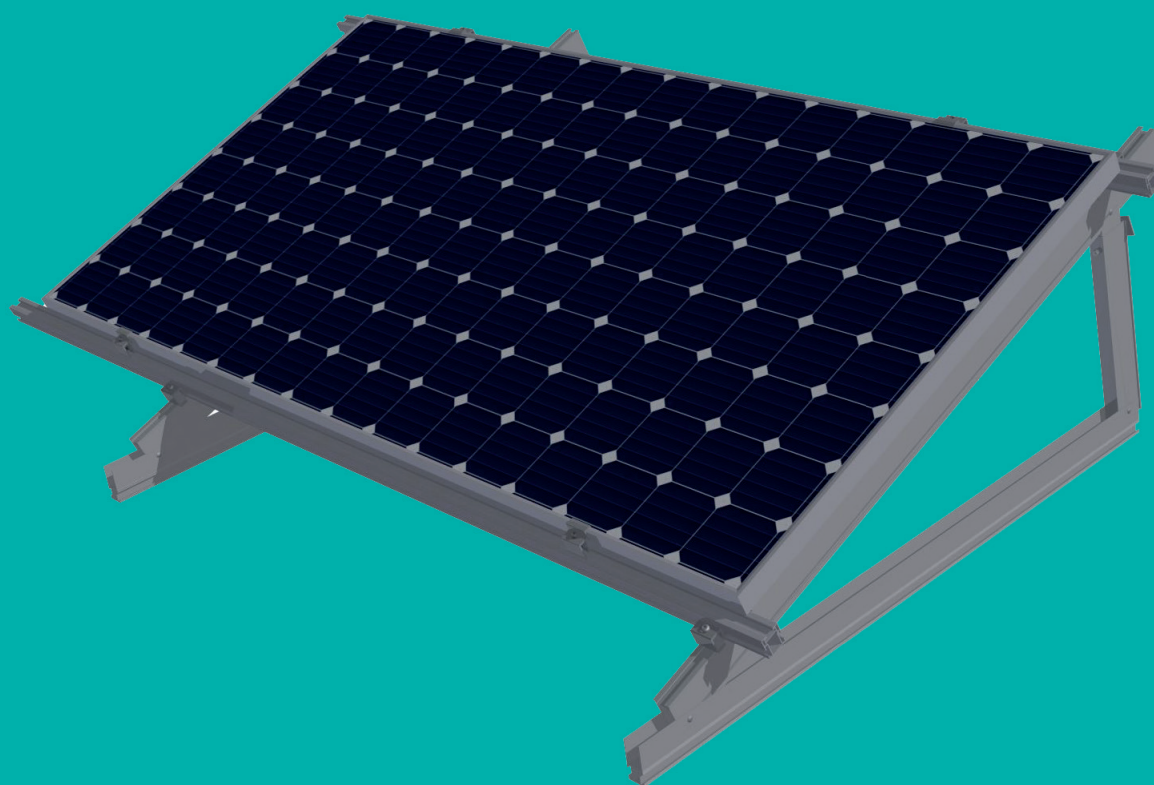


Trifix ProLine

Installation manual



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1. Introduction

1.1 Short Description

The Trifix ProLine flat roof system is a racking system for the installation of PV modules on flat roofs. It consists of aluminium support rails and all necessary small parts for the fastening of the rails to the roof, the modules on to the rails as well as for the connection of the components with each other. Trifix ProLine allows both portrait and landscape installation of the modules.

1.2 About These Instructions

Content

These instructions describe the mounting of the flat roof system Trifix ProLine and all system-specific information for planning, components and safety warnings. The first part of the instructions (chapter 4) demonstrates the fastening options of triangles on the roof. There after, (chapters 5-8) the mounting steps for complete installation of framed modules are explained.

Applicable Documents

In addition to this document, the document "Installation Instructions for PV Mounting Systems: General Part" is part of each product delivery. This document describes the general applicable information for Mounting Systems products on standardisation, safety, transport, maintenance, disassembly and disposal. Both the present Instructions and the "Installation Instructions for PV Mounting Systems: General Part" are an integral part of the system Trifix ProLine and must be adhered to for each installation.

It is crucial to carefully read these instructions as well as all applicable documents prior to carrying out any installation, maintenance or disassembly work.

You are provided with the information required for the safe and complete installation, maintenance and disassembly. Should you have any questions, please contact Mounting Systems GmbH.

User Group

Mounting Systems GmbH's installation instructions are intended for the following persons (user group):

- Skilled personnel
- Instructed personnel

Skilled personnel

Skilled personnel are individuals who, on the basis of their professional training, are able to execute installation, maintenance, and disassembly work appropriately.

Instructed personnel

Instructed personnel are individuals who have been instructed and taught appropriately regarding the assigned tasks and the possible risks in the event of improper conduct. An instructed individual must have received instructions regarding the required safety policies, precautions, relevant regulations, accident prevention regulations, as well as operating conditions and must have demonstrated his/her competence. The implemented work must be approved by skilled personnel.

Orientation Guide

The following visual aids will make installation easier.

Pictograms:



This symbol indicates important information and useful tips.



This symbol indicates tips and tricks to make processes easier.

1.3 Warnings

The warnings used in these mounting instructions indicate safety-related information. They include:

- Warning symbols (pictograms)
- Signal words for the identification of the hazard level
- Information about the type and source of the hazard
- Information about potential consequences in case of the hazard being disregarded
- Measures for the prevention of hazards and the prevention of injuries or damage to property.

The signal words of the warnings respectively indicate one of the following hazard levels:

 DANGER	Indicates a great and extraordinary danger, which may result in death or serious injury if ignored.
 WARNING	Indicates a potentially dangerous situation, which may result in serious or medium injury or damage to the property.
 CAUTION	Indicates a potentially dangerous situation, which may result in minor injuries or damage to the property if ignored.
 ATTENTION	Indicates potential danger, which can result in damage to the property.

1.4 Safety

All generally applicable safety regulations for products of Mounting System GmbH can be viewed in the document "Installation Instructions for PV mounting Systems: General Part". Please read this document carefully and adhere to the described points – only use the system for its intended purpose, comply with the obligations of the building proprietor and follow both the general and specific safety instructions.

In addition, please observe the specific safety instructions which precede the process steps in the present product-specific mounting instructions.

2. Technical Description

2.1 System Overview

In the following, the most important system parts are described.

The design of the individual system components can vary, or additional components (e.g. cross rail connectors) may be required, depending on:

- Type of roof (substructure and roof cladding)
- Type of module
- Number of modules and configuration
- Local conditions

