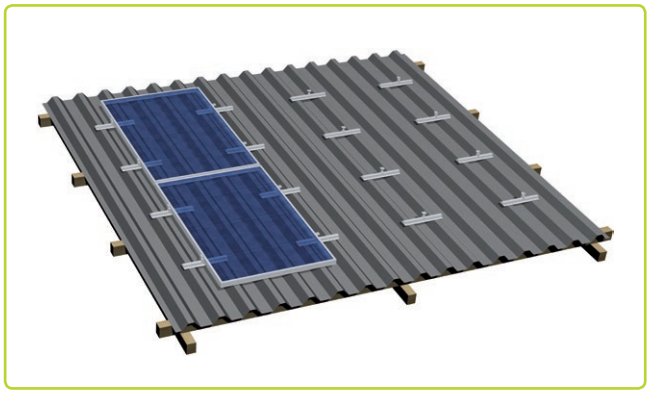
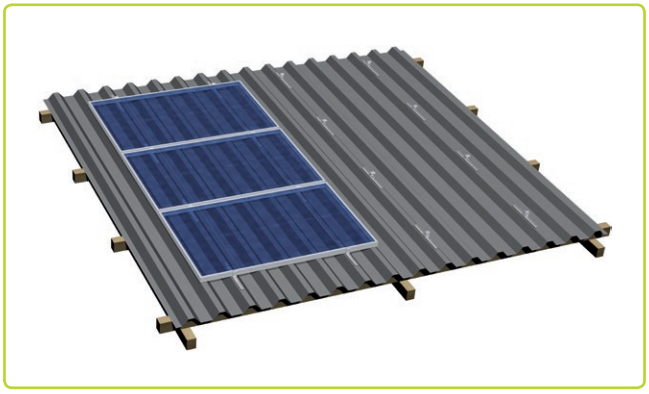
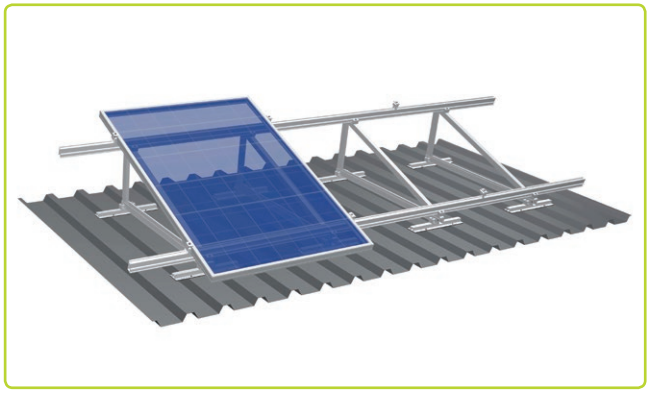
S:FLEX

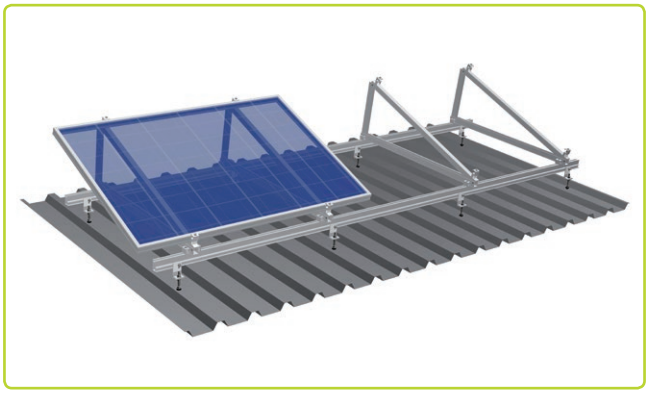
Installation Manual

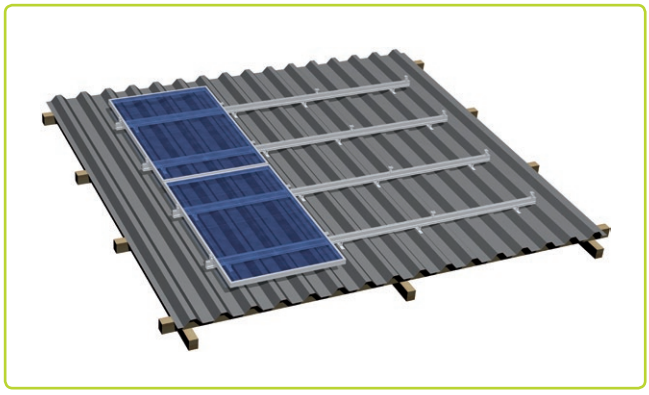
ROOF MOUNTING SYSTEMS











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This installation manual must be read carefully before installation of the S:FLEX mounting system and subsequently kept for future reference.

This installation manual is only complete with the project-related execution planning (project report)!

1.1 Intended use

The S:FLEX PV mounting system is a frame system for mounting PV modules. It is designed exclusively for the installation of PV modules.

Any other use is considered improper. In particular, compliance with the information in this installation guide is part of the intended use.

S:FLEX GmbH is not liable for damage resulting from non-compliance with the installation instructions, or from misuse or improper use of the product.

1.2 Safety warnings

The warnings included in this installation guide refer to safety-relevant information.
They consist of:

Failure to comply will result in a significant risk of injury as well as a danger to life.

Failure to comply may result in property damage.

1.3 General information — standards and guidelines

Photovoltaic systems must always be installed in accordance with the instructions contained in this **installation manual** and the **project report**.

This installation manual is based on the technological state of the art as well as extensive experience of installing our systems. It must be ensured that only the current and complete installation manual is used for the installation and that a printout of the installation manual is kept in the immediate vicinity of the system. All products are subject to technical modifications.

The project report is part of the installation instructions and is created on a project-specific basis. All specifications in the project report must be strictly adhered to. The location-specific structural calculations are also included in the project report. The design and planning of the S:FLEX mounting systems must be carried out using the S:FLEX software (Solar.Pro.Tool).

Each roof has special features to consider, which require prior clarification by qualified experts. Before installation, the installer of the PV system must ensure that the existing roof covering and roof substructure are designed to support the additional loads.
The condition of the roof substructure must be checked carefully (e.g. the quality and strength of the purlins, and if necessary the rafters and roof battens, the quality of the roof covering, adequate fastening of the roof covering to the substructure, and the maximum load-bearing capacity of the roof covering). For this purpose, you should consult a structural engineer.

When installing the PV systems, always observe the assembly instructions provided by the module manufacturer. In particular, it is essential to check that the module manufacturer's specifications regarding the module clamping specifications (clamping surface and clamping area on the module) are complied with. If this is not the case, either the module manufacturer's declaration of consent must be obtained or the frame must be adapted to the module manufacturer's specifications prior to installation.

The requirements for lightning and surge protection for PV mounting systems must be satisfied in accordance with the applicable regulations, whereby the specifications provided by the respective energy supply company must be observed.
It must also be ensured that the PV system to be installed does not impair the effectiveness of the existing lightning protection system. Furthermore, ensure that the PV system is configured so that it can be included in the protection zone of the building's lightning protection system. The separation distances between the PV system and the lightning protection system prescribed by the applicable regulations must be adhered to. For this purpose, you should consult a specialist installer of lightning protection systems.

During installation, the applicable fire protection regulations – for example, overlaying of fire walls is prohibited – and the corresponding clearances must be observed.

When changing the roof covering, the manufacturer's instructions must be followed. Both during and after installation, the frame parts must not be stepped on or used as a climbing aid. There is a risk of falling and damage to the underlying roof covering.

Prior to installation, the installer of the photovoltaic system must ensure that the installation is carried out strictly in accordance with the national and site-specific building regulations, occupational safety and accident prevention regulations, and applicable standards and environmental regulations.

Installers of S:FLEX PV mounting systems are required to independently ensure that they are aware of all relevant rules and regulations governing technically correct planning and installation, and to comply with these during the installation. This also includes obtaining the current versions of the respective rules and regulations as amended.

The installation of the PV system may only be carried out by appropriately trained specialists.

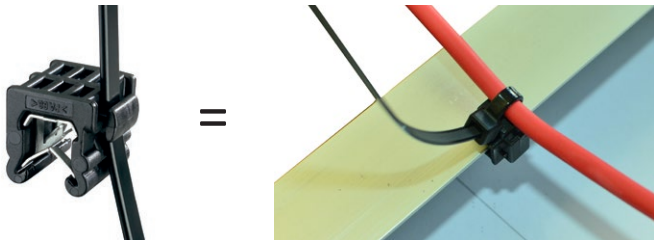
Please note:
The installation of the S:FLEX substructure and the PV system may only be carried out by trained specialists.
System components (roof hooks, mounting rails) must not be used as stepladders; the modules must not be stepped upon.
When working on roofs, there is a risk of falling off and through roofs. A fall may result in injury or death. Ensure that appropriate safe access equipment and fall protection (e.g. scaffolding) are provided as well as protection from falling parts.

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

The local and national regulations for lightning and surge protection for PV mounting systems must be observed. S:FLEX GmbH assumes no liability for damage caused by non-compliance with the lightning and surge protection requirements.

Cable routing for string cables (DC):
When laying the string and module cables, ensure that the cables are firmly and permanently fixed to the mounting system or modules. The cables must not sag or rest on the roof. The plug connectors must be mounted with tension relief and must never lie in water. Faulty cable routing may lead to failure of the PV system or cable fires.
The cable tie clips allow proper cable routing.

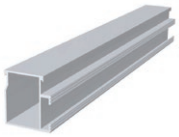
Note about cable clips:
Click the cable clips onto the module frame.



1.4 Cross-system components

Mounting rails

ST-AK 5/40



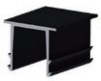
ST-AK 5/40 black

ST-AK 13/60

End caps

End cap 5

End cap 5 black

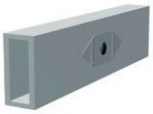


End cap 13

Connectors

Connector 5 earth

Connector 13 earth



Cross adapters

Cross adapters

End clamps

EH AK II Klick 30-50

EH AK II Klick 30-50 black

Mid clamps

MH AK II Klick 30-50

MH AK II Klick 30-50 black

Ground

Earthing plate for end clamp

Earthing clamp DEH uni HK

Sheet-metal screw

Self-tapping sheet metal screw 5,5x35

Locking clips

Locking clip AK

Locking clip AK black

Anti-slip set

Anti-slip set

Cable clips

Cable tie edge clip KC 15

Sets

Article no. 0010040124

Aluminium rail, silver 40x37, 2380 mm

Component	Qty.
ST-AK 5/40 l=2380 mm	1

Article no. 0010040125

Aluminium rail, silver 40x37, 2380 mm, 12

Component	Qty.
ST-AK 5/40 l=2380 mm	12

Article no. 0010040136

Aluminium rail, black 40x37, 2380 mm

Component	Qty.
ST-AK 5/40 l=2380 mm	1

Article no. 0010040137

Aluminium rail, black 40x37, 2380 mm, 12

Component	Qty.
ST-AK 5/40 l=2380 mm	12

Article no. 0010040134

Aluminium rail, silver 60x37, 2380 mm

Component	Qty.
ST-AK 13/60 l=2380 mm	1

Article no. 0010040135

Aluminium rail, silver 60x37, 2380 mm, 12

Component	Qty.
ST-AK 13/60 l=2380 mm	12

Article no. 0020271103

End cap, silver, 4 pcs.

Component	Qty.
End cap 5	4

Article no. 0020271104

End cap, black, 4 pcs.

Component	Qty.
End cap 5 black	4

Article no. 0010029477

End cap 13, silver, 4 pcs.

Component	Qty.
End cap 13	4

Article no. 0020271099

Connector aluminium rail 40x37, 2 pcs.

Component	Qty.
Connector 5 earth	2

Article no. 0010029476

Connector aluminium rail 60x37, 2 pcs.

Component	Qty.
Connector 13 earth	2

Article no. 0020271100

Cross adapters aluminium rail, 4 pcs.

Component	Qty.
Cross adapters	4

Article no. 0010047056

End clamp, 30-50 mm, silver, 4 pcs.

