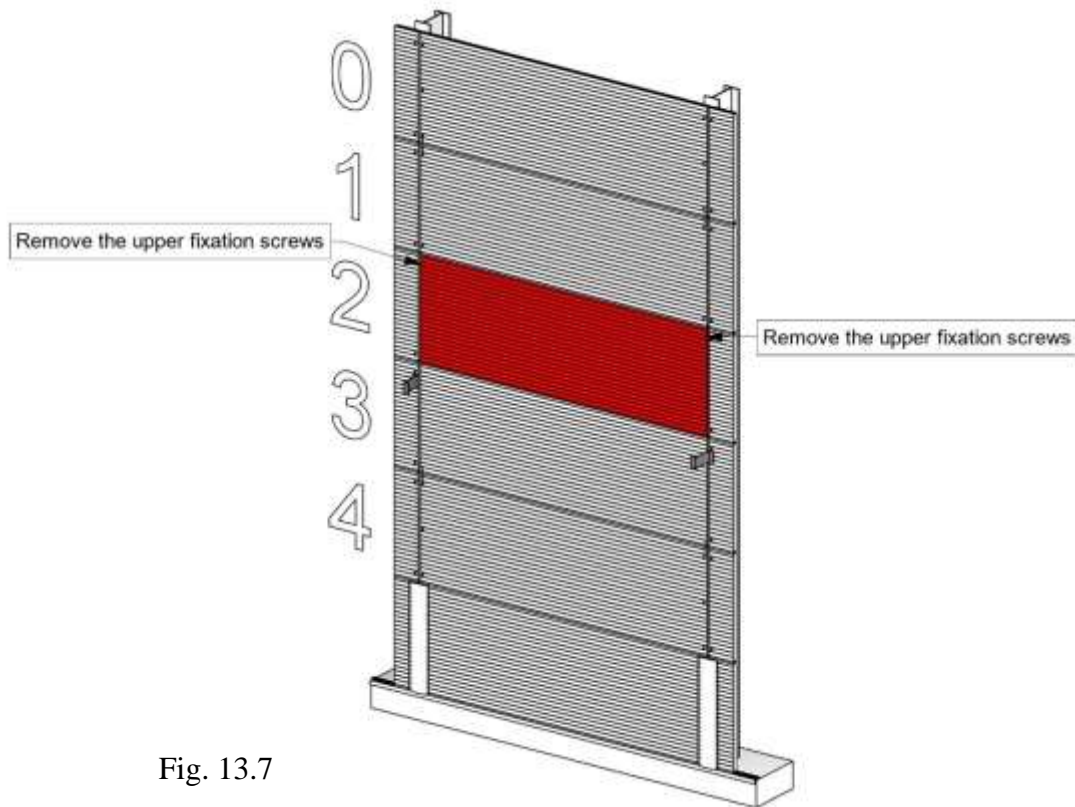


Fig. 13.7

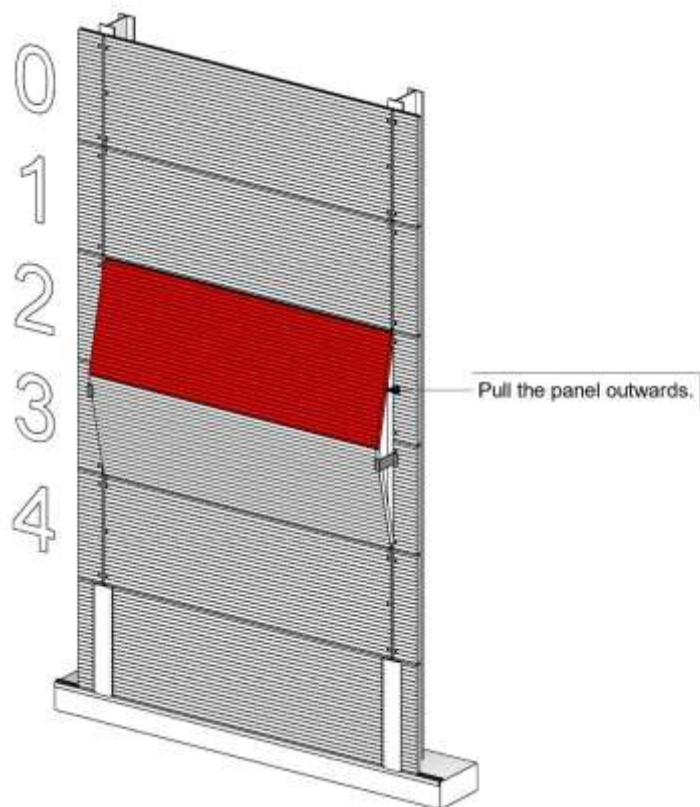


Fig. 13.8

## 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 7. Fix the gripping mechanism to the new panel. Check sealing tapes if any are required.

STEP 8. Place the new panel on the male lock of the tilted panel 3.

STEP 9. Join panels 3 and the new one by connecting the female lock of a new panel to the male lock of panel 3.

STEP 10. Take off the gripping mechanism from the new panel.

STEP 11. Press the panel onto the column and check whether they are connected correctly (the panel must fit well onto the column) (Figure 13.9).

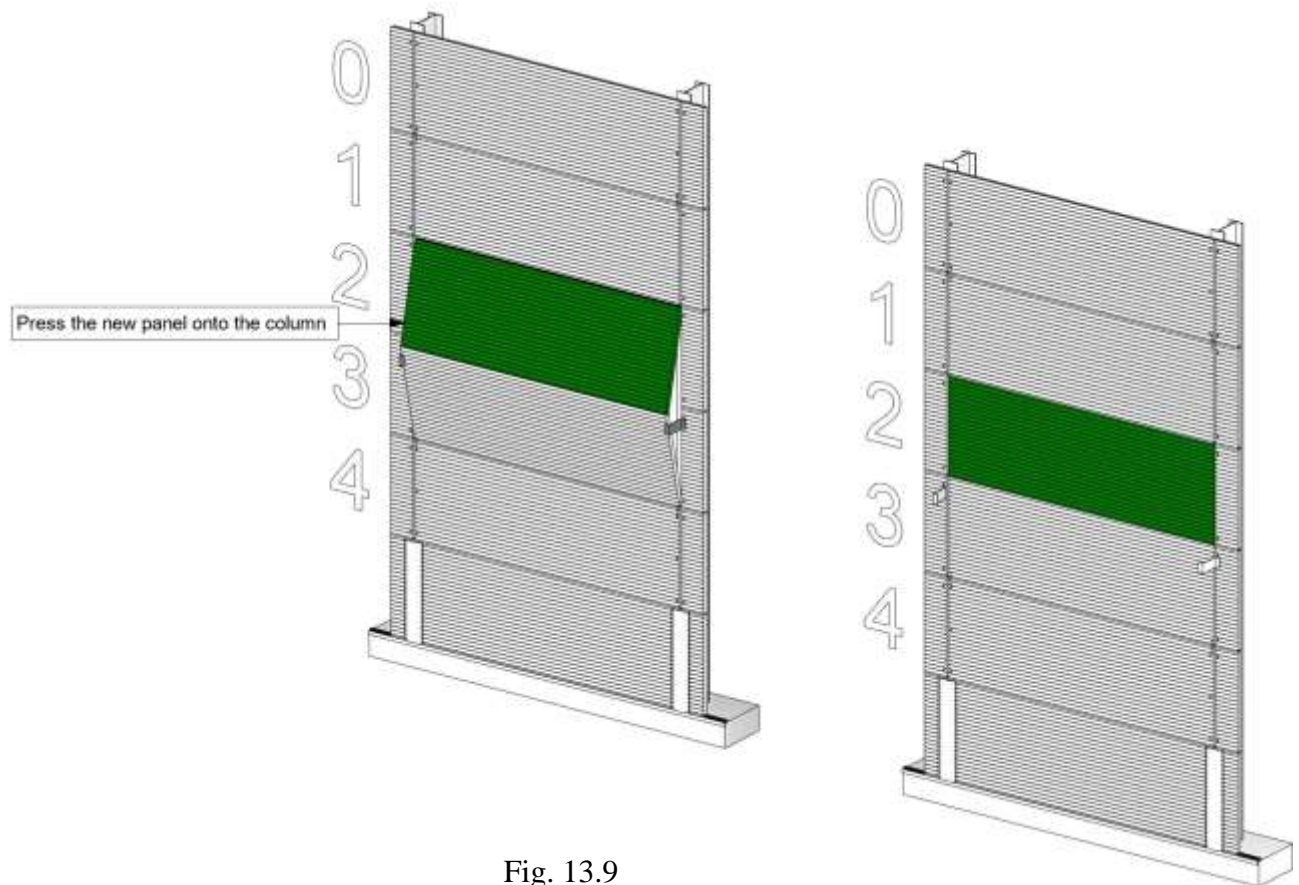


Fig. 13.9

STEP 12. Fix panels onto the columns with new screws. Remove all safety fastenings (steel sheets, safety ties or stopper profiles).

### 13. REPLACING PANELS. HORIZONTAL INSTALLATION

STEP 13. Screw back all the flashings (Figure 13.10).

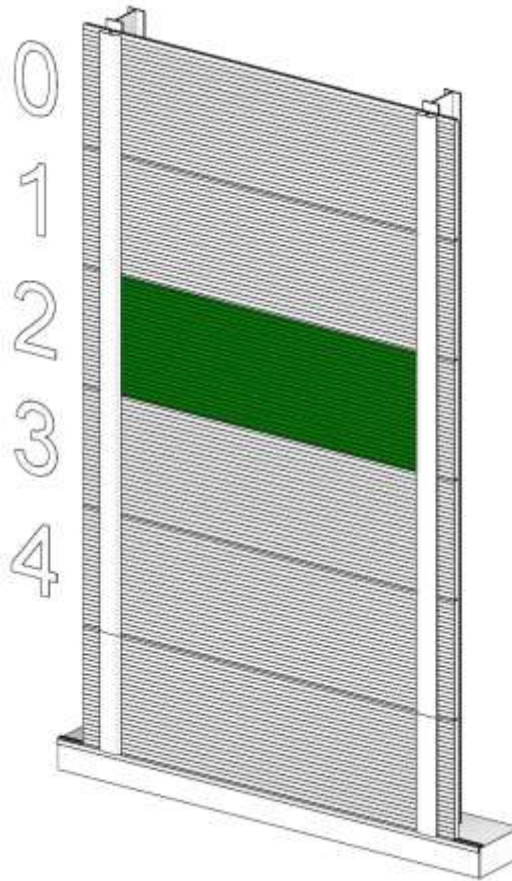


Fig. 13.10

## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

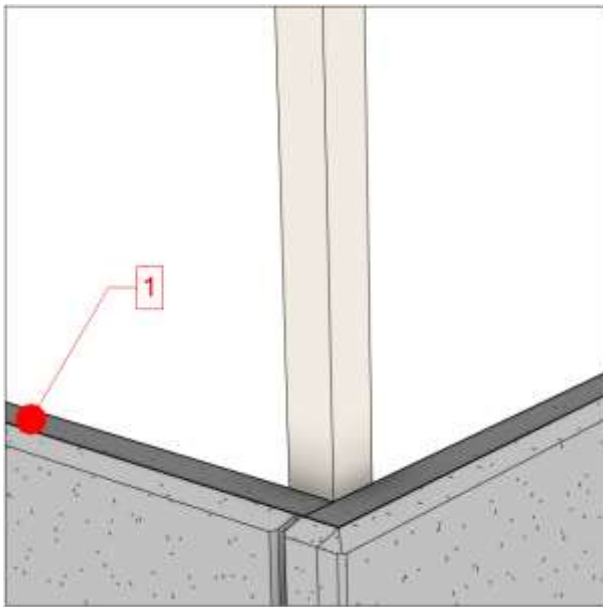
The installation must be carried out according to the building project. Installation begins at the bottom and proceeds upwards with the tongue of the panel facing up.

**WARNING:** Always remember work safety and wear protective gear during the installation!

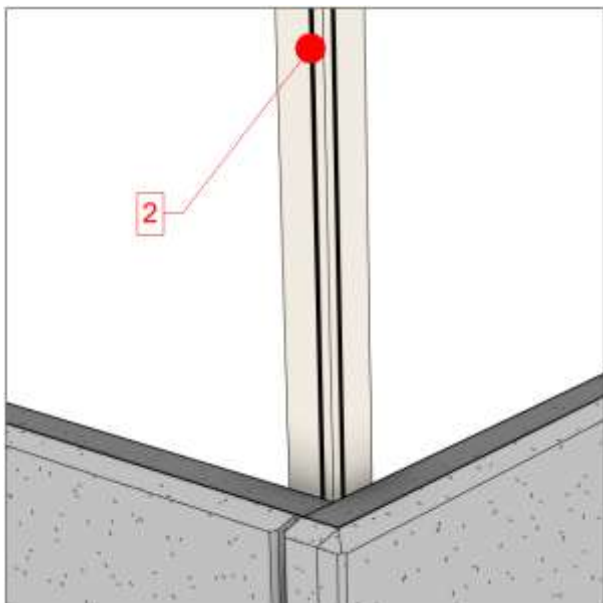
If you do not complete the installation from start to finish, then make sure that any exposed wool surfaces are appropriately protected against the weather. The factory-applied protective film on the upper joint of the PIR panels ensures that the exposed top surface of the panel is automatically protected against rain. Cut edges of the elements (e.g., window or door openings) should be sealed carefully.

