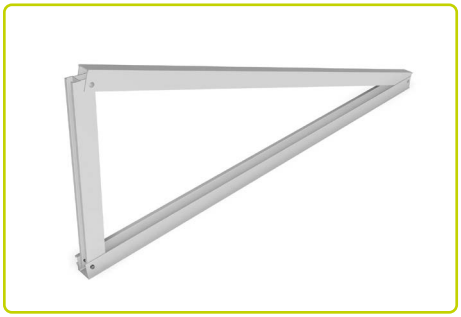
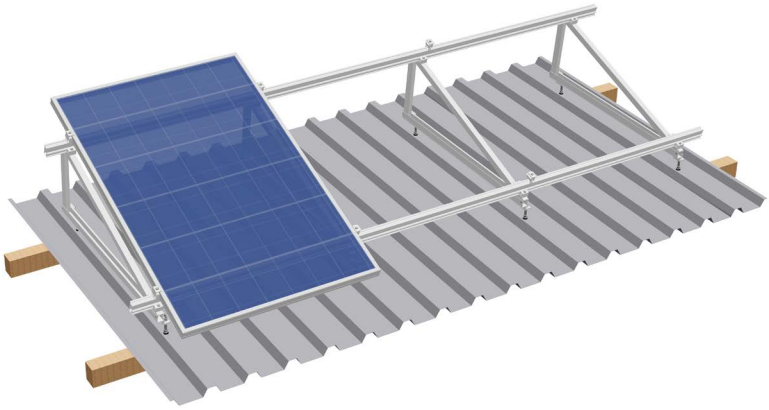
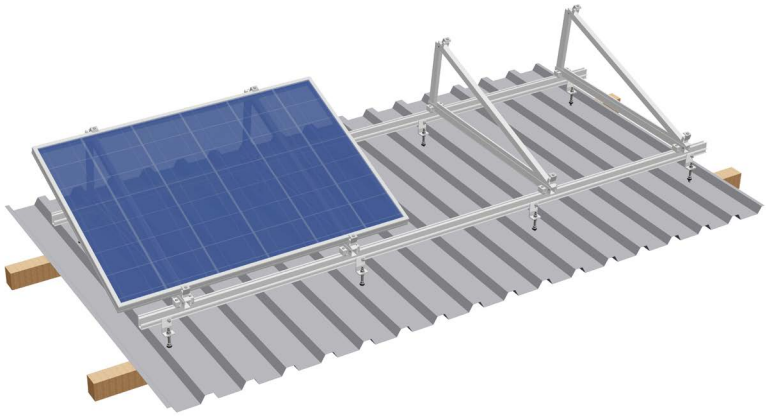
Installation instructions

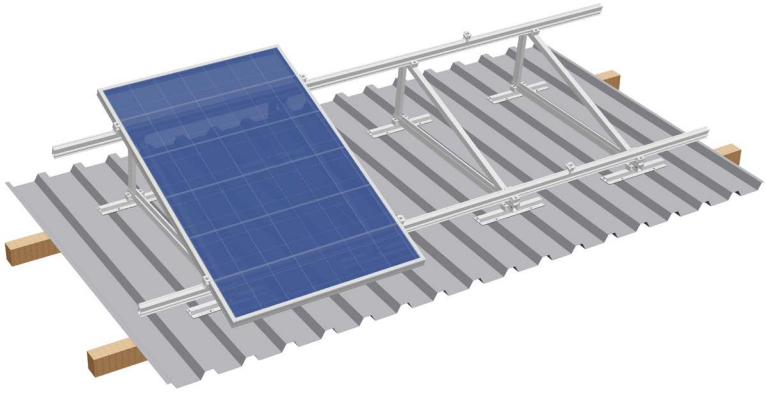
S:FLEX DELTA TRIANGLE INSTALLATION

For flat roofs and pitched roofs









Read these installation instructions carefully before installing the S:FLEX mounting system and retain them for future reference!
These installation instructions are only complete with the project-specific implementation plans (project report)!

The S:FLEX PV fastening system for flat and pitched roofs with the Delta Triangle is a frame system for mounting PV modules. The Delta Triangles allow the PV modules to be mounted in an elevated position at the desired angle of inclination. Installation is possible on flat roofs (under 5° roof pitch) and pitched roofs.
There is the option of direct connection to the roof substructure with hanger bolts, the option of connection to the roof covering for trapezoidal sheet metal roofs and the option of ballasted installation. Another option is a direct roof connection on concrete roofs.
Both vertical and horizontal installation of the modules is possible using the S:FLEX fastening system.
An outstanding feature of the S:FLEX PV fastening system is the high availability of pre-assembled parts. The system's patented and proven click technology ensures the shortest possible installation times.
All components are generally made of aluminium and stainless steel. The high degree of corrosion resistance ensures a long service life and offers the possibility of complete recycling.
These installation guidelines are intended for a group of people with relevant qualifications who have been instructed by the operator of the PV system.
The installation of the S:FLEX PV mounting system on flat and pitched roofs with different coverings requires extensive expertise on the part of the installer. We therefore recommend contacting a specialist roofing contractor for this purpose.

1.1 Intended use

The S:FLEX PV fastening system Delta Triangle is a frame system for mounting PV modules.
It is designed exclusively for the installation of PV modules.
Any other use in this regard is considered misuse of the product. In particular, compliance with the instructions in these installation guidelines constitutes intended use. S:FLEX GmbH accepts no liability for damage resulting from non-observance of the installation guidelines or from misuse or incorrect use of the product.

1.2 About this document

The S:FLEX PV fastening system Delta Triangle enables the installation of elevated PV systems on flat and pitched roofs. The maximum possible roof pitch and elevation is shown in the project report.

This installation recommendation describes the installation process using the Delta Triangles. This is possible with:

- *Trapezoidal and corrugated sheets*
- *Corrugated fibre cement*
- *Foil and bitumen roofs*
- *Concrete roofs*
- *Roofs with gravel*
- *Sandwich elements*

When installing PV systems on flat roofs, ensure that the insulation has sufficient load-bearing capacity and compressive strength to support the installation. This applies in particular to ballasted installations. A building permit may be required for elevated structures.

1.3 Warnings

The warning texts provided in these installation instructions relay safety-related information.
These consist of the following:

Unless observed, there is a major risk of injury as well as a risk of death.

Non-compliance may lead to property damage.

1.4 General information – standards and guidelines

Every photovoltaic system must be installed in accordance with the specifications in the respective installation instructions and project report.
These installation guidelines are based on the currently recognised state of the art and many years of experience installing our systems. It must be ensured that only the current and complete installation guidelines are used for the installation and that a print-out of the installation guidelines is stored in the immediate vicinity of the system. The system and these guidelines are subject to technical changes.

The project report is part of the installation instructions and is created on a project-specific basis. All of the information contained in the project report must be strictly observed. The project report contains the location-specific structural calculations. The S:FLEX mounting system must be designed and created with the S:FLEX software (Solar.Pro.Tool).

Since individual project-specific features must be considered with every roof, expert advice must always be sought prior to installation. Before installation, the PV system creator must ensure that the existing roofing and roof substructure are suitable for the additional loads. The condition of the roof substructure, the quality of the roof covering and the maximum load-bearing capacity of the roof construction must be checked by the system creator.
Contact a local structural engineer for this purpose.

When installing the PV system, always comply with the module manufacturer's installation instructions. In particular, it is necessary to check that the module manufacturer's instructions regarding the module clamping guidelines (module clamping surface and clamping range) are complied with. If this is not the case, the customer must obtain a declaration of consent from the module manufacturer before the installation; alternatively, the mounting system must be adapted in accordance with the module manufacturer's specifications.

The requirements for the protection of PV mounting systems against lightning and surges must be met in accordance with the DIN and VDE regulations. The specifications of the relevant power supply company must be observed.

Care must be taken that the PV system to be installed does not impair the functioning of the existing lightning protection system.
Option 1: It is important to ensure that the PV system is designed so that it can be included in the protection zone of the building's lightning protection system.
Option 2: No connection to the lightning protection system: The separation distances between the PV system and the lightning protection system specified in the relevant regulations must be adhered to.
To ensure this, contact a company that specialises in lightning protection.

The valid fire protection regulations must be observed during installation. Fire protection walls may not be built over, fire protection compartments must be preserved and the corresponding spacing regulations must be adhered to.

If the roofing is altered, the manufacturer's guidelines must be observed. During and after installation, the frame components may not be stepped on or used as a climbing aid. There is a risk of falling and the roofing underneath could be damaged.

Prior to installation, the creator of the photovoltaic system must ensure that the installation is carried out while strictly adhering to national and local building regulations, safety and accident prevention regulations, standards and environmental protection regulations.

Every person who installs the S:FLEX PV mounting systems is obligated to independently inform himself/herself about all rules and regulations for professionally correct planning and installation, and to comply with said rules and regulations during the installation process. This also includes compliance with the latest versions of the respective rules and regulations.
Installation of the PV system may only be carried out by trained specialists.

All system components must be checked for damage before installation.
Damaged components must not be used!

Installation of the S:FLEX substructure and the PV system may only be carried out by trained specialists. System components must not be used as step ladders. The modules must not be stepped on. When working on roofs, there is a risk of falling off and falling through roofs. A fall can result in injury or death. Ensure that appropriate climbing aids and fall-protection equipment (e.g. scaffolding) are provided as well as protection from falling parts.

Check the building statics and construction/condition of the roof substructure before starting the installation.
During installation, the specifications in the installation instructions and project report must be strictly observed. Failure to observe the installation guidelines and the project report may result in damage to the PV system and to the building.

1.5 Description of the system

The S:FLEX system including the Delta Triangle offers suitable solutions for different requirements:

System properties – Delta Triangle

Application:	PV mounting system for elevated installations on flat and pitched roofs
Roof covering:	corrugated fibre cement, trapezoidal and corrugated sheet metal; foil, bitumen, gravel, concrete, sandwich panels
Module type:	framed modules; frameless modules on request
Module orientation:	Upright, transverse
Module dimensions:	- Transverse mounting: L x W = 1310–2,100 mm x 808–1,175 mm - Upright mounting: L x W = 1,310–1,700 mm x 808–1,200 mm - Larger modules available on request
Max. load:	2.4 KN/m²
Material:	Aluminium EN AW-6063 T6, stainless steel A2 fasteners and screws
Colour:	Natural aluminium

The module manufacturer's installation instructions must always be followed. All of the manufacturer's specifications relating to installation on the roofing must be observed.

Mounting rails

The S:FLEX pitched roof system is available with aluminium mounting rails of different thicknesses to ensure the system corresponds
optimally to the requirements of the location and the installation situation.
The S:FLEX mounting rails feature a hammerhead slot on the side for connection to the fasteners. The mid clamps and end clamps are mounted from above by means of click technology.

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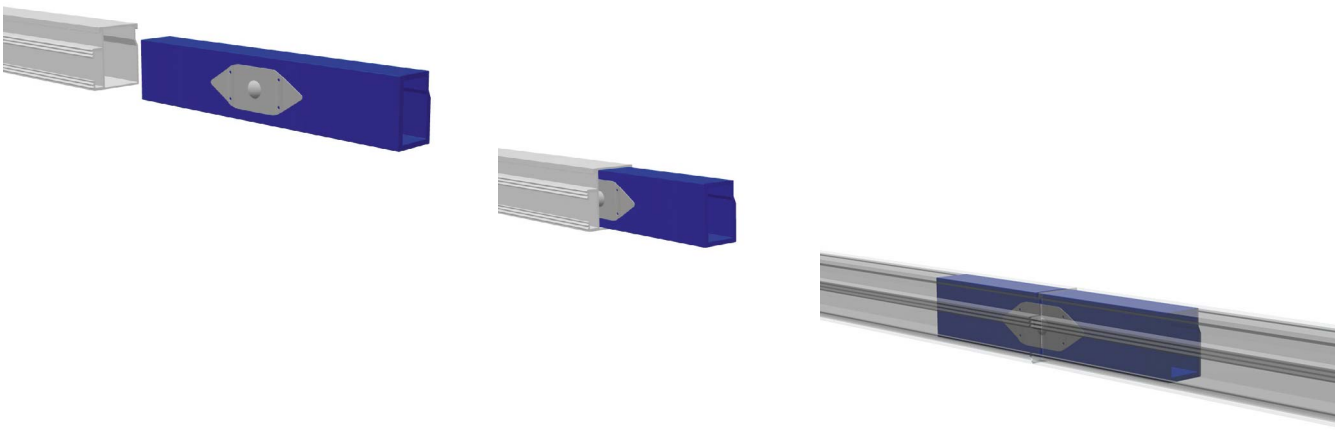
Rail splices

In addition to the basic installation, the splice technology allows a system orientation without a reduction in the load-bearing capacity in the area of the splices, since they have the same static values as the associated mounting rail.

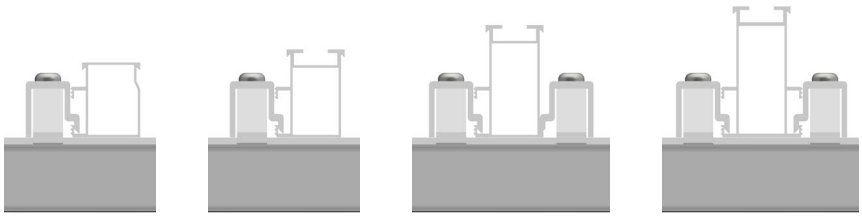
When connecting the mounting rails in succession using splices, an earthed connection can be created by applying pressure to push the mounting rails together flush to the splices. It must be ensured that the earthed connection is professionally inspected on site after installation.

In addition, the splice technology offers the possibility to quickly and easily create expansion joints according to the conditions of the roof.



Cross adapter

Intersection points (for double-layer systems) can be quickly realised in a load-bearing manner with cross adapters with patented and proven click technology. Depending on the structural requirements of the location and the installation situation, two or four cross adapters must be arranged per intersection point.



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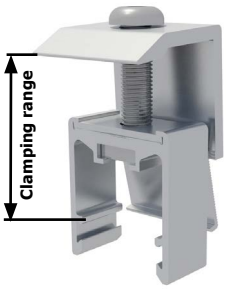
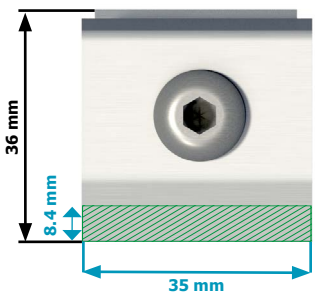
Module mid clamps and module end clamps

Height-adjustable mid clamps and end clamps with click technology allow for maximum flexibility in the installation of virtually all framed module types with a frame height of 30 – 50 mm. When installing the PV modules to the mounting rail, always comply with the installation instructions of the module manufacturer.