Component	Qty.
End clamp, 30-50	4

Article no. 0010047057

End clamp, 30-50 mm, silver, 10 pcs.

Component	Qty.
End clamp, 30-50	10

Article no. 0010047054

End clamp, 30-50 mm, black, 4 pcs.

Component	Qty.
End clamp, 30-50, black	4

Article no. 0010047055

End clamp, 30-50 mm, black, 10 pcs.

Component	Qty.
End clamp, 30-50, black	10

Article no. 0020276021

Mid clamp, adjustable 30-50 mm, silver 2 pcs.

Component	Qty.
Mid clamp, 30-50	2

Article no. 0020276030

Mid clamp, adjustable 30-50 mm, black 2 pcs.

Component	Qty.
Mid clamp, 30-50, black	2

Article no. 0020271101

Earthing plate, 2 pcs.

Component	Qty.
Earthing plate for module clamp	2

Article no. 0020271105

Universal earthing clamp, 5 pcs.

Component	Qty.
Earthing clamp DEHN UNI	5
Sheet-metal screw 5.5x35	5

Article no. 0020228554

Locking clip AK

Component	Qty.
Locking clip AK	20

Article no. 0020228541

Locking clip AK black

Component	Qty.
Locking clip AK black	20

Article no. 0020228553

Anti-slip set

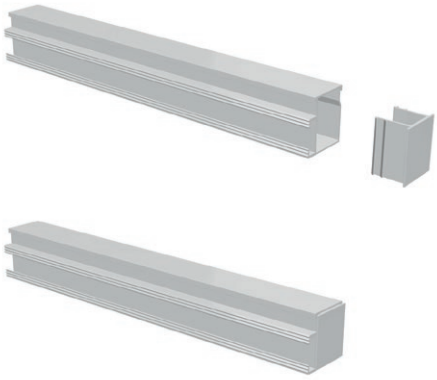
Component	Qty.
Hexagon nut M6 A2	25
Hexagon head screw M6x22	25

1.4 General description of the system

Mounting rails

The S:FLEX mounting rail ST-AK 5/40 features a lateral hammerhead channel for connection to the fasteners.
The module clamps and end clamps are mounted from above via Click technology.
The cover caps are clamped in place to ensure lateral closure of the mounting rails. The cover caps do not need to be screwed in place.

ST-AK 5/40

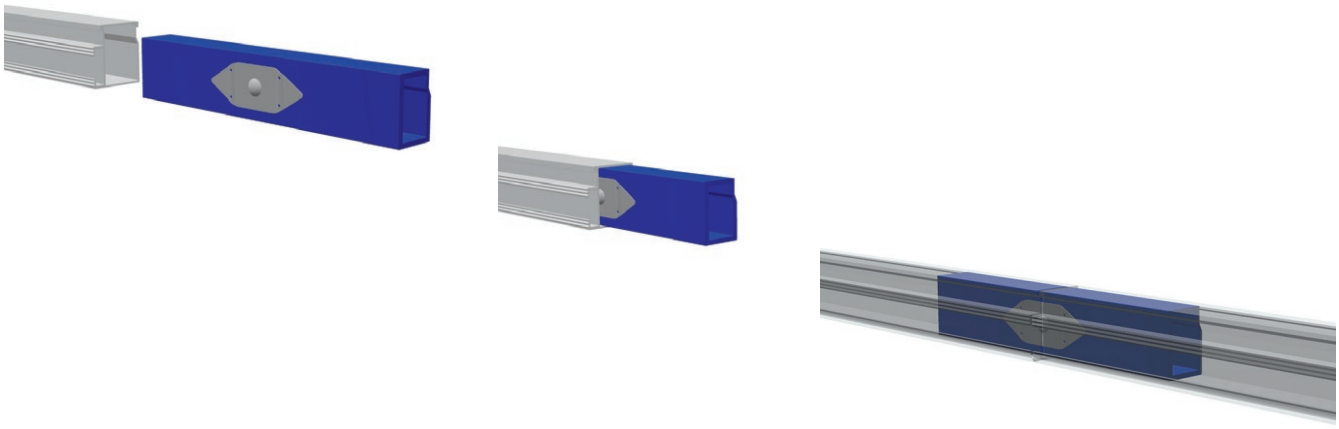


Connectors

Besides facilitating installation, our connector technology enables alignment of the system without reducing the load capacity in the area of the connectors, since they have the same static values as the respective mounting rails.

When the mounting rails are connected together by means of connectors, a short-circuit to earth is created by pushing the mounting rails together flush on the connector using appropriate pressure. The customer must have the short-circuit to earth professionally checked after installation.

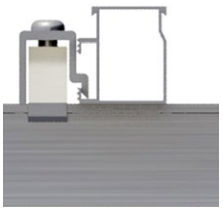
In addition, our connector technology makes it possible to easily and quickly produce expansion joints according to the conditions on the roof.



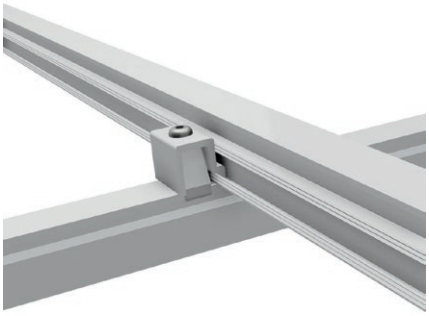
Cross adapters

Intersection points (in the case of double-layered systems) can be realised quickly and efficiently via cross adapters with our patented and proven Click technology. One cross adapter is installed per intersection.

Cross adapters



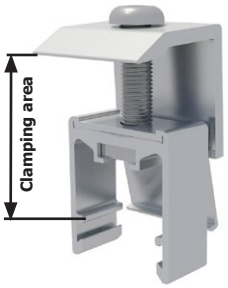
ST-AK 5/40



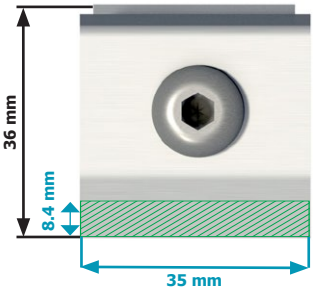
Module clamps and end clamps

Height-adjustable module clamps and end clamps with Click technology allow maximum flexibility when mounting almost all framed module types with a frame height of 30 to 50 mm. When attaching the PV modules to the mounting rails, always observe the assembly instructions provided by the module manufacturer.

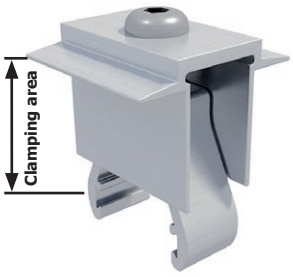
When mounting using the module clamp and end clamp, make sure that they are attached to the part of the module's frame that is defined as the clamping surface by the module manufacturer. The module manufacturer's installation instructions must be observed.



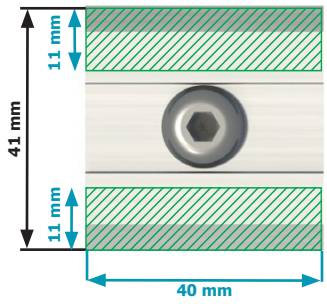
End clamp (EH)



maximum clamping area EH II:
A=8.4*35=294mm²



Module clamp (MH)



maximum clamping area MH:
A=11*40=440mm² (per side)

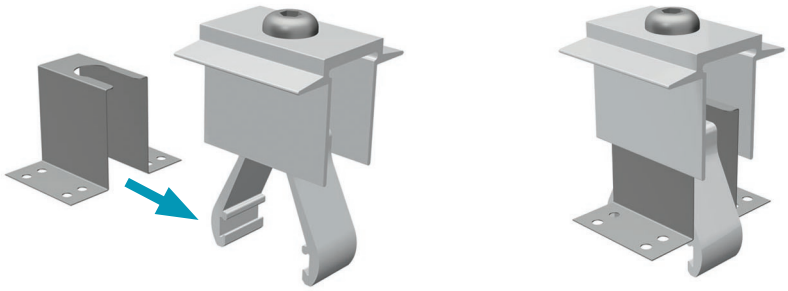
Earthing

The equipotential bonding between the individual system components must be ensured in accordance with the respective country-specific regulations and standards. These may include the use of system-specific properties (see connector technology).

An earthing concept is not included in this installation manual and must be calculated and created by the installer in accordance with the applicable standards and guidelines.

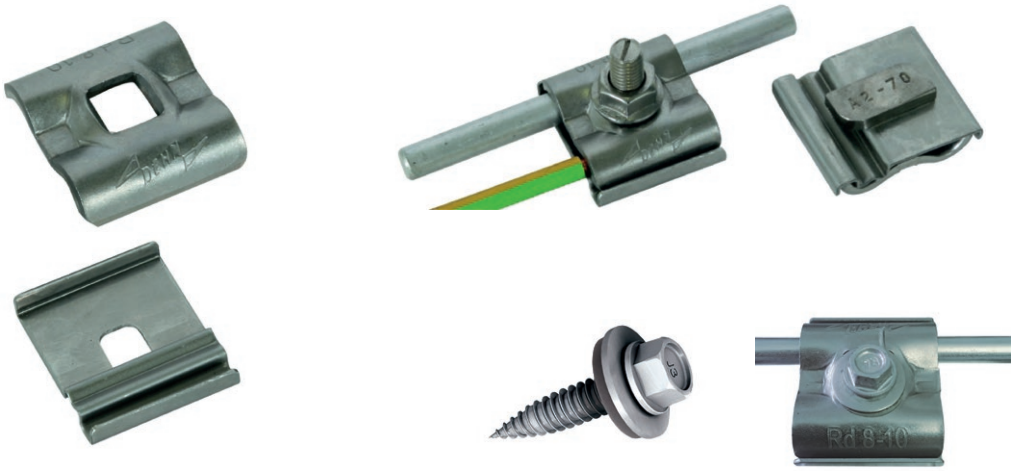
Earthing is not the same thing as a lightning protection system! For the installation of a lightning protection system, consult a specialist company and prepare a project-specific lightning protection plan.
Always observe the installation instructions provided by the module manufacturer.

The short-circuit to earth for the mounting rail is created by the connector. Additional earthing of the modules can be achieved via the earthing plate by mounting it to the module clamps. When earthing the modules, the specifications provided by the module manufacturer must be observed.



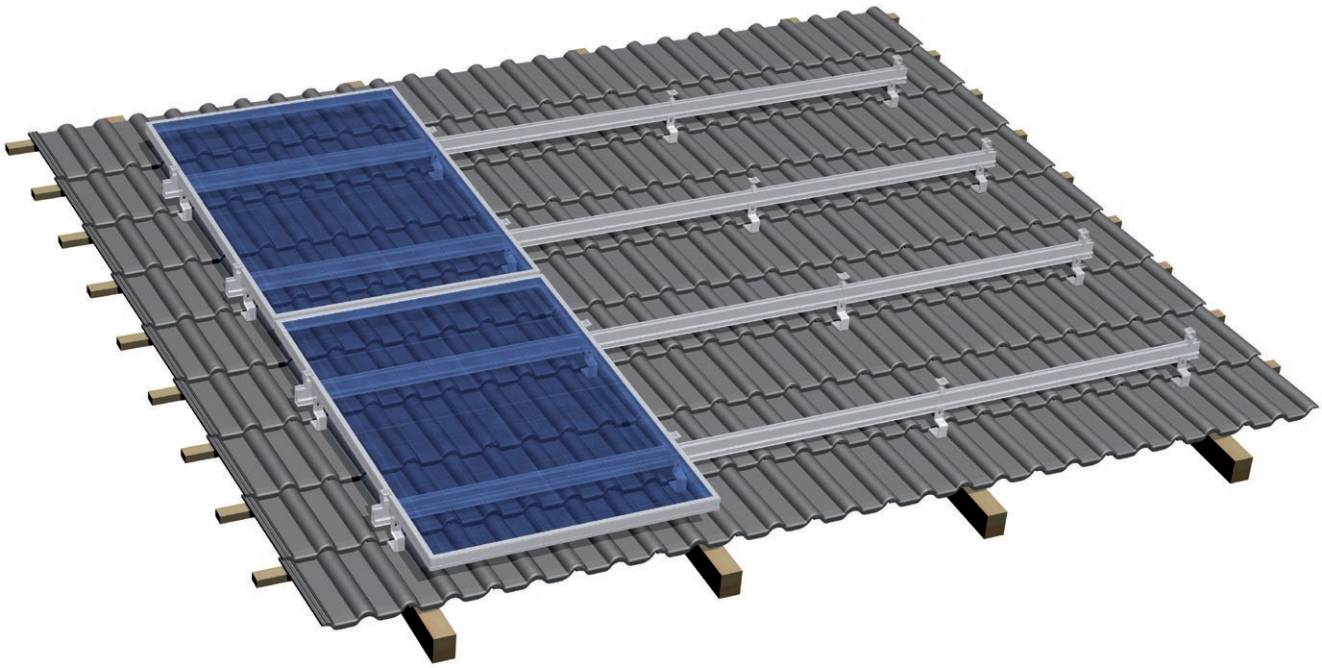
The earthing clamps are used to integrate the mounting system into the equipotential bonding system. Clamping area for round wire 8–10mm; connection area of 4–50 mm² (single and stranded) is possible.