Before installation begins, always check the straightness of the installation surfaces. Install the plinth sealing and the sealing strip (PE 3x10 mm) between the columns and the panels. The sealing strip is installed on the face of the columns inside the line of fasteners as per the detailed drawings and plans. This way, the holes for the fasteners can be made vapour-tight without any extra work.

### STEP 1. Plinth sealing



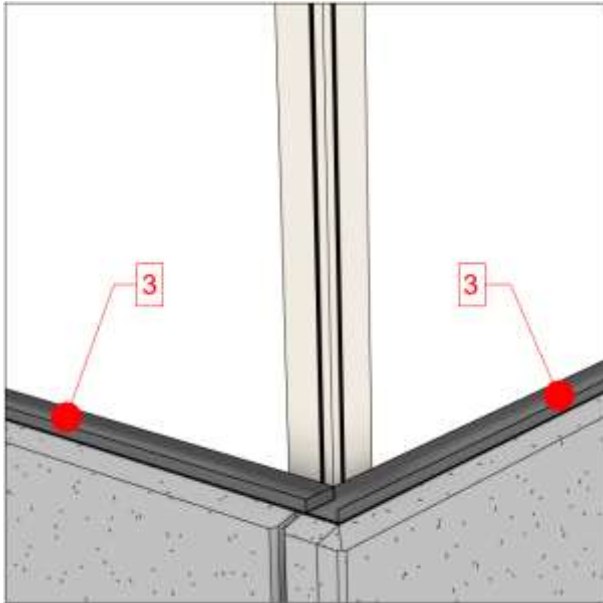
### STEP 2. Self-adhesive sealing tape PE 10x3



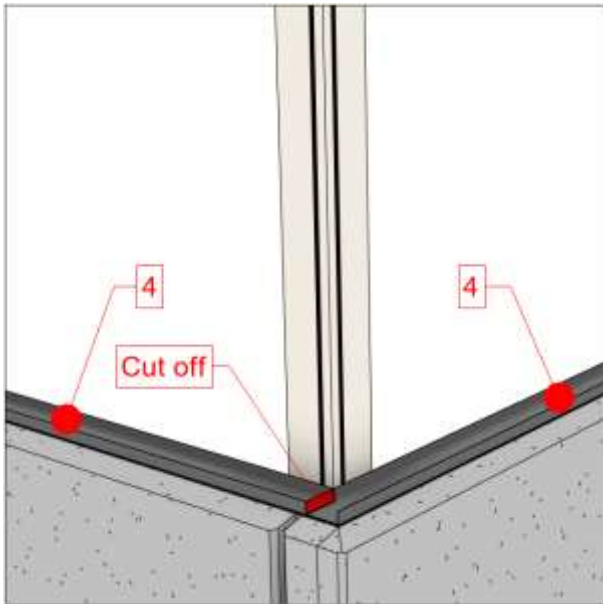


## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

STEP 3. Starting profile [Thermo profile]



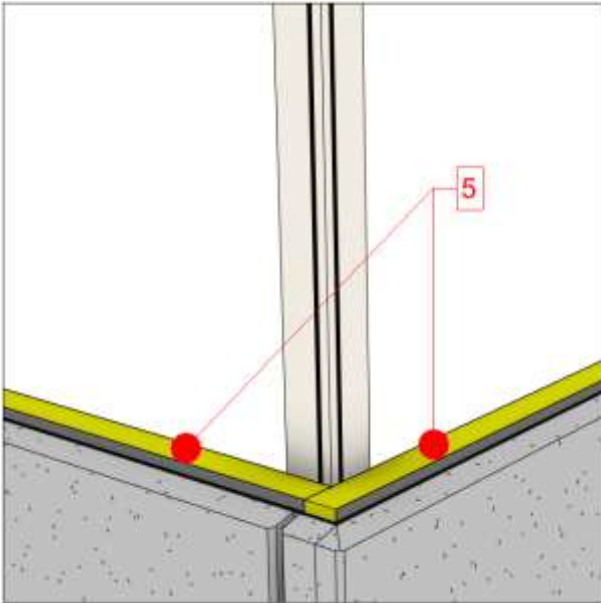
STEP 4. Fastener (fastening as per project)



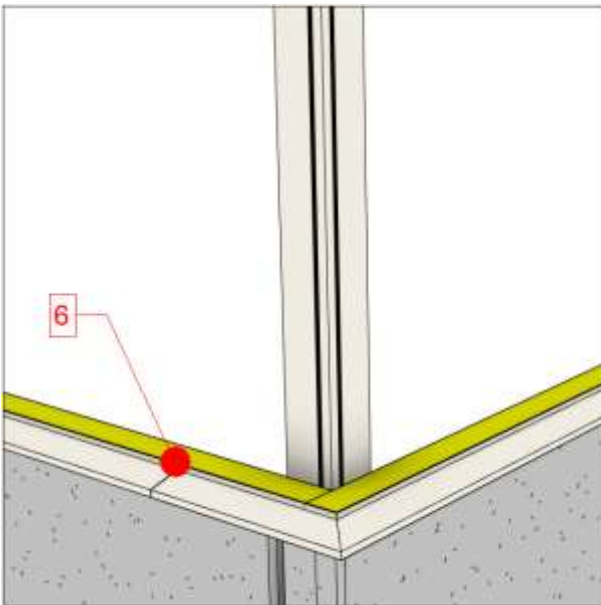
Install the insulating wool inside the starting profile. Place the plinth flashing in the starting profile as shown in the detailed drawing. Fasten if required. The order in which the flashings are installed depends on the flashing type. Overlap and apply sealant mastic into the plinth flashing lengths on a length of approximately 100 mm. Make a vertical joint in the plinth flashing in the outer and inner corners.

## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

STEP 5. Insulating wool



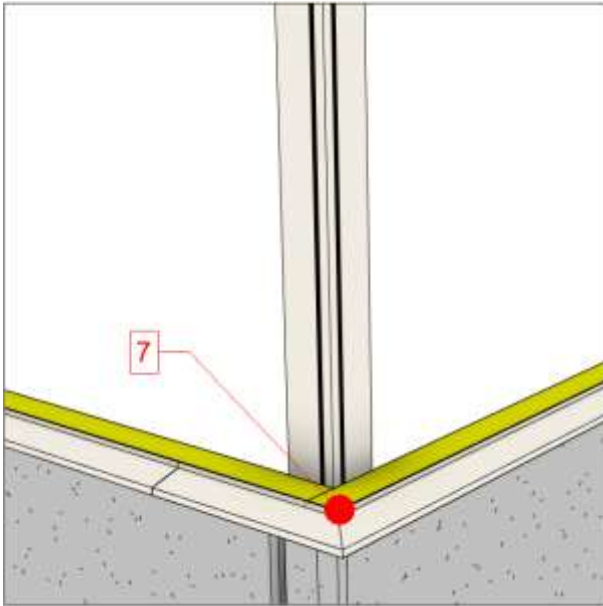
STEP 6. Plinth flashing overlap (100 mm)





## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

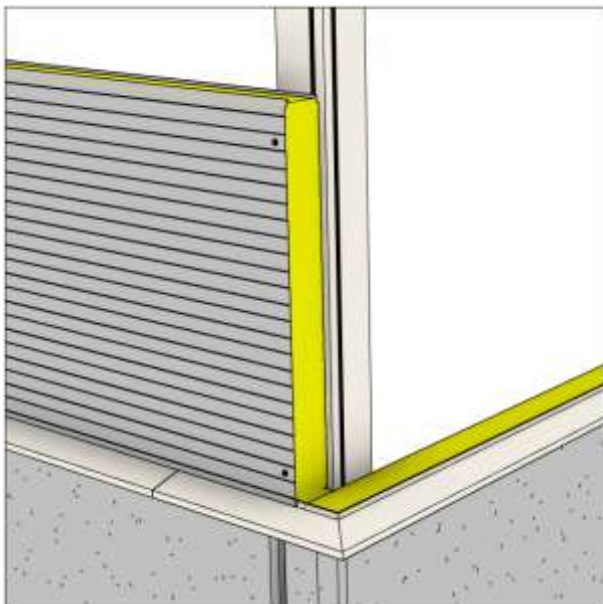
STEP 7. A vertical joint in the inner and outer corner



Fasten the panel lifting tool or tools on the top panel in the package. Follow the instructions for use and the safety instructions provided with the lifting tool. Use a safety strap around the panel to be lifted.

Raise the panel into an upright position and take care not to scratch the surface of the lower panel in the package. Remove any protective films from the panel, either from the edge portions or entirely.

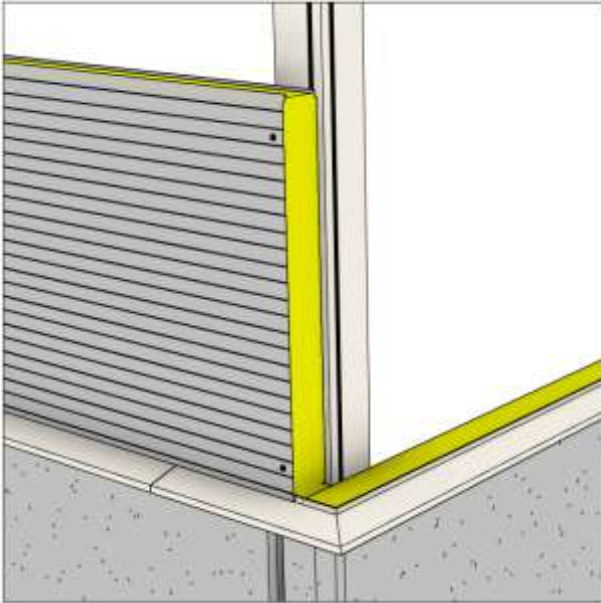
Remove the safety strap before positioning the panel. Install the panel on the starting profile and fasten it to the frame columns as shown in the detailed drawing. Make sure that the distance of the fasteners from the edge is maintained. The fasteners must be placed at a minimum distance of 30 mm from the panel end. Do not over-tighten the fasteners, as this would cause dents in the panel surface under the fastener. It would also impair the load-bearing capacity of the fastening. Over-tightening can be avoided by using a depth limiter or a torque screwdriver.



**WARNING:** During installation, make sure that the panel joint sealing tape installed at the factory is in its place!

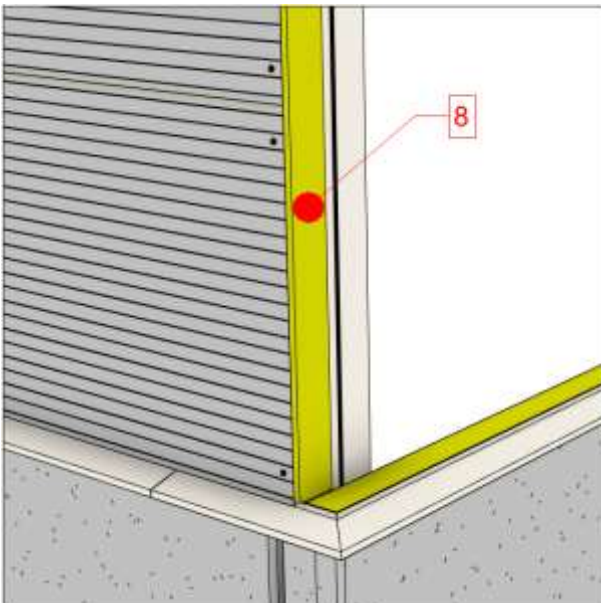
## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

After the installation of the first panel, check that the panel is level. Install the other panels following the installation order from the bottom upwards, one span at a time.



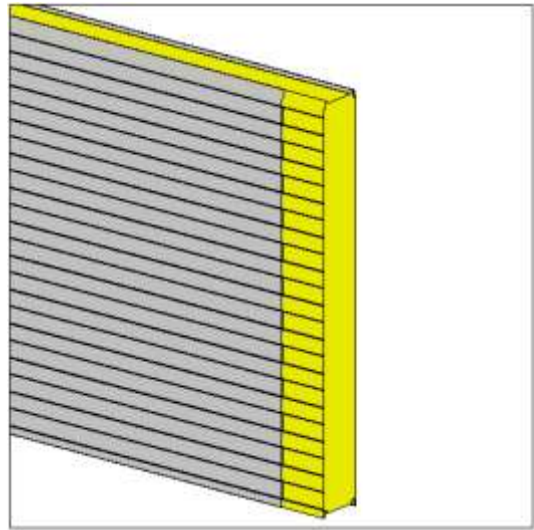
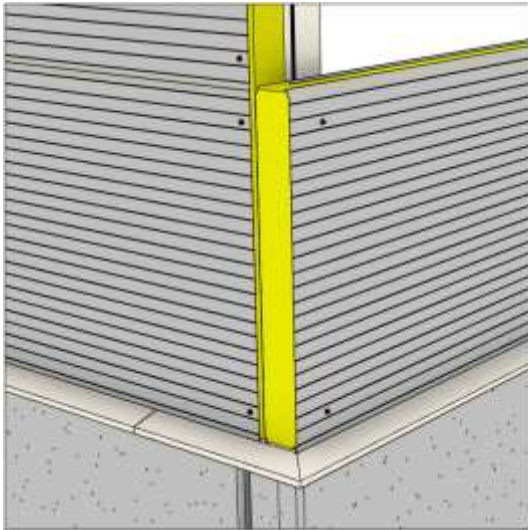
Once you have completed one span, install insulating wool at the panel ends before installing the panels in the next span (for mineral wool panels). This makes it easy to seal the wool at the joints with the panels of the next span or, in a corner, with the adjoining panel. Apply insulating wool into all corners and vertical joints between the panels.