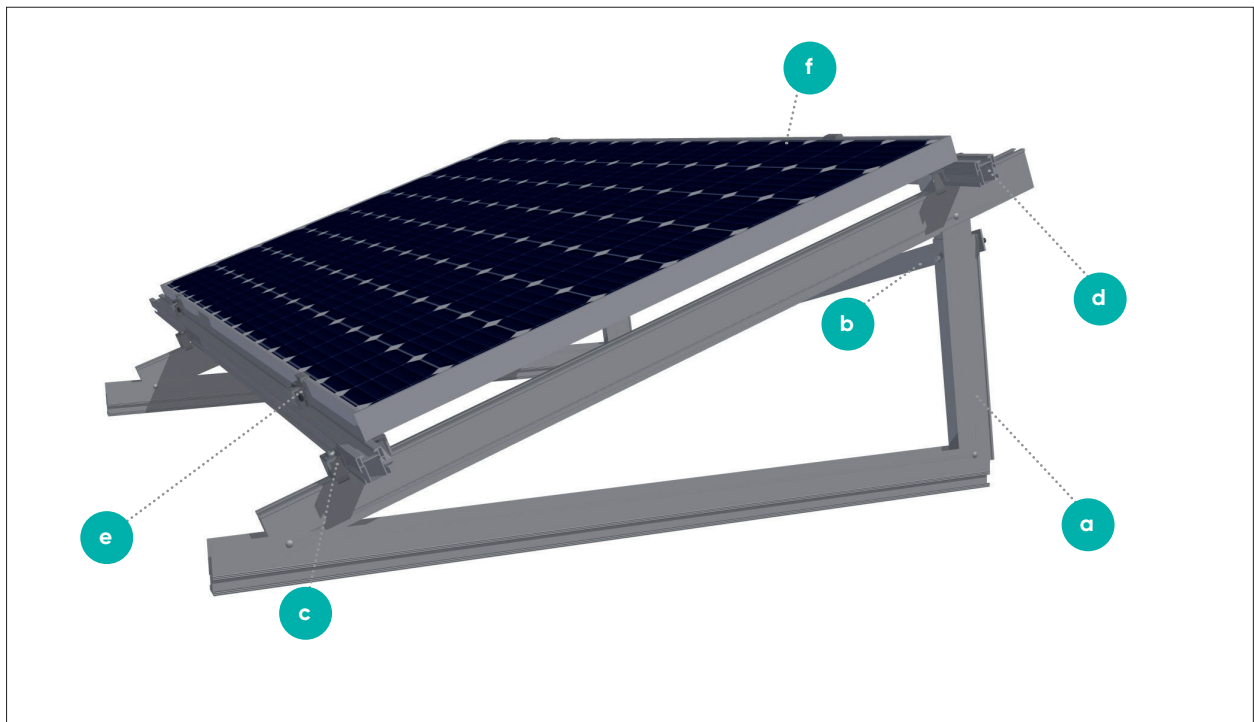


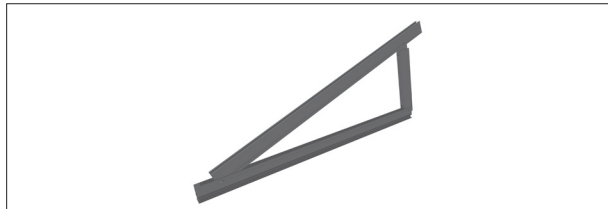
Image 2.1-1 Landscape installation

Trifix ProLine Components:

- a Triangle
- b Stiffening of triangle
- c Cross rail connector (outer click mechanism)
- d Base rail
- e Module clamp/Module end clamp
- f Module

2.2 Components

In the following all mounting system parts of the Trifix ProLine are shown, which can be included in the scope of the delivery. The exact scope of the delivery and the number of individual components depends on your order.

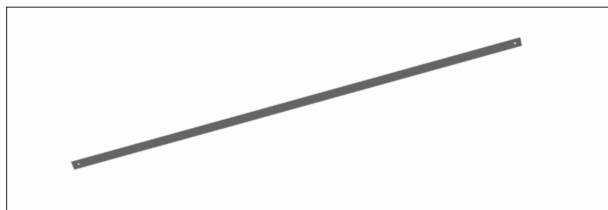


2.2-1 Triangle, options:

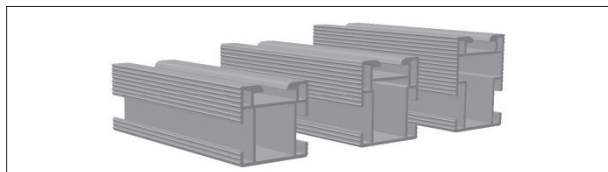
- Tilt 10°-15°
- Tilt 20°-30°
- Tilt 25°-45°



2.2-2 Cross rail connector (outer click mechanism)

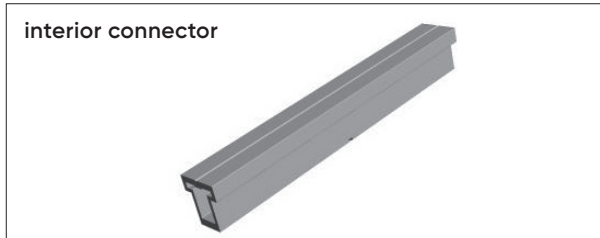


2.2-3 Stiffening triangles

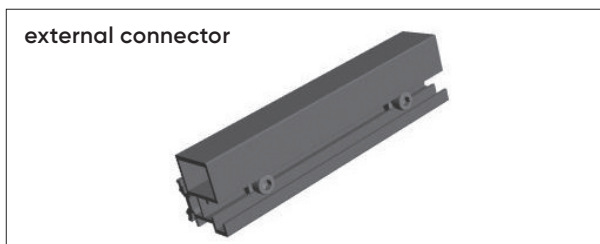


2.2-4 Base rail (BR), options:

- BR 4/35 in various length
- BR 6/40 in various length
- BR 10/48 in various length



interior connector



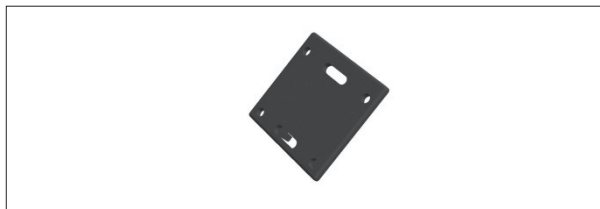
external connector

2.2-5 Connector, options:

- interior connector (respectively for BR)
- external connector (respectively for BR)

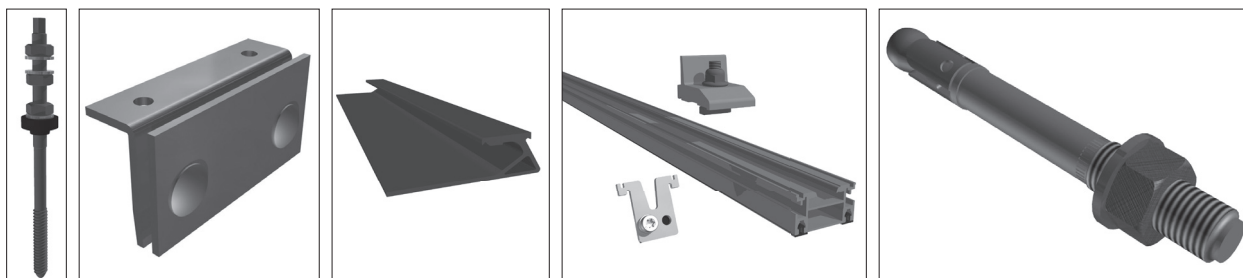


2.2-6 Telescoping end-piece (optional), options:
- for BR 4/35 and BR 6/40



2.2-7 End cap (optional), options:

- aluminium (respectively for BR)
- black (respectively for BR)



2.2-8 Roof connections (depending on roofing)

2.3 Technical Data

Application	Flat roof ¹ , ground and pitched roof
Building height	Depending on wind zone and terrain category
PV modules	Framed, unframed
Module assembly	In row (up to approx. 12 m, depending on rack unit)
Module orientation	Portrait, landscape
Pitch	10°- 15°, 20°-30°, 35-45°
Size of module array	No special requirements
Distance lower edge to ground	8 to 10 cm (variant upon request)
Standards	Eurocode 0 – Action on structures Eurocode 1 – Action on structures Eurocode 9 – Design of aluminium structures ²
Supporting profiles	Extruded Aluminium (EN AW 6063 T66)
small parts	Stainless steel (V2A)
Colour	Aluminium: plate finish
Warranty	10 Years ³

¹ Attention: Please check the structural condition of the roof prior to mounting the system!

² If desired, verifiable calculations are available for additional charge.

³ Please find the exact terms in the Mounting Systems GmbH warranty document.

3. Important Mounting Information

3.1 Conditions of Use

The Trifix ProLine flat roof system is designed with different rail and flat roof fastener variations in accordance with Eurocode 1–DIN EN 1991–1–1 for various maximum loads. The suitability of the material must therefore be verified for each system, e.g. by means of the Trifix ProLine configuration tool. Please also observe the constraints, listed in chapter 2.3 “Technical Data”.

3.2 Mounting Preparations

Mounting Systems recommends having collected all the necessary information concerning the local conditions, before ordering the Trifix ProLine. Please acquaint yourself with:

- The roof structure and any irregularities
- Dimensions, material, quality and distance of the rafters/purlins
- Type, quality and fastening method of the roofing

3.3 Mounting Aids and Required Tools

For the installation of the mounting system, you will require the following tools:

- Allen key/hexagon socket drill bit, 5 mm
- Socket key/socket key attachment size 13
- Cordless screwdriver/electric drill with attachment for fastening the wood screws, depending on roofing:
 - Socket key attachment size 9
(for M12x300 hanger bolts)
 - Socket key attachment size 7
(for M12x200 hanger bolts)
 - Angle grinder with
 - Metal cutting disc
 - Stone disc
- Chalk Line
- Spirit level
- Yard stick / tape measure

3.4 About the Installation Instructions

In the following chapters all steps for the planning and mounting of the Trifix ProLine are listed in the correct sequence.