The connection to the hammerhead channel is made using a hammerhead screw and self-locking nut. A self-tapping sheet-metal screw must be used for mounting directly on the aluminium profile.



2 PITCHED ROOF INSTALLATION

For roofing tiles, plain tiles and slates



2.1 Installation

The installation manual describes the installation of the S:FLEX PV mounting system on pitched roofs with roofing tiles, plain tiles and slates. The installation instructions are intended for people with relevant qualifications who have been instructed by the operator of the PV system.

We recommend having the substructure installed by a specialist roofing company.

The S:FLEX PV mounting system for pitched roofs with roofing tiles consists of mounting rails, roof hooks and all necessary small parts for mounting the PV modules on the mounting rails, interconnecting the components and mounting them to the roof substructure.

With the S:FLEX PV mounting system, both vertical and horizontal mounting of the modules is possible. It is also possible to install single-layered and double-layered systems.

The S:FLEX PV mounting system for pitched roofs with roofing tiles is characterised by a very high degree of pre-assembly. In addition, the use of our patented and proven Click technology further reduces the required installation time.

All components are made from aluminium or stainless steel. Their high level of corrosion resistance guarantees the longest possible service life and means they can be completely recycled.

2.2 About this document

This installation manual describes the process for mounting the pitched roof frame on tiled roofs. The S:FLEX PV mounting system includes suitable solutions to ensure easy attachment to the existing roof substructure. In the context of this installation manual, the various installation options are described separately for the most common types of roofing material:


Roofing tiles


Plain tiles


Slates

The document includes the installation instructions for following mounting types:

- *single-layered with framed PV modules in vertical mounting*
- *double-layered with framed PV modules in horizontal mounting*

2.3 Description of the system

Adjustable roof hooks

For pitched roofs with roofing tiles, the S:FLEX PV mounting system includes suitable roof hooks to ensure easy attachment to the existing roof substructure. In this installation manual, a distinction is made between the following common roofing materials:

Roofing tiles

Roof hook Alu

Roof hook Hybrid

Plain tiles

Roof hook plain tile

plain tile Vario metal roof plate

Slates

Roof hook slate

The roof hooks are only suitable for horizontal installation of the mounting rails. Detailed information about the various roof hooks are provided in the sections that describe the mounting process.

Height adjustment in the area of the roof battens and rails allows a level PV array to be installed even on uneven roof surfaces, making the system suitable for use on both old and new buildings alike. This is made possible thanks to the advantages of extrusion process used during production. The intermeshing of corrugated, optimally matched surfaces on roof hooks and mounting rails ensures force-fit and form-fit connections with a high degree of variability.

2.4 System components

Roof hooks

Roof hook Alu 93-7-45 complete

Roof hook slate complete

Roof hook Hybrid 112-7-46 8mm II

Roof hook plain tile complete

Metal roof plate plain tile Vario, galvanised

Wood screws

S:FLEX wood screw 6x80 A2 TX 30

S:FLEX wood screw 6x100 A2 TX 30

Wood screw TK SK A2 8.0x80/72 TX 40

Wood screw SEKO 6x80 A2 TX25

Sets

Article no. 0010047052

Basic set, pitched roof, silver

Component	Qty.
Roof hook Alu 93-7-45	4
S:FLEX wood screw 6x100 A2 TX 30	12
Cable holder clips	1
End clamp, 30-50	4
Hexagon nut M6 A2	2
Hexagon head screws M6x22	2
End cap 5	4

Article no. 0010040142

Basic set, pitched roof, black

Component	Qty.
Roof hook Alu 93-7-45	4
S:FLEX wood screw 6x100 A2 TX 30	12
Cable holder clips	1
End clamp, 30-50, black	4
Hexagon nut M6 A2	2
Hexagon head screws M6x22	2
End cap 5 black	4

Article no. 0010047053

Basic set, pitched roof, heavy load, silver

Component	Qty.
Roof hook Hybrid 112-7-46 8 mm II	4
S:FLEX wood screw 6x100 A2 TX 30	12
Cable holder clips	1
End clamp, 30-50	4
Hexagon nut M6 A2	2
Hexagon head screws M6x22	2

Article no. 0020271092

Roof hooks for slate, stainless steel, 2 pcs.

Component	Qty.
Roof hook slate	2

Article no. 0020271093

Roof hooks for plain tile Vario, 2 pcs.

Component	Qty.
Roof hook plain tile	2

Article no. 0010029479

Roof hooks, flexible, heavy load, 2 pcs.

Component	Qty.
Roof hook Hybrid 112-7-46 8 mm II	2

Article no. 0020271090

Roof hooks, standard, adjustable, 2 pcs.

Component	Qty.
Roof hook Alu 93-7-45	2

Article no. 0020228536

Roof hooks for slate, stainless steel, 10 pcs.

Component	Qty.
Roof hook slate	10

Article no. 0020228534

Roof hooks for plain tile Vario, 10 pcs.

Component	Qty.
Roof hook plain tile	10

Article no. 0010029478

Roof hooks, flexible, heavy load, 10 pcs.

Component	Qty.
Roof hook Hybrid 112-7-46 8 mm II	10

Article no. 0020228531

Roof hooks, standard, height-adjustable, 10 pcs.

Component	Qty.
Roof hook Alu 93-7-45	10

Article no. 0020275997

Extension kit +1, pitched roof, silver

Component	Qty.
Roof hook Alu 93-7-45	2
S:FLEX wood screw 6x100 A2 TX 30	6
Cable holder clips	1
Mid clamp, 30-50	2
Hexagon nut M6 A2	2
Hexagon head screws M6x22	2

Article no. 0020275998

Extension kit +2, pitched roof, silver

Component	Qty.
Roof hook Alu 93-7-45	4
S:FLEX wood screw 6x100 A2 TX 30	12
Cable holder clips	2
Mid clamp, 30-50	4
Connector 5 Erdung	2
Hexagon nut M6 A2	4
Hexagon head screws M6x22	4

Article no. 0020276004

Extension kit +1, pitched roof, black

Component	Qty.
Roof hook Alu 93-7-45	2
S:FLEX wood screw 6x100 A2 TX 30	6
Cable holder clips	1
Mid clamp, 30-50, black	2
Hexagon nut M6 A2	2
Hexagon head screws M6x22	2

Article no. 0020276003

Extension kit +2, pitched roof, black

Component	Qty.
Roof hook Alu 93-7-45	4
S:FLEX wood screw 6x100 A2 TX 30	12
Cable holder clips	2
Mid clamp, 30-50, black	4
Connector 5 earth	2
Hexagon nut M6 A2	4
Hexagon head screws M6x22	4

Article no. 0010029484

Extension kit +1, pitched roof, heavy load, silver

Component	Qty.
Roof hook Hybrid 112-7-46 8 mm II	2
S:FLEX wood screw 6x100 A2 TX 30	6
Cable holder clips	1
Mid clamp, 30-50	2
Hexagon nut M6 A2	2
Hexagon head screws M6x22	2

Article no. 0010029483

Extension kit +2, pitched roof, heavy load, silver

Component	Qty.
Roof hook Hybrid 112-7-46 8 mm II	4
S:FLEX wood screw 6x100 A2 TX 30	12
Cable holder clips	2
Mid clamp, 30-50	4
Hexagon nut M6 A2	4
Hexagon head screws M6x22	4

Article no. 0020271094

Metal roof plate plain tile 207x373, 2 pcs.

Component	Qty.
Metal roof plate plain tile Vario	2
Foam wedge	2

Article no. 0020228535

Metal roof plate plain tile 207x373, 10 pcs.

Component	Qty.
Metal roof plate plain tile Vario	10
Foam wedge	10

Article no. 0020228550

Wood screw SEKO 6x80 A2 TX 25

Component	Qty.
Wood screw SEKO 6x80 A2 TX 25	200

Article no. 0020228549

Wood screw TK SK A2 8.0x80/72 TX 40

Component	Qty.
Wood screw TK SK A2 8.0x80/72 TX 40	100

Article no. 0020228544

S:FLEX wood screw 6x80 A2 TX 30

Component	Qty.
S:FLEX wood screw 6x80 A2 TX 30	100

Article no. 0020271098

S:FLEX wood screw 6x100 A2 TX 30

Component	Qty.
S:FLEX wood screw 6x100 A2 TX 30	100

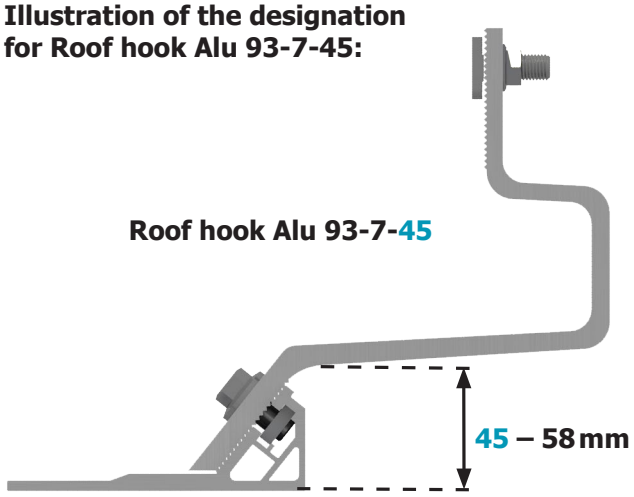
2.5 Installing roof hooks

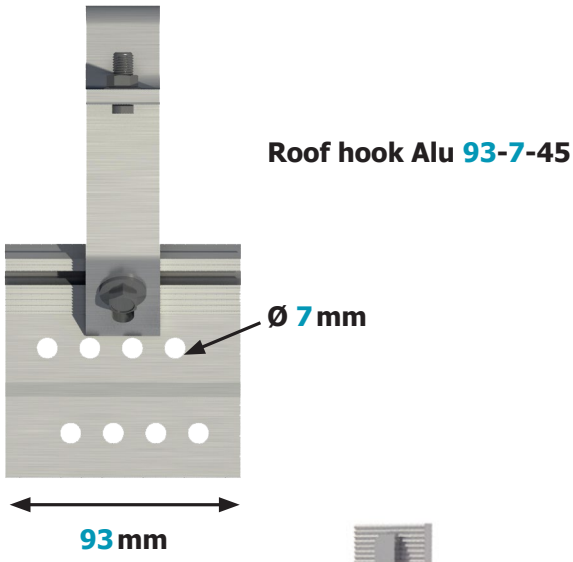
In most cases, the roofing material consists of some type of roofing tiles. Accordingly, the S:FLEX PV mounting system is available with adjustable roof hooks to ensure the necessary connection to the existing roof covering (tile dimensions) or roof construction (tile thickness and height of the roof battens).