STEP 8. Insulating wool (for MW panels)



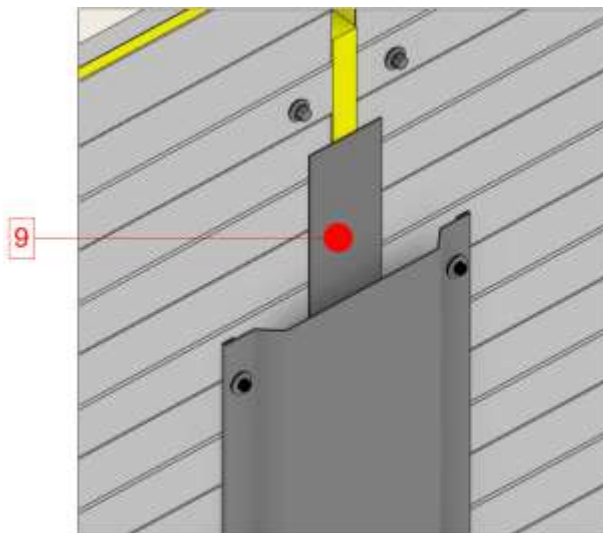
## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

Cut off sheet metal from other of the panels to be installed in the corner so that the cut-off portion corresponds to the thickness of the adjoining panel. This prevents cold-bridging in the corner structure.



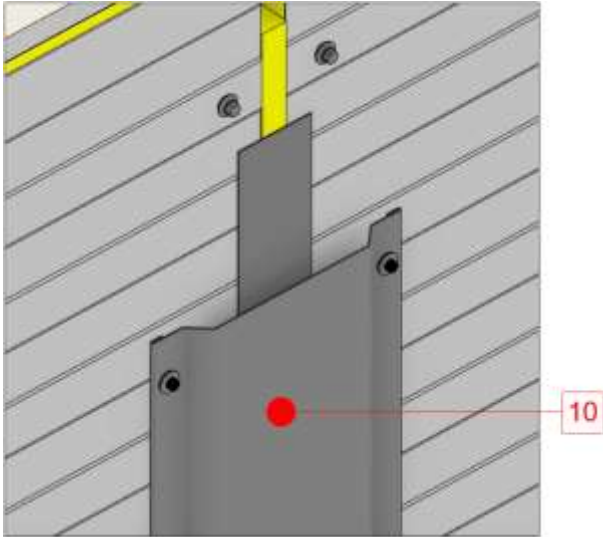
Protect the vertical seams against the weather immediately with self-adhesive sealing tape. Fold the top edge of the sealing tape at the eave on top of the panel seam to prevent rainwater from entering the vertical seam between the panels. Use wider tape for outer corners. Ensure that the sheet metal face of the panel is dry and clean before applying the tape, and apply the tape by pressing it carefully throughout. If necessary, use a roller or a trowel to press the tape to ensure that the tape is applied adequately. Apply sealing strips to the vertical flashing before installing the flashings if necessary. The flashings are installed with 300 mm spacing unless otherwise indicated in drawings. When using a fastening plate, remember to lock the fastening plate into the sheet metal face of the panel and always fasten the panels above openings with through-fasteners.

### STEP 9. Self-adhesive sealing tape



## 14. EXTERNAL WALL. HORIZONTAL INSTALLATION

### STEP 10. Vertical flashing



### Finishing the installation

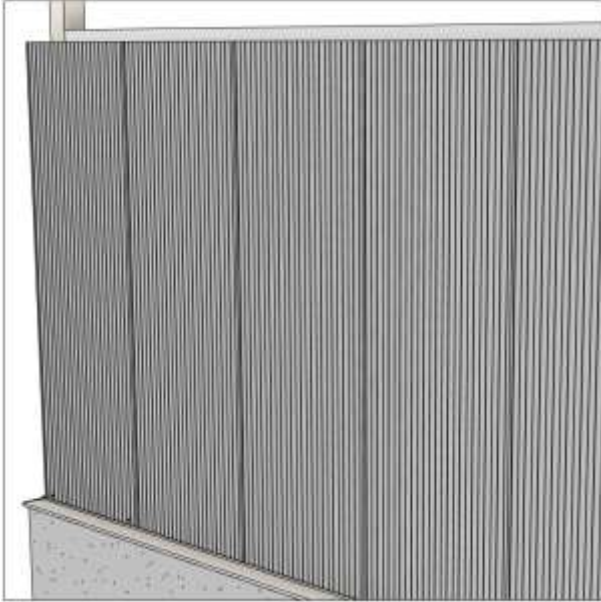
Remove the protective films right after the installation or at the latest once the wall is completed. The protective films protect the surface of the panels against scratching and contamination during construction. The protective films will be more difficult to remove if they are left on the panel for a long time.

## 15. EXTERNAL WALL. VERTICAL INSTALLATION

The installation must be carried out according to the project. Begin the installation so that the tongue of the panel is facing in the direction of installation.

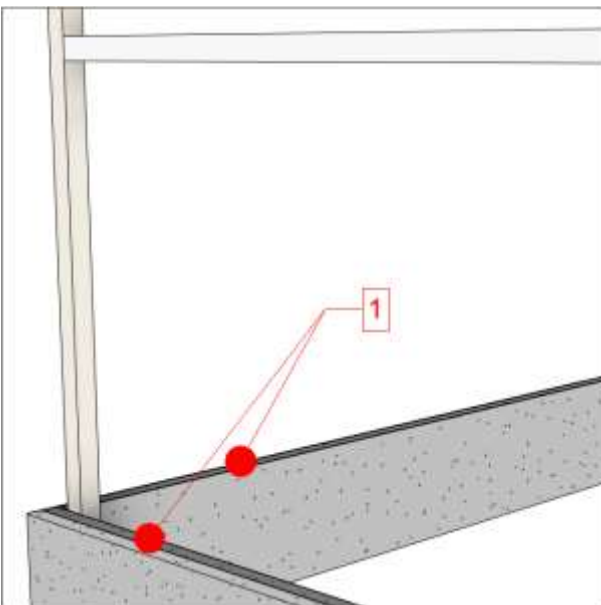
**WARNING:** Always remember work safety and wear protective gear during the installation!

If you do not complete the installation, the exposed wool surfaces of the panels, both those that have already been installed and those remaining in the package, must be appropriately protected against the weather.



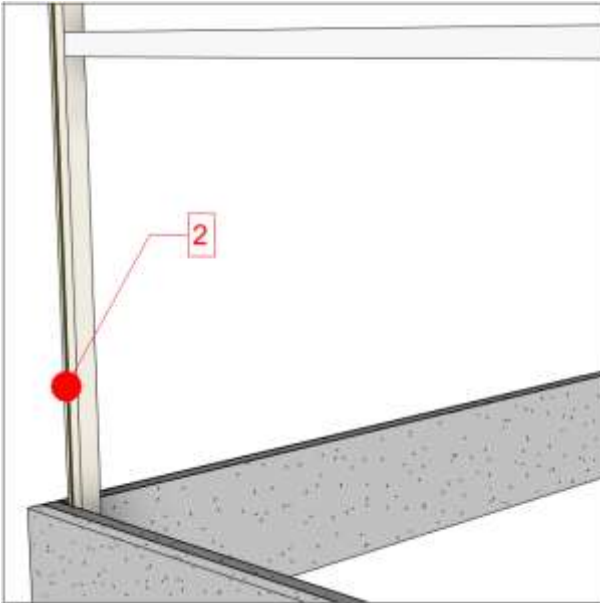
Before installation begins, always check the straightness of the installation surfaces. Install the plinth sealing and the sealing strip (PE 3x10 mm) between the frame and the panels. The sealing strip is installed on the face of the columns and the plinth purlin inside of the line of fasteners as per the detailed drawings and plans. This way, the holes for the fasteners can be made vapour-tight without any extra work.

### STEP 1. Plinth sealing

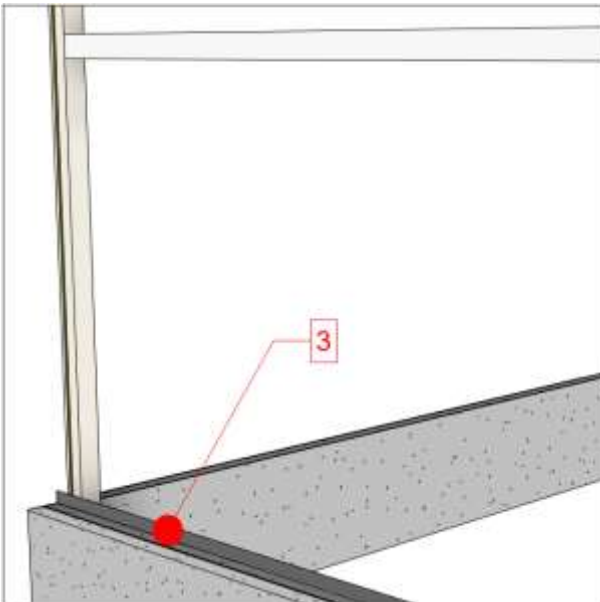


## 15. EXTERNAL WALL. VERTICAL INSTALLATION

STEP 2. Self-adhesive sealing tape PE 10x3



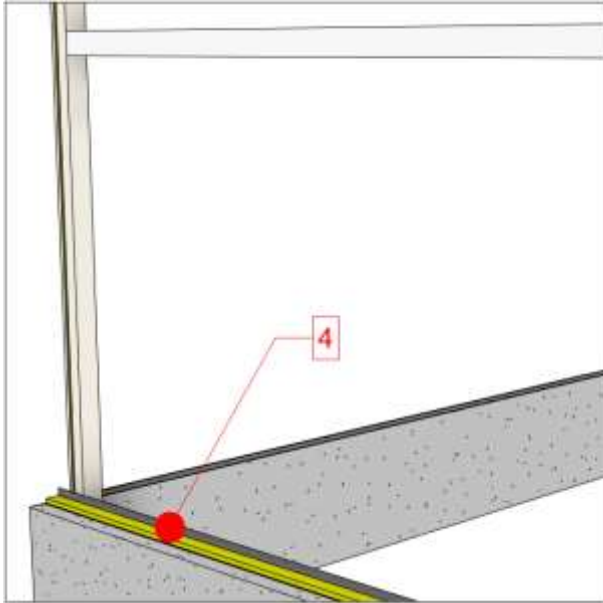
STEP 3. Plinth purlin [fastening with a spacing of 600 mm]



## 15. EXTERNAL WALL. VERTICAL INSTALLATION

Insulating wool must be installed in the plinth purlin to ensure the tightness and thermal insulation of the external wall.

### STEP 4. Insulating wool

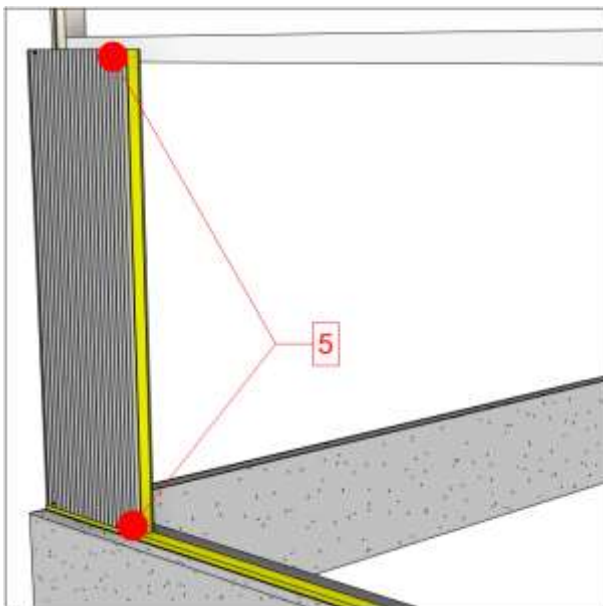


### STEP 5. Vertical sandwich panel installation

Check that panel grooves are provided with joint seals. Fasten the panel lifting tool or tools on the topmost panel in the package. Follow the instructions for use and the safety instructions provided with the lifting tool. Use a safety strap around the panel to be lifted and, if required, use the boom during the lifting operation. Raise the panel into an upright position and take care not to scratch the surface of the lower panel in the package. Remove any protective films from the panel, either from the edge portions or entirely.

Begin the installation of the first panel with the tongue facing in the direction of the installation. Lift the panel in place with the lifting tool. Always read the instructions for use and the safety instructions of the panel lifting tool thoroughly before starting installation.

Remove the safety strap before positioning the lower end of the panel.