Please adhere to the mounting steps listed and be ensure to follow the safety instructions.



DANGER

Risk of fatal injury from damage to roof

Excessive loads can severely damage the roof.

- Before mounting and installation, please make sure that the building and especially the roof cladding meets the increased structural requirements for the PV system and the mounting operation.



DANGER

Risk of fatal injury from falling objects

Parts falling from the roof can result in serious injuries or death.

- Before commencing with the installation, please ensure that the material used meets the structural requirements of the site.

4. Mounting of triangles

4.1 Planning information

The triangles are pre-assembled and very depending on type and length. The installation of triangles is identical. Base triangle is manually adjustable in 5° steps.



CAUTION

Material damage due to inappropriate mounting.

Improper mounting of the triangles can cause tearing off of the triangles and leaks.

- Fasten the triangles properly
- Check the fastening of the triangles after finishing the mounting works!

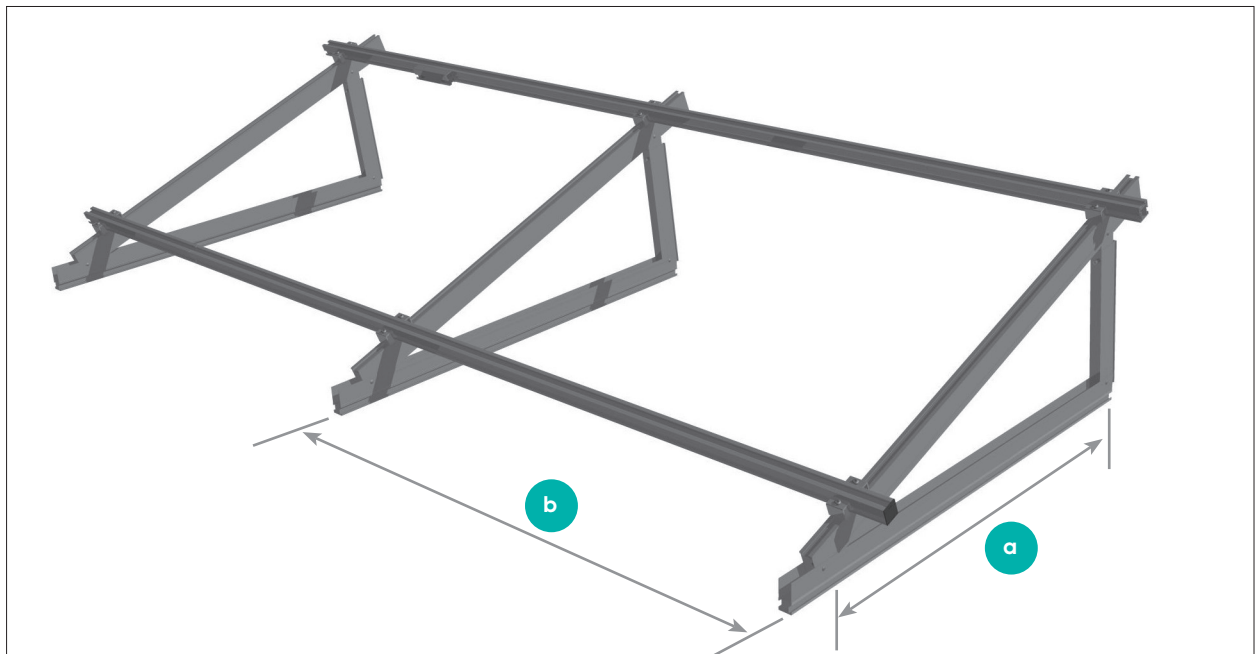


Image 4.1-1 Distances of triangles

- a Distance between fastening points on structure.
(Base triangles = 1100 mm or base triangle short = 980 mm)
- b Distance between triangles depending on static calculation.

4.2 Installing Hanger bolts

Hanger bolts can be used as roof fasteners on tin or cement asbestos roofs. These roof types have different sealing methods (rubber seal or caps) and different threading types on the lower part of the bolt (for wood or metal purlins) the correct fit of the seals is crucial to a correct installation.

Mounting steps

- Pre-drill holes for the hanger bolts. Always make sure that the hanger bolts sit on the high beads. Also observe the permissible edge distance when drilling into the substructure.
- Insert screw.
- Sufficiently tighten the sealing or cap with the nut, without damaging or deforming the roof cladding.
- Fasten bracket between the nuts and washers on the hanger bolt (Image 4.2-5)
- Place pre-assembled triangles on the bracket and fasten with a T-head bolt. Make sure the T-head bolt sits correctly in the rail channel. (Image 4.2-6) (torque 20 Nm)



CAUTION

Damage to building from leaking

Incorrectly positioned hanger bolts can lead to leaks.

- Always place hanger bolts on the high beads, never in the low beads.
- Ensure a clean fit and contact pressure of the rubber seal or cap.

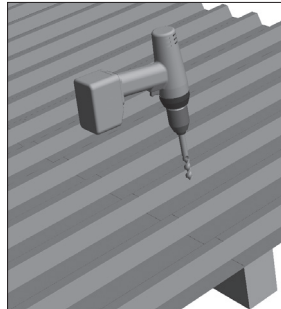


Image 4.2-1

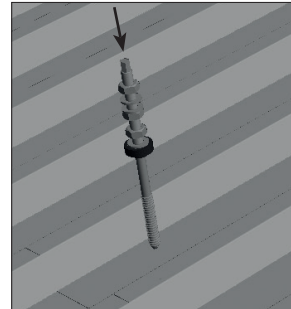


Image 4.2-2

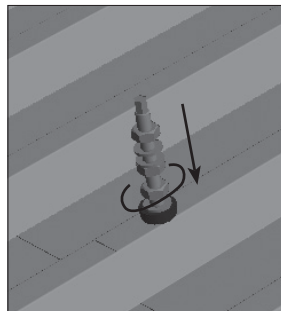


Image 4.2-3

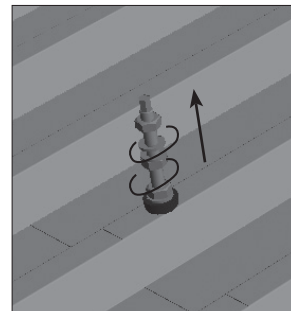


Image 4.2-4

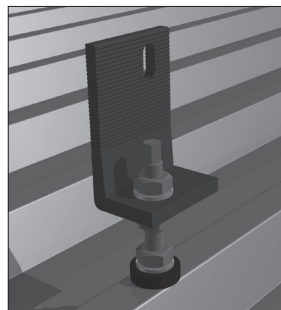


Image 4.2-5

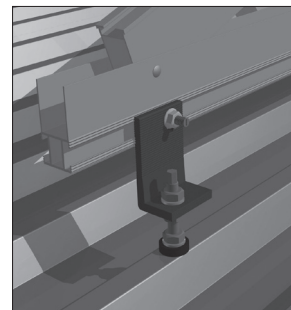


Image 4.2-6



CAUTION

Damage to the building and the PV system due to incorrect installation

Incorrectly mounted hanger bolts can pull out.

- Pre-drill holes for the hanger bolts.
- Make sure to observe the permissible edge distance for drill holes in wood / metal when fastening in the purlin.

4.3 Installing Standing Seam Clamps

Standing seam clamps can be used as roof fasteners on standing seam roofs. The design of standing seam clamps varies according to the type of standing seam. It is important to note that for this type of fastening, the roof cladding must be able to absorb the wind suction forces flowing from PV system. The suitability of the roof cladding and fastener must therefore be verified on site for each project. Additional structural measures such as e.g. an improved fastening of the sheet metal elements on to the purlins might be required.