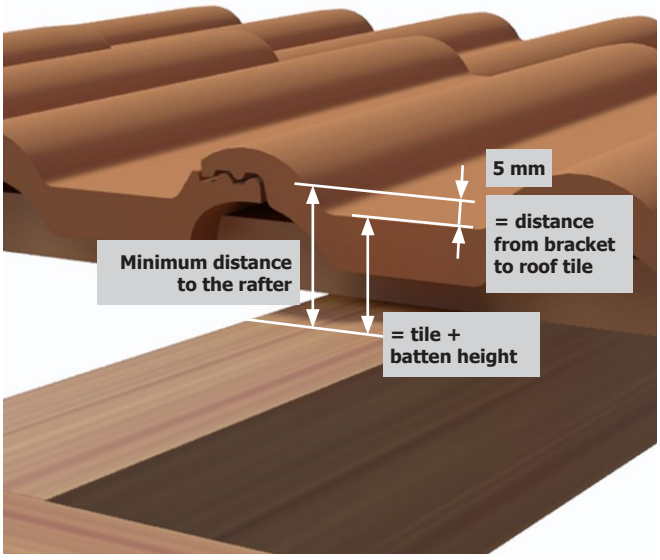
Our Roof hook Alu is suitable for attachment to horizontal mounting rails. For different tile sizes, we can supply roof hooks with suitable adapter plates to achieve the required lateral adjustment. The roof hooks are installed using 6-mm-thick wood screws. The roof hooks offer variable adjustment from 45 to 58 mm in the area of the roof batten/tile. If the adjustment range of the roof hooks is insufficient, they must be underlaid with a pressure-resistant base over the entire surface.

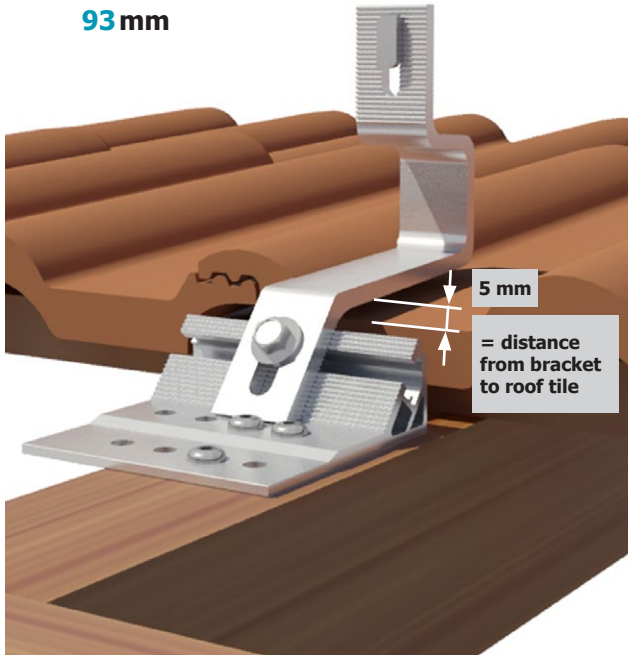
The included adjustment options are contained in the designation of the roof hooks as follows:
Roof hook Alu base plate width – hole pattern – minimum distance to the rafter.
Example: Roof hook Alu 93-7-45

Illustration of the designation for Roof hook Alu 93-7-45:









The positioning of the roof hooks must be determined according to the prevailing structural requirements and the installation situation. In so doing, it is important to check once again whether the dimensions used in the planning correspond to the actual dimensions on the roof (if necessary, adjustments must be made). Check that the spacing between the mounting rails is in line with the specified clamping distances for the module. Remove the roof tiles at the marked positions (if possible, only push them up).

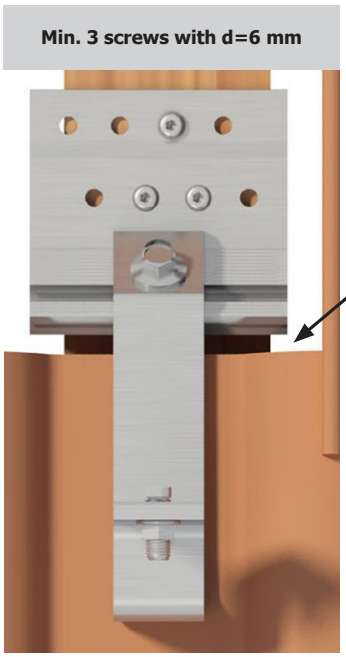
Check the installation plan.

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

Align roof hooks using a guideline.

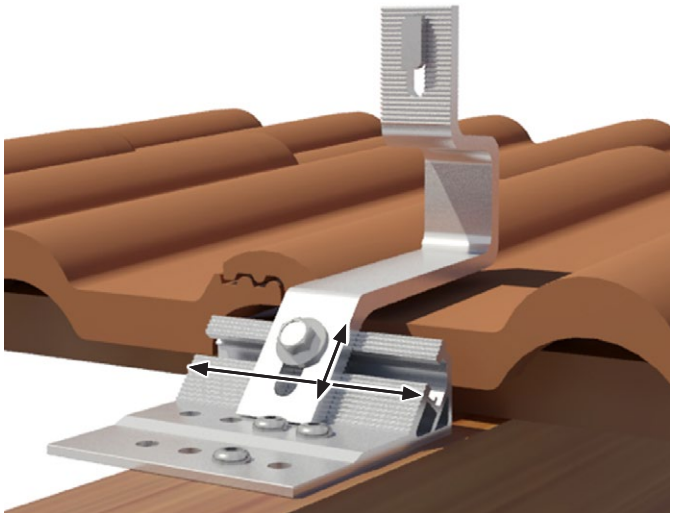
Loosen the screw on the roof hook bracket until it can be moved. Position the roof hook (use a guideline) and secure it to the rafters with at least three 6 x 100 wood screws.
When mounting, place two screws are in the bottom row of holes and one in the top row of holes.
The minimum rafter width for the installation of roof hooks is 45mm.

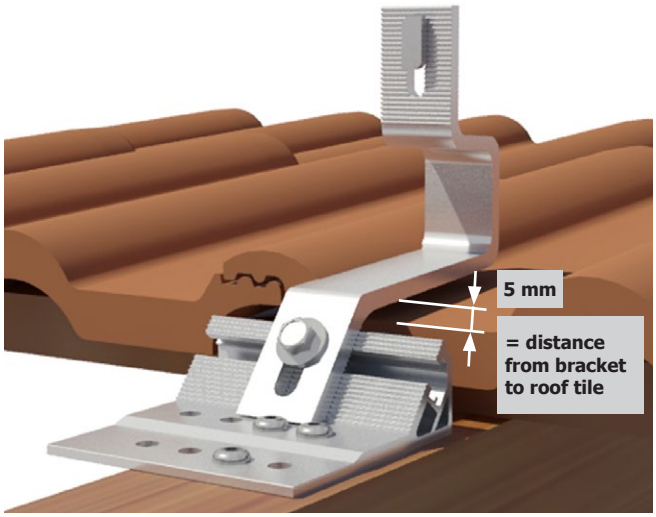
Edge clearance: Screw centre – rafter edge: at least 2.5 x d



Observe screw arrangement and edge distances.

Now adjust the roof hook bracket vertically and laterally so that it is located in the "wave trough" of the tile. There must be a 5 mm gap between the roof tile and the bracket. Tighten the bracket via the screw (tightening torque 20–25 Nm).





Observe the required clearance to the roof tile.

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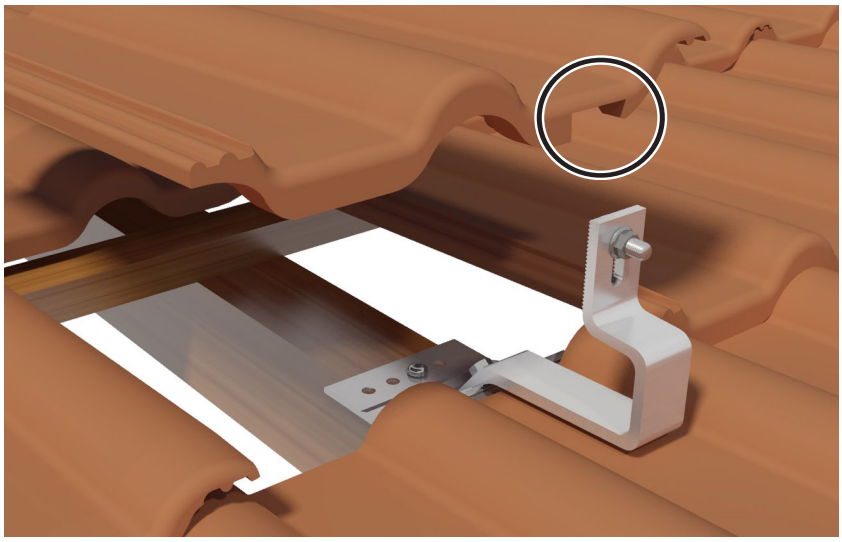
Properly reposition the removed roof tiles. If necessary, use an angle grinder to create a recess in the roofing tile directly above the roof hook at the point where it obstructs the hook. The overlying roofing tile must fit properly and lie flat, and must not be raised by the roof hook. With interlocking tiles, the lowest tile should also be recessed.
Pay attention to the leak-tightness of the roofing. In special cases, it is advisable to install a sheet metal tile (metal roof plate) instead of altering a tile. Suitable sheet metal tiles for all common tile types can be purchased via S:FLEX.



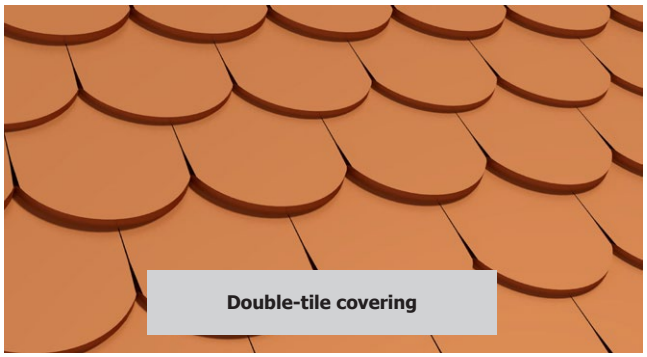
Cut a recess in the roof tiles

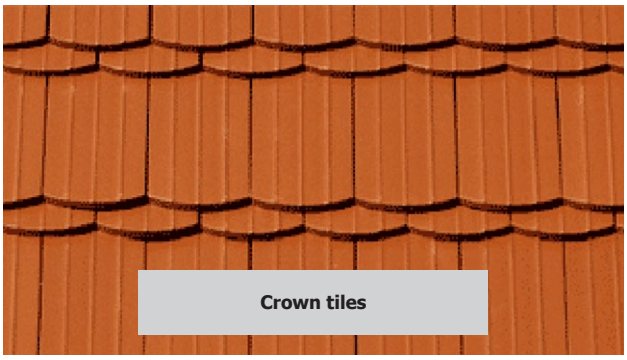
Roof connection for plain tiles

For plain tiles, the S:FLEX PV mounting system is available with our Roof hook Alu and Roof hook plain tile. For the installation, it may be necessary to remove and possibly alter (recess) some of the plain tiles.
The plain tile located under the roof hook must be replaced with a metal roof plate, so that the roof hook does not press on the roofing. The metal roof plates are included in the S:FLEX product range.

In order to design the connection of the S:FLEX PV mounting system to roofs covered with plain tiles, we recommend contacting a specialist roofing company.

Our Roof hook Alu and Roof hook plain tile are suitable for attachment to horizontal mounting rails.
Depending on the region, different types of plain tile and roof coverings may be used, e.g. double-tile covering or crown tiles. The most common form of plain-tile roofing is the double-tile covering. In this case, the installation is carried out using our Roof hook plain tile. For other roofing materials, such as crown tiles, the Roof hook Alu can also be used. The selection of the appropriate roof hook must be made on site by the roofer.


Double-tile covering


Crown tiles

Depending on the roofing type, plain-tile thickness, roof-batten height and sheet thickness, it may be necessary for the roof hook to be completely underlaid with a pressure-resistant base.
The installation sequences for the roof connection are described below using the example of a double-tile covering (most frequently encountered) and our Roof hook plain tile.