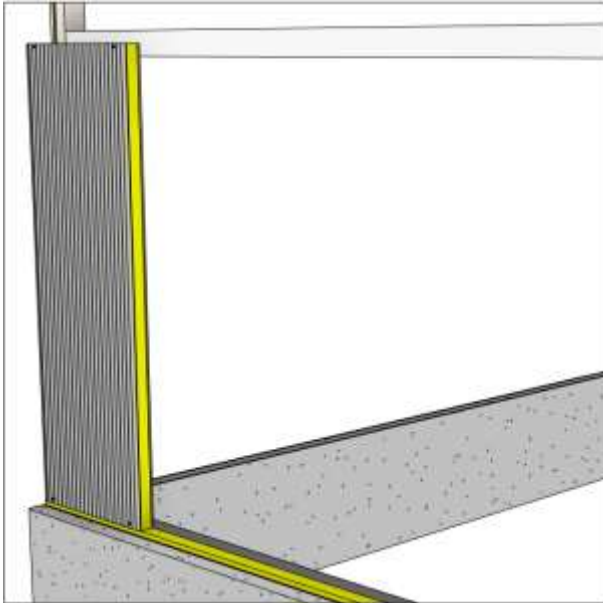


## 15. EXTERNAL WALL. VERTICAL INSTALLATION

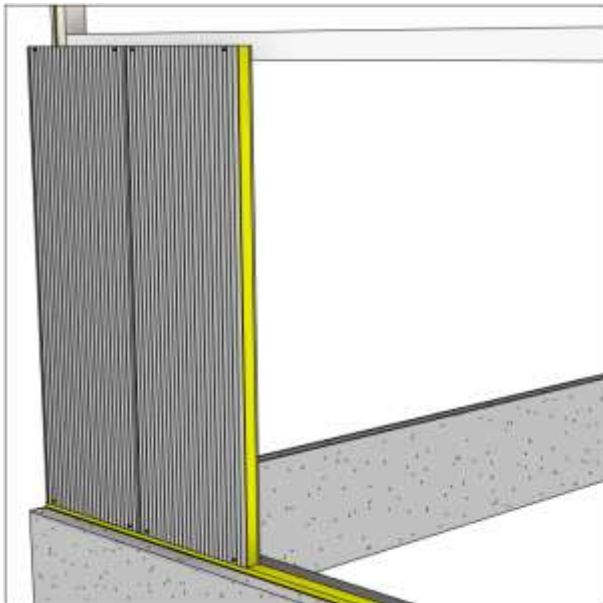
Fasten the panel from the lower and upper ends to the frame structures. Use a depth limiter in the screwdriver to prevent over-tightening and damaging the panel surface.

Fastening the end of the panel.

Check that the installed panel is vertical. The panel straightness must be at least  $\pm 2$  mm. Check the run and straightness of the wall to be installed at different levels after each installation of two new panels. Well-aligned panels ensure that the joints are securely locked and that the wall is vapour-tight.



Install an insulating wool in the plinth purlin for the next panel. Raise the next panel into an upright position on the insulating wool. Remove the safety sling before positioning the lower end of the panel.



Push the panel to be installed firmly against the preceding panel before fastening, it to ensure the tightness of the structure. Use manual suction cups or a wide clamp belt.

When using a clamp, make sure not to damage the joints of the panel. Fasten the panel on the upper and lower support structures. Continue the installation as described above, one wall at a time.



## 15. EXTERNAL WALL. VERTICAL INSTALLATION

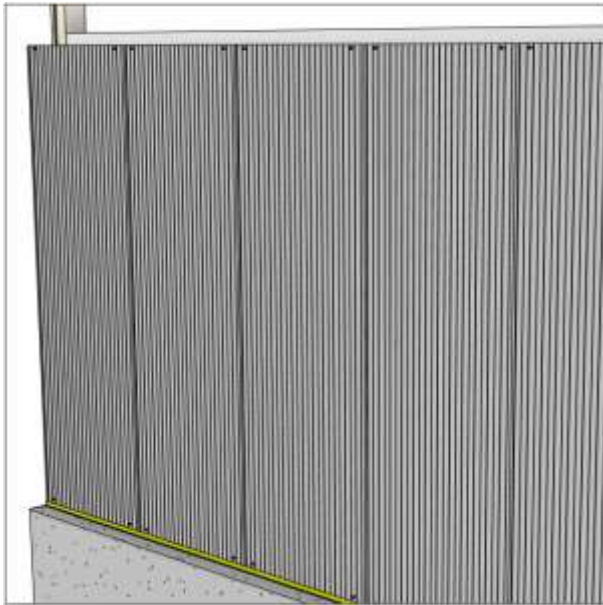
Make sure that the inner and outer joint seals installed in the panel groove joints at the factory remain in place during installation. Check the structural plans for any special tightness requirements.

### STEP 6. Finishing installation

Apply insulation, sealant and flashings on the finished wall structure. Install a plinth flashing at the bottom edge of the panel and seal the upper edge of the flashing with mastic sealant.

Also, install the flashings covering the panel's upper edge and the frame structure and apply a sealant (fastening with a spacing of 300 mm).

Remove the protective films right after the installation or at the latest once the wall is completed. The protective films protect the surface of the panels against scratching and contamination during construction. The protective films will be more difficult to remove if they are left on the panel for a long time.

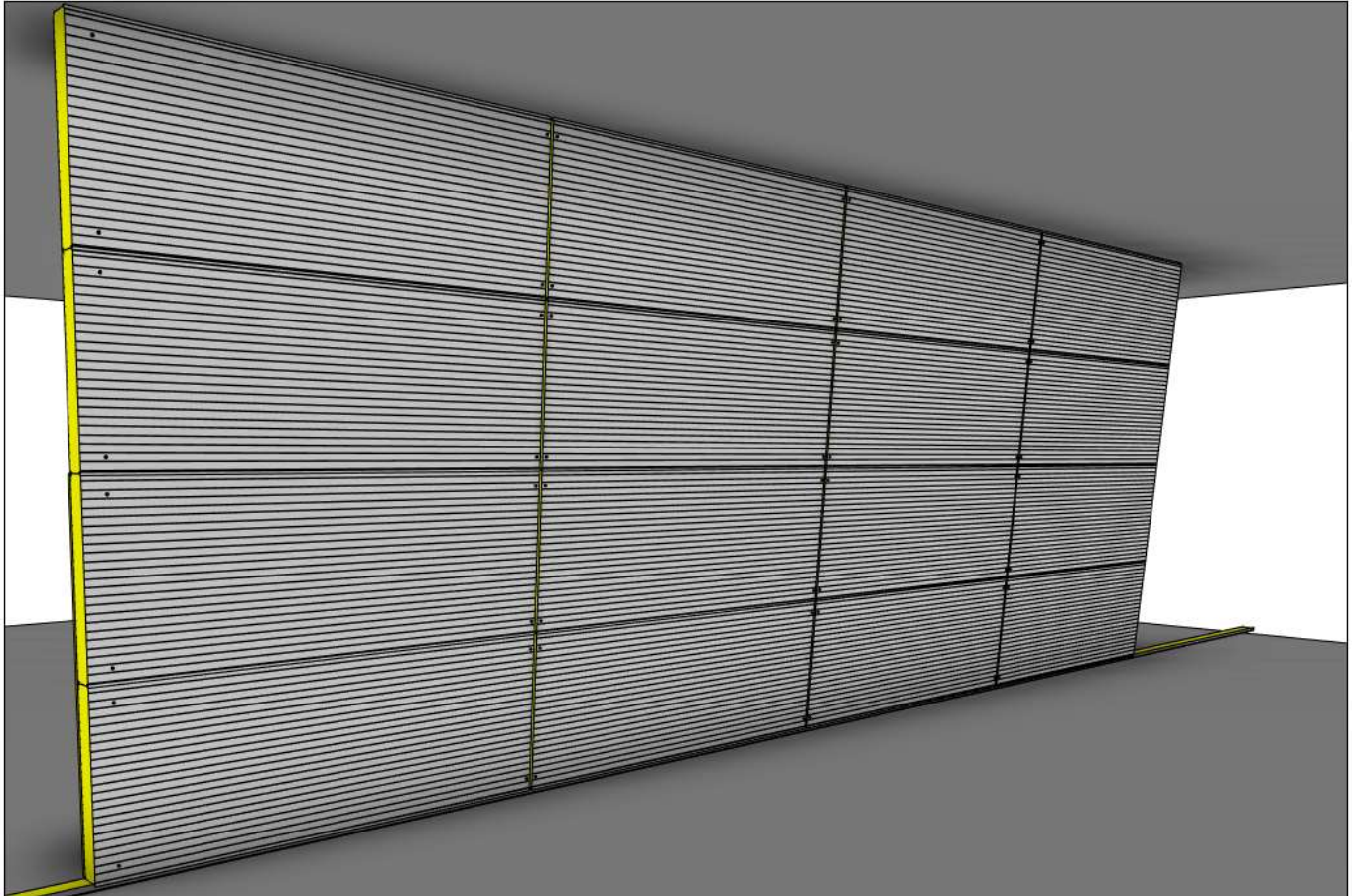


## 16. PARTITION WALL. HORIZONTAL INSTALLATION

The installation must be carried out according to the project. Begin the installation at the bottom and proceed upward with the tongue of the lower panel facing up. Proceed one span at a time. Pay attention to the sealing of the partition wall joints to ensure fire safety.

**WARNING: Always remember work safety and wear protective gear during the installation!**

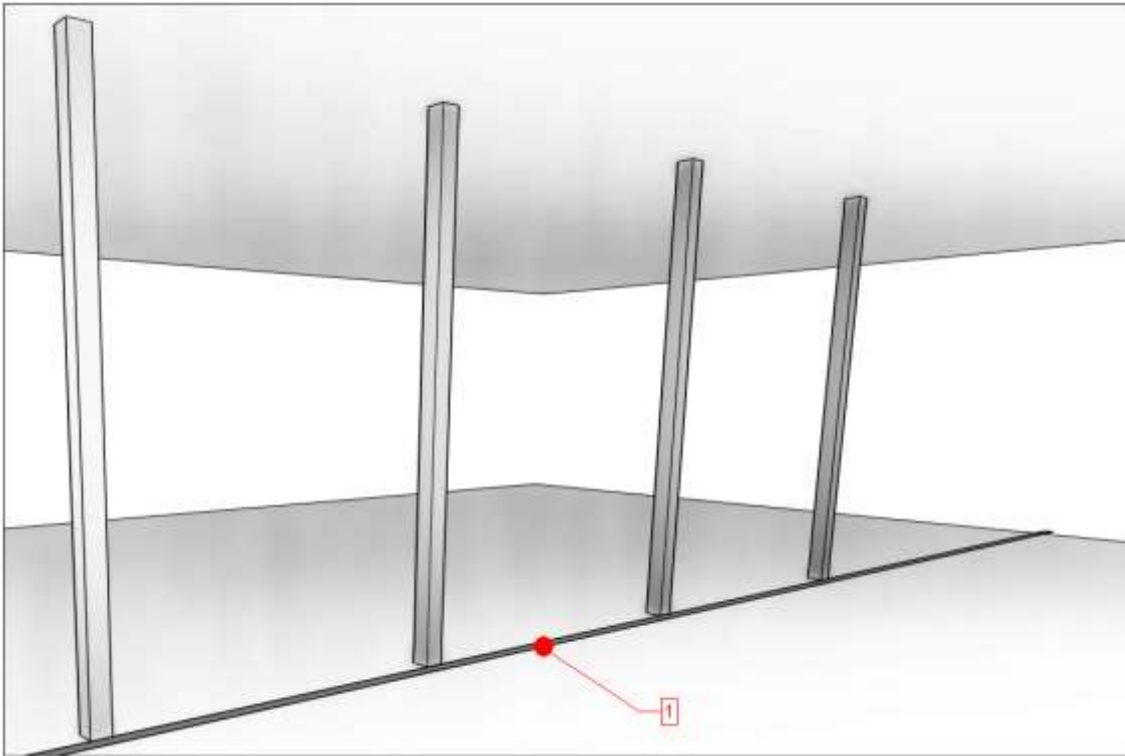
If you do not complete the installation, the exposed wool surfaces of the panels, both those that have already been installed and those remaining in the package, must be appropriately protected against the weather.



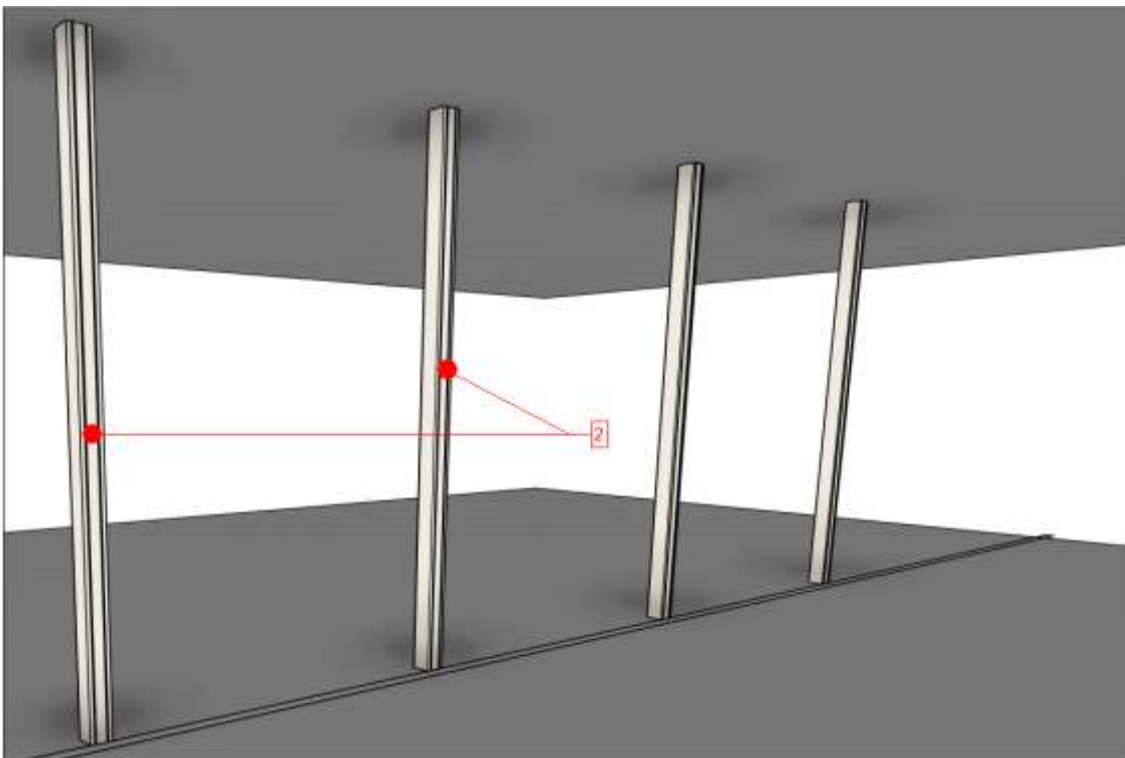
Check the straightness of the installation surfaces. Install the plinth sealing on the plinth or the floor. Install the sealing strip (PE 3x10 mm) between the columns and the panels (if applicable). The sealing strip is installed on the surface of the columns inside of the line of fasteners of the panel as per the detailed drawings and plans. This way, the holes for the fasteners can be made vapour-tight without any extra work.