Mounting steps

- Place the standing seam clamps at the defined fastening points on the standing seam. (Image 4.3-1)
- Align standing seam clamps, e.g. with the help of a chalk line.
- Tighten the standing seam clamps. Make sure to adhere to the torques specified by the respective manufacturers of the standing seam clamp.
- Fasten the supplied L-bracket with bolt, washer, lock washer and nut to the seam clamp see Image 4.3-2. (torque 20 Nm)

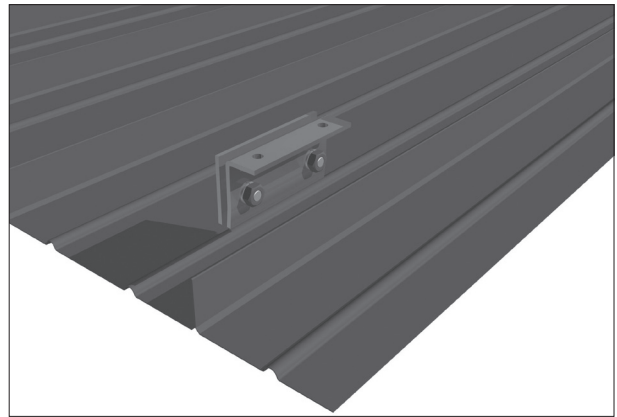


Image 4.3-1

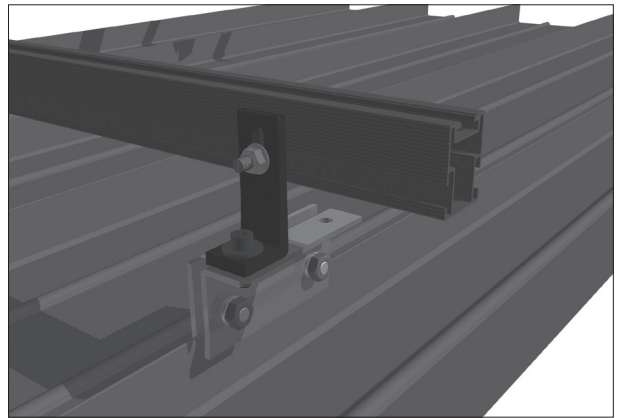


Image 4.3-2

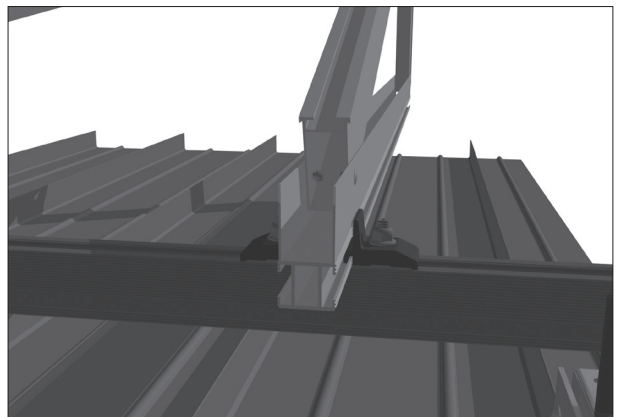


Image 4.3-3



CAUTION

Damage to the building and the PV system due to an unsuitable roof structure

Installation on unsuitable or inadequately fastened standing seam roofs can result in severe damage to or the breakaway of the sheet metal elements.

- Prior to installation, make sure the sheet metal elements and the fastening thereof are suited to permanently carrying the additional PV-system.
- Do not install standing seam clamps on suitable roof structures!
- Make sure to perform any additional structural measures that might be required in accordance with the national and local regulations. If you have any doubts please contact a specialist roofing company!



CAUTION

Damage to the building and the PV system due to incorrect installation

Incorrectly installed standing seam clamps can break away.

- When installing the standing seam clamps, adhere to the torque specified by the manufacturer.

4.4 Installing Sheet of metal rail with Ballast

Some roofs cannot be penetrated or equipped with roof fasteners. In such cases, the mounting can be installed on the roof using sheet of metal rail which are ballasted afterwards with gravel or concrete blocks. This method requires strict observance of the roof's load taking capacity. The necessary ballast will be defined in the layout of the mounting.



CAUTION

Ballast

Observance the roof's load taking capacity.

- Prior to installation, make sure the structural condition is suited for the mounting of the system.

Mounting steps

- Position the sheet of metal rails and protection mat or something like that between the rail and roof skin (Image 4.4-1). Make sure that the sheet of metal rails are aligned to each other.
- Place pre-assembled triangles on the rails and fasten it with 4 cross rail connectors (outer click mechanism). Click the cross rail connectors on the rail. Make sure that the head of the cross rail connector hooks into the side of the rail channel. Fasten to cross rail connector with a torque of 8-10 Nm (Image 4.4-2 and Image 4.4-3). Put the concrete blocks on the sheet of metal rail.

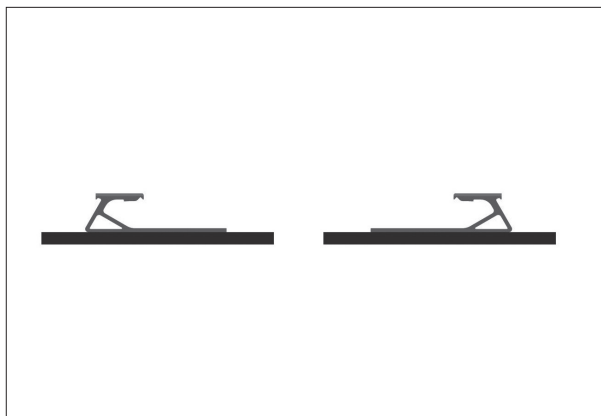


Image 4.4-1

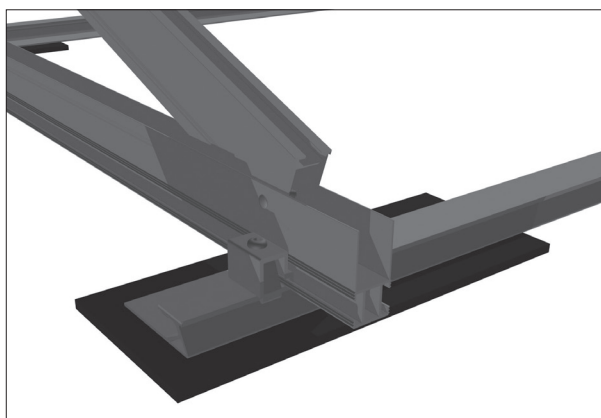


Image 4.4-2

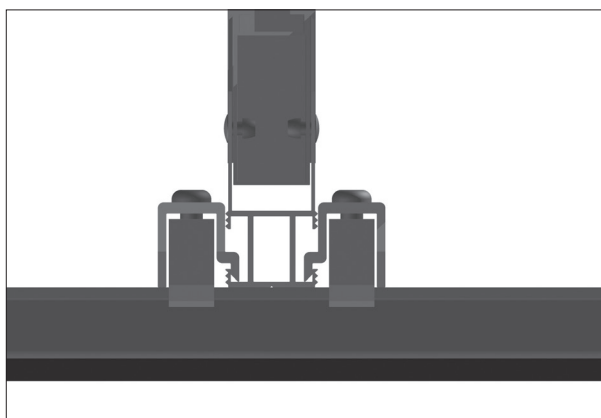


Image 4.4-3



Image 4.4-4

4.5 Installing Trapeze-Sheet of metal rail with Ballast

Some roofs cannot be penetrated or equipped with roof fasteners. In such cases, the mounting can be installed on the roof using trapezoidal sheets which are ballasted afterwards with gravel or concrete blocks. This method requires strict observance of the roof's load taking capacity. The necessary ballast will be defined in the layout of the mounting.



Ballast

Observe the roof's load taking capacity.

- Prior to installation, make sure the structural condition is suited for the mounting of the system.

Mounting steps

- Position trapezoidal sheets and possible protection mat or something like that between the sheet and roof skin.
- Fasten the rail on defined fastening points with trapeze fasteners (Image 4.5-1 and image 4.5-2)
- Place pre-assembled triangles on the rails and fasten it with cross rail connector (torque 8 Nm). Make sure that the head of the cross rail connector hooks into the side of the triangle and T-head bolt is correct into the rail channel.