The installation instructions below describe the connection of the S:FLEX PV mounting system to roofs covered with plain tiles (double-tile covering) as an example. To ensure a technically correct execution of the connection to the roof, a specialist roofing company should be consulted.

The positioning of the roof hooks must be determined according to the prevailing structural requirements and installation situation. In so doing, it is important to check once again whether the dimensions used in the planning correspond to the actual dimensions on the roof (if necessary, adjustments must be made). Check that the spacing between the mounting rails is in line with the specified clamping distances for the module.

Check the installation plan and remove roof tiles as necessary (if possible, only push them up).

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

Always use the metal roof plate.

Align roof hooks using a guideline.

At the marked locations, install four plain tiles and replace the plain tiles under the roof hooks with a metal roof plate. Glue a foam wedge into the metal roof plate.
Position the plain-tile roof hook and fasten with two flat plate head screws (8 x 80).
Check that the connecting bolt is correctly tightened on the bracket (tightening torque 12 – 15 Nm).
Re-position the remaining three plain tiles.

Installation with two screws (plate head) with d = 8 mm

Observe screw arrangement and edge distances.

Roof connection for slates

For slate roofs, the S:FLEX PV mounting system is available with our Roof hook slate. The Roof hook slate should be installed at the same time as the roofing itself (new construction). For existing roofs, some slates must be removed and, if necessary, altered (recessed) before installation.

Typically, a titanium zinc plate is fastened to the formwork above the formwork track. The plate should cover the exposed area and overlap the slates far enough to ensure that the roofing remains leak-tight. Above this plate, the Roof hook slate is mounted to the rafters. Above the Roof hook slate, another titanium zinc plate is attached to the formwork to ensure the leak-tightness of the roofing. The titanium zinc plate must be procured by the customer and adapted to the existing roofing. The plate is not included in the S:FLEX scope of supply.

In order to design the connection of the S:FLEX PV mounting system to slate roofs, we recommend contacting a specialist roofing company.

Our Roof hook slate is suitable for attachment to horizontal mounting rails.
Depending on the region, different slate designs and roofing styles may be encountered.

Universal coverage

The installation sequences for the roof connection are described below using the example of universal coverage with full boarding and our Roof hook slate.

The installation instructions below describe the connection of the S:FLEX PV mounting system to slate roofs as an example. To ensure a technically correct execution of the connection to the roof, a specialist roofing company should be consulted.

The positioning of the roof hooks must be determined according to the prevailing structural requirements and the installation situation. In so doing, it is important to check once again whether the dimensions used in the planning correspond to the actual dimensions on the roof (if necessary, adjustments must be made). Check that the spacing between the mounting rails is in line with the specified clamping distances for the module. At the marked positions either remove the slate tiles or, if possible, only push them up.

Check the installation plan and remove slate tiles if necessary.

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

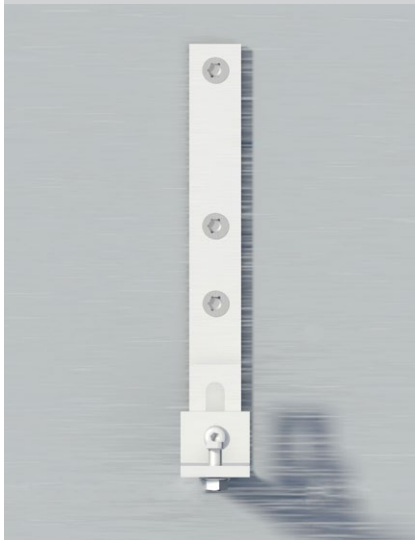
Align roof hooks using a guideline.

Use a titanium zinc plate and ensure a sufficient overlap.

Depending on the size of the slate tiles, you can replace one to two slates with titanium zinc plates, which are attached to the formwork. Care must be taken to ensure that the plate reaches far enough below the adjacent slate tiles, and far enough over the slate tiles below, so that the leak-tightness of the roofing is not compromised.

Position the Roof hook slate (use a guideline) and secure it to the rafters with at least three 6 x 80 wood screws.

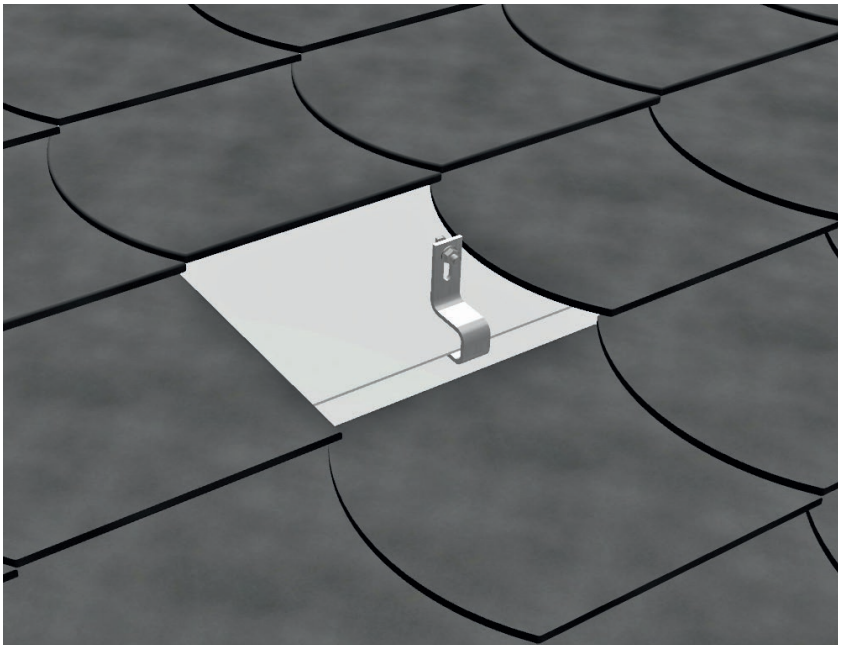
Installation with three screws (countersunk head) with d = 6 mm



Observe screw arrangement and edge distances.

An additional titanium zinc plate must be mounted above the roof hook. The resulting gaps between the titanium zinc plates and adjacent slates must be sealed using sealing tape (to be provided by the customer).

The adjacent slates must be fixed in place in accordance with the relevant roofing regulations.



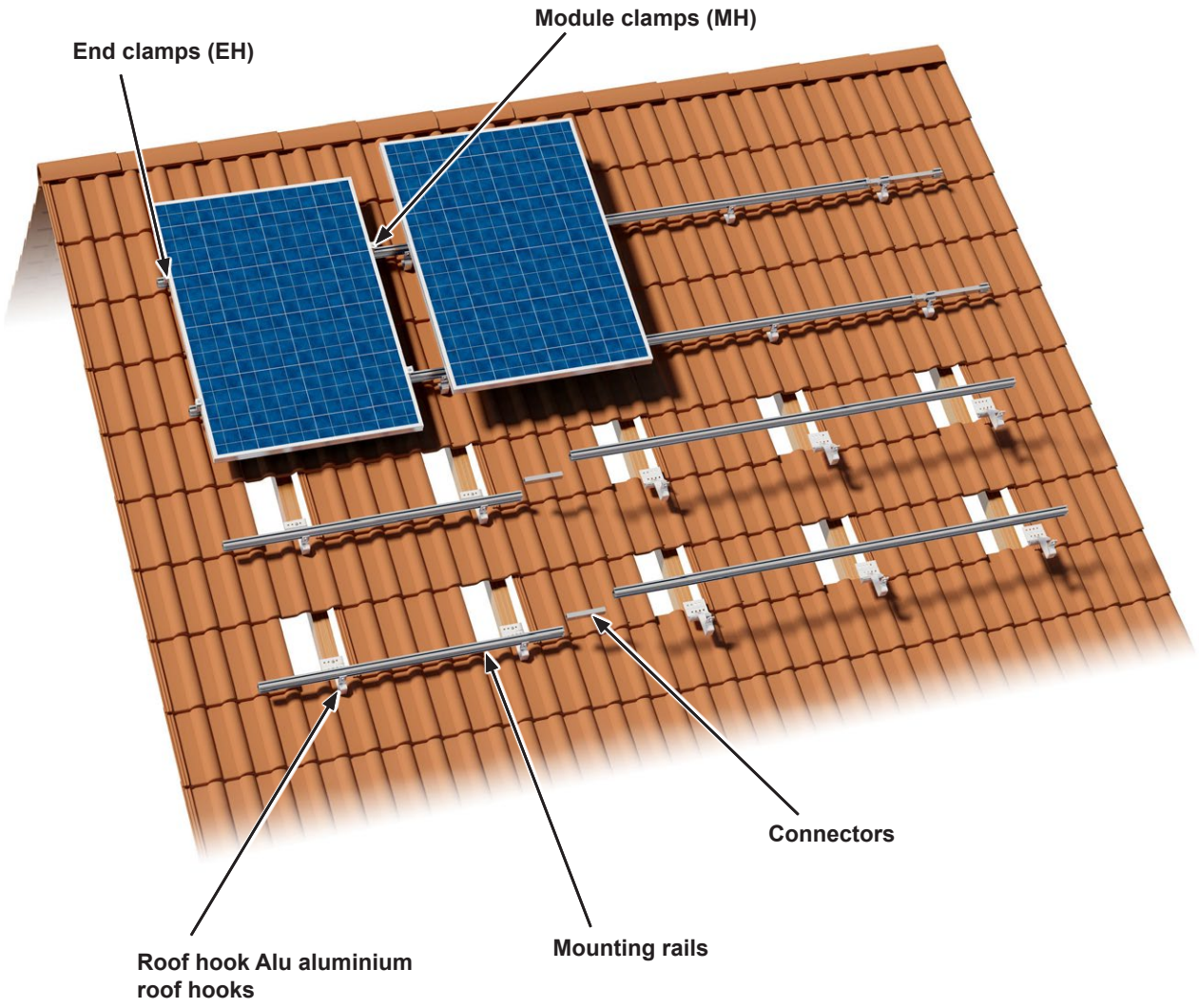
Seal all gaps with sealing tape.

If necessary, cut recesses in the slates.

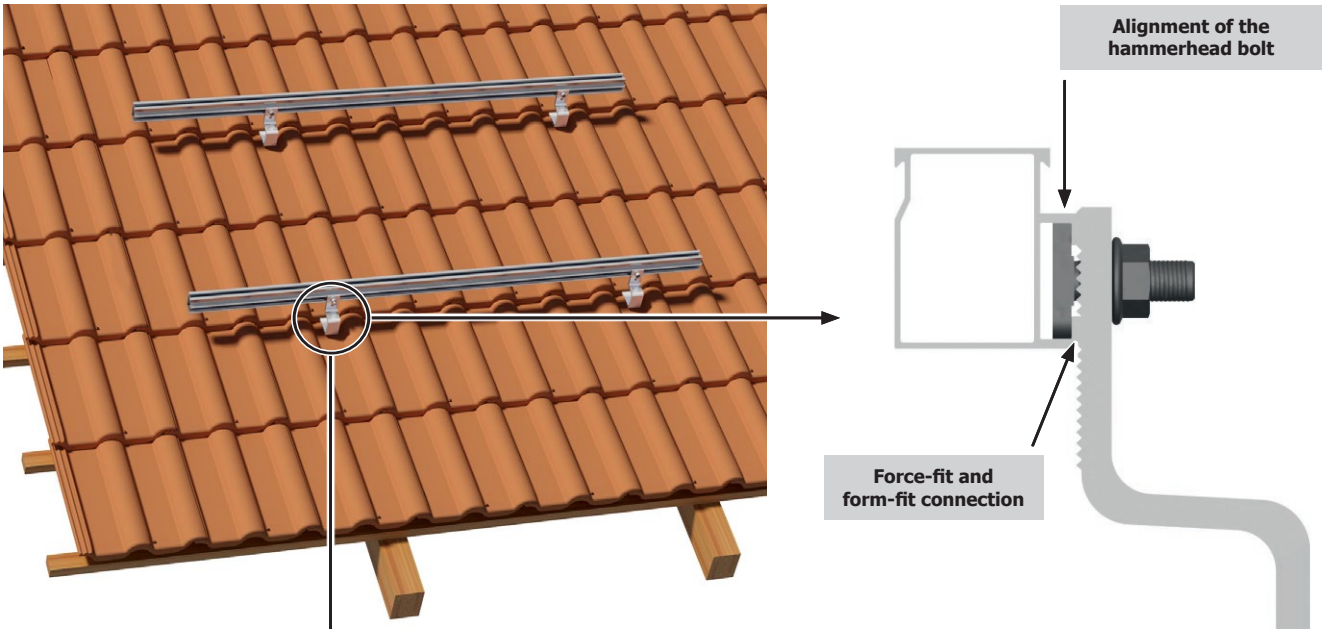
Layout diagram – due to the variety of types of slate roofing, the roof hooks should always be installed by **a specialist roofing company.**.