## 16. PARTITION WALL. HORIZONTAL INSTALLATION

### STEP 1. Plinth sealing



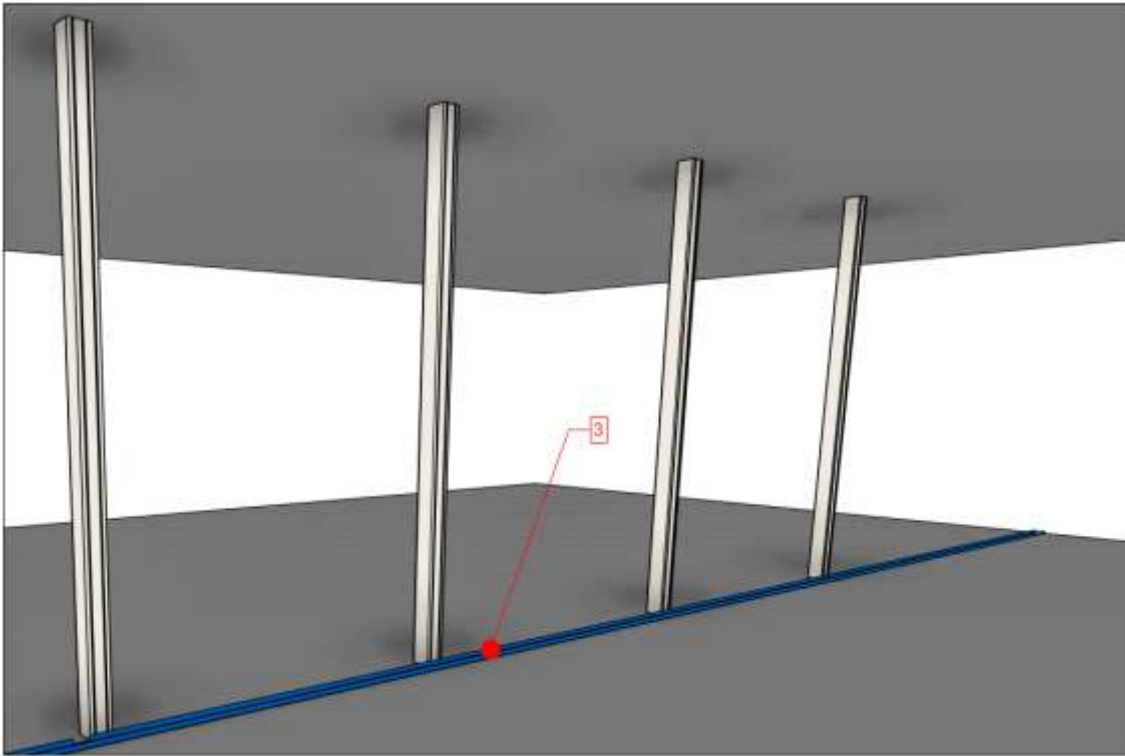
### STEP 2. Self-adhesive sealing tape PE 10x3



## 16. PARTITION WALL. HORIZONTAL INSTALLATION

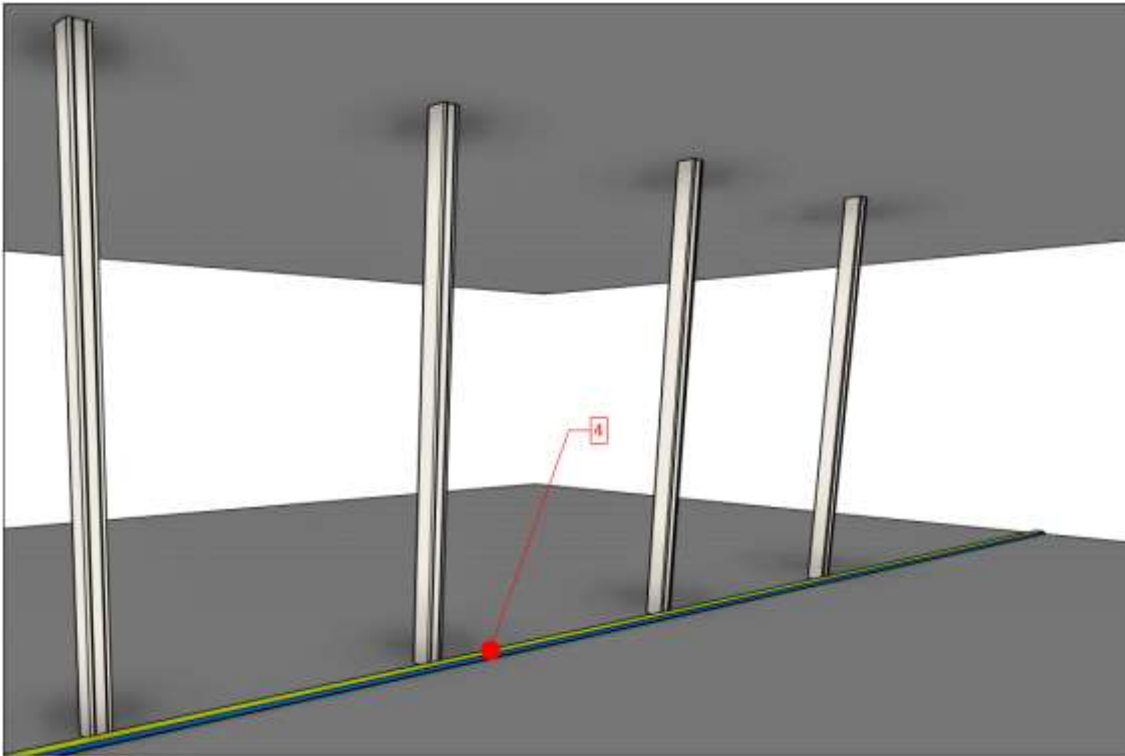
Install the starting profile on the sealing as shown in the detailed drawing. Make sure that the starting profile is straight. Leave a gap of approximately 7–9 mm between the starting profile and the frame. The panel's inner side groove must fit into this space. Fasten the purlin on the partition base or the floor and install insulating wool inside it, if required.

### STEP 3. Starting profile



## 16. PARTITION WALL. HORIZONTAL INSTALLATION

STEP 4. Insulating wool



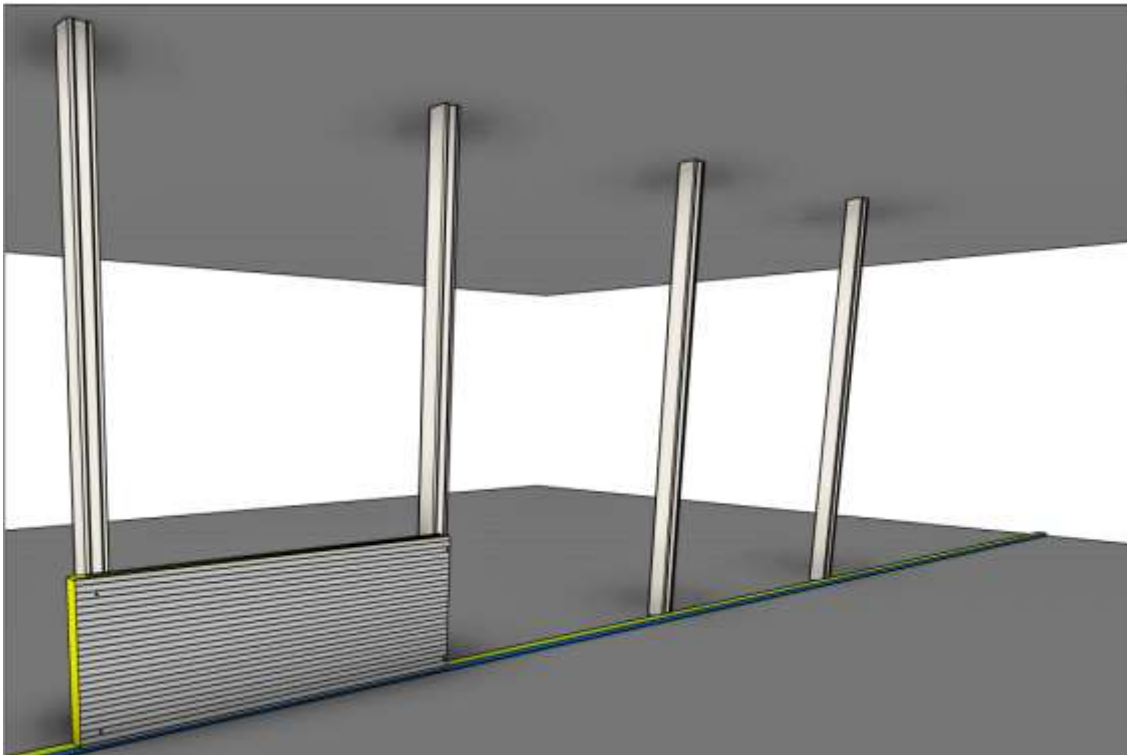
## 16. PARTITION WALL. HORIZONTAL INSTALLATION

### STEP 5. Horizontal sandwich panel installation

Fasten the panel lifting tool or tools on the topmost panel in the package. Follow the instructions for use and the safety instructions provided with the lifting tool. When lifting, for example, the top element against a roof/floor slab, the use of a vacuum lifting tool and manual suction cups is recommended. Be careful of the sharp edges of the element.

Raise the panel into an upright position and take care not to scratch the surface of the lower panel in the package. Remove any protective films from the panel, either from the edge portions or entirely.

Install the bottom wall panel on the starting profile and fasten it to the frame as shown in the detailed drawing. Make sure that the distance of the fasteners from the edge is maintained. The fasteners must be placed at a minimum distance of 30 mm from the panel end. Do not over-tighten the fasteners, as this would cause dents in the panel surface under the fastener. It would also impair the load-bearing capacity of the fastening. Over-tightening can be avoided by using a depth limiter or a torque screwdriver.



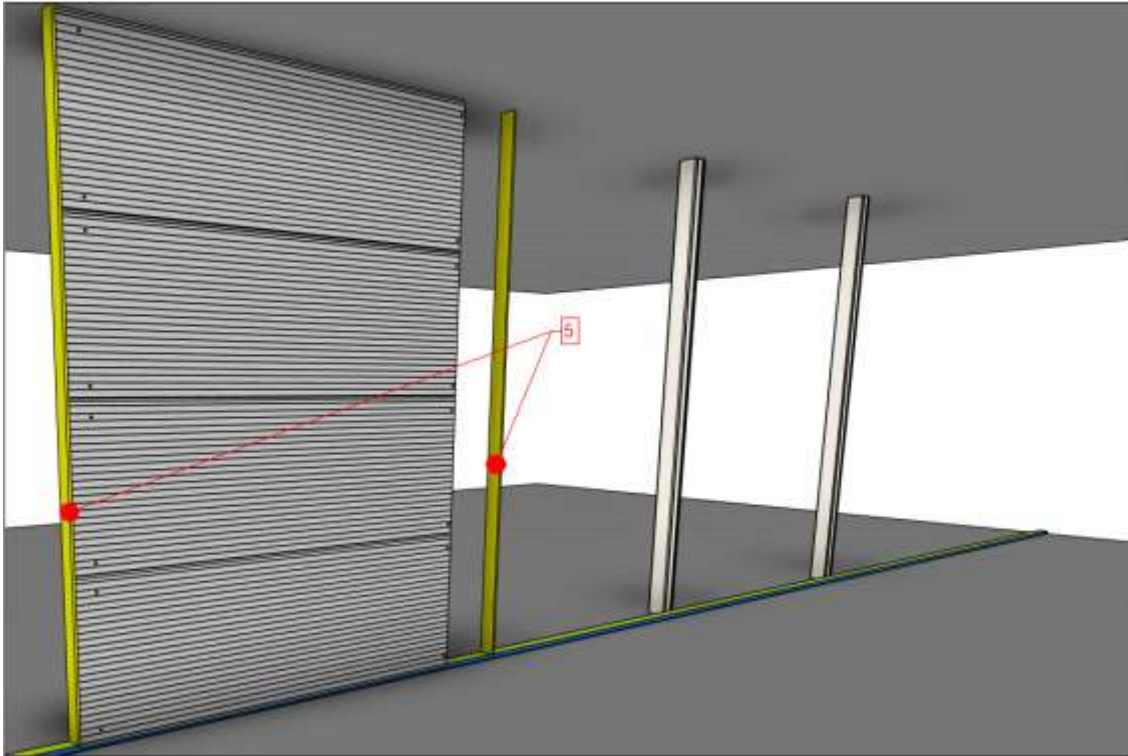
Make sure during installation that the joint seals installed in the grooves at the factory are in place (if required).