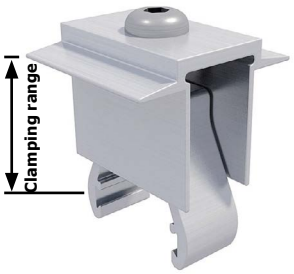
When fastening using the mid clamp and end clamp, ensure that these clamp onto the module frame over the clamping area defined by the module manufacturer. Every person who installs S:FLEX PV fastening systems is obligated to ensure that the existing clamping areas correspond with the module manufacturer's installation instructions. If the maximum clamping areas of the mid clamps and end clamps are insufficient, it is also possible to obtain the components in different lengths.

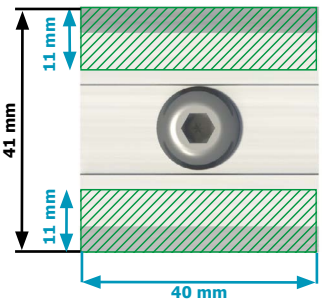




Module end clamp (EC)

Maximum clamping area EC II: A=8.4*35=294 mm²





Module mid clamp (MC)

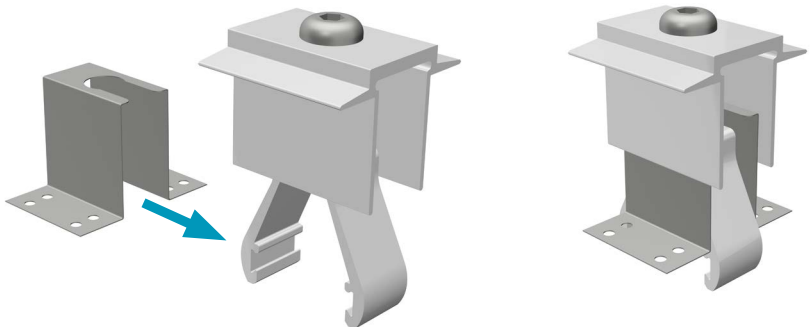
Maximum clamping area MC: A=11*40=440 mm² (per side)

Earthing

Equipotential bonding between the individual system components must be ensured in accordance with the respective country-specific guidelines and standards. System-specific properties (see splice technology) among other things can be used for this purpose.
This installation recommendation does not include an earthing concept and must be calculated or compiled by the installer in accordance with the applicable standards and guidelines.

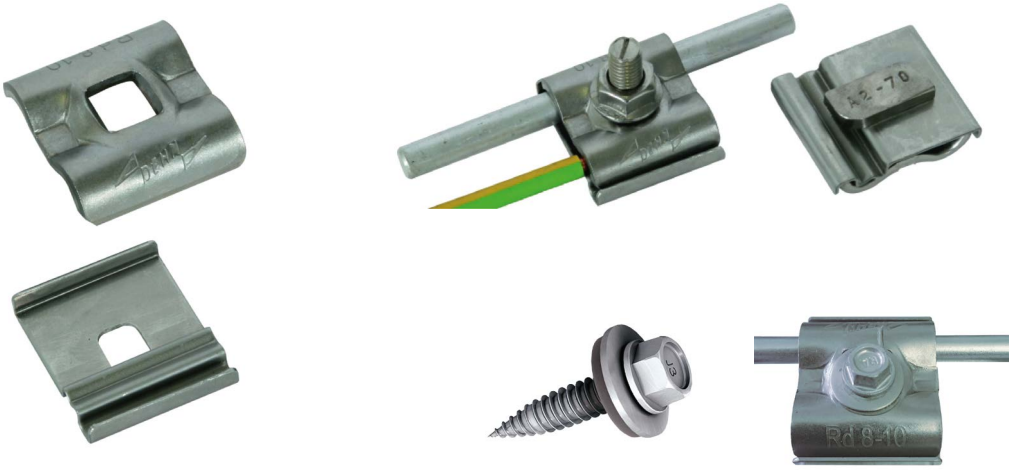
The earthing system is not a lightning protection system! When installing a lightning protection system, a specialist company must be consulted and a project-specific lightning protection plan drawn up. The module manufacturer's installation instructions must always be observed.

The earthed connection of the mounting rails is established by the splice. Additional earthing of the modules can be achieved via the grounding plate by mounting it under the mid clamps. Before earthing the module, the corresponding specifications issued by the module manufacturer must be followed.



The earthing terminals are used to integrate the mounting system into the equipotential bonding system. Clamping range for round wire: 8–10 mm; connection area: 4–50 mm² (solid and stranded wires are possible).

The connection to the hammerhead channel is made with a hammerhead bolt and locking nut. If mounting directly on the aluminium profile, use a thin sheet metal screw.



2.1 System components

① **Triangle**

Delta Triangle AK II 1230

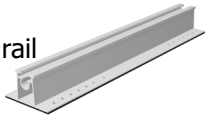
Optional:

Bracing: Delta AS l=1,180 mm
Hammerhead bolt M8x25
Lock nut M8

② **System components**

Trapezoidal sheet metal rail AK complete l=395/24

S:FLEX Lift trapezoidal sheet metal rail 375



③ **Mounting rails**

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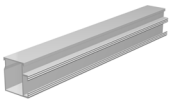

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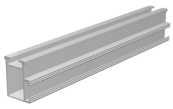

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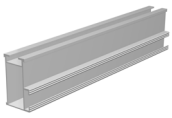

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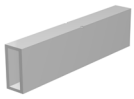
④ **Splices**

Splice 5

Splice 7

Splice 13



Splice 26

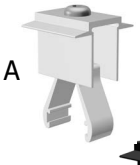
⑤ **End clamp**

EH AK II Klick 30-50

EH AK II Klick 30-50 black

⑥ **Mid clamps**

MH AK II Klick 30-50 A



MH AK II Klick 30-50 black

⑦ **Cross adapter**

Cross adapter AK

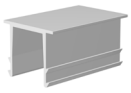
MH AK II Klick 30-50 with grounding plate

⑧ **Covering caps**

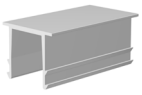
Covering cap 5

Covering cap 7

Covering cap 13



Covering cap 26



⑨ **Connecting element**

Hangar bolt

Solar fastener A

Solar fastener BZ

Angle bracket 60 mm M10 complete

Bolt anchor SP-BOZ A4 10.0X10/90

⑩ **Slipping protection set**

Slipping protection set

⑪ **Locking clips**

Locking clip AK

⑫ **Grounding clamp**

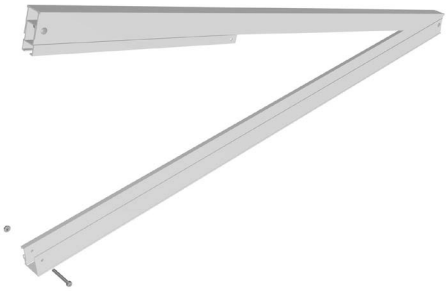
⑬ **Cable clips (optional)**

Cable ties
Cable clip KC 15

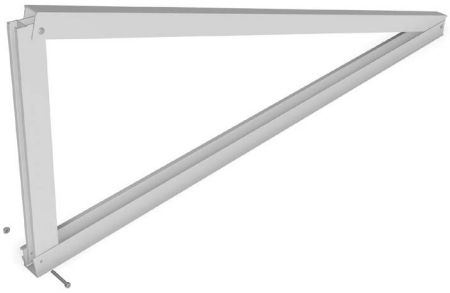
2.2 Structure of Delta Triangle

The S:FLEX Delta Triangle is supplied folded for transport.

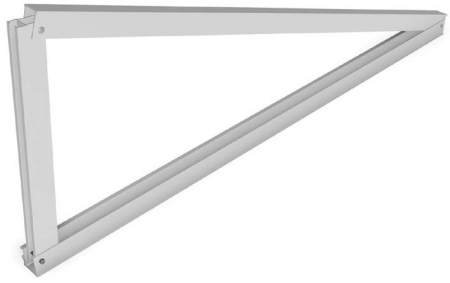
Open the Delta Triangle, loosen the DIN 912 5×40 screw and nut, and remove them from the ground rail.



Unfold the backrest and slide the lower end into the ground rail so that the holes are aligned.



Push the DIN 912 5x40 bolt through the holes in the back support and ground rail and screw it in with the nut. Tightening torque 8–10 Nm.



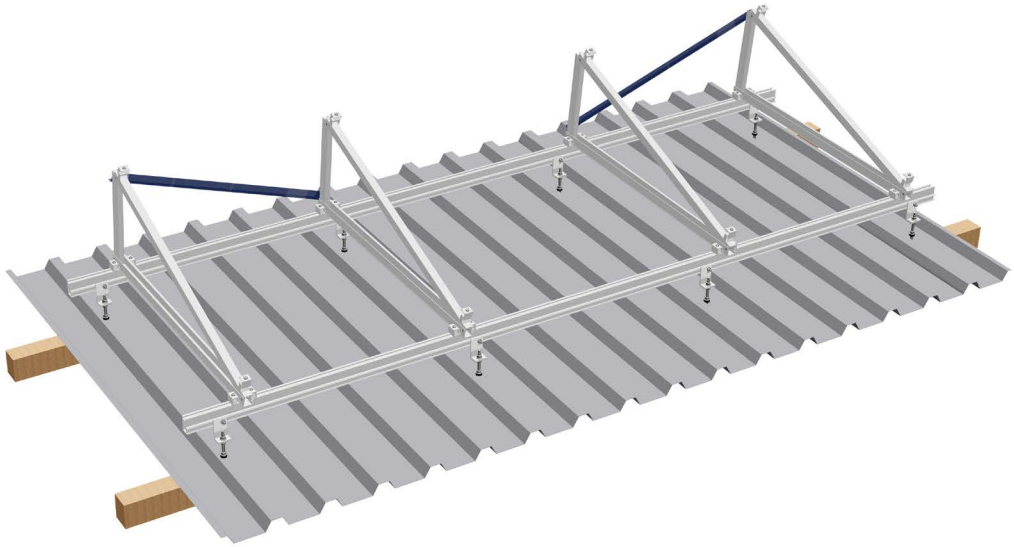
2.3 Frame assembly

The following sections show the most common mounting variants for elevated installation with the Delta Triangle. There are also other options. These can be planned on a project-specific basis and the chosen installation process can be described in detail. The S:FLEX mounting system with the Delta Triangles allows both transverse and upright mounting of the PV modules. The selected module orientation depends on the available roof area, shading distance and the structural requirements, taking wind and snow loads into account.

Module installation, transverse
The PV modules are mounted directly onto the triangles. Two Delta Triangles are required per module.

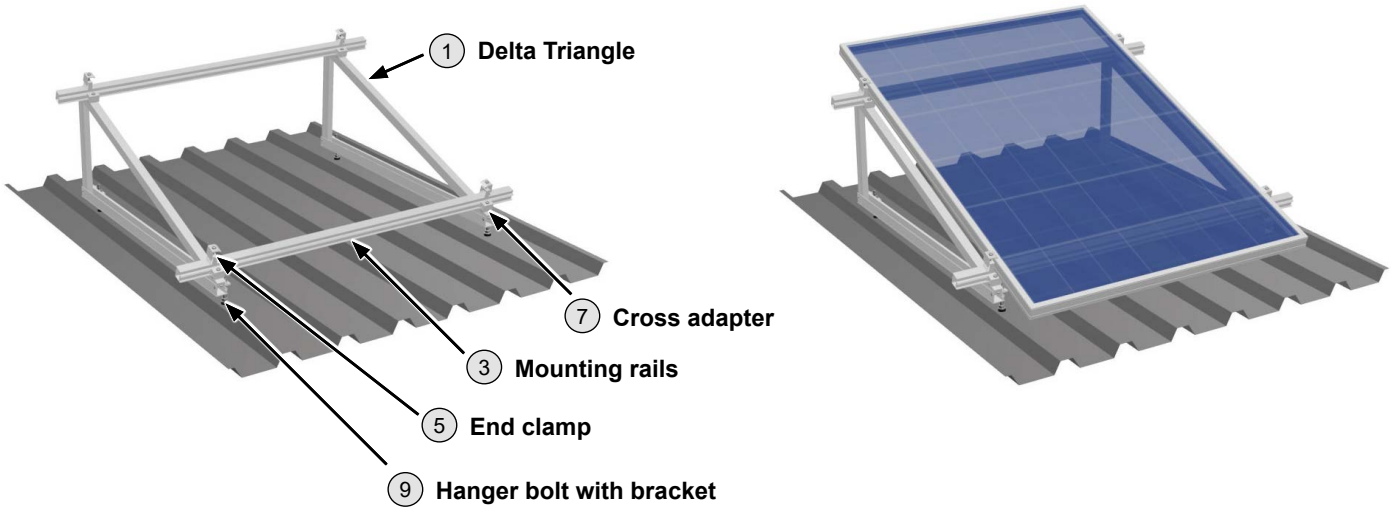
Module installation, upright
In the first step, two horizontal rows of mounting rails are mounted on the triangles.
The modules are mounted on the mounting rails.
The number of Delta Triangles required can be found in the project report.

Optional additional bracing
Depending on the wind and snow loads, it may be necessary to install additional bracing (diagonal braces) on the back of the triangles. Observe the information in the project report.
They are attached to the triangles' back supports of the using hammerhead bolts.

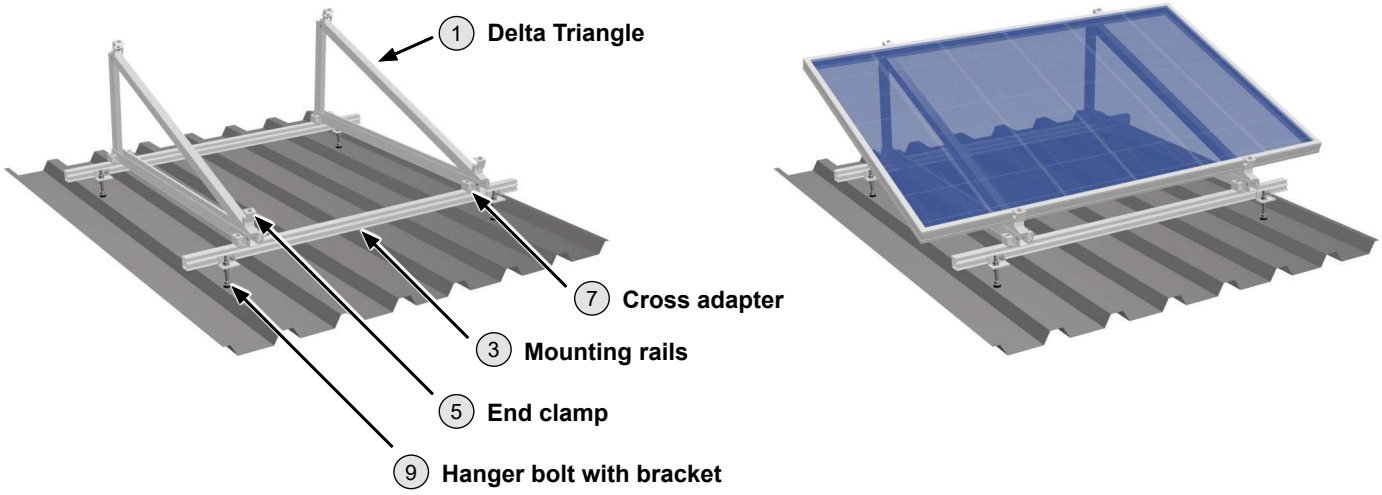


2.3.1 Installation with hanger bolts/solar fasteners

Example 1 Installation with hanger bolts:
Modules mounted upright, Delta Triangles attached directly to hanger bolts.