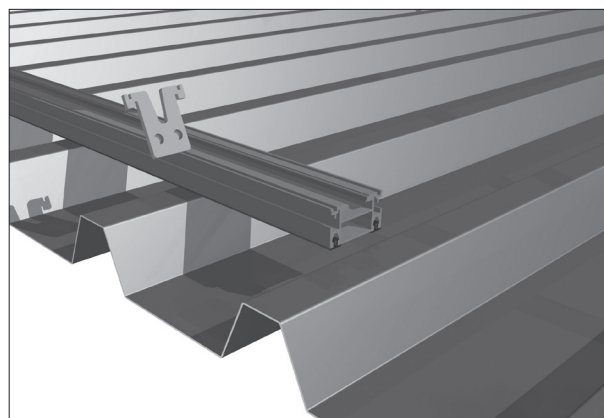


Image 4.5-1

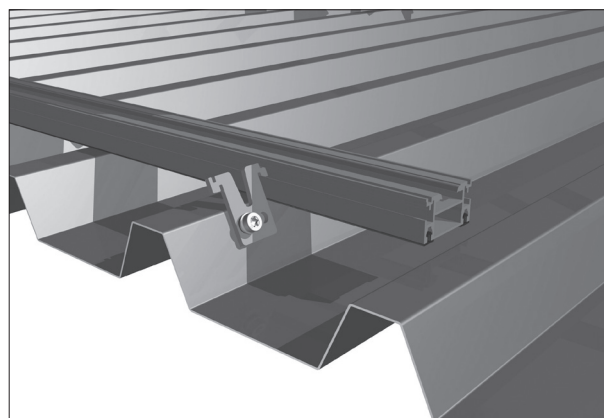


Image 4.5-2

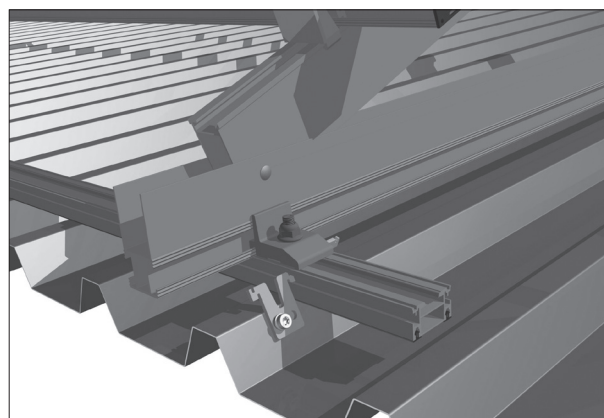


Image 4.5-3

4.6 Installing Metal dowel with Ballast

Some roofs cannot be penetrated or equipped with roof fasteners. In such cases, the mounting can be installed on the roof using concrete blocks. This method requires strict observance of the roof's load taking capacity. The necessary ballast will be defined in the layout of the mounting.

Mounting steps

- Position concrete blocks and possible protection mat or something like that between the blocks and roof skin.
- Pre-drill holes for the metal dowel. Observe the permissible edge distance when drilling into the concrete blocks (Image 4.6-1).
- Thrust the metal dowel through the bracket into the concrete substructure. (Image 4.6-2)
- Sufficiently tighten the metal dowel with the nut, without damaging the bracket.
- Place pre-assembled triangles on the bracket and fasten it with T-head bolt. Make sure that the T-head bolt is correct into the rail channel. (torque 20 Nm)



Ballast

Observance the roof's load taking capacity.

- Prior to installation, make sure the structural condition is suited for the mounting of the system.

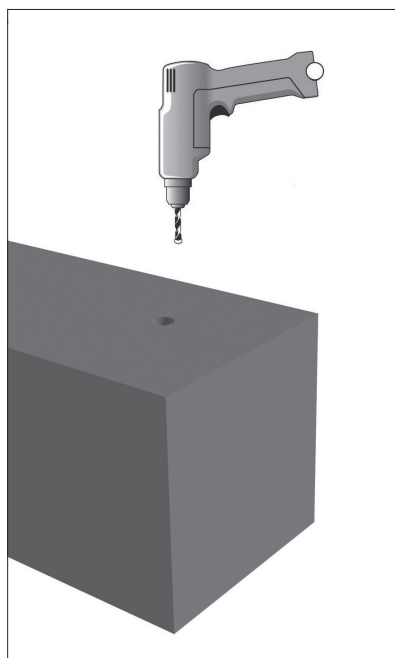


Image 4.6-1

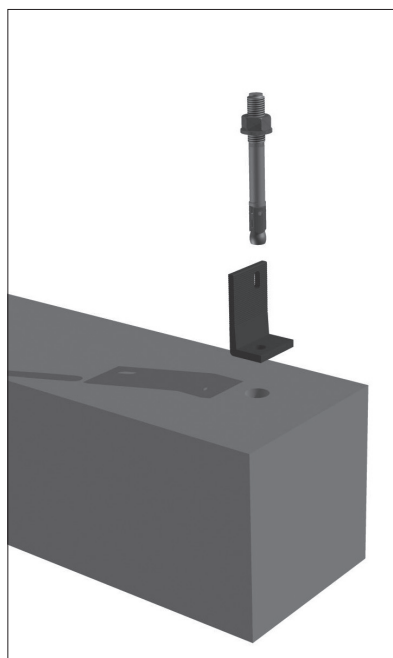


Image 4.6-2

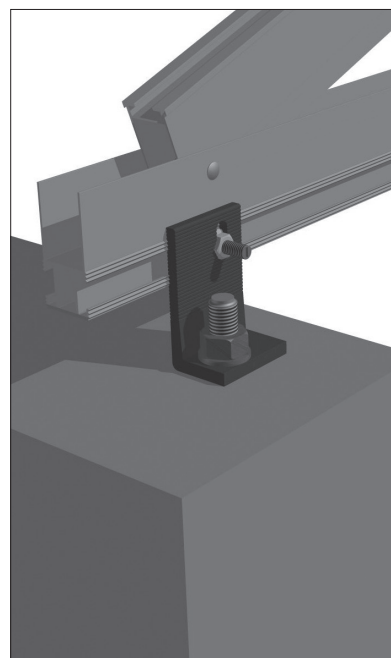


Image 4.6-3

5. Stiffening of triangles

When all triangles are mounted after respective fastening type, the stiffeners are attached. The stiffeners are to install on each completed row and at least every 12 m.

Mounting steps

- Fasten the stiffener on the triangle strut with a T-head bolt set.
- Turn the T-head bolt 90° to the stop so that the head of the bolt cross rail channel.
- Tighten the locking nut (torque 20 Nm) and finalized the connection.

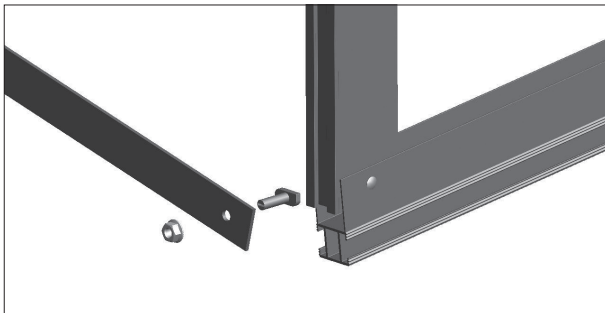


Image 5-1

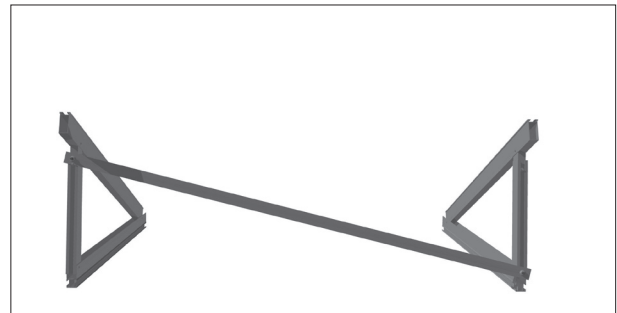


Image 5-2



CAUTION

Material damage due to incorrect installation

Incorrectly installed T-head bolts can pull out.

- When inserting the T-head bolts, always ensure the correct, vertical fit of the bolt head in the channel.
- When aligning the rails and during the final fastening of the T-head bolts, make sure that the head of the bolt does not slip into an incorrect position unnoticed.
- Adhere to the specified torque of 20 Nm!