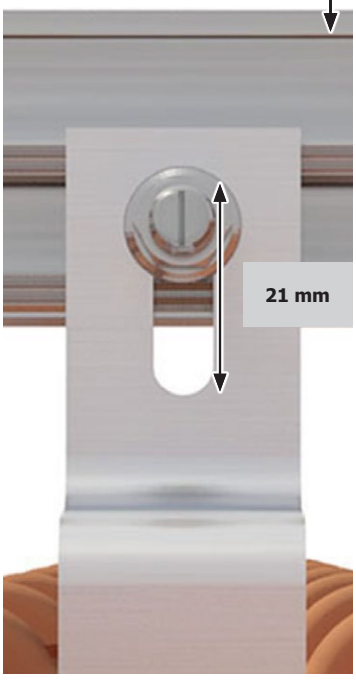
2.6 Single-layer installation with framed PV modules in vertical mounting

The installation instructions for "Single-layer installation with framed PV modules in vertical mounting" are only valid in conjunction with the instructions in Section 2.5. It is the installer's responsibility to ensure that only current and complete installation instructions are used for the installation.



Attach the horizontal (parallel to the verge) mounting rail using an M8 x 25 hammerhead bolt and a self-locking nut. Ensure correct alignment of the hammerhead bolts in the channel of the mounting rail (tightening torque 12–15 Nm) and that the mounting rails are installed without any tension. To do this, use the adjustment options created by the corrugation of the components and the elongated hole. Ensure that a force-fit and form-fit connection is created by interlocking the corrugations.





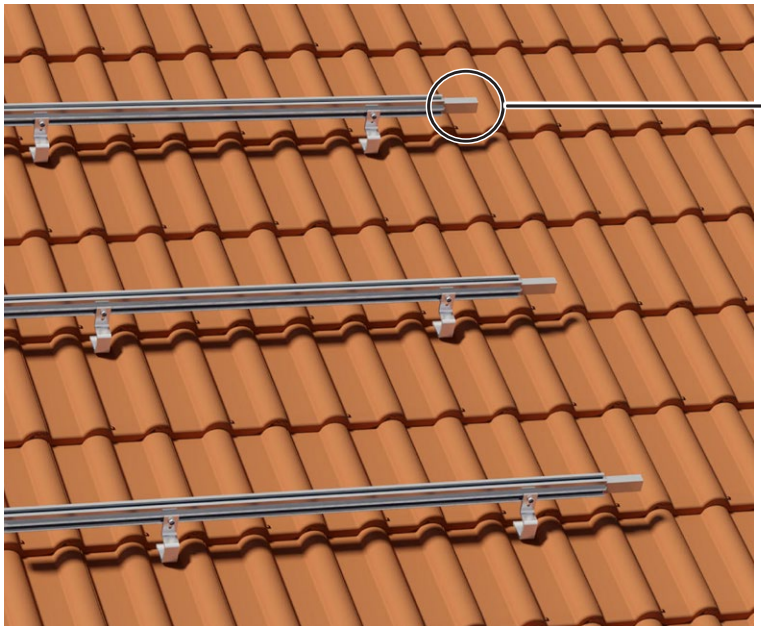
13

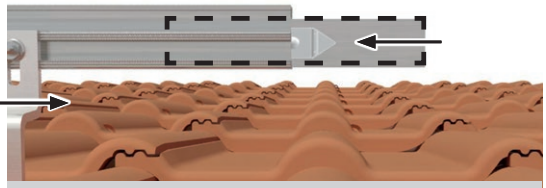
Check the alignment of the hammerhead bolts. The hammerhead bolt is only correctly mounted if the notch is visible vertically.

Use the corrugation and slot for adjustment.

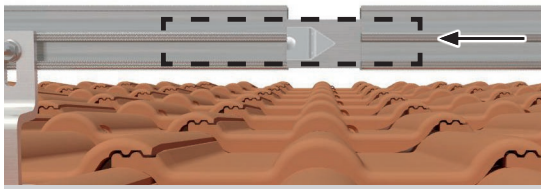
Create a force-fit and form-fit connection.

To align several mounting rails, push the connector, which has the same static values as the mounting rails, halfway into the already installed rail. Then slide the other mounting rail onto the connector and push the mounting rails flush together using sufficient pressure.
The connection is completed.
Attach the newly installed mounting rail to the roof hook as described.

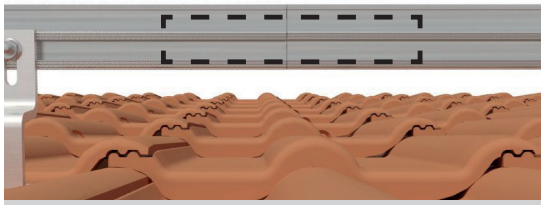




Insert connector



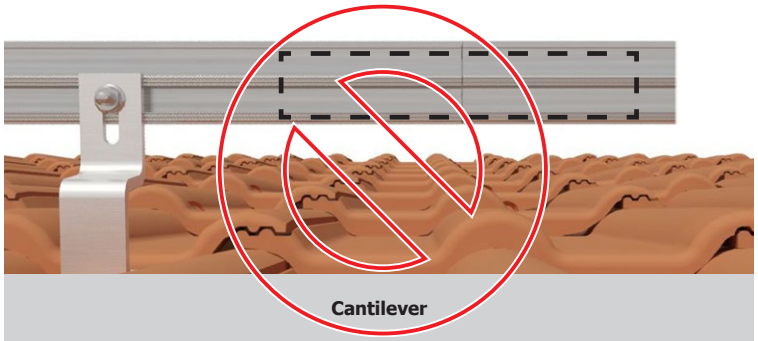
Push mounting rails together



Finished

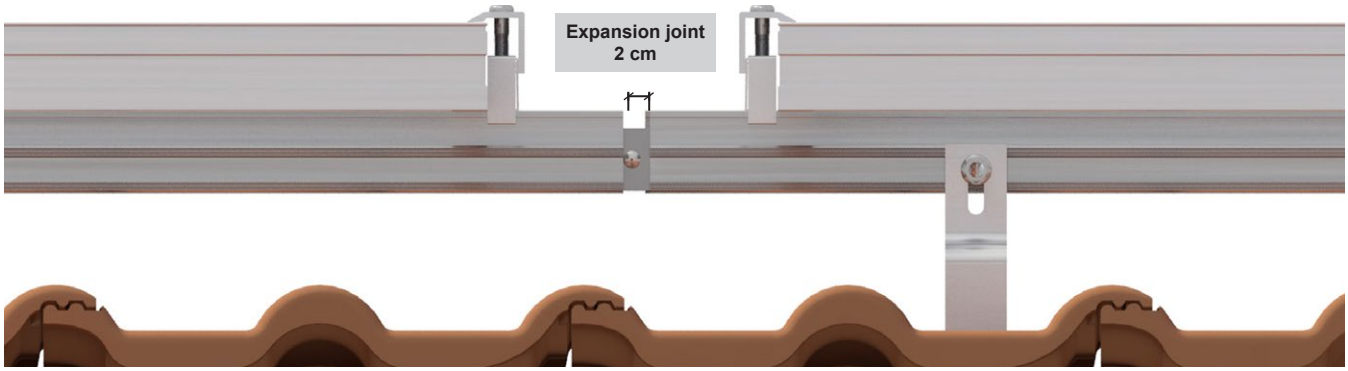
Insert connector.

Do not create cantilevers with connectors. Always position the connectors so that they lie between two fastening points.

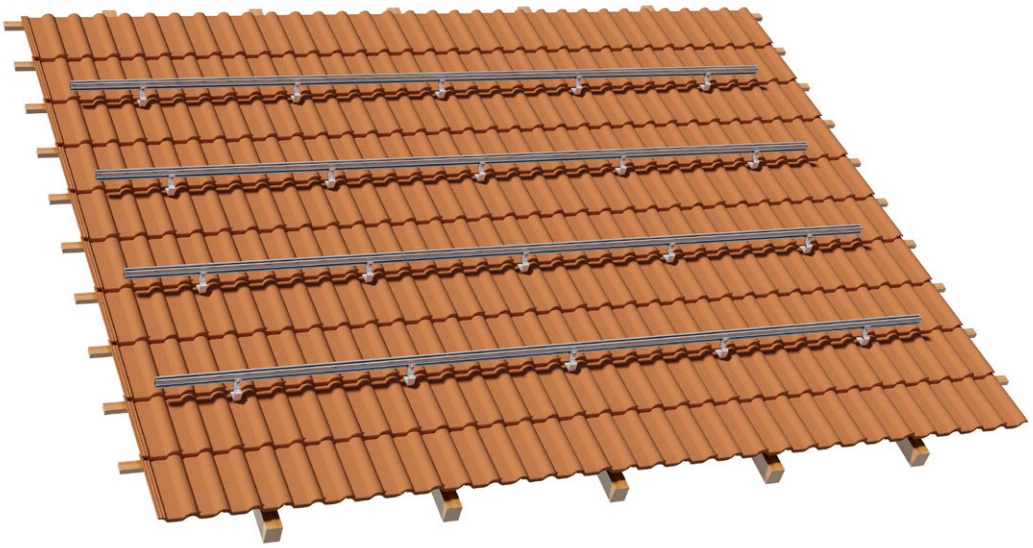


Cantilever

If the mounting rail is longer than 12 m, the module array must be separated by attaching two end clamps. In the area between the end clamps, the mounting rail must be separated and connected by means of a splice so that a length compensation of 2 cm is possible (expansion joint).
The arrangement of the expansion joints must be adapted to suit the roof conditions and the respective expansion properties of the materials.
For placement of the end clamps, please refer to the section "Mounting the PV modules" in this installation manual. Modules must not be installed over expansion joints.