Example 2 Installation with hanger bolts:
Modules mounted crosswise, Delta Triangles mounted with mounting rail.



Hanger bolts/solar fasteners enable installation directly on the purlins or rafters. This creates a load-bearing connection between the building substructure and the PV mounting system. This mounting variant is particularly advantageous in regions with high wind loads. Hangar bolts/solar fasteners can be used for direct connection to the roof substructure for the following roof coverings:

- *Trapezoidal and corrugated sheets*
- *Corrugated fibre cement sheets*
- *Sandwich elements*
- *Flat roof coverings with bitumen or shingles*

Hanger bolts are used for wooden roof substructures. Solar fasteners can be used for roof substructures made of metal or wood. These connections are possible for pitched roofs with a max. roof inclination of 75°.
Positioning of the hangar bolts must be determined in accordance with the structural requirements of the site and the respective installation situation. When doing so, it must again be checked whether the measurements used during planning match the actual measurements found on the roof (if necessary, adjustments must be made).
At the marked positions, the roof covering must be drilled through in the area of the raised corrugation / wave crest and the hanger bolts must be fastened to the rafters or purlins, depending on the roof substructure. A form fit connection must be ensured between the gaskets or calottes and the roof cladding.

If using EPDM gaskets/shield gaskets, make sure that they are not compressed too much. The gasket must not be pressed beyond the end nut.

For flat roof coverings with artificial slate, bitumen shingles and sheet metal shingles, Multi-solar plates can be used for roof sealing.
It must be ensured that the hanger bolts are capable of safely transferring the occurring forces into the roof structure and guaranteeing the tightness of the roof covering. The load-bearing capacity of the hanger bolts must be verified.

Wood substructure – specifications for the mounting of hanger bolts and type A solar fasteners
- Standard: DIN EN 1995-1-1:2010-12 Eurocode 5 Dimensioning and design of timber structures
- Wood substructures must be pre-drilled for the installation of wood screws with screw diameter d>6 mm (d = screw diameter)
- Purlins and rafters made of wood (d >/=8 mm) must ALWAYS be pre-drilled before installation of hanger bolts and type A solar fasteners.
- Pre-drilling diameter: 0.7xd
- Screw-in depth: at least 4xd (screw in the entire thread up to the shank!)
- Purlin installation edge distance at bottom and top: at least 4xd each
- **Purlin installation, minimum timber width: 8xd** e.g. for hanger bolt 10x200: Minimum timber height 80 mm
- Rafter installation, lateral edge distance: at least 4xd
- Hole spacing in fibre direction: at least 7xd
- **Rafter installation minimum timber height: 8xd** e.g. for hanger bolt 10x200: Minimum timber height 80 mm

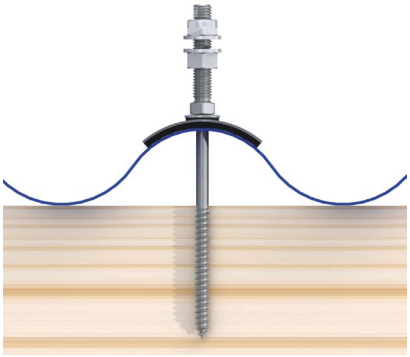
Wood is an organic building material. The quality of wood can deteriorate due to weathering and ageing. Check the quality of the purlins (or rafters) before installation and seek advice from a professional.

Metal substructure – regulations for mounting with type BZ solar fasteners
- Standard: DIN EN 1993-1-1 Eurocode 3 Dimensioning and design of steel structures
- Mounting with type BZ solar fasteners (d=8.0 mm)
- Minimum material thickness: 1.5 mm steel (e.g. Z purlins)
- The steel substructure must be pre-drilled before installing type BZ solar fasteners
- Steel substructure 1.5–5.0 mm: pilot hole width 6.8 mm
- Steel substructure 5.0–8.0 mm: pilot hole width 7.0 mm
- Steel substructure 8.0–10.0 mm: pilot hole width 7.2 mm
- Steel substructure > 10.0 mm: pilot hole width 7.4 mm
- Screw-in depth: at least 20–25 mm
- Purlin installation, edge distance at bottom and top: at least 24 mm (3xd each) / minimum metal width: 48 mm
- Rafter installation, lateral edge distance: at least 30 mm / minimum metal width: 60 mm
- Hole spacing: at least 40 mm

The selection of the appropriate hanger bolts/solar fasteners depends on the material and structure of the roof substructure, the thickness of the roof covering (core thickness and crest height), the roof pitch and the expected loads. Refer to the S:FLEX project report for the appropriate screws.

Wood substructure

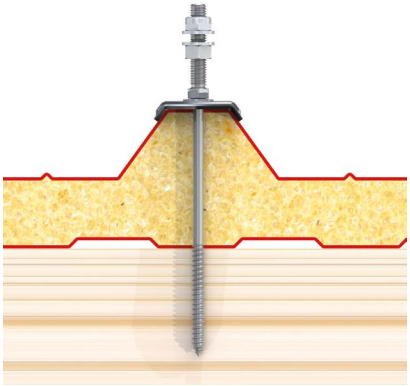
Corrugated sheet metal: Type A solar fastener or hanger bolt (EPDM shield gasket or matching calotte)



Corrugated fibre cement: Type A solar fastener or Hanger bolt (EPDM shield gasket)

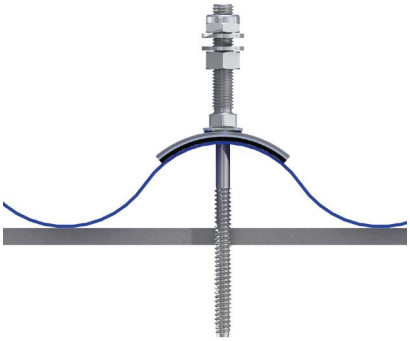
Trapezoidal sheet metal (without illustration): Type A solar fastener or hangar bolt (EPDM shield gasket or suitable calotte)

Sandwich profiles: Solar fastener Type A (suitable calotte)

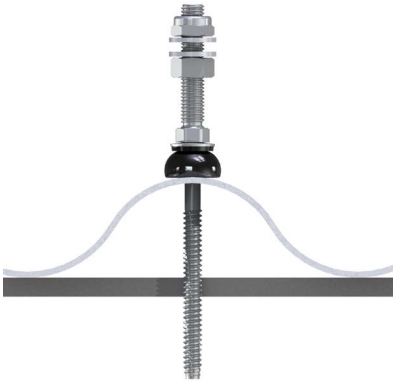


Steel/metal substructure

Corrugated sheet metal: Solar fastener Type BZ (EPDM shield gasket or suitable calotte)

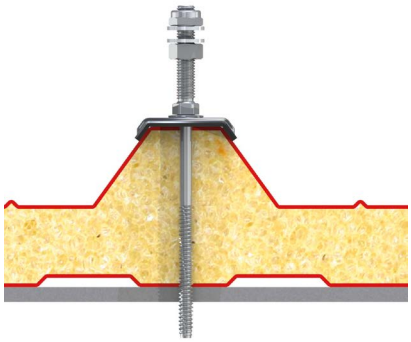


Corrugated fibre cement: Solar fastener Type BZ (EPDM shield gasket)



Trapezoidal sheet metal (without illustration): Type BZ solar fastener (EPDM shield gasket or suitable calotte)

Sandwich profiles: Solar fastener Type BZ (suitable calotte)

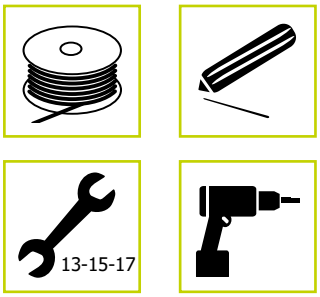


Check planning basis.

Align the hanger bolt using a plumb line.

Position them in accordance with the structural requirements and the installation situation.

Observe edge distances and screw-in depths.



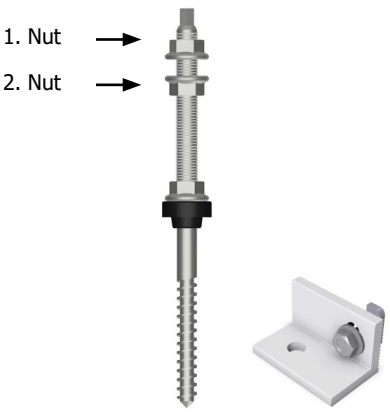
Mounting the brackets

Following the installation of the hanger bolts, brackets are attached to the hanger bolts/solar fasteners. The brackets are used to attach them to the mounting rails. Select the bracket depending on the diameter of the upper metric section of the hanger bolt/solar fastener:

- Bracket 40 mm, M8
- Bracket 60 mm, M10
- Bracket 60 mm, M12

The load-bearing capacity of the hanger bolts is designed to allow a maximum distance from the bracket to the roof surface. The maximum distance between the mounted bracket and the roof surface must not exceed 40 mm.

Mounting the brackets: remove the first nut (or nut + lock washer); set the desired mounting height of the angle with the second nut; position the bracket; screw on the first nut (tightening torque M8:
12–15 Nm, tightening torque M10: 20–25 Nm, tightening torque M12: 25–30 Nm). The maximum distance of the bracket to the roof covering must be observed.

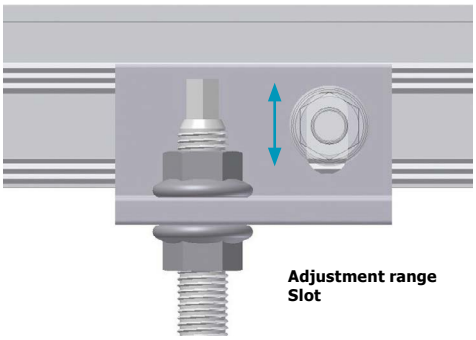


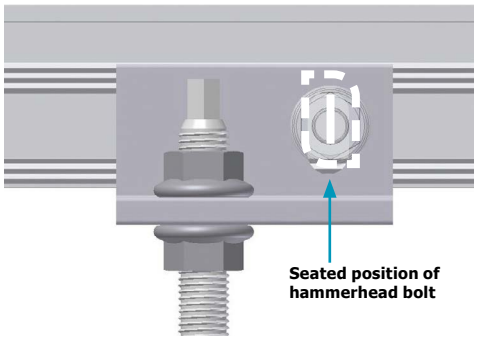
Mounting the Delta Triangle directly on a hanger bolt

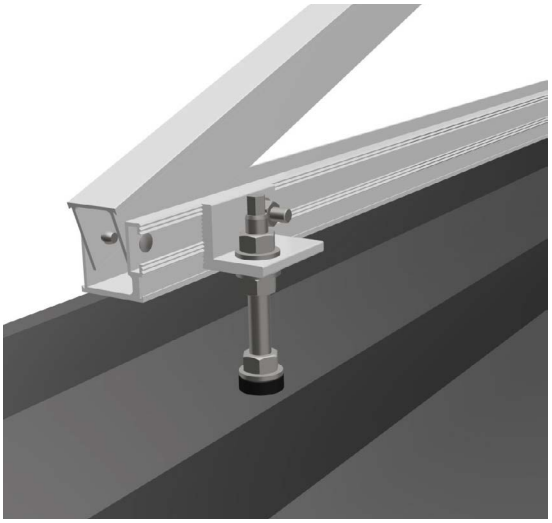
The distances between the Delta Triangles and the required number of fastening points can be found in the project report. If the fastening points are in the area of the roof substructure (purlins or rafters), the triangles can be mounted directly to the hanger bolts.

The Delta Triangles are attached to the hanger bolts using brackets. The height can be adjusted using the brackets on the hanger bolts. Each triangle must be attached to at least two hanger bolts / brackets. Depending on the information in the project report, more fastening points may be required per triangle.

The outer hanger bolts / brackets must each be mounted within 0–200 mm of the end of the Delta Triangle's bottom rail.

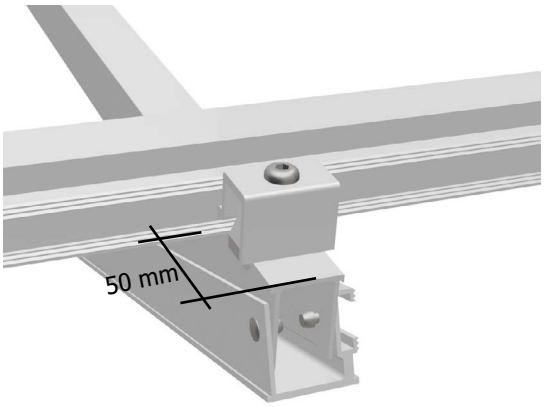


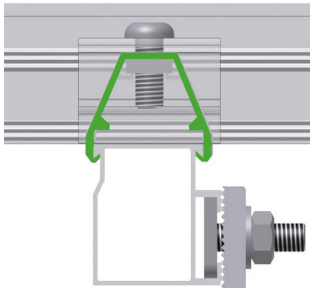




Check the alignment of the hammerhead bolts. The hammerhead bolt is only correctly mounted if the vertical notch is visible.

When installing the mounting rails, an expansion joint must be created after a maximum of 12 metres. The expansion joint must not be covered with modules. The mounting rails must be positioned within 50 mm of each end of the upper Delta profile.