6. Installing the Base Rails

6.1 Mounting the Base Rails

The top layer of rails fastens to the triangle with a cross rail connector (outer click mechanism). Two horizontal base rails are mounted per row.

Mounting steps

- Click 4 cross rail connectors on each triangle.
- Observe the notes of the module manufacturer for the distance between the cross rail connectors.
- Place the base rails at angle of 90° on the top of the mounted triangles. Hook the cross rail connector in the slot of the base rail and fasten it with a torque of 8 Nm.

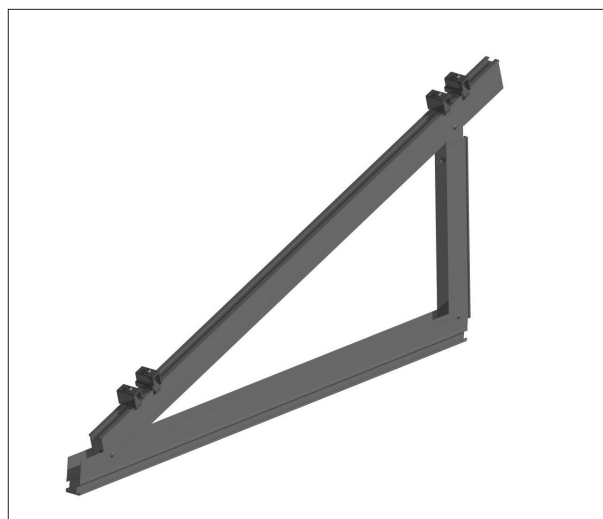


Image 6.1-1

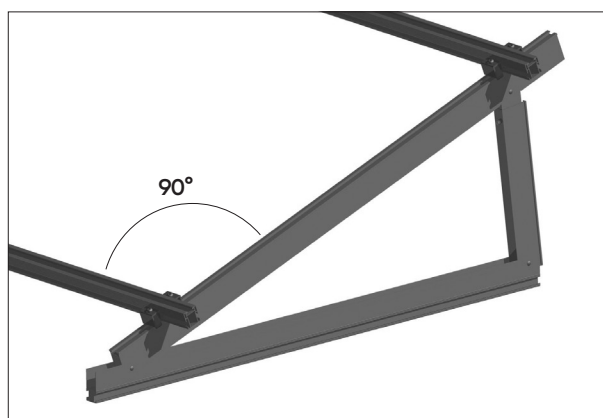


Image 6.1-2

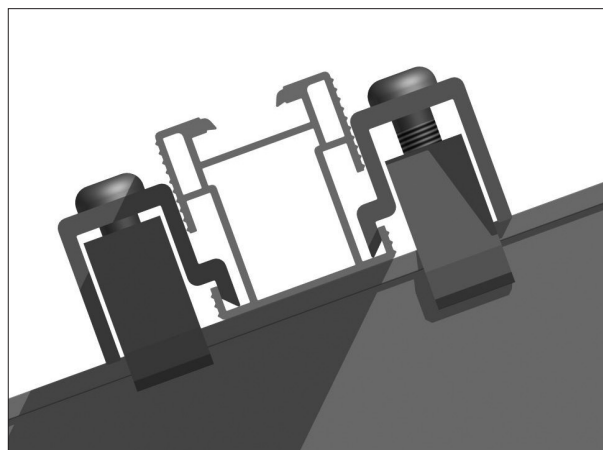


Image 6.1-3

6.2 Connection of the Base Rails

Rail connectors are provided for the linking of the individual base rails. There are two different versions of connectors available for each rail thickness, interior and outer connector.



NOTE!

Connected rails should not exceed a length of 12 m. Thereafter, an expansion joint (approx. 2-3 cm) must be considered. Do not install modules over expansion joints. The total rail length required depends on the width of the module field.

Mounting steps – interior connector

- Insert the rail connector into the first base rail until the stop.
- Slide the next base rail onto the placed rail connector until the stop.

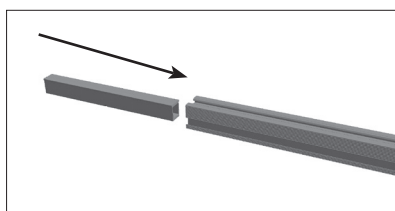


Image 6.2-1

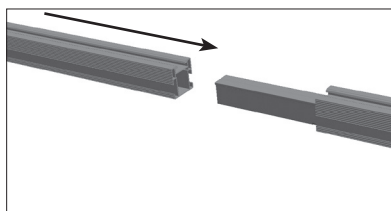


Image 6.2-2

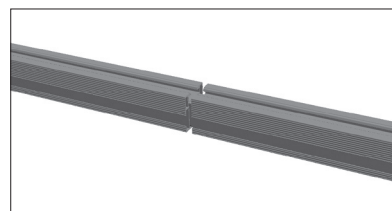


Image 6.2-3

Mounting steps – outer connector

- Slide the connector halfway into the side channel on the back of the base rail.
- Push the second base rail to the stop on the connector.
- Tighten both bolts manually, thus completing the connection (torque 20 Nm).

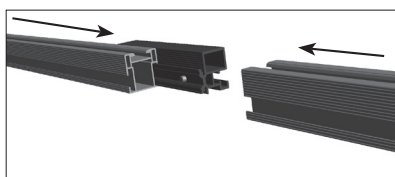


Image 6.2-4

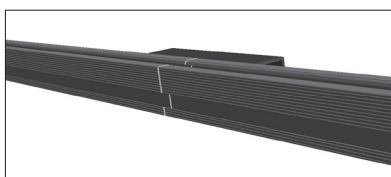


Image 6.2-5

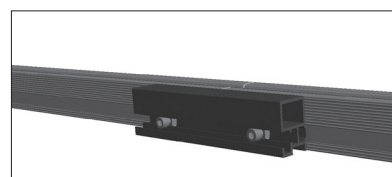


Image 6.2-6

6.3 Placing the End Caps

The end caps are optional components and only have an optical function.

Mounting steps

- From the outside push the end caps onto the ends of the base rails.

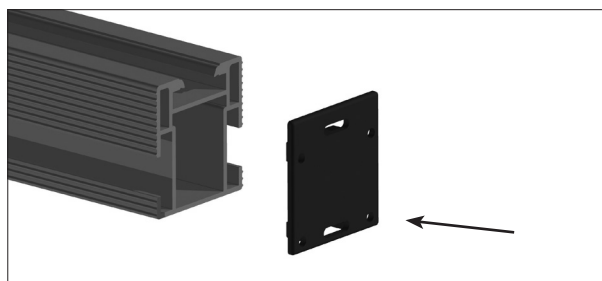


Image 6.3-1

6.4 Telescoping End Pieces

The telescoping end pieces allow for the cut-out-free setting of the base rail length, precisely to the millimeter. They are placed on the right side of each continuous base rail row. You can lengthen the base rail by a maximum of 66 cm. The telescoping end pieces are supplied pre-assembled including a narrow base rail section for fastening to the roof fastener as well as a slightly wider base rail section for fastening the module end clamp.

Mounting steps

- Do not finish the base rail row with a pre-cut base rail but with the telescoping end piece.
- Slide the telescoping end piece into the side channel on the back of the base rail.
- If required, push the loose base rail section to the position of the last roof fastener. Adjust the slide-in to achieve the desired length for the rail row. For a clean finish, the rail and telescope should protrude by the width of the module +5 cm over the second last module.
- Tighten the socket head screw of the telescope end piece see image 6.4-3 – torque 20 Nm.
- Mount the last triangle and the module as described above.