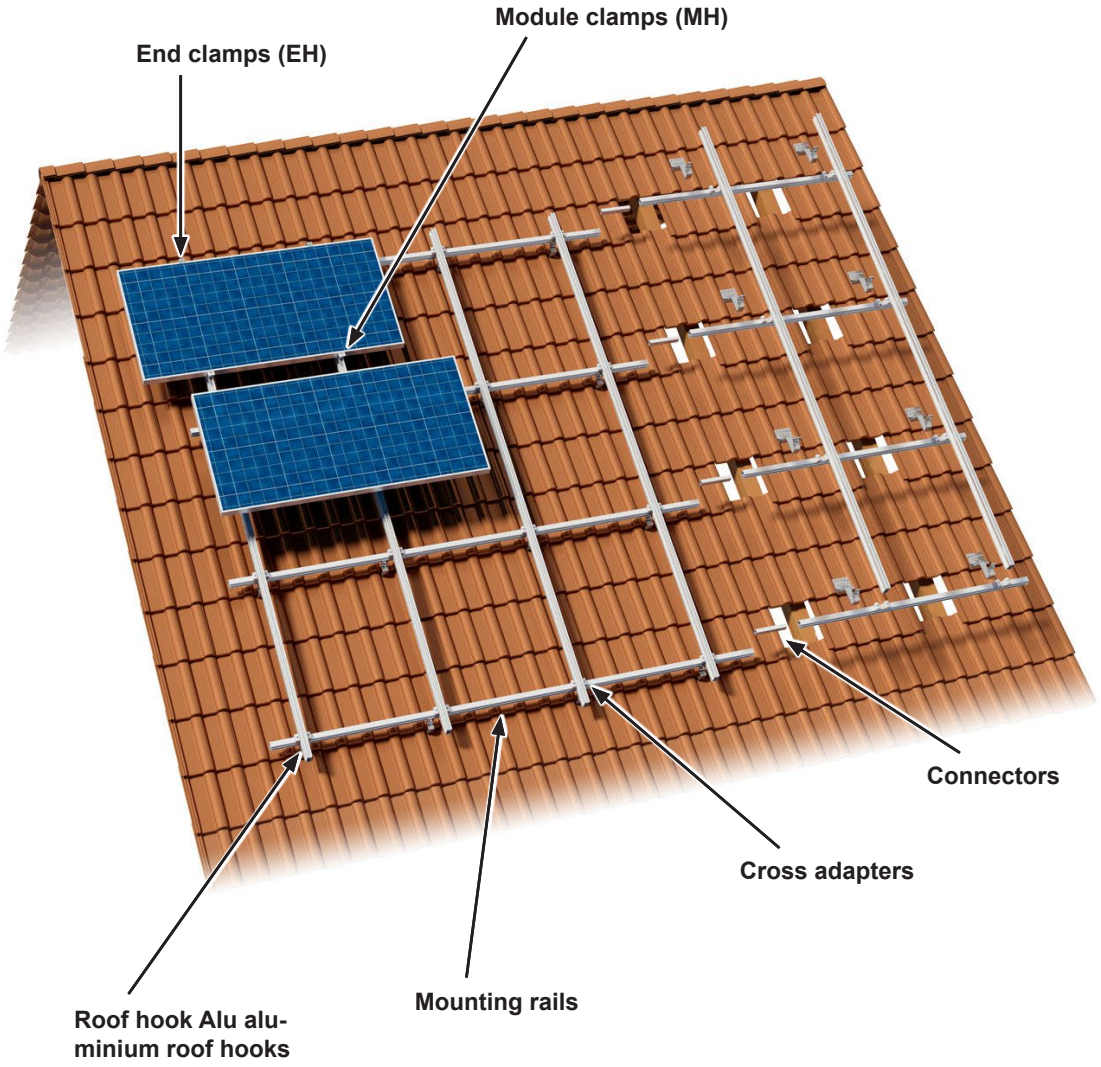
Completing the installation of the mounting rail layer.



This concludes the installation process for the single-layer substructure.
A description of the subsequent module assembly can be found in **section 6**.

2.7 Double-layer installation with framed PV modules in horizontal mounting

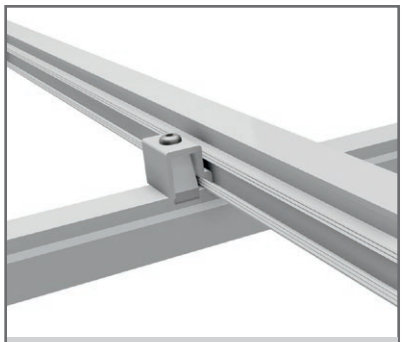
The installation instructions for "Double-layer installation with framed PV modules in horizontal mounting" are only valid in conjunction with the instructions in section 2.6. It is the installer's responsibility to ensure that only current and complete installation instructions are used for the installation.



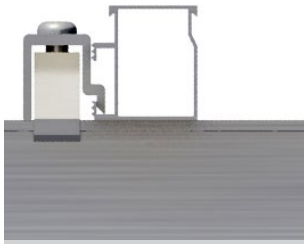
Install the lower horizontal rail layer as shown in section 2.6 "Single-layer installation".

Install the vertical mounting rail for each module row using cross adapters on the horizontal mounting rail. Determine the distance of the vertical mounting rail by referring to the clamping areas described in the module's installation instructions. Click the cross adapter onto the horizontal mounting rail and use it to secure the vertical mounting rail. Check that the spacing between the vertical mounting rails corresponds to the specified clamping distances for the module.
The vertical mounting rails should always be installed from bottom to top. The lowest rail section per row must be connected to the horizontal rail layer with at least two cross connectors at least two points.

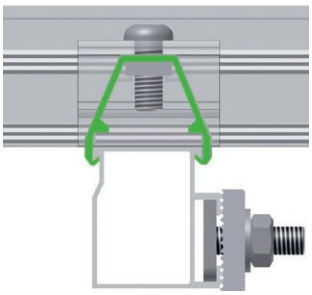
Ensure that the cross adapter is clicked in properly and tighten the screws (tightening torque 8–10 Nm).



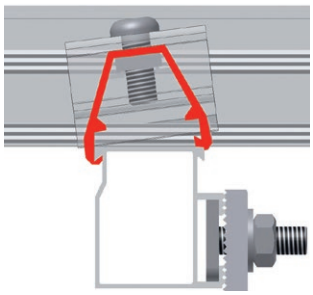
Install the cross adapters



Cross adapter in the lateral hammerhead bolt channel



Click in on both sides



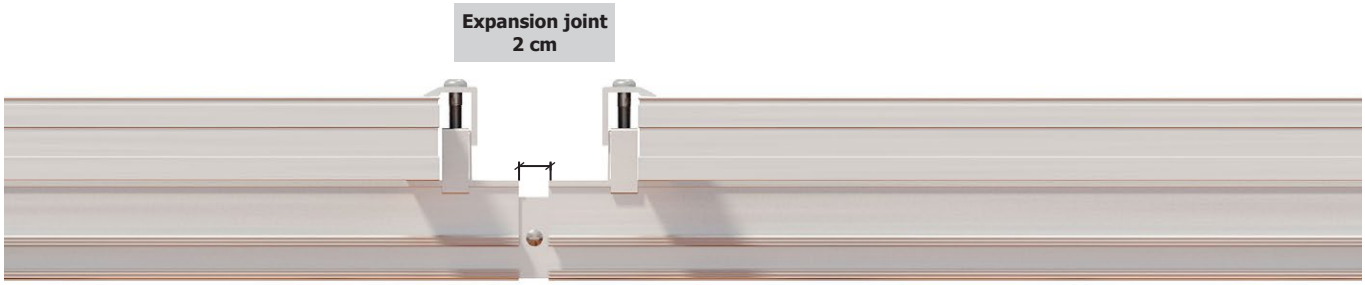
INCORRECT

To align several mounting rails, push the connector, which has the same static values as the mounting rails, halfway into the already installed rail.
Then slide the other mounting rail onto the connector and push the mounting rails flush together using sufficient pressure. The connection is completed.

Attach the newly installed mounting rail to the horizontal mounting rail using cross adapters as described.

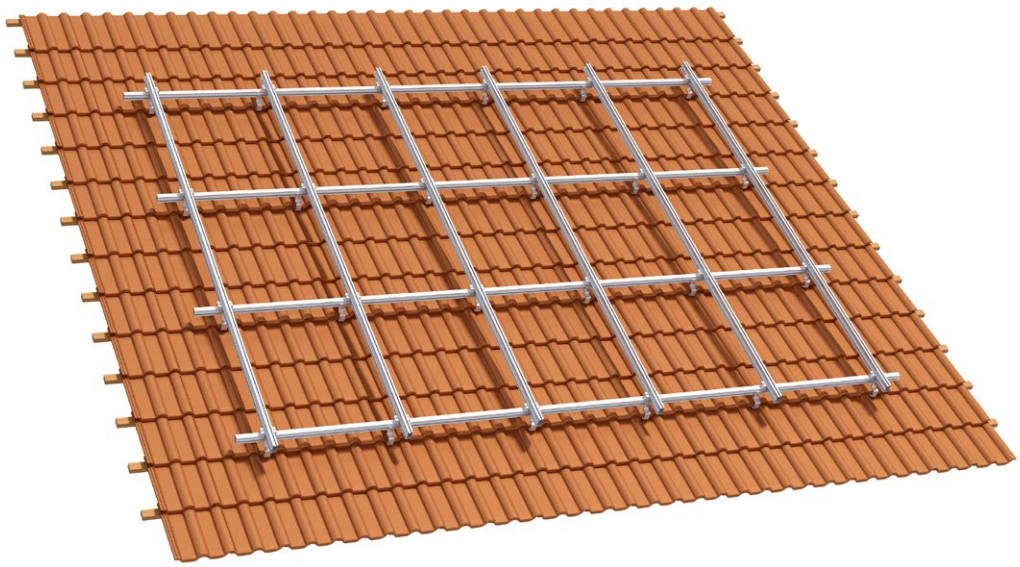
The vertical mounting rails are connected together in the same way as shown for horizontal mounting rails. The connectors should be positioned so that they are between two mounting rail intersections (do not create cantilevers with connectors). When extending the vertical mounting rails at the low eaves, make sure that the short mounting rail sections connected at the bottom overlap at least two rails on the bottom rail layer.

If the mounting rail is longer than 12 m, the module array must be separated by attaching two end clamps. In the area between the end clamps, the mounting rail must be separated and connected by means of a splice so that a length compensation of 2 cm is possible (expansion joint).
The arrangement of the expansion joints must be adapted to suit the roof conditions and the respective expansion properties of the materials.
For placement of the end clamps, please refer to the section "Mounting the PV modules" in this installation manual. Modules must not be installed over expansion joints.



Expansion joint in upper layer

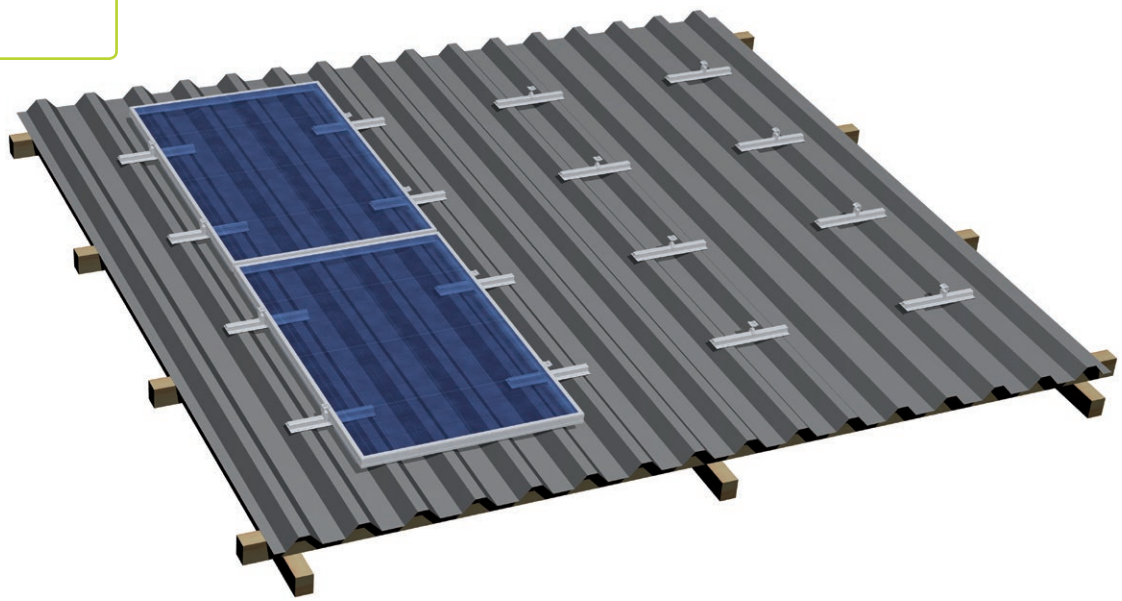
Completed installation of the upper mounting rail layer.

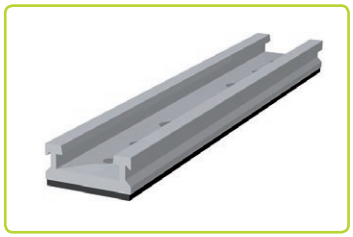


This concludes the installation process for the double-layered substructure.
A description of the subsequent module assembly can be found in **section 6**.

3 MOUNTING ON TRAPEZOIDAL SHEET METAL

For vertical and horizontal mounting on trapezoidal sheet-metal roofs





3.1 Installation

The installation recommendation describes the installation of the S:FLEX PV mounting system on trapezoidal and corrugated sheet-metal roofs. The installation recommendation are intended for people with relevant qualifications who have been instructed by the operator of the PV system.