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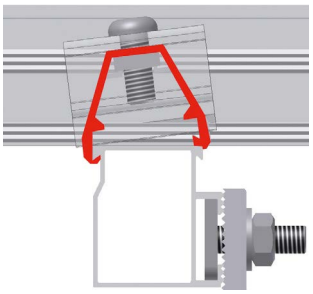


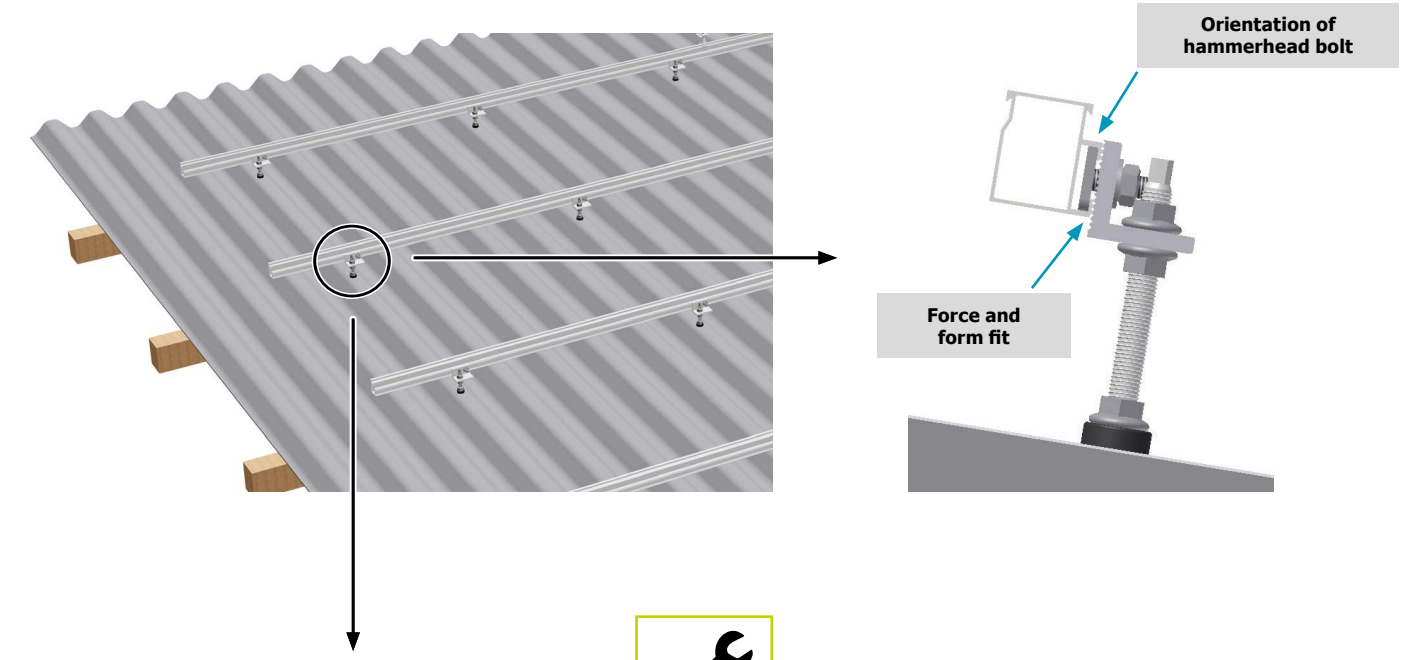
INCORRECT

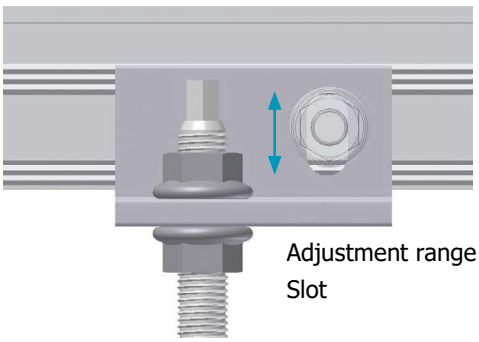
Note the expansion joints when installing the mounting rails.

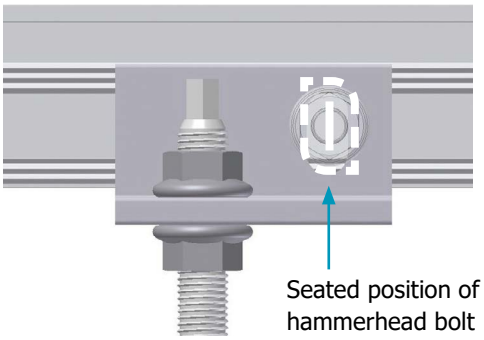
2.3.1.2 Delta Triangle installed with mounting rail

Alternatively, the Delta Triangles can be installed on mounting rails. According to the project report, this means that the positioning of the connection points can be varied. The height is adjusted using the brackets on the hanger bolts.

The mounting rails are installed horizontally (parallel to the eaves) as the bottom layer and must be positioned with the hammerhead channel facing downwards. The bracket must always be attached to the eaves side.







Check the alignment of the hammerhead bolts. The hammerhead bolt is only correctly mounted if the vertical notch is visible.

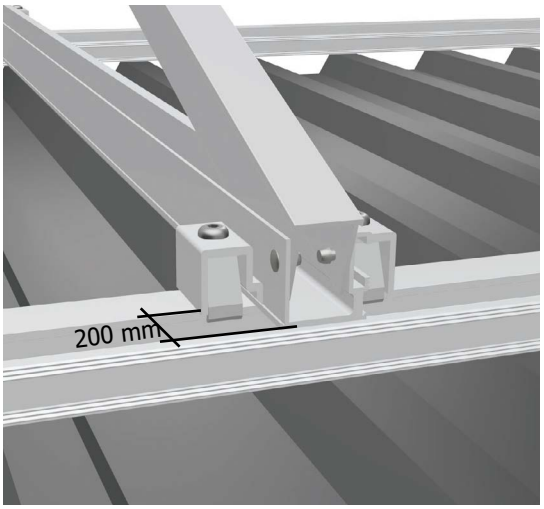
Use the adjustment range created by the combination of the corrugation and slot.

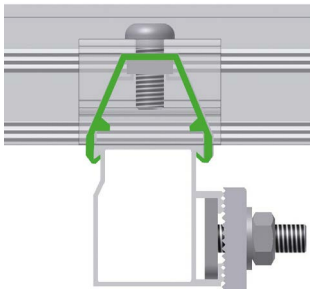
Create a force-fit and form-fit connection.

Observe the orientation of the rails.

The Delta Triangles are attached to the mounting rails using cross adapters. Two cross adaptors must be fitted at each fastening point.
Each triangle must be attached to at least two mounting rails. The exact number of mounting rails required can be found in the project report.
The Delta Triangles may project a maximum of 200 mm over the mounting rails.

When installing the mounting rails, an expansion joint must be created after a maximum of 12 metres. The expansion joint must not be covered with modules or mounting rails.





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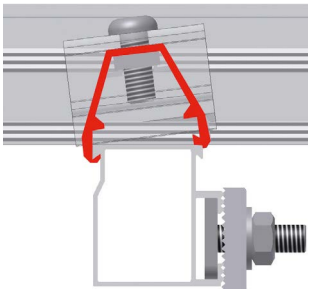
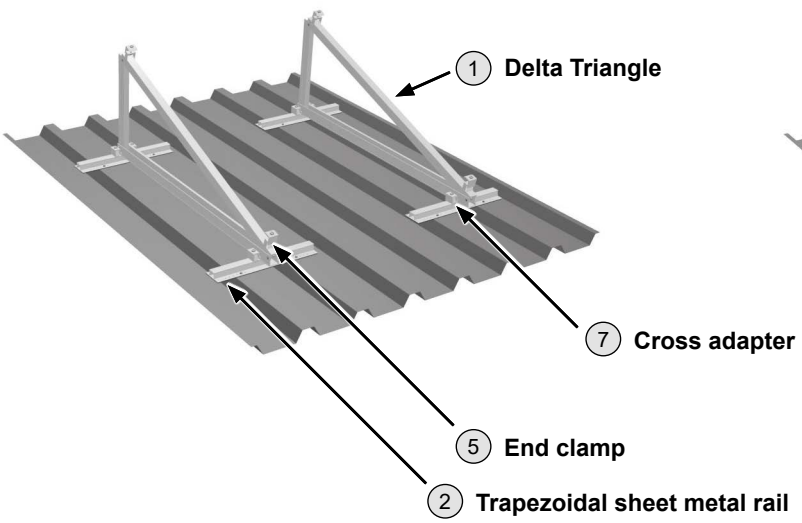


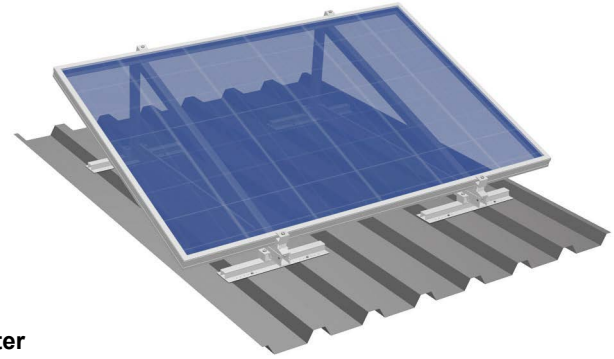
INCORRECT

Note the expansion joints when installing the mounting rails.

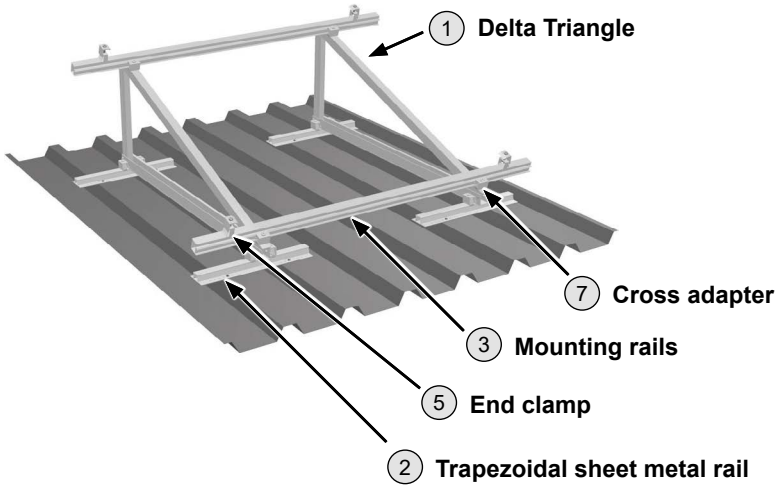
2.3.2 Installation on trapezoidal sheet metal

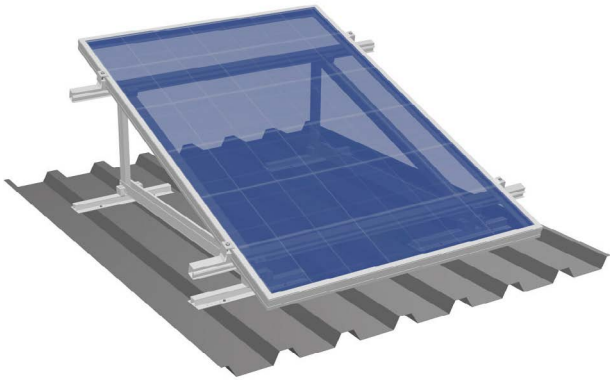
Example 1 Trapezoidal sheet metal installation:
Modules mounted transversely, Delta Triangles attached to trapezoidal sheet metal rails





Example 2 Trapezoidal sheet metal installation:
Modules mounted upright, Delta Triangles attached to mounting rails

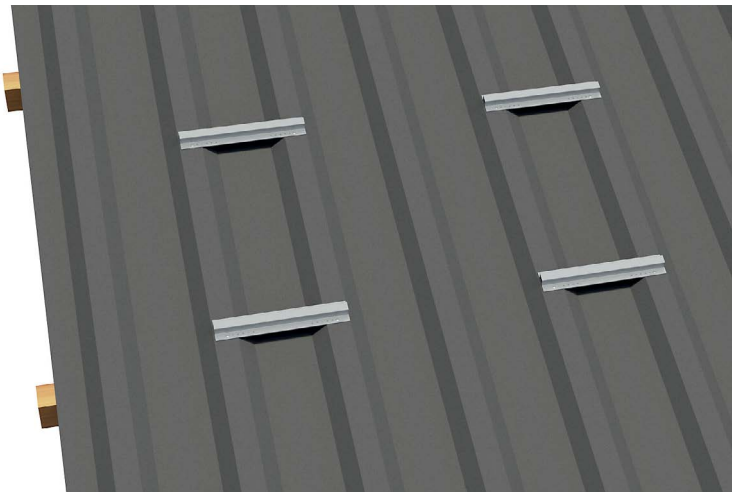




Before mounting on the trapezoidal sheet roofing, it must be checked whether the sheet is adequately secured to the substructure to bear the expected loads.

Mounting the Delta Triangles on trapezoidal sheet metal rails enables installation directly on the roof covering. Installation with trapezoidal sheet metal rails is possible for trapezoidal and corrugated sheet metal roofs.

The positioning of the trapezoidal sheet metal rails (Trapezoidal sheet metal rail AK complete l=395 / 24) must be determined in accordance with the structural requirements of the location and the installation situation. When doing so, it must again be checked whether the measurements used during planning match the actual measurements found on the roof (if necessary, adjustments must be made). The positioning of the Delta triangles as specified in the project report is decisive for the installation of the trapezoidal sheet metal rails. The triangles must be installed in the area between two fastening points of the trapezoidal sheet metal rails (between two raised corrugations).



Check planning basis.

Position the roof hooks in accordance with the structural requirements and installation situation.

Align the trapezoidal sheet metal rails using a plumb line.

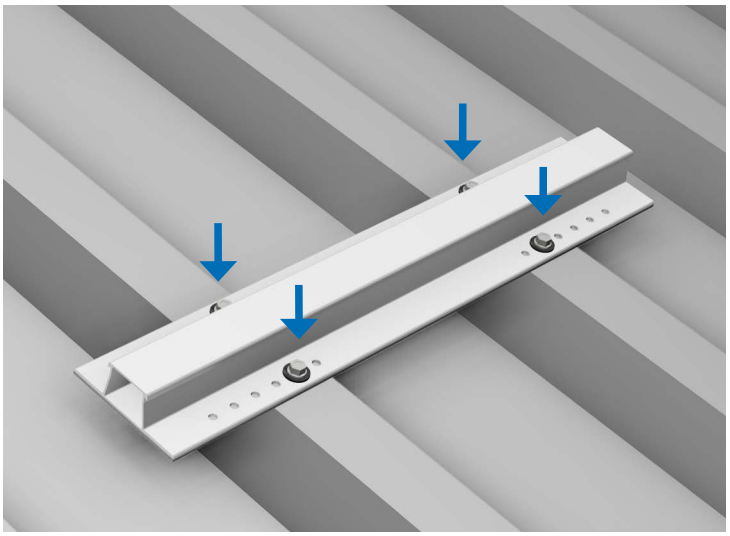
Attach the trapezoidal sheet metal rails with the sheet metal screws.