After the installation of the first panel, check that the panel is level. Install the other panels in the order of installation from the bottom upwards, one span at a time.



## 16. PARTITION WALL. HORIZONTAL INSTALLATION

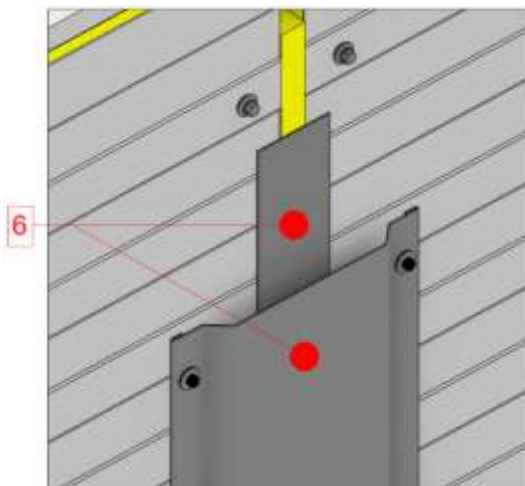
Once you have completed one span, install insulating wool at the panel ends before installing the panels in the next span. This way, the wool can be sealed easily with the panels of the next span. Insulate all corners and vertical joints between the panels.



### STEP 6. Finishing installation

Install the sealing strips for flashings. Install the flashings on the vertical joints of the panels. Install the seals and fire insulation (if necessary) on the joint between the panel wall and the ceiling. Install all protective flashings and seals of the panels according to the structural plans.

Remove the protective films right after installation or at the latest once the wall is completed. The protective films protect the surface of the panels against scratching and contamination during construction. The protective films will be more difficult to remove if they are left on the panel for a long time.



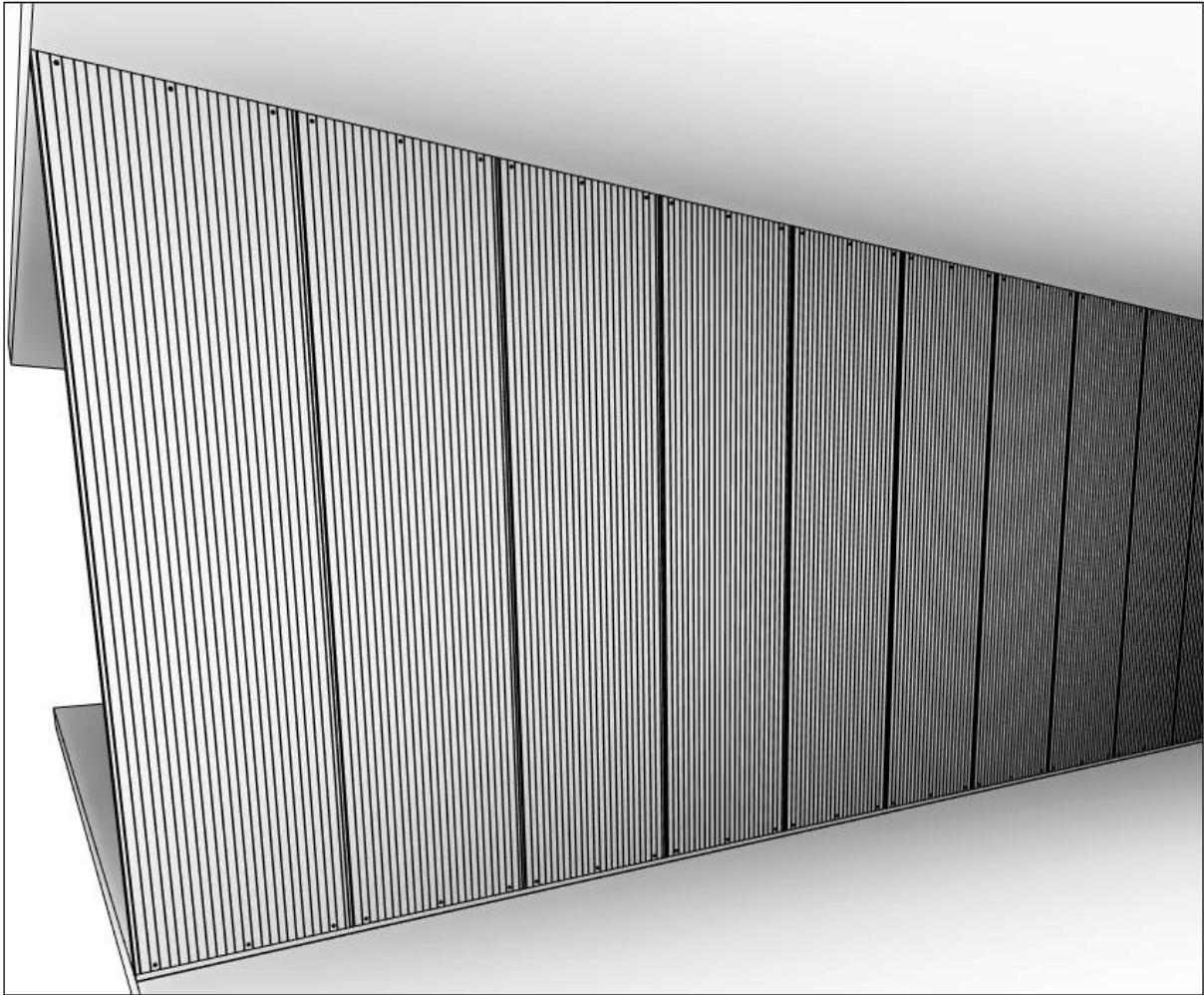


## 17. PARTITION WALL. VERTICAL INSTALLATION

Installation must be carried out according to the project. Begin the installation so that the tongue of the panel faces the direction of the installation. Pay attention to the sealing of the partition wall to ensure fire safety (if required).

**WARNING:** Always remember work safety and wear protective gear during the installation!

If you do not complete the installation, the exposed wool surfaces of the panels, both those that have already been installed and those remaining in the package, must be appropriately protected against the weather.

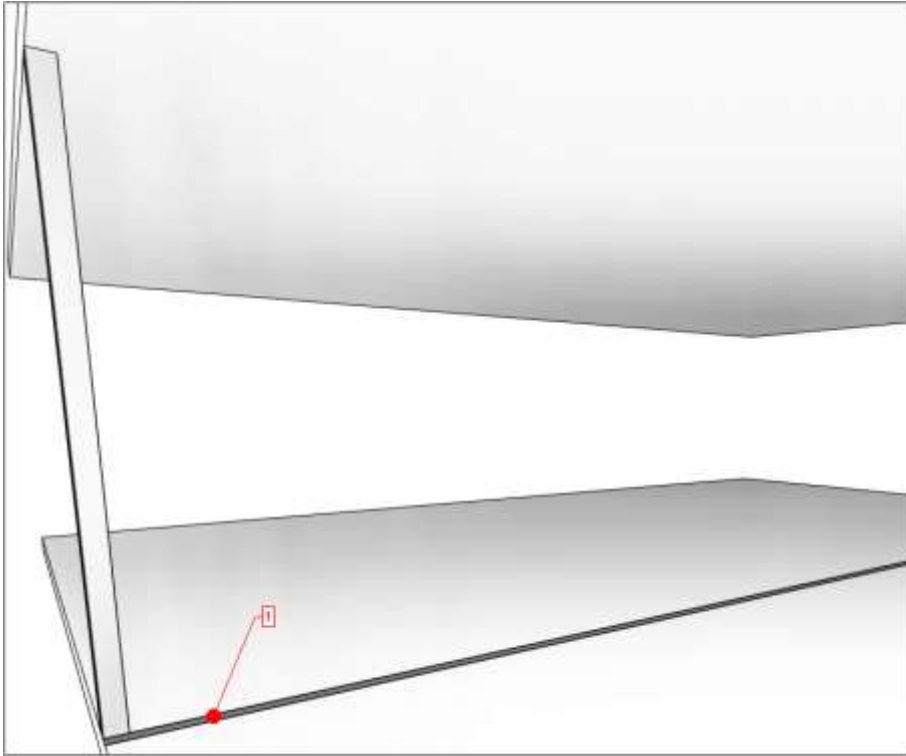


Check the straightness of the installation surfaces. Install the plinth sealing on the floor or the plinth. Install the sealing strip between the columns and the panels (if applicable).