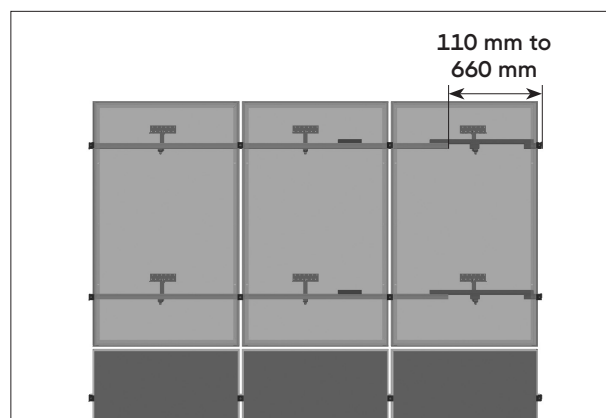


Image 6.4-1

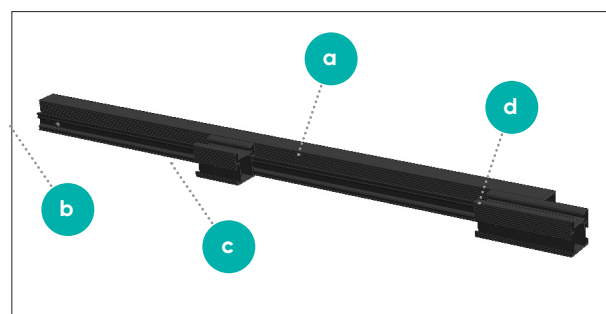


Image 6.4-2

- a - Connector piece for variable insertion into the base rail
- b - Bolt and square nut for fastening to the base rail
- c - Loose base rail section for connection to a roof fastener
- d - Permanently mounted base rail section to take the module end clamp

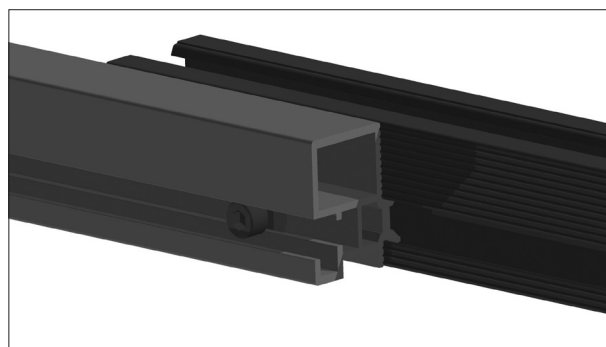


Image 6.4-3

7. Installing the Clickstones

Clickstones are used for the fastening of the modules. The Clickstone is a special clip with which the module clamps are fastened in the base rail. You only need an allen key (5 mm) for the installation. You can insert the Clickstone from above into the top channel of the base rail.

Mounting Steps

- Insert the Clickstone at a slight angle into the rail channel.
- Push the Clickstone down. Make sure you hear the Clickstone clicking into the base rail.
- Tighten the bolt with a torque of 8 Nm.



NOTE!

The shape of the Clickstone corresponds exactly to the profile of the rail channel. It has been consciously constructed not to run easily in order to prevent unintentional slipping in vertical rail tracks. To move the Clickstone, press lightly on the bolt, from above, and move the stone with a little pressure along the rail channel.

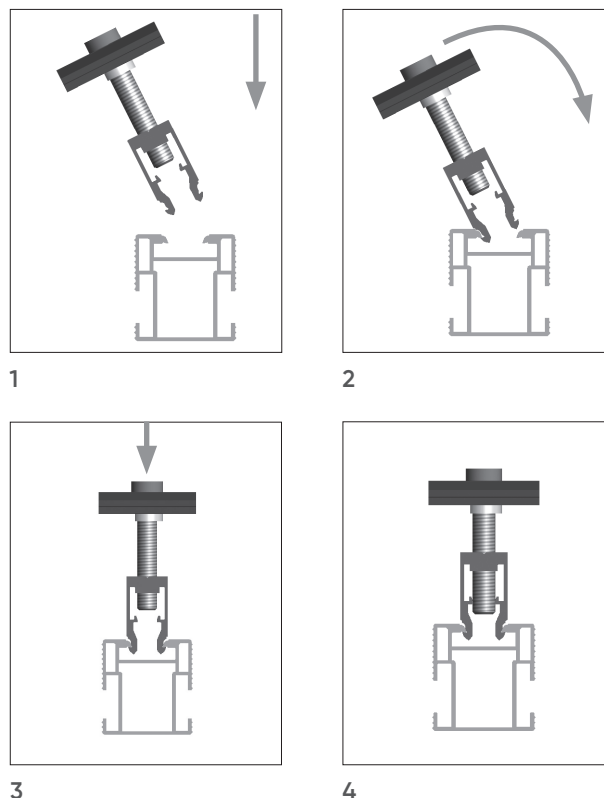


Image 7 - 1 Mounting Steps

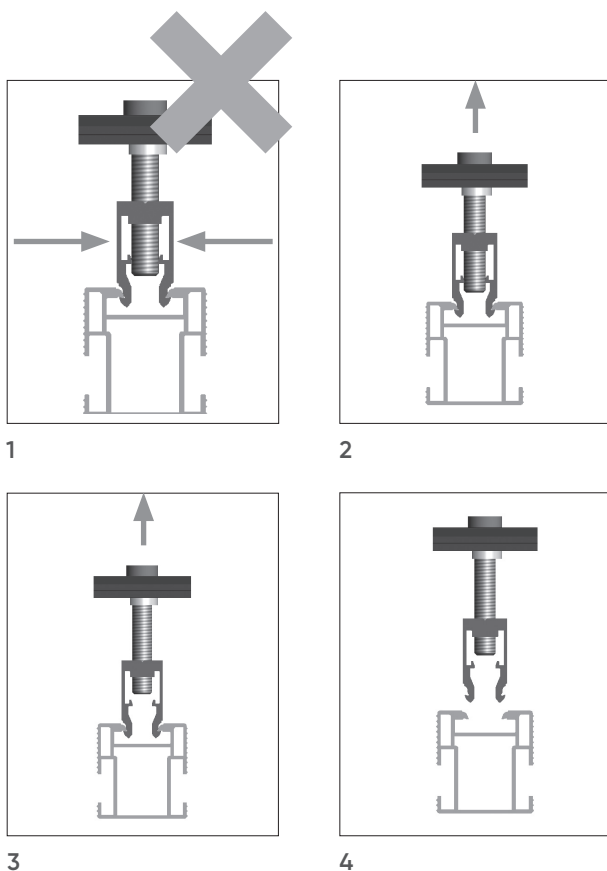


Image 7 - 2 DeMounting Steps



NOTE:

The lugs on the inside of the Clickstones are designed in such a way that once the bolt has been tightened, they prevent a "click out" mechanically. Accordingly, the bolt must first be unscrewed to above the lugs before the Clickstone can be removed from the base rail by pressing the sides of the stone together and lifting.



CAUTION

Material damage due to incorrect installation

Incorrectly mounted Clickstones can slip out. PV modules can fall and be damaged.

- Mount all Clickstone connections in accordance with the instructions.



CAUTION

Material damage caused by deformed Clickstones

If clearly deformed Clickstones are used, the safety of the module fastening is not guaranteed. PV modules can fall and be damaged.

- Only use Clickstones where the lugs are parallel to each other and you can clearly hear them clicking into the rail channel.
- Replace deformed Clickstones prior to installation.

8. Module Installation

The modules are installed on the base rails one by one. Mounting Systems GmbH recommends mounting the modules starting from one side. Module clamps and module end clamps are used for the fastening of the modules. The module end clamps can hold one module each. The module clamps are positioned between two modules.

8.1 Fastening the Modules on the Outer Side

The margin modules of the PV system are on the left and right side at a portrait installation (image 8.1-1) and on the up and down side at a landscape installation (image 8.1-2). These modules are fastened on the outer side with two module end clamps each.



NOTE:

Please adhere to the module-clamp standards of the module manufacturer. Basically, the modules are clamped at the quarter points.

Mounting Steps

- Position and adjust the module on the base rail.
- Insert the Clickstone of the module end clamp into the channel of the base rail.
- Push the module end clamp right to the module frame (max. permissible gap 1 mm).
- Tighten the bolt (torque 8 Nm) and thus clamp the module.



CAUTION

Material damage due to incorrect mounting

Incorrectly fastened modules can fall and become damaged.

- Make sure the Clickstones click in correctly.
- Push the module end clamp all the way to the module.
- Adhere to the stipulated torque of 8 Nm when tightening the bolt.
- Check the module fits tightly after mounting.