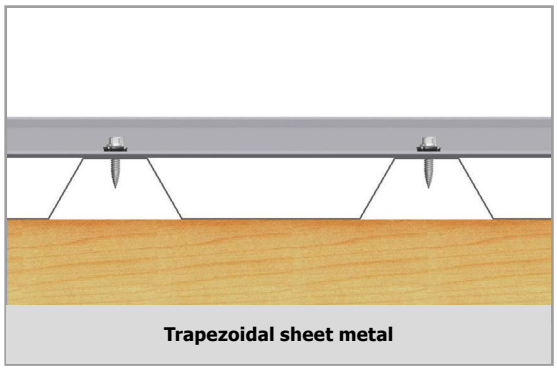
When attaching the sheet metal screws, the regulations stated in the approvals from the building authorities regarding the sheet metal screws must be observed (e.g. area of application, pre-drill diameter, minimum strength of the materials to be connected, hole diameter for existing holes).

The required sheet metal screws are included with your order. Selecting the fasteners depends on the roofing and the occurring forces. Sheet metal screws must only be positioned in the area of the raised corrugations/crests.

Sheet metal screws:
4.5 x 25 A2 / bimetal
Installation: SW 8

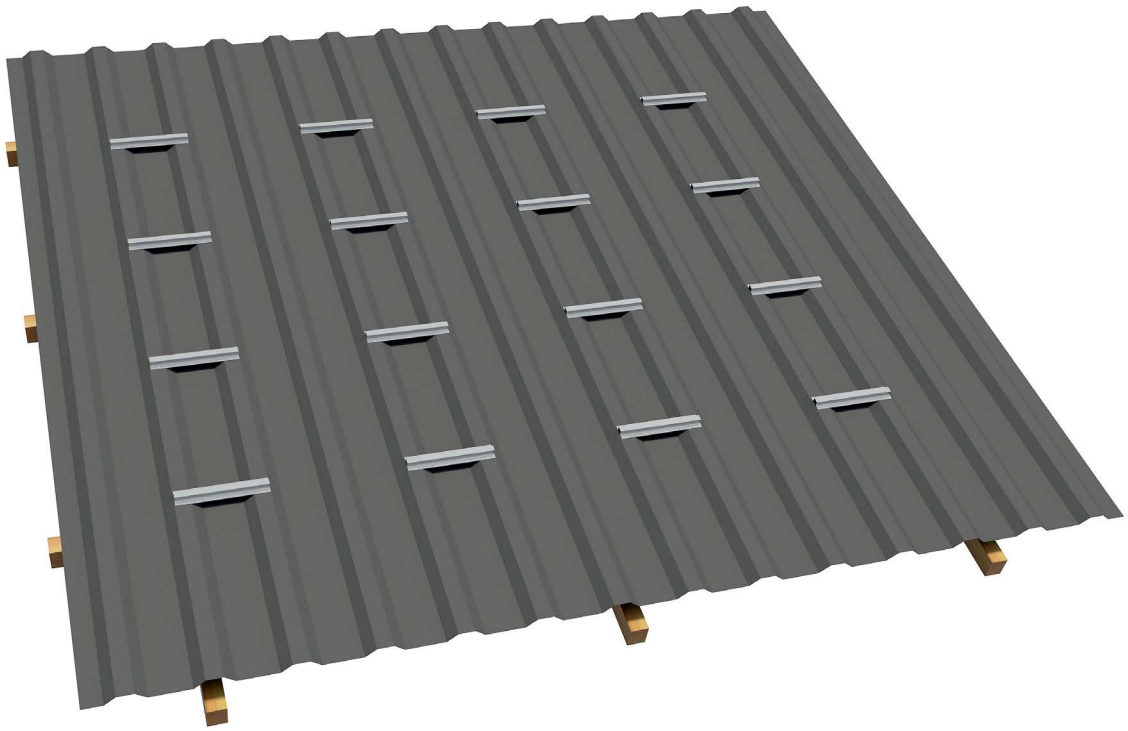
Attach the trapezoidal sheet metal rail with the sheet metal screws.
Use 4 sheet metal screws per trapezoidal sheet metal rail (2 sheet metal screws per raised corrugation/crest).
To prevent water from penetrating between the trapezoidal sheet metal rail and the roofing, the trapezoidal sheet metal rail must always be mounted on a raised corrugation/crest.
The Trapezoidal sheet metal rail AK complete l=395 / 24 is pre-drilled with a 5.0 mm hole for conventional corrugation distances/crest lengths of 173 mm to 333 mm and the underside is extensively bonded with EPDM sealing tape.





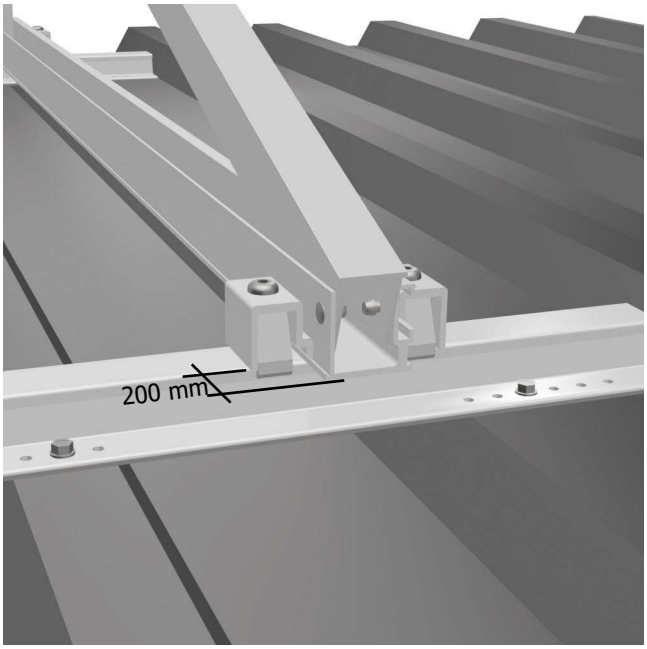
2 sheet metal screws per corrugation/crest (4 pcs. per trapezoidal sheet metal rail).

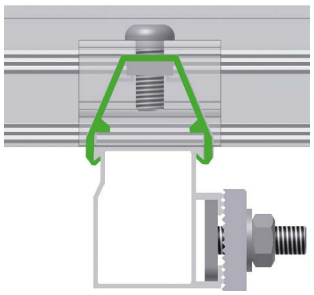
Completed installation of the rail layer.



Each triangle must be mounted on at least two trapezoidal sheet metal rails. Depending on the information in the project report, more trapezoidal sheet metal rails may be required per triangle.

The Delta Triangles may project a maximum of 200 mm over the trapezoidal sheet metal rails.





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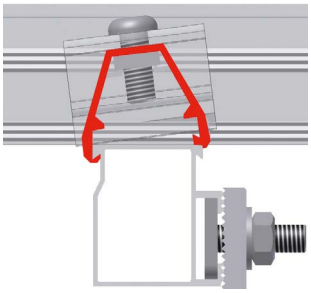
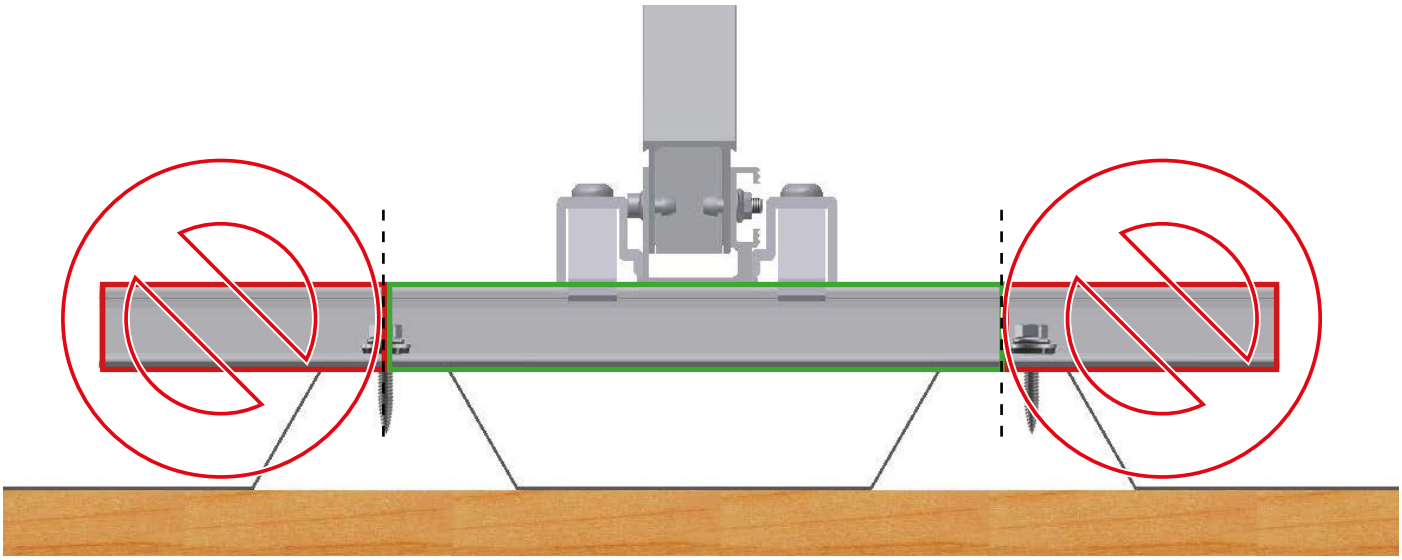


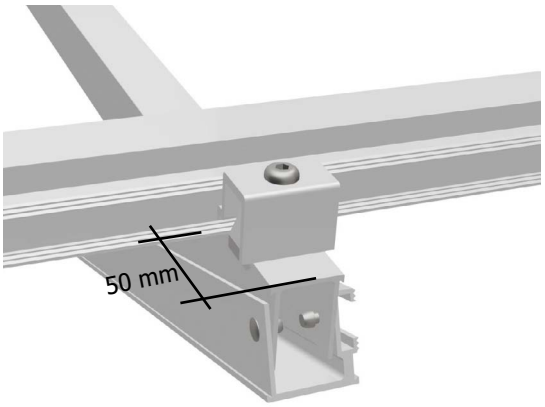
INCORRECT

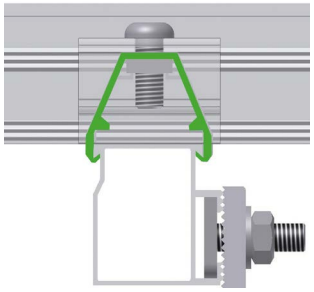
The Delta Triangles are attached to each trapezoidal sheet metal rail with two cross adapters. The fastening points must lie within the screw connections between the trapezoidal sheet metal rail and the trapezoidal sheet.



Installation not permitted | **Installation area** | **Installation not permitted**

When installing the mounting rails, an expansion joint must be created after a maximum of 12 metres. The expansion joint must not be covered with modules. The mounting rails must be positioned within 50 mm of each end of the upper Delta profile.





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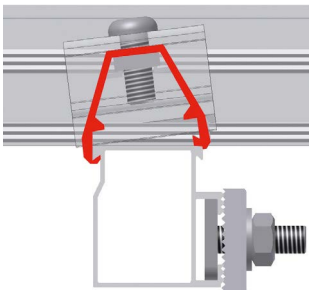
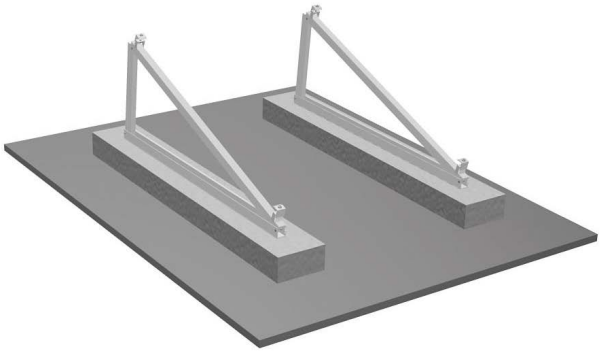


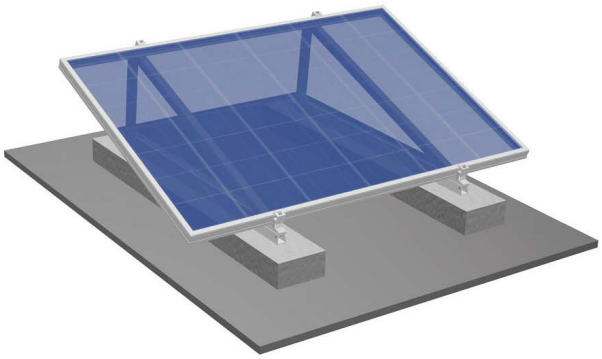
INCORRECT

Note the expansion joints when installing the mounting rails.

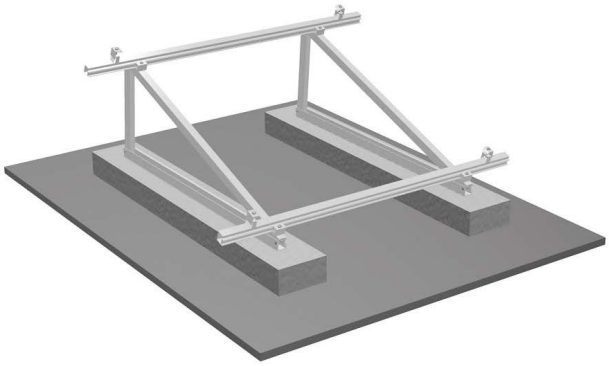
2.3.3 Installation with ballast

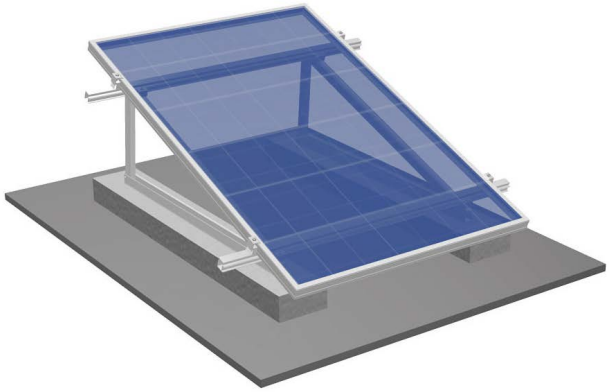
Example 1 Installation with ballast:
Modules mounted transversely, Delta Triangles mounted directly on ballast blocks.





Example 2 Installation with ballast:
Modules mounted upright, Delta Triangles mounted directly on ballast blocks.





If roof penetration is not possible or desirable, it is possible to ballast the PV system. The Delta Triangles are attached to ballast blocks.

Ballasted installation is possible for foil and bitumen roofs, concrete roofs and roofs with a gravel layer.
On concrete roofs, the triangles can also be mounted directly on the concrete layer. The prerequisite is sufficient concrete thickness and approval by the customer. The installation process is identical to installation with ballast blocks.