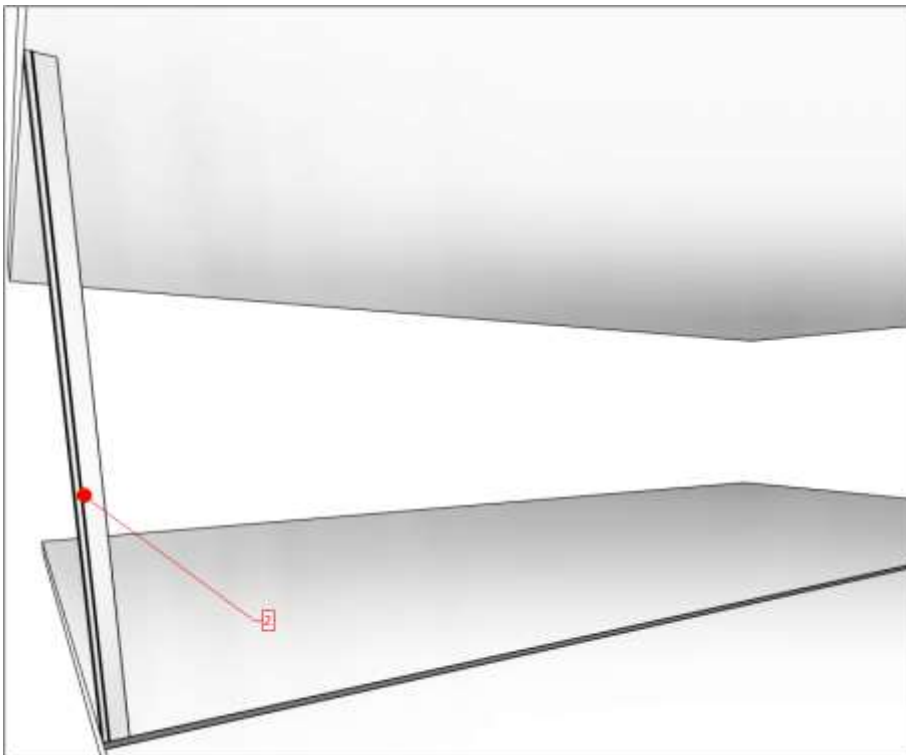


## 17. PARTITION WALL. VERTICAL INSTALLATION

### STEP 1. Plinth sealing

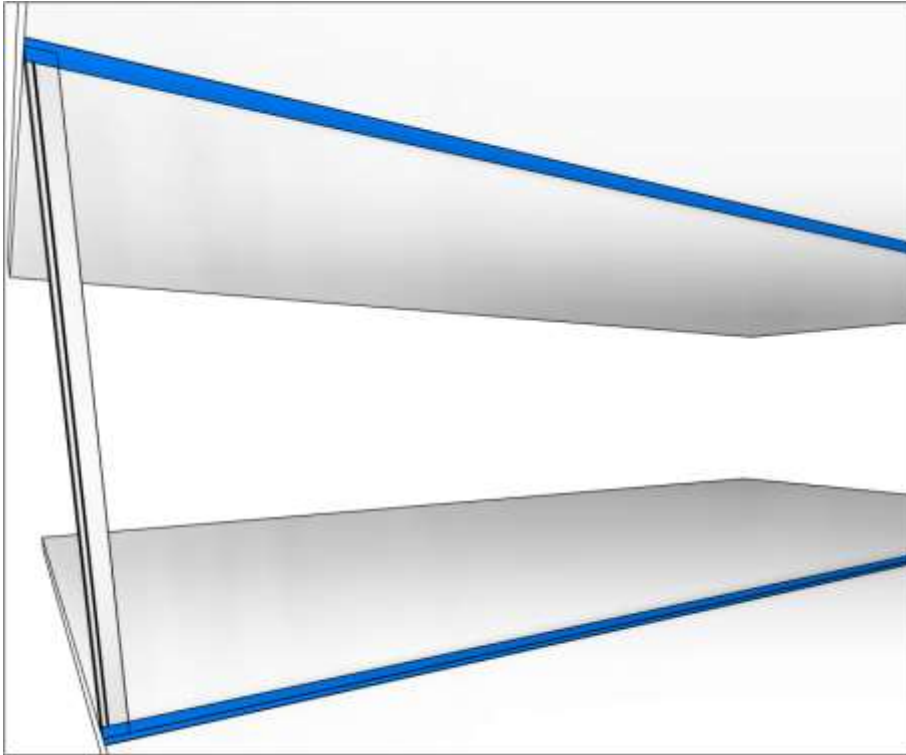


### STEP 2. Self-adhesive sealing tape PE 10x3



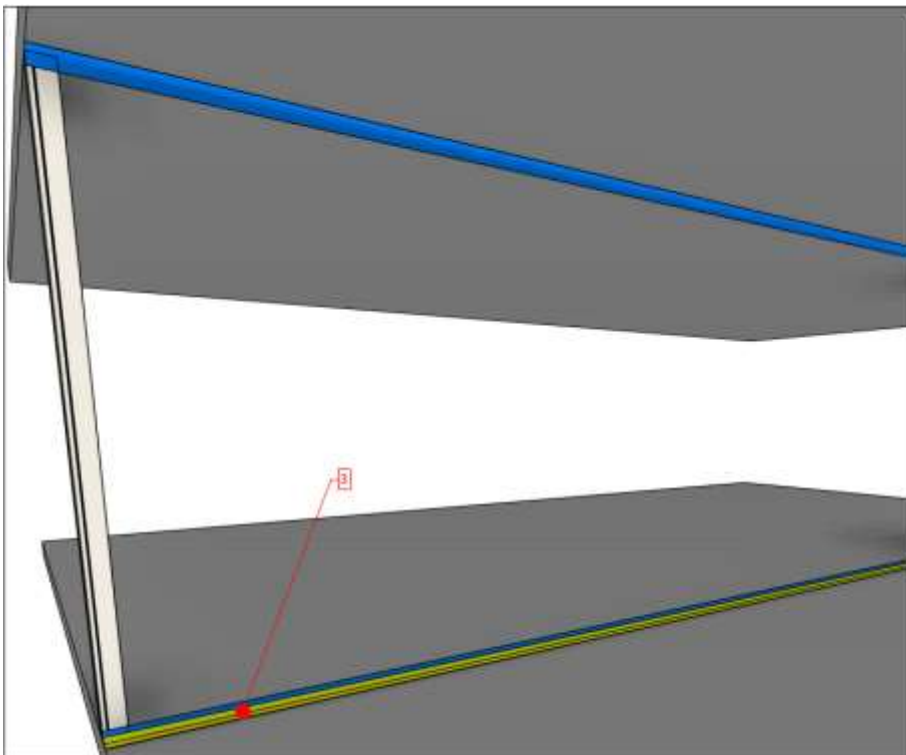
Measure and mark the locations for the lower and upper support purlins. The upper support purlin is L-shaped and the lower support purlin is L- or U-shaped. Fasten the support purlins. Install the sealing strips into the support purlins.

## 17. PARTITION WALL. VERTICAL INSTALLATION



Install insulating wool in the lower support purlin to ensure the tightness and thermal insulation of the wall. Cut the insulating wool to the panel width.

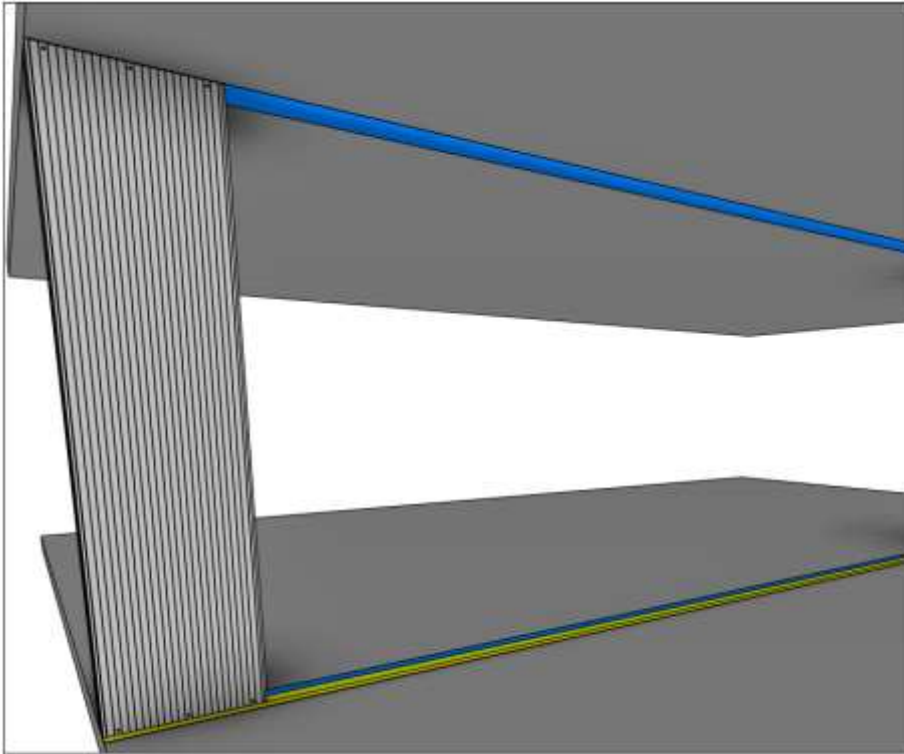
STEP 3. Insulating wool



## 17. PARTITION WALL. VERTICAL INSTALLATION

Begin the installation of the first panel with the tongue facing in the installation direction. Lift the panel in place with the lifting tool. Always read the instructions for use and the safety instructions of the panel lifting tool before starting installation.

Fasten the panel by installing support purlins between the panel and ceiling and between the wall and floor. Usually, no fasteners are installed on the panel itself between the ceiling and wall connection to allow the ceiling to settle. Alternatively, a fastening that allows settling (oval perforated fastening corner flashings) can be used. The panel straightness must be at least  $\pm 2$  mm.



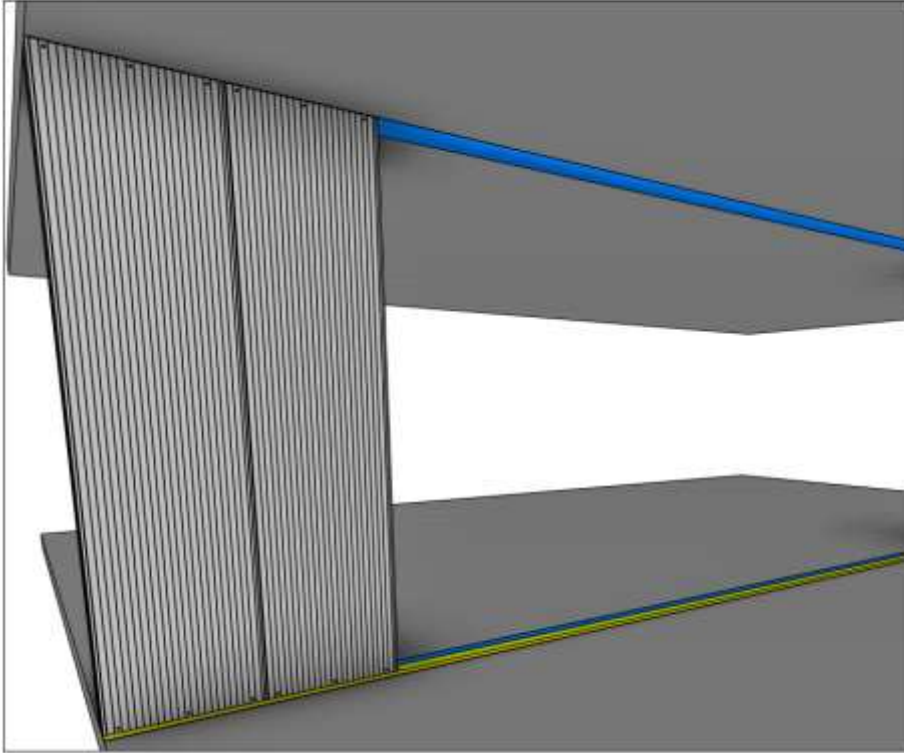
Fastening the panel by installing the lower support purlin on the floor and to the panel.

Check the run and straightness of the wall to be installed at different levels always after having installed a few panels. The panel straightness must be at least  $\pm 2$  mm. Good alignment of the panels ensures that the joints are securely locked and that the wall is vapour-tight.



## 17. PARTITION WALL. VERTICAL INSTALLATION

Raise the next panel into an upright position on the insulating wool. Push the panel to be installed firmly against the preceding panel before fastening it to ensure the tightness of the structure. Use a suction-cup lifting tool or a wide clamp sling. When using a clamp, make sure not to damage the tongue and groove of the panel.

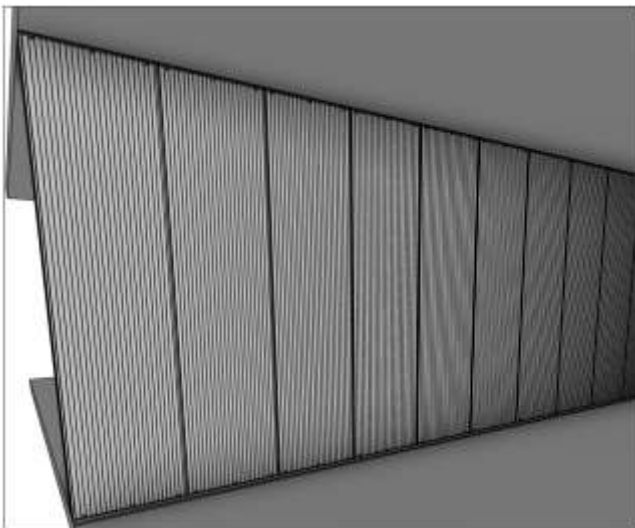


Make sure that the inner and outer joint seals installed in the panel joints at the factory remain in place during installation (if required). Check the structural plans for any special tightness requirements and take appropriate measures.

Apply insulation, sealant and flashings on the finished wall structure. Install the seals and fire insulation (if necessary) on the joint between the panel wall and the ceiling. Install all protective flashings and seals of the panels according to the structural plans.

### STEP 4. Finishing installation

Remove the protective films right after the installation or at the latest once the wall is completed. The protective films protect the surface of the panels against scratching and contamination during construction. The protective films will be more difficult to remove if they are left on the panel for a long time.



## 18. ASSEMBLY OF ROOF PANELS

### Roof sandwich panels – Safety considerations

18.1 Check that the panels have been stored as recommended in chapter 5.

18.2 Check that the purlins (supporting structure of the panels) comply with the project drawings (span length, the width of purlin's flange, etc.), they are not deformed, and that they form a plane. Panels are designed for installation on plane surfaces, with a minimum slope of **7%**.

18.3 Check that safety measures have been implemented as per current regulations for working at height (parapets, anti-fall safety net, lifeline, etc.)

18.4 Check that installation workers wear the appropriate personal safety equipment, as per current regulations.

18.5 Prepare the power supply lines for the power hand tools, as per current regulations.

18.6 Check for eventual overhanging power lines, and strictly observe precautions and safety measures, as per current regulations.

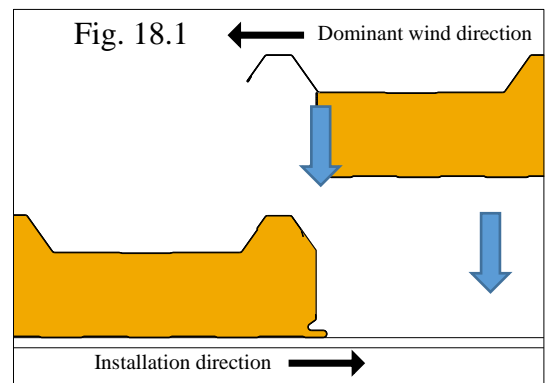
18.7 Installation workers are recommended to wear hand gloves (cutting precaution) and footwear with soft soles to avoid eventual panels' surface scratching/damage.

### Roof sandwich panels – installation procedure

The polyethene protective film on the internal side must be removed before the panel installation. On the external side, the protective film should be partially removed (along panels edges – joint), to allow for additional protection during installation works. The film should be completely removed by the end of the working shift, and in any case, before the panels' fixing. Any eventual traces of adhesive (from the film) on the panel's surfaces should be removed, with the use of a water-detergent mixture.

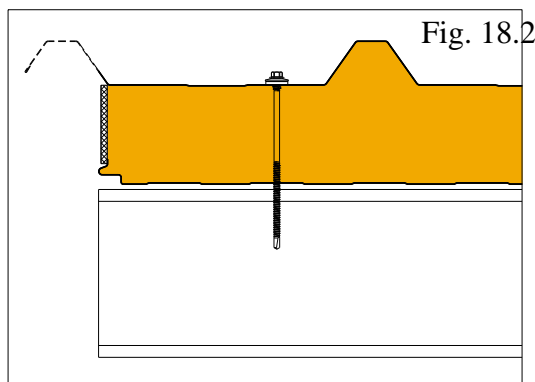
Before panels installation, check project construction details, and check for accessories and flashing elements that should be installed before panels (e.g. gutter, under-ridge, containing profile on the gable edge of the roof, gaskets, etc.)

**WARNING:** Installation direction of the panels should be opposite to the prevailing wind direction (figure 18.1).



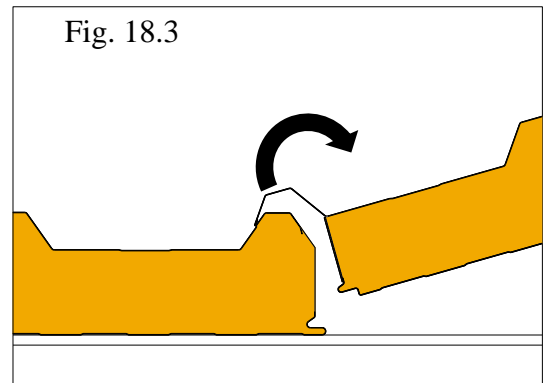
Place the first panel and fix it in place, making sure that it is perfectly aligned and squared with the roof structure.