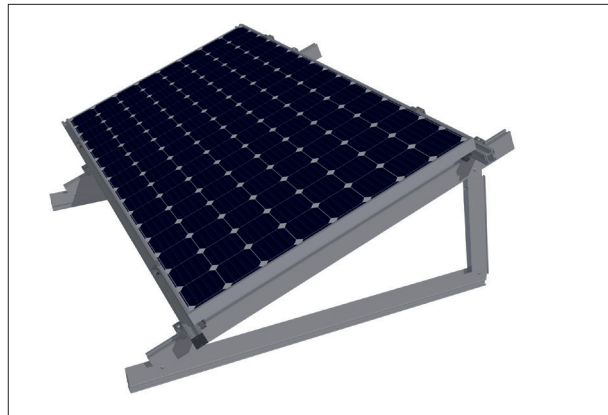


Image 8-1 Portrait installation

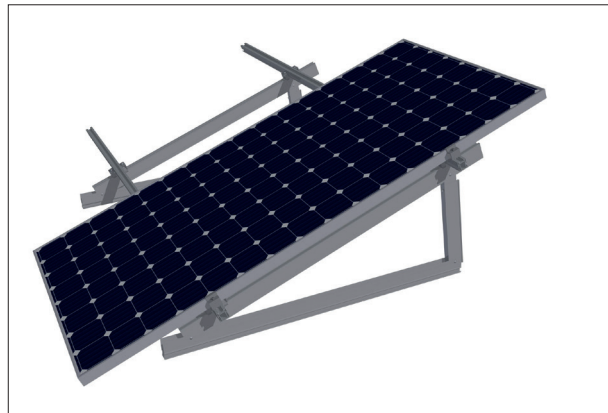


Image 8-2 Landscape installation

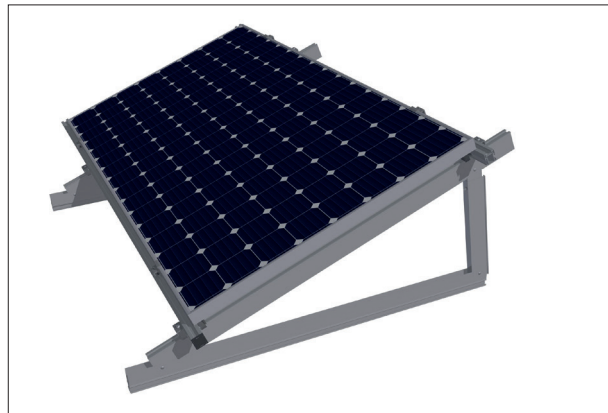


Image 8-3 Orientation of modules

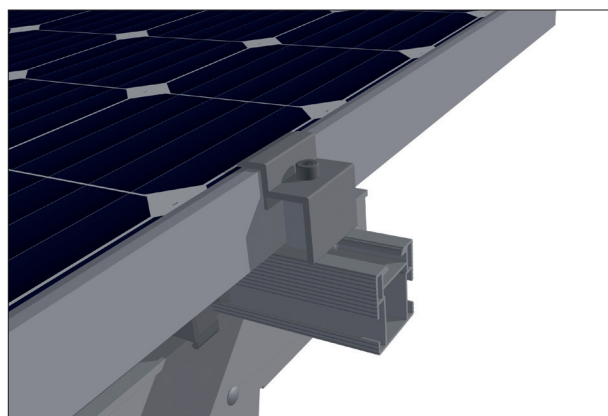


Image 8-4 Mounting of module end clamp

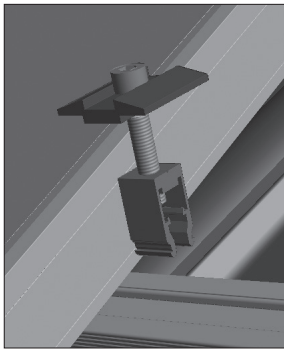
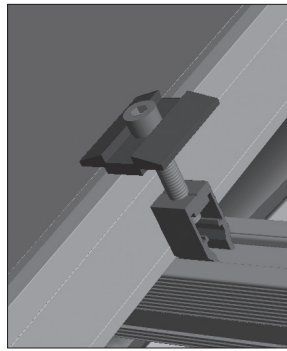


Image 8.2 - 1



8.2 - 3

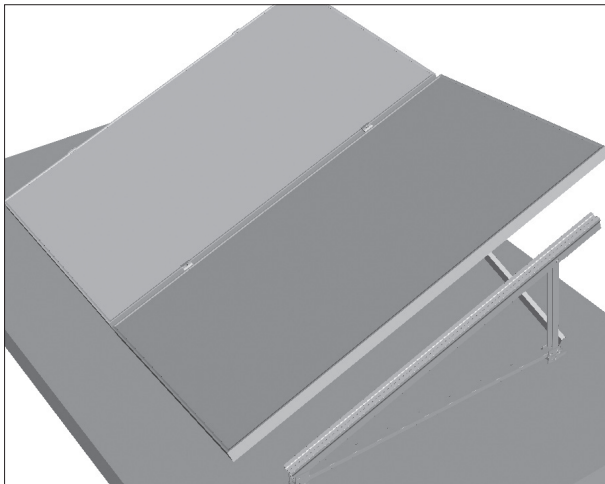


Image 8.2 - 3

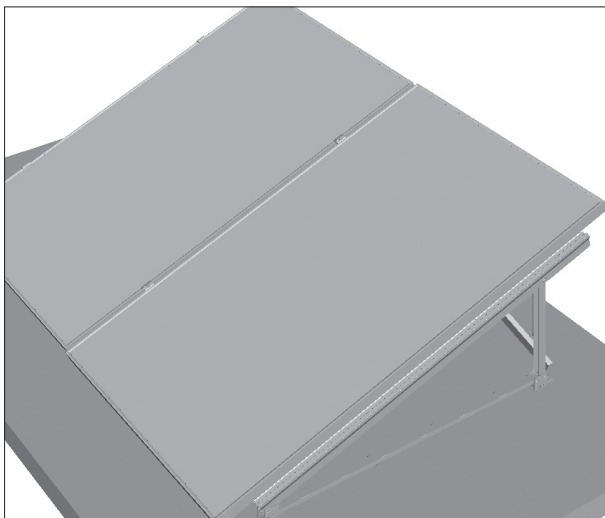


Image 8.2 - 4

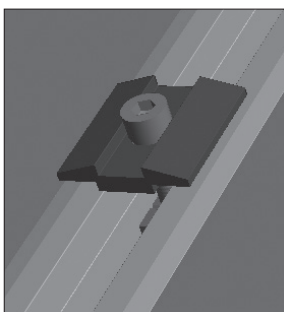


Image 8.2 - 5

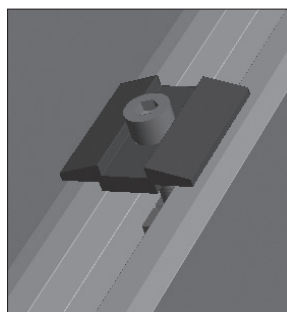


Image 8.2 - 6

8.2 Fastening the Modules on the Inner Side

Two module clamps are fastened between two modules.

Mounting Steps

- Insert the Clickstone of the module clamp into the channel of the base rail.
- Push the module clamp all the way to the frame of the already mounted module.
- Push the second module to the module clamp (max. permissible gap between two modules: 19mm) and align.
- Tighten the bolt (torque 8 Nm) and thus clamp the modules.



CAUTION

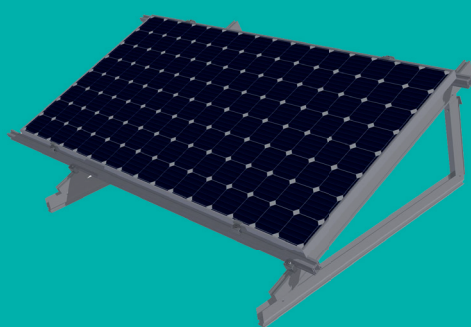
Material damage due to incorrect mounting

Incorrectly fastened modules can fall and get damaged.

- Make sure the Clickstones click in correctly.
- Push the modules all the way to the module clamp.
- Adhere to the stipulated torque of 8 Nm when tightening the bolt.
- Check both modules fit tightly after mounting.



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