With this installation variant, the roof is loaded with additional weight. Before installation, ensure that the insulation has sufficient load-bearing capacity and compressive strength to support the installation. Care must be taken to ensure that the ballast blocks do not damage the roof covering. A suitable protective fleece (or building screen mat) must be placed underneath. Particularly with foil roofs, the compatibility between the protective fleece and the roofing must be checked. Ballast blocks and protective fleece are not included in the S:FLEX delivery.

Before applying the ballast, check the load-bearing reserve of the roof and the compressive strength of the insulation. Check the compatibility of the protective fleece and roof covering.

Delta Triangle installed directly on ballast blocks

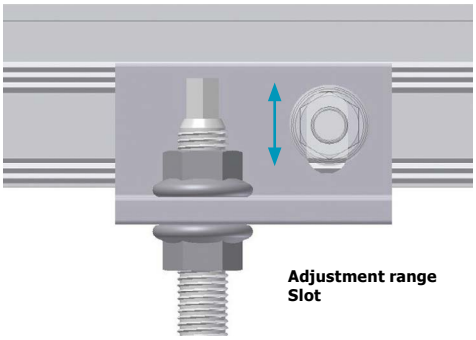
The distances between the triangles and the required number of fastening points can be found in the project report. Note the ballast information per triangle.

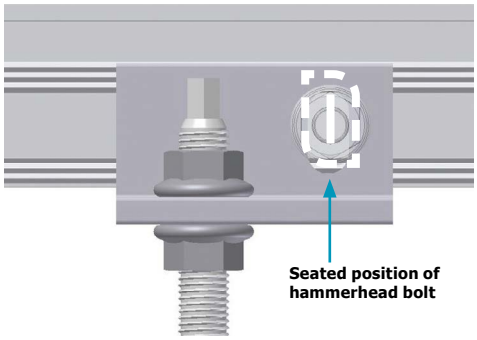
The Delta Triangles can be mounted directly onto the ballast blocks. Brackets are attached to the side of the ground rail for this purpose. These brackets are fixed to the ballast blocks with bolt anchors.

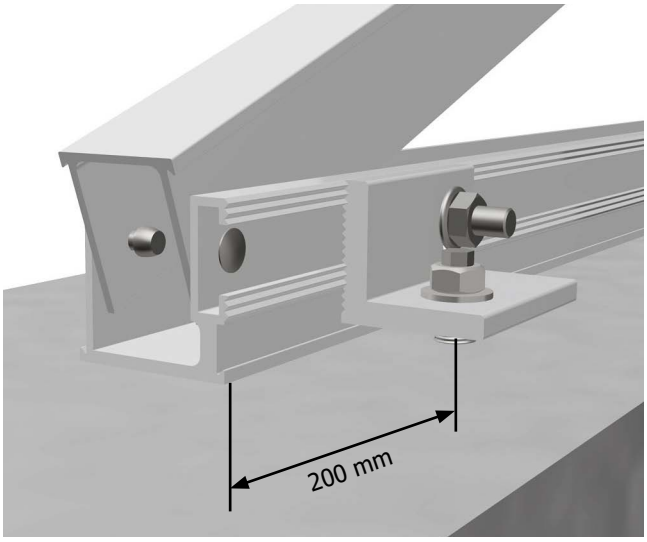
To install a bolt anchor: drill a hole in the ballast block, blow out any dust, hammer in the bolt, fit the component, place the washer and tighten the nut.
Drilling depth: 80 mm
Drill hole diameter: 10 mm

Each Delta Triangle must be fastened to at least two brackets with bolt anchors.
Depending on the information in the project report, more fastening points may be required per triangle.

The Delta Triangles may protrude a maximum of 200 mm above the fastening points.

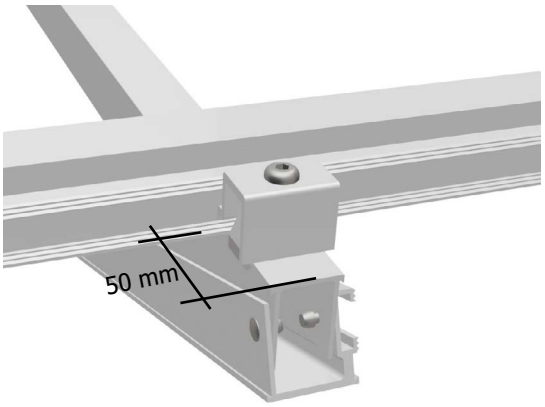


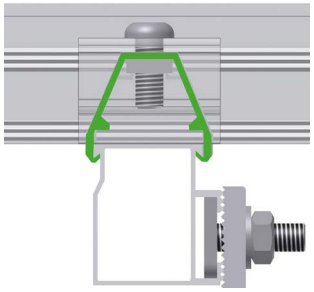




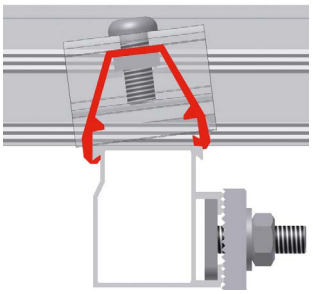
Check the alignment of the hammerhead bolts. The hammerhead bolt is only correctly mounted if the vertical notch is visible.

When installing the mounting rails, an expansion joint must be created after a maximum of 12 metres. The expansion joint must not be covered with modules. The mounting rails must be positioned within 50 mm of each end of the upper Delta profile.





CORRECT
- clicked on both sides -



INCORRECT

Note the expansion joints when installing the mounting rails.

Delta Triangle installed with mounting rail

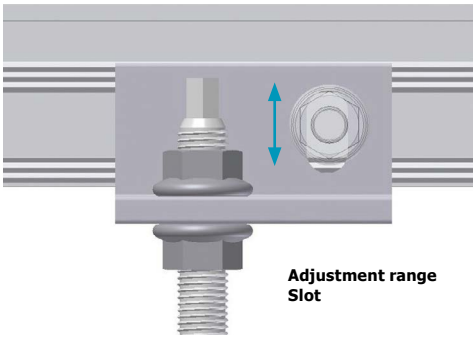
Alternatively, the Delta Triangles can be installed on a mounting rail. The ballast blocks are connected to a mounting rail. Brackets are attached to the side of the mounting rails for this purpose. These brackets are fixed to the ballast blocks with bolt anchors.

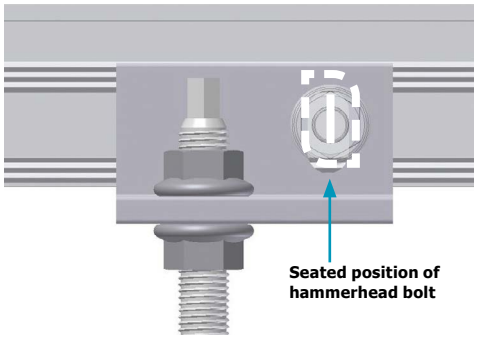
To install a bolt anchor: drill a hole in the ballast block, blow out any dust, hammer in the bolt, fit the component, place the washer and tighten the nut.
Drilling depth: 80 mm
Drill hole diameter: 10 mm

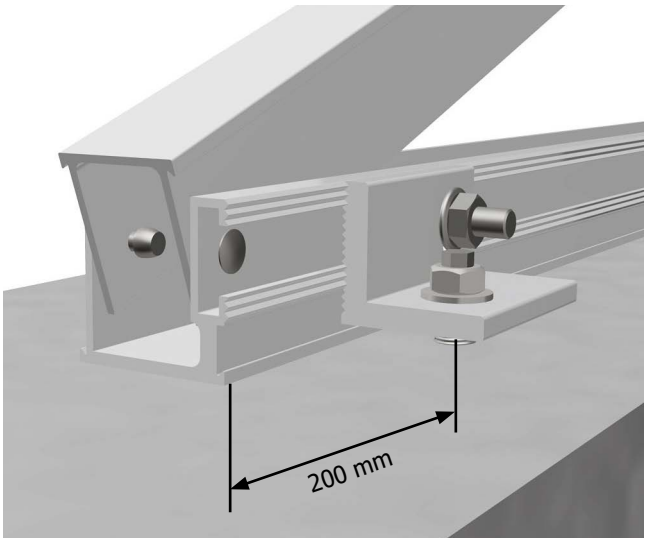
The triangles are fastened to the mounting rails at each fastening point using two cross adapters.

Each triangle must be attached to at least two mounting rails. Depending on the information in the project report, more mounting rails may also be required.
The Delta Triangles may project a maximum of 200 mm over the mounting rails.

When installing the mounting rails, an expansion joint must be created after a maximum of 12 metres. The expansion joint must not be covered with modules or mounting rails.



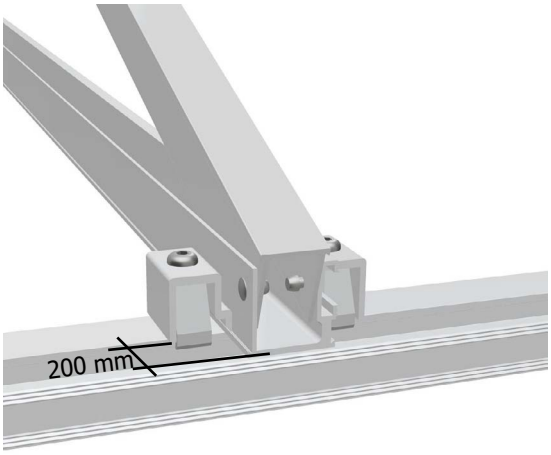


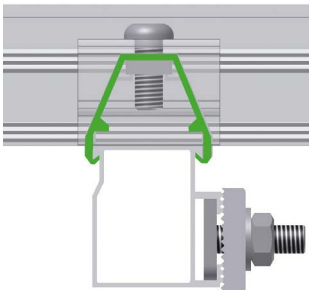


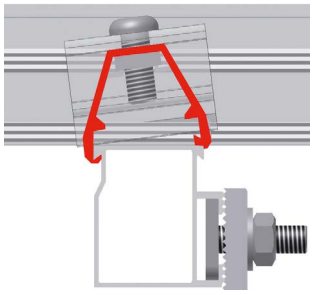
Check the alignment of the hammerhead bolts. The hammerhead bolt is only correctly mounted if the vertical notch is visible.

The Delta Triangles are attached to the mounting rails using cross adapters. Two cross adaptors must be fitted at each fastening point.
Each triangle must be attached to at least two mounting rails. The exact number of mounting rails required can be found in the project report.
The Delta Triangles may project a maximum of 200 mm over the mounting rails.

When installing the mounting rails, an expansion joint must be created after a maximum of 12 metres. The expansion joint must not be covered with modules or mounting rails.





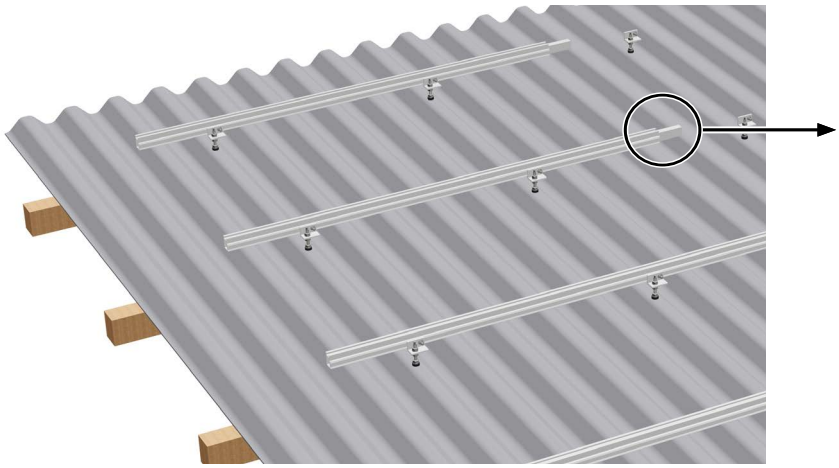


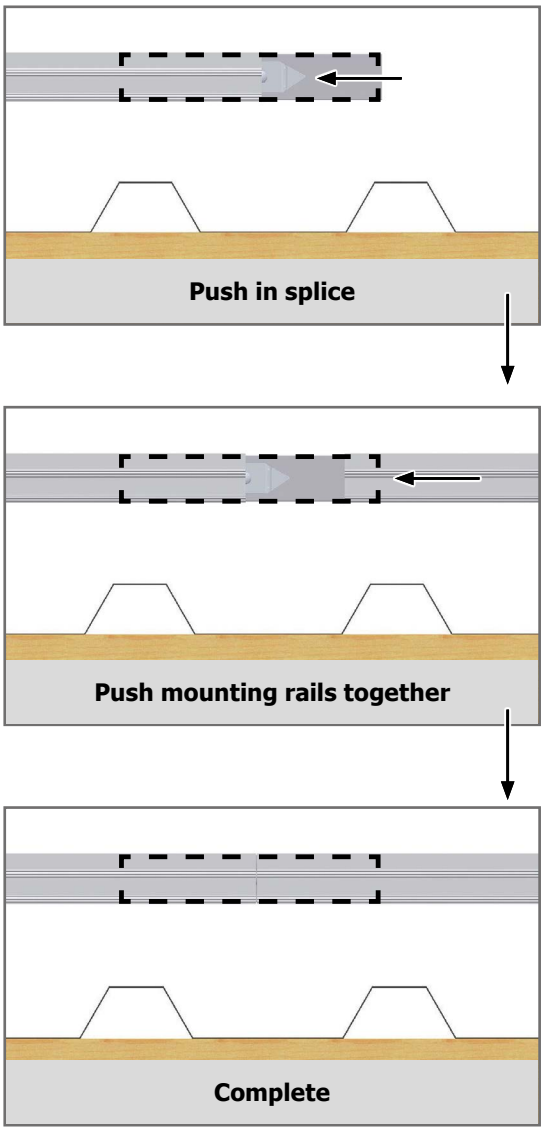
Note the expansion joints when installing the mounting rails.

2.3.4 Installing the splice

To join several rails together, a splice with identical static values to the mounting rail is pushed half-way into the previously installed mounting rail. Then push the next mounting rail onto the splice. The connection is then complete. Fasten the pushed-on mounting rail as described above.

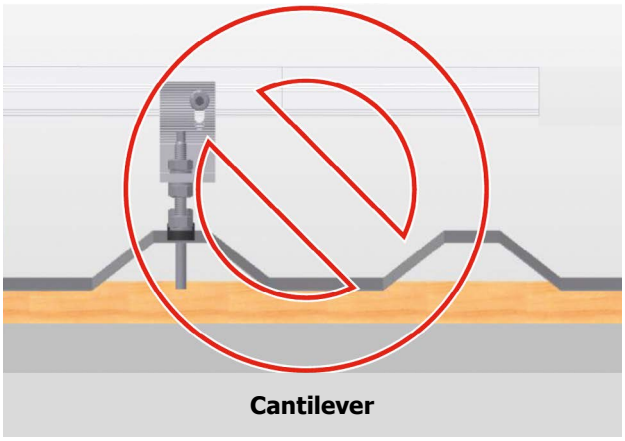
The mounting rails in the lower and upper rail layer can be connected in succession using splices, both for vertically and horizontally arranged mounting rails.