The first panel is secured on the roof gable edge, by fixing it in the "valley", immediately after the first (empty) rib (figure 18.2). Fixing element: self-drilling screw with metal washer & EPDM gasket.



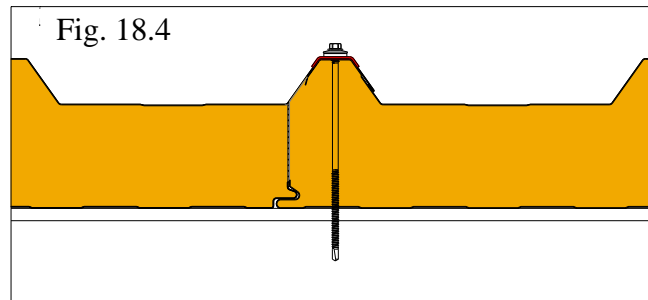
## 18. ASSEMBLY OF ROOF PANELS

The second panel is installed by overlapping its first (empty) rib on the last (full) rib of the first panel (figure 18.3) and fixing them together on the roof purlins (figure 18.4). Fixing element: self-drilling screw with saddle cap.

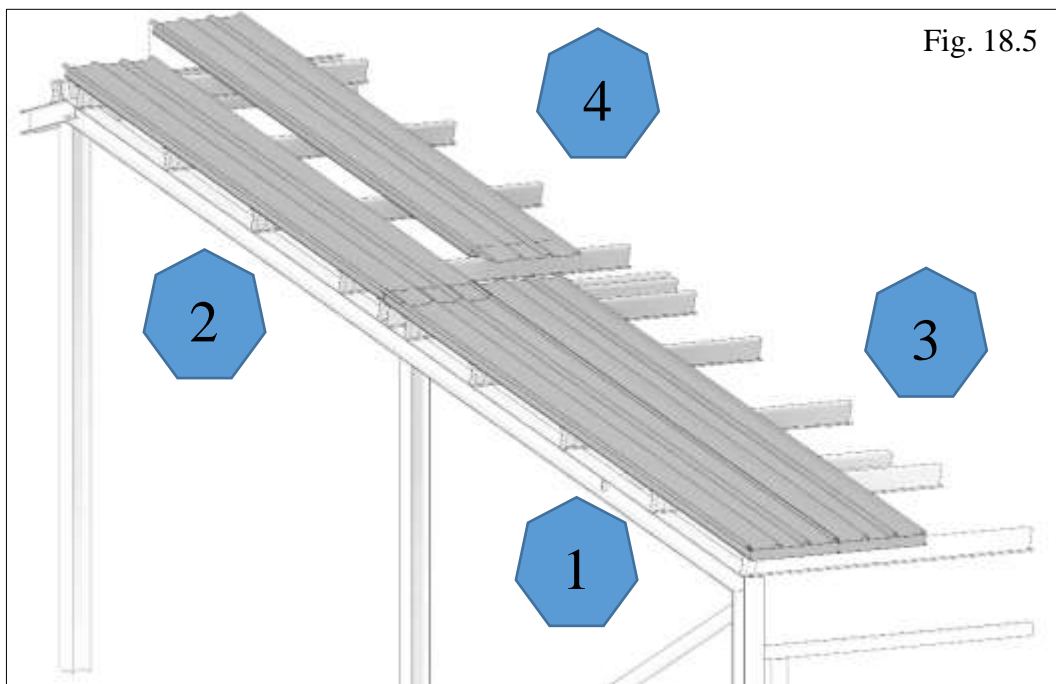


The fixing element should be placed perpendicularly to the panel's surface and positioned in the middle line of the rib. The use of original saddle caps is mandatory:

- ❖ they allow for even distribution of pressure on the panel's rib,
- ❖ they can be used as a template, and ensure that fixing is effected in the correct position.

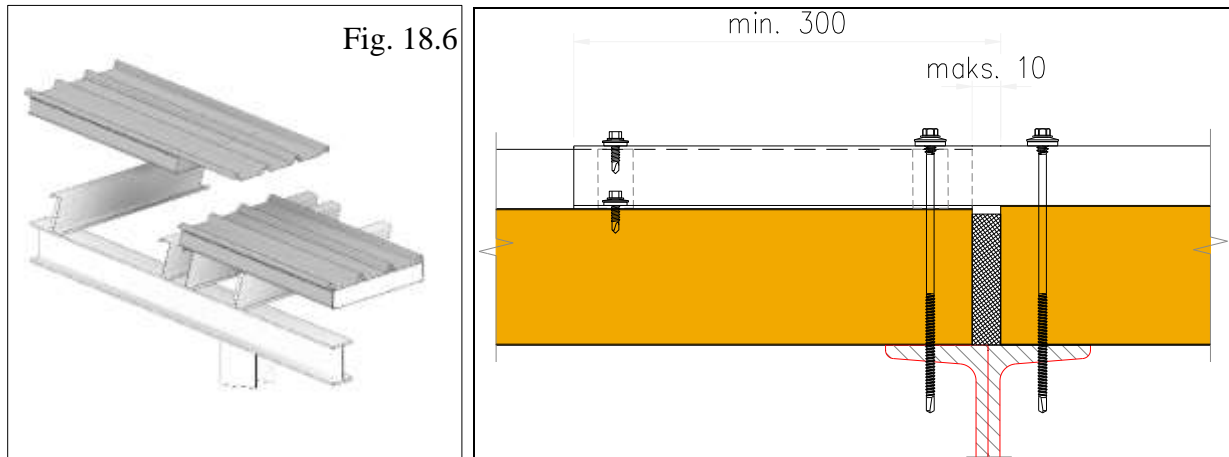


In cases where the pitch length of the roof is covered by more than one panel, panels should be installed as per figure 18.5.



## 18. ASSEMBLY OF ROOF PANELS

Installation by longitudinal overlapping (figure 18.6).

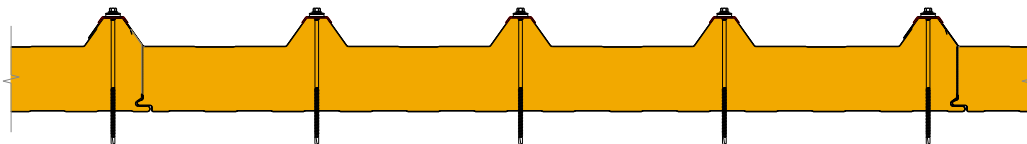


Roof sandwich panels – fixation

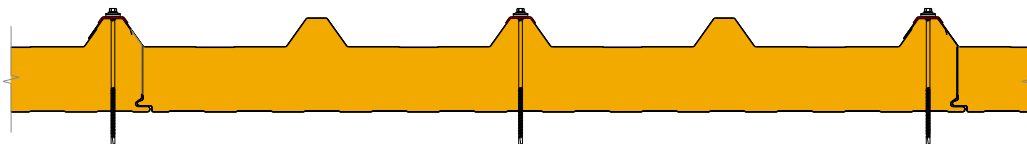
Roof panels should be secured on the roof structure as per the fixing scheme indicated in figure 18.7.

Fixing positions:

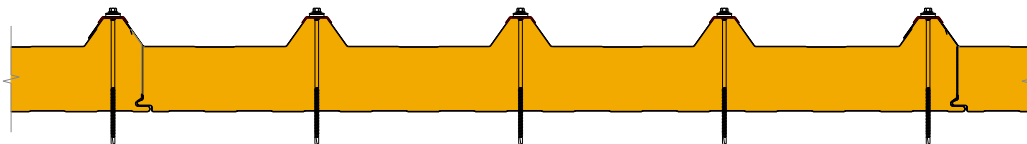
1. Panels' downstream edge (gutter). One screw with the original saddle cap, on each rib.



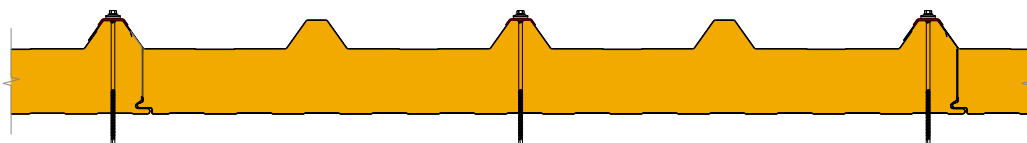
2. Intermediate support. One screw with the original saddle cap, on the joint rib, plus one more on the middle internal rib.



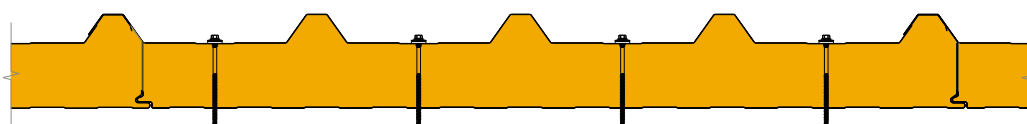
3. Eventual overlapping position. One screw with the original saddle cap, on each rib.



4. Intermediate support. One screw with the original saddle cap, on the joint rib, plus one more on the middle internal rib.

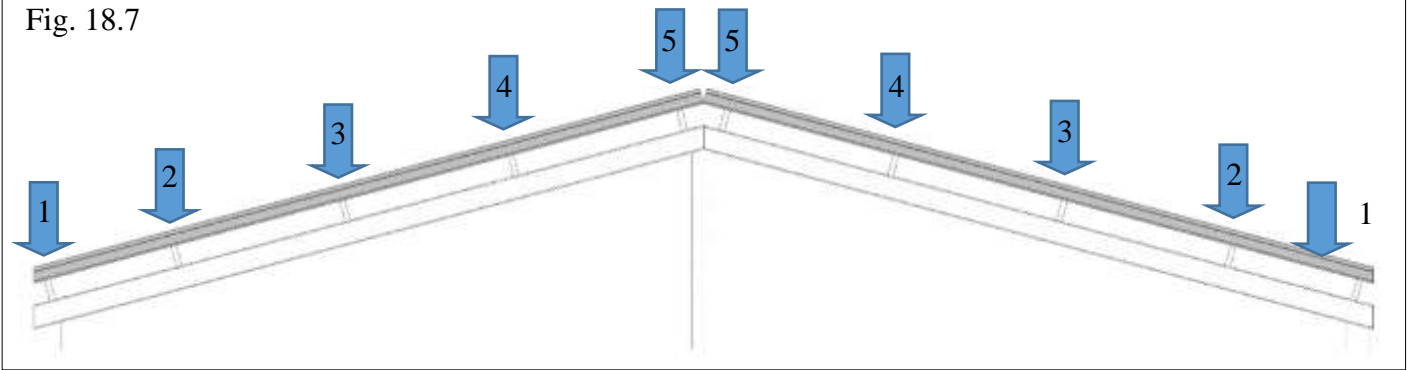


5. Panels' upstream edge (ridge). One screw with metal washer and EPDM gasket, on each low rib (between main ribs), underneath ridge flashing element.



## 18. ASSEMBLY OF ROOF PANELS

Fig. 18.7



The required number of screws to be used will be decided by the project's engineer, based on:

- Project wind loads,
- Type of panels' supporting structure,
- Steel thickness of panel's faces,
- Type of screws to be used, and relevant supplier's instructions.

In addition to primary fixing (securing panels on structure), secondary fixing elements should also be applied along panels' joints, to improve joint tightness, and ensure a uniform effect of panels. Such fixing elements (e.g.  $\varnothing 6.3 \times 25 \text{ mm}$  plus saddle cap), are placed on joint ribs, between supporting purlins, and at a maximum distance of 300 mm (figure 18.8 & 18.9).

Fig. 18.8

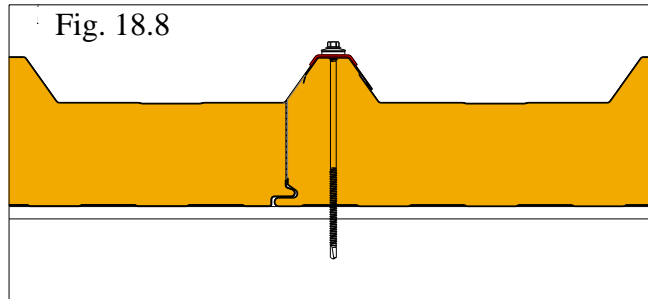
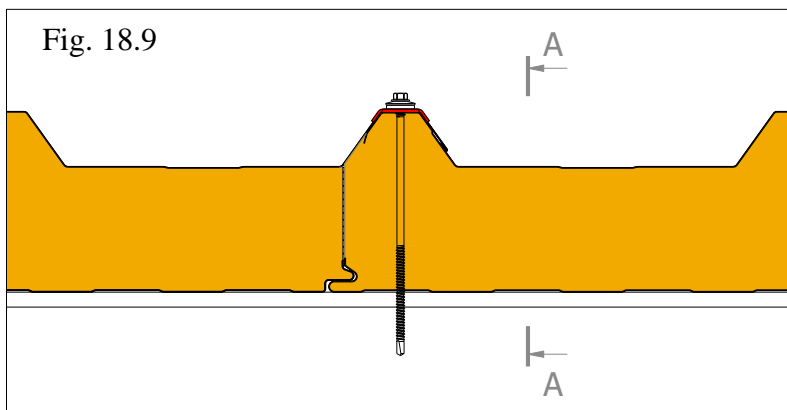


Fig. 18.9



A-A