Installation of the S:FLEX PV mounting system on trapezoidal and corrugated sheet-metal roofs requires extensive expertise on the part of the installer. It is therefore advisable have installations of this kind carried out by a specialist roofing company.

The S:FLEX PV mounting system for trapezoidal sheet-metal roofs is a frame system for mounting PV modules. both vertical and horizontal mounting of the modules is possible with the S:FLEX mounting system.

The S:FLEX PV mounting system for trapezoidal sheet-metal roofs is characterised by a very high degree of pre-assembly. In addition, the use of our patented and proven Click technology further reduces the required installation time.

All components are made from aluminium or stainless steel. Their high level of corrosion resistance guarantees the longest possible service life and means they can be completely recycled.

3.2 About this document

The S:FLEX PV mounting system for trapezoidal sheet-metal roofs allows the installation of roof-parallel PV systems.

This installation manual describes the installation process using trapezoidal sheet-metal rails. These can be used on:

- *trapezoidal and corrugated sheet metal*
- *if necessary, sandwich profiles (provided that manufacturer's approval for attachment to the covering shell has been obtained)*

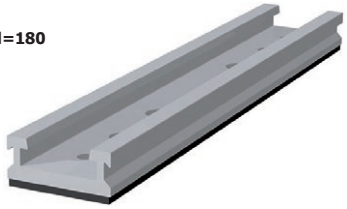
When installing PV systems on roofs with corrugated sheet-metal coverings, the permissibility of the installation must be ensured and, if necessary, additional waterproofing measures in the area of the connection to the roof cladding must be ensured.

3.3 System components

Components for roof connections

Trapezoidal sheet-metal rail AK complete l=395 / 24

ST-AK 1/12 complete l=180



Sheet-metal screw

Self-tapping sheet-metal screw 4.5x25

Sets

Article no. 0020271148

Rail, trapezoidal sheet metal, horizontal mounting, 2 pcs.

Component	Qty.
ST-AK 1/12 l=180 mm	2
Sheet-metal screw 4.5x25	6

Article no. 0020271149

Rail, trapezoidal sheet metal, horizontal mounting, 2 pcs.

Component	Qty.
ST-AK 1/12 l=180 mm	10
Sheet-metal screw 4.5x25	30

Article no. 0020271150

Rail, trapezoidal sheet metal, vertical mounting, 2 pcs.

Component	Qty.
Trapezoidal sheet-metal rail AK l=395 24	2
Sheet-metal screw 4.5x25	10

Article no. 0020271151

Rail, trapezoidal sheet metal, vertical mounting, 2 pcs.

Component	Qty.
Trapezoidal sheet-metal rail AK l=395 24	10
Sheet-metal screw 4.5x25	50

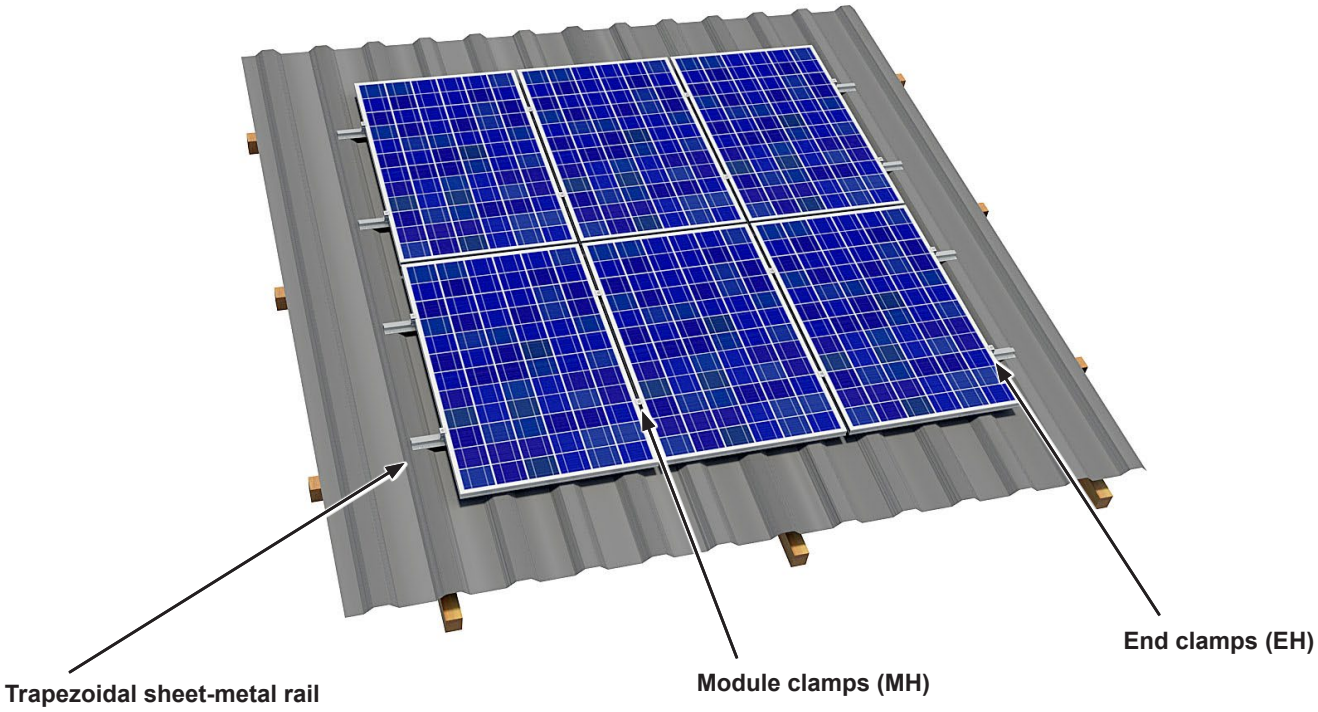
3.4 Direct roof connection using self-tapping sheet-metal screws

When installing the self-tapping sheet-metal screws, the regulations specified in the building authority approvals for the self-tapping sheet-metal screws must be observed (e.g. area of application, pilot hole diameter, minimum thickness of the materials to be joined, hole diameter for existing perforations).

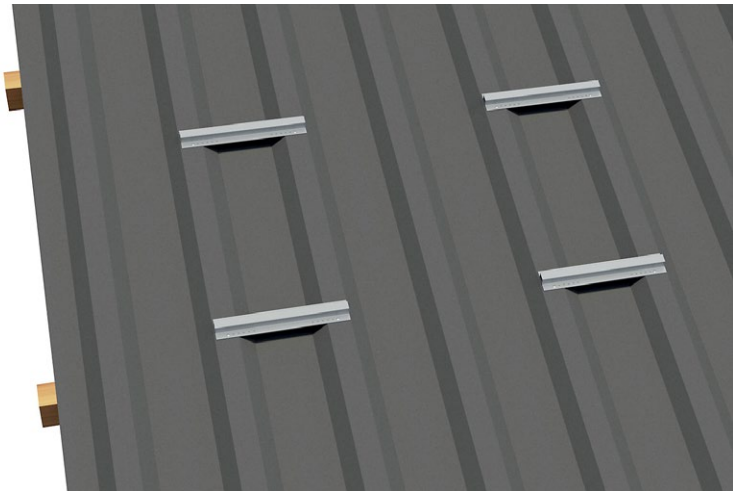
The appropriate self-tapping sheet-metal screws are included in the scope of delivery. The choice of fasteners depends on the respective roofing and the forces that will be applied. Self-tapping sheet-metal screws must be only be installed in the area of the raised bead/corrugation peak.

Self-tapping sheet-metal screw:
4.5 x 25 A2 / bimetallic
Installation: SW 8

3.5 Single-layer installation with framed PV modules in vertical mounting



The positioning of the trapezoidal sheet-metal rails (trapezoidal sheet-metal rail AK complete l=395 / 24) must be determined according to the prevailing structural requirements and the installation situation. The trapezoidal sheet-metal rails must be positioned so that the end clamps and module clamps can later be mounted between the fastening points on the trapezoidal sheet-metal plate. In so doing, it is important to check once again whether the dimensions used in the planning correspond to the actual dimensions on the roof (if necessary, adjustments must be made). For single-layer substructures, the trapezoidal sheet-metal rails must be aligned with the prescribed clamping distances of the modules.

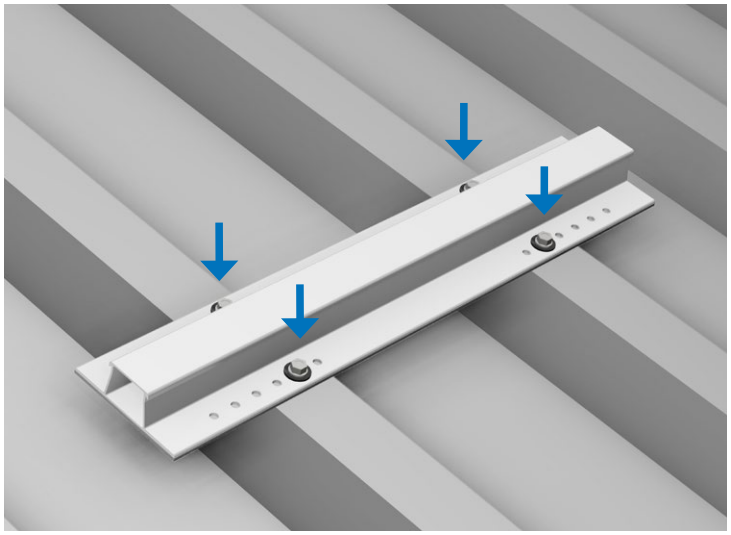


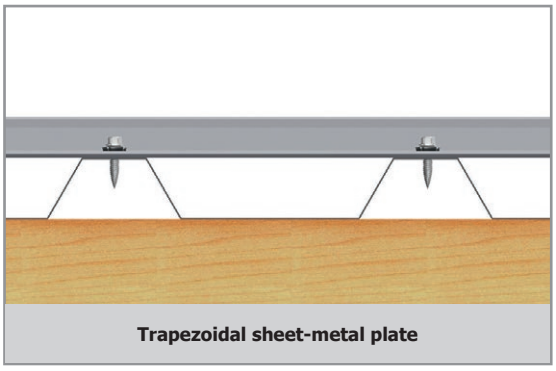
Check the installation plan.

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

Align trapezoidal sheet-metal rails using a guideline.

Mount the trapezoidal sheet-metal rail with the self-tapping sheet-metal screws. Use four self-tapping sheet-metal screws per trapezoidal sheet-metal rail (in each case, two self-tapping sheet-metal screws per raised bead or corrugation peak). To prevent water from penetrating between the trapezoidal sheet-metal rail and the roofing, the trapezoidal sheet-metal rail must always be mounted on the raised bead/corrugation peak.
The trapezoidal sheet-metal rail AK complete l=395 / 24 is pre-drilled for the standard raised bead/corrugation peak lengths from 173 mm to 333 mm with 5.0 mm and covered on the underside with EPDM sealing strips.

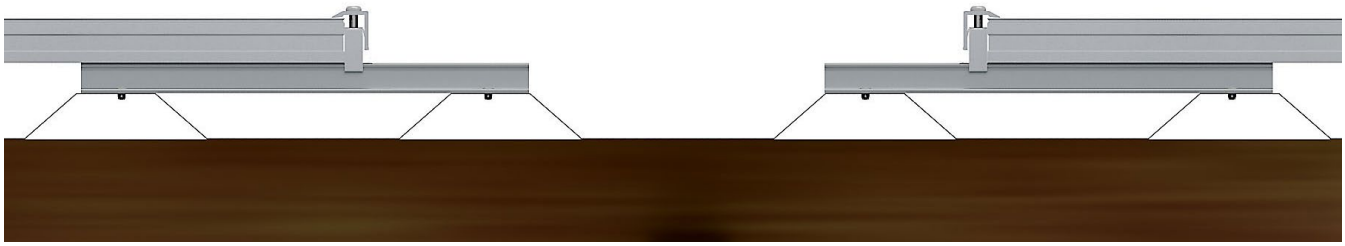