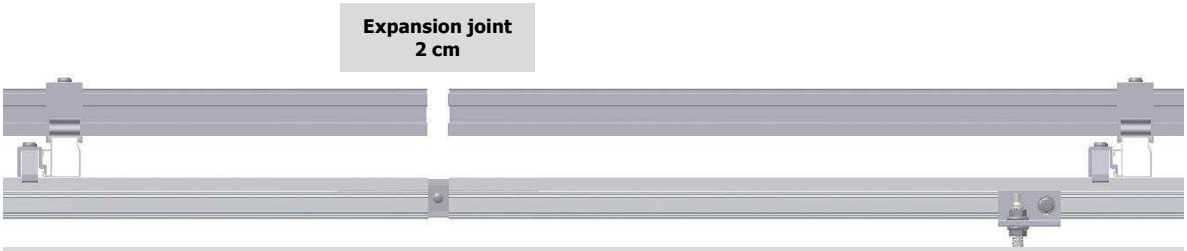


Push in splice.

No cantilevers with splices. Position the splices so that they are between 2 brackets, 2 adapter rails or 2 mounting-rail intersection points.



With double-layer substructures, expansion joints are arranged in both layers. If the lower mounting rail exceeds 12.00 m in length, it must be separated and joined using a connector that allows for 2 cm of length compensation (expansion joint).
The arrangement of the expansion joints must be adapted in accordance with the structural conditions of the roof and the expansion properties of the respective materials.
Modules must not be installed over expansion joints.



Expansion joint for lower layer

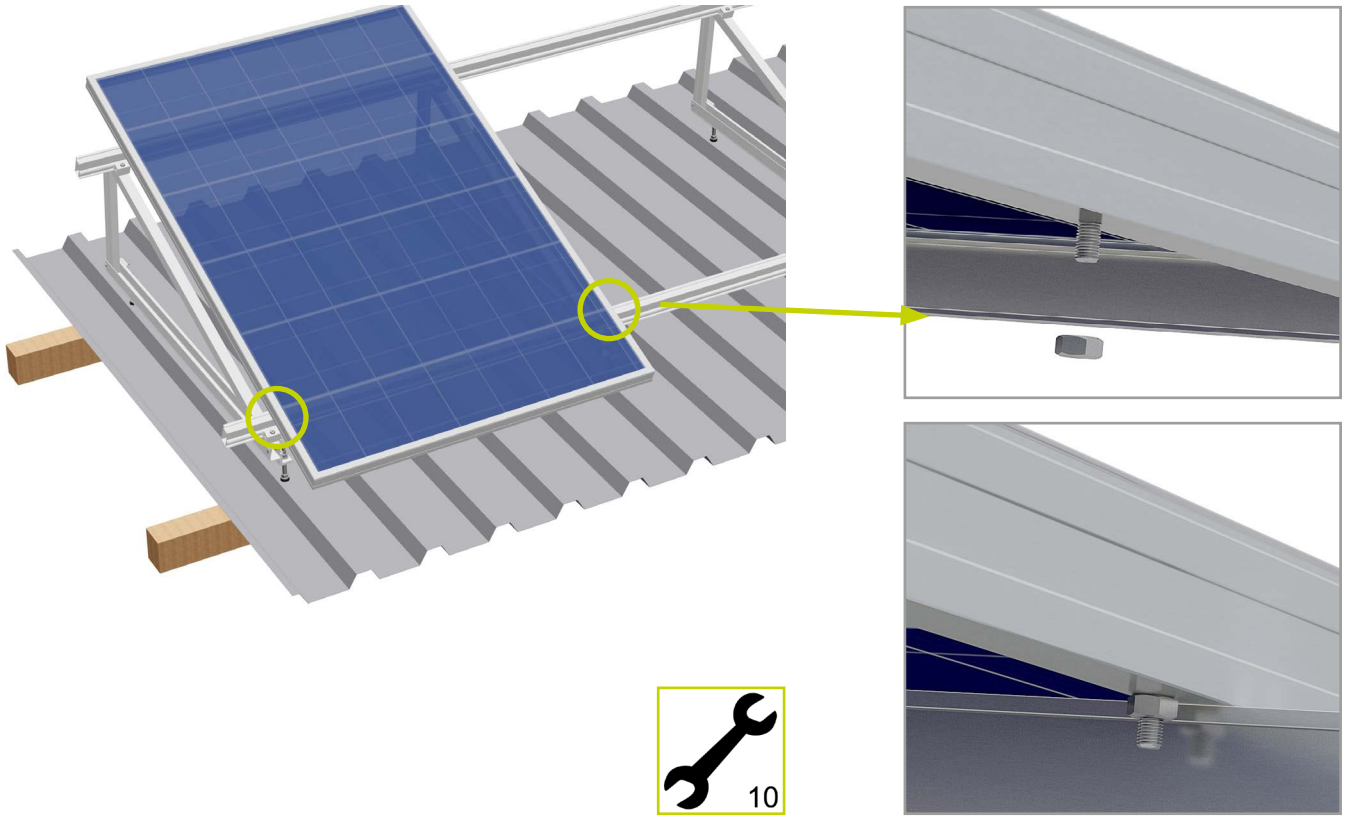
2.4 Installing PV modules

The installation instructions provided by the module manufacturer must be observed, especially with regard to clamping surfaces and clamping areas. S:FLEX GmbH is not liable for damage to the modules and all other consequences resulting from non-compliance with the module manufacturer's installation instructions.

2.4.1 Module installation, upright

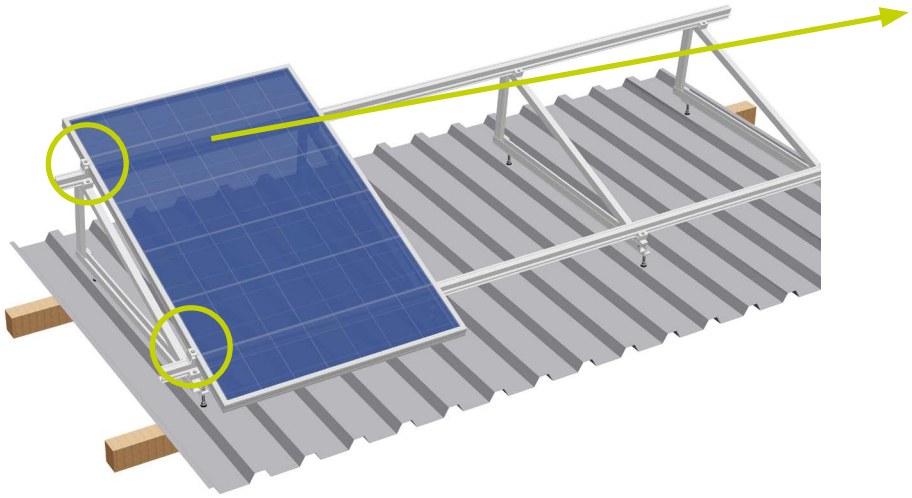
Before installing the modules in the lowest row of modules, the modules generally need to be equipped with slipping protection. The same applies to modules which do not have any modules directly below them (modules above obstructions such as windows, chimneys, etc.).

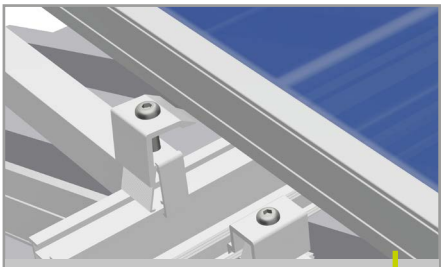
Fix two screws M6 x 20 (with the shank downward) with nuts M6 in two of the module's frame holes (8 mm) so that the screws are at the same level and, when installed, they are above at least one horizontal mounting rail layer.
If the lower mounting hole is larger than 8 mm, please use an appropriately sized (8 mm) screw.



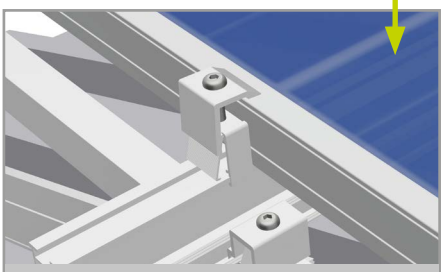
Module installation – (end clamps)

Place the module on the mounting rails. Install the end clamps. Click each end clamp on to the mounting rail and push it on to the module. Ensure that the end clamp is clicked in to both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (torque 8–10 Nm). Pay attention to the prescribed clamping areas and clamping surfaces.
The distance between the module frame and rail end must be at least 35 mm.



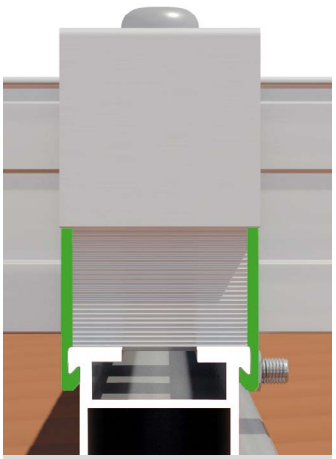


Snap in the end clamp...



Push in and tighten

Install the end clamp



Both sides clicked in

INCORRECT

Defined clamping area

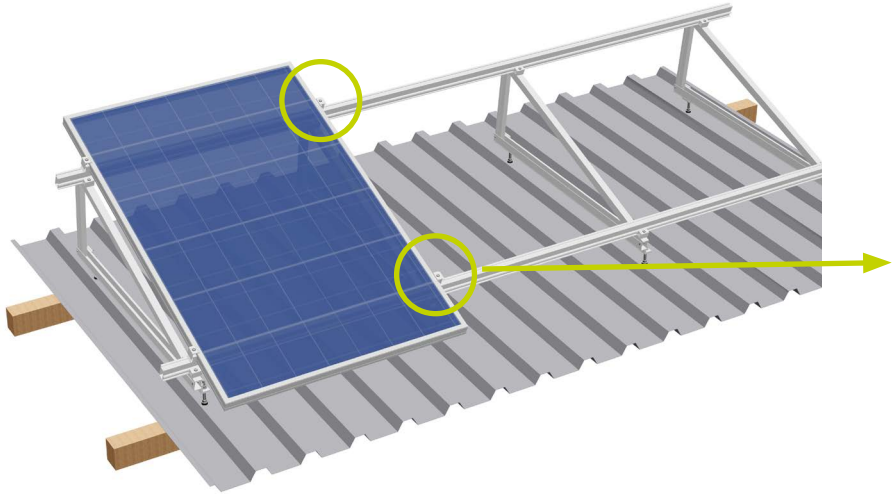
INCORRECT

End clamps are approved for one-off installation. Check the end clamp has been clicked in

Observe the module manufacturer's instructions: Check the defined clamping area

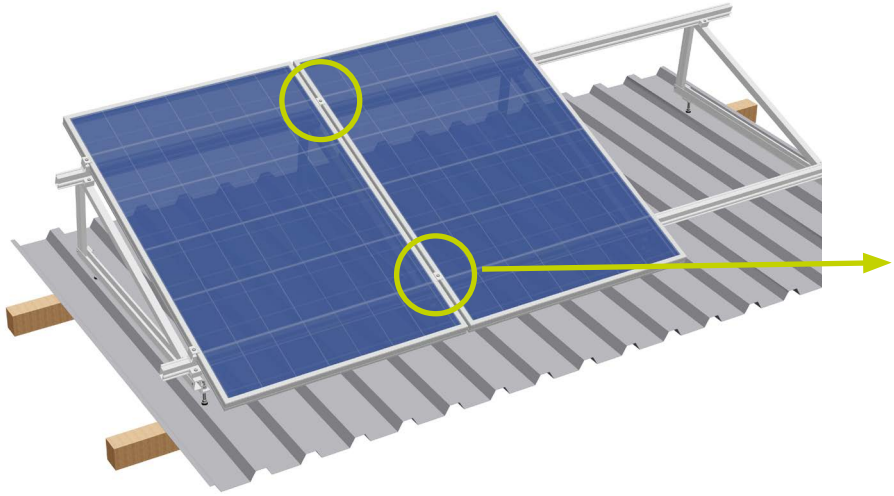
Module installation – (mid clamps)

Now install the mid clamps. The grounding plate must be fitted (if required) before mounting the mid clamp. The grounding plate is inserted laterally into the mid clamp between the "clamp" and the "upper part" (see 1.4). Next, click each mid clamp onto the mounting rail and push it on to the module. Ensure that the mid clamp is clicked in to both sides of the mounting rail.
Pay attention to the prescribed clamping areas and clamping surfaces. When using the grounding plate, the module must be positioned between the plate and the "upper part" of the mid clamp. The grounding plate is thus pressed against the mounting rail from the underside of the module frame.



Snap on the mid clamp and push in

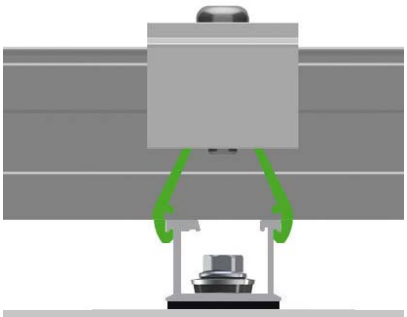
Align the upper row of modules with the aid of a guide or levelling instrument.
Now slide the next module underneath the mid clamp, adjust the mid clamp to the height of the module's frame and tighten the screw (tightening torque 8–10 Nm).



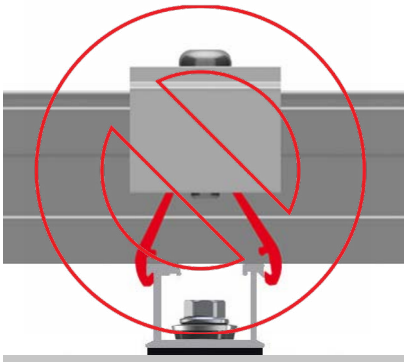
Slide module underneath and tighten mid clamp

Install mid clamp

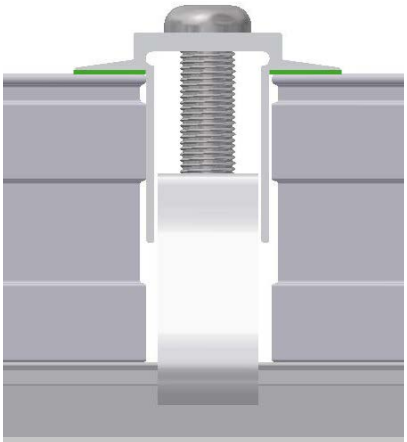
Ensure that the mid clamp grips both of the module frames over the clamping area defined by the module manufacturer.



Clicked in



INCORRECT



Defined clamping area

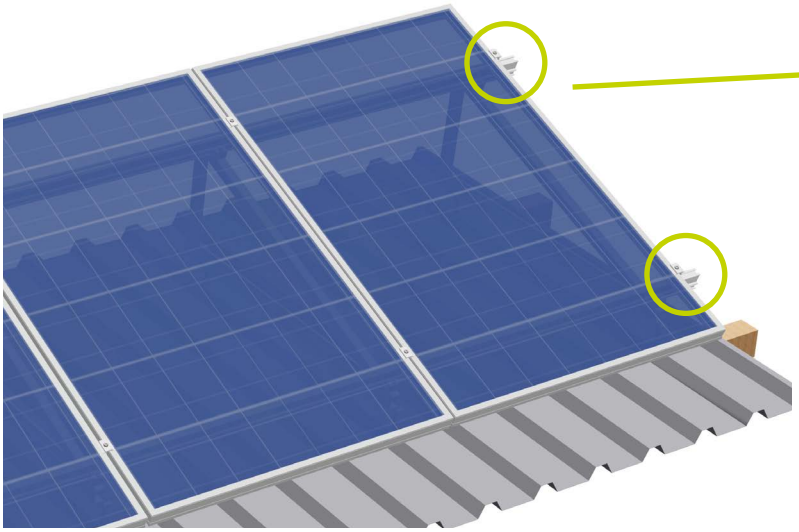
INCORRECT

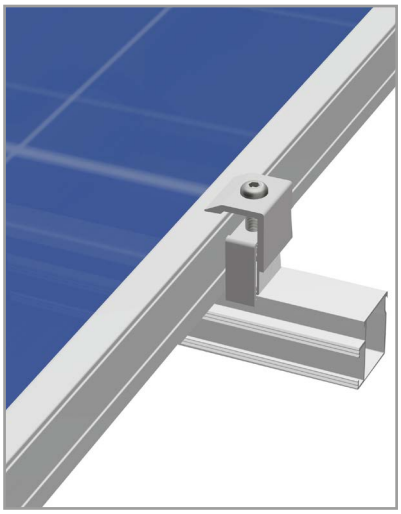
Mid clamps are approved for one-off installation. Check the mid clamp has been clicked in

Observe the module manufacturer's instructions: Check the defined clamping area

Module installation – (end clamps at the end of the row)

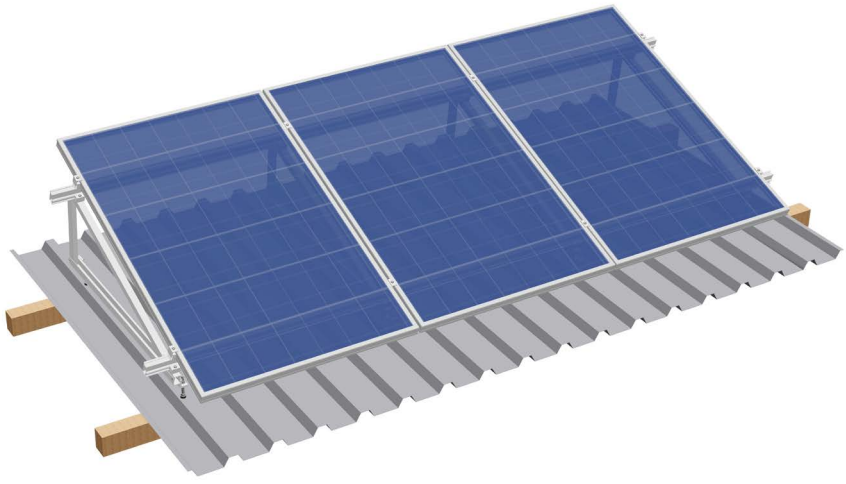
End clamps must be installed on the last module in each row (if applicable, on expansion joints). Click each end clamp on to the mounting rail and push it on to the module. Ensure that the end clamp is clicked in to both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (torque 8–10 Nm).
Pay attention to the prescribed clamping areas and clamping surfaces. Shorten projecting rails parallel to the module frame. The distance between the module frame and rail end must be at least 35 mm.





Install end clamp on the last module

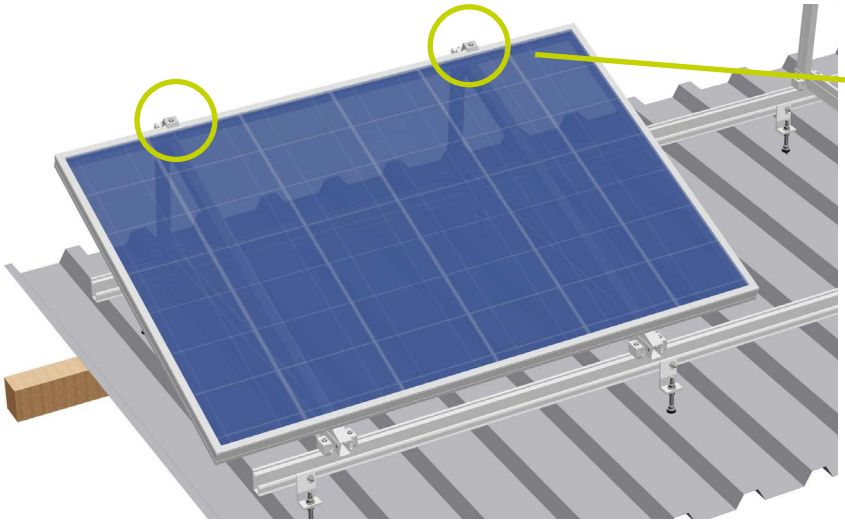
Proceed as described for the following rows.



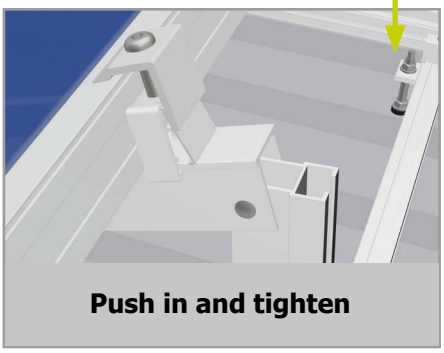
2.4.2 Module installation, transverse

Module installation - (end clamps, top)

Place the module on the mounting rails. Install the end clamps. Click each end clamp on to the mounting rail and push it on to the module. Ensure that the end clamp is clicked in to both sides of the mounting rail.
Now adjust the end clamp to match the height of the module and tighten the screw (torque 8–10 Nm). Pay attention to the prescribed clamping areas and clamping surfaces.

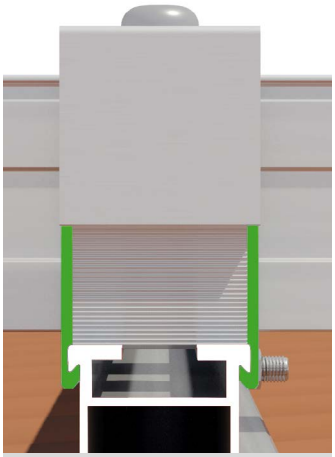


Snap in the end clamp...



Push in and tighten

Install the end clamp



Both sides clicked in

INCORRECT

Defined clamping area

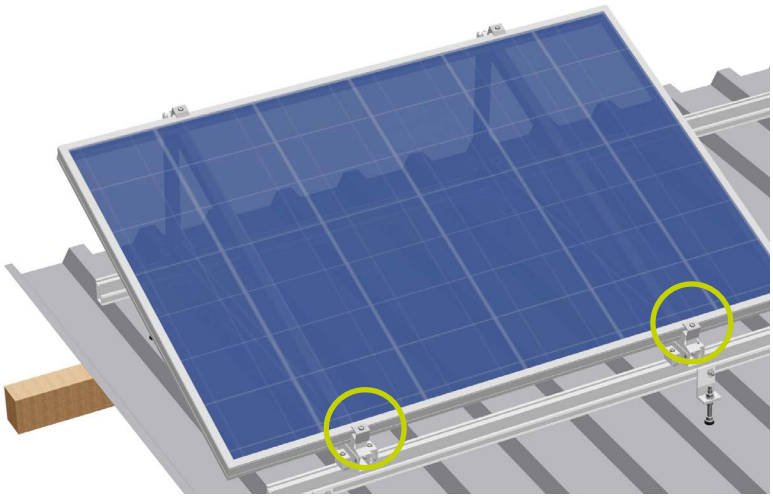
INCORRECT

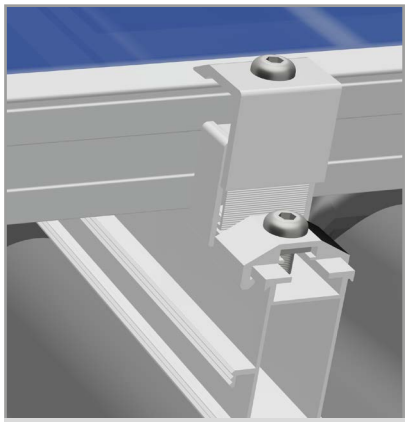
End clamps are approved for one-off installation. Check that the end clamp has been clicked in properly

Check the clamping surface defined by the module manufacturer, follow the instructions in section 1.5 (observe module manufacturer's specifications).

Module installation - (end clamps, bottom)

End clamps must be fitted at the end of the module row and in the area of the expansion joints. Click each end clamp on to the mounting rail and push it on to the module. Ensure that the end clamp is clicked in to both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (torque 8–10 Nm).
A locking clip must generally be mounted on the vertical rail below the bottom row of modules. The same applies to modules which do not have any modules directly below them (modules above obstructions such as windows, chimneys, etc.). The locking clip serves as an additional slipping protection. Push the locking clip onto the mounting rails from below up to the end clamp and tighten it (tightening torque 8–10 Nm).
Pay attention to the prescribed clamping areas and clamping surfaces.

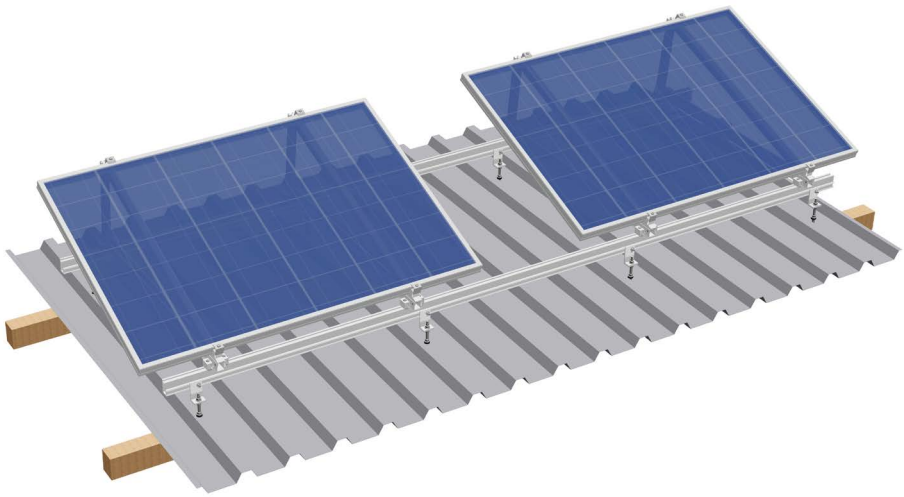




Mount end clamp and locking clip

Install end clamp and locking clip on the last module.

Proceed as described for the following rows.
It should be ensured here that all end clamps are secured in a horizontal line.
Align the upper row of modules with the aid of a guide or levelling instrument.



3.1 Disassembly

Disassembly of the S:FLEX mounting system may only be carried out by trained specialist personnel. Observe the same safety instructions, standards and guidelines as provided for the installation. In general, disassembly is carried out in reverse order to the described installation.

Before disassembly, disconnect the PV modules from the mains network. Disconnect all of the PV modules' electrical cables (string lines and plug connectors) and remove them from the frame system.

Then remove the modules and store them safely. Improper disassembly can lead to damage to the modules.

Disassemble frame system and safely store all of the parts.
Any holes in the roof must be sealed by a specialist.

3.2 Disposal

The S:FLEX mounting system is made from aluminium, stainless steel and steel components. These materials can be recycled after disassembly. The frame system must only be disposed of by a specialist waste management company. Observe the applicable national standards and guidelines.

4.1 User agreement for Delta Triangle

We expressly point out that the mounting system is sold under a purchase agreement.
Its installation/processing or acquisition by a third party is not carried out in the name of, or on behalf of, S:FLEX GmbH. Installation/processing of the system must be carried out by appropriately qualified personnel and strictly in accordance with the installation instructions.

The design and planning of the system must be undertaken using the S:FLEX planning tool. S:FLEX GmbH is neither responsible for the project-specific structural analysis of the roof structure, nor for obtaining and documenting the approval of the roof manufacturer for use of the respective fastening systems on the roof in question (in the terms of the warranty), nor for correct installation of the fastening system.

S:FLEX GmbH accepts no liability for faults and damage and/or a restricted or limited operational capability of the system which has resulted from incorrect installation and/or installation which was not undertaken in accordance with the installation instructions and/or the project report (Solar.Pro.Tool). In the case of incorrect installation, the buyer's right to assert claims for material defects shall expire.

The system warranty is only valid if all system components were acquired from S:FLEX GmbH.

4.2 Warranty / disclaimer

The information regarding dimensioning provided in these instructions is merely suggested values based on prior experience. Binding structural analyses for installation frames can be created using the S:FLEX planning software (Solar. Pro.Tool).

As an installation company, you are responsible for the correct execution of the installation. S:FLEX GmbH is not liable for the dimensional information contained in commercial system quotations.

As the installation company, you are responsible for the mechanical durability of the installed interface connections on the building envelope, in particular also for their watertightness. The components supplied by the company S:FLEX GmbH are designed for the expected loads and in accordance with the currently available technology.
In this context, you must provide the company S:FLEX GmbH with information about all general technical conditions in writing via the project data collection sheet (information about the supporting structure, snow load zone, building heights, wind loads, etc.).

S:FLEX GmbH is not liable if the installed components are not properly handled. Any use close to the sea needs to be clarified with S:FLEX GmbH directly on a case-by-case basis due to the increased risk of corrosion. Provided that the system is handled properly and dimensioned according to the structural conditions and normal environmental and ambient conditions, the company S:FLEX GmbH provides a warranty from transfer of risk to the warranty holder, which guarantees that the metallic components of the racks will remain free from defects with regard to material and workmanship for a period of 10 years. This warranty does not apply to wear parts. For additional information, please refer to the separate warranty provisions.

This applies within the context of the generally prevalent weather and environmental conditions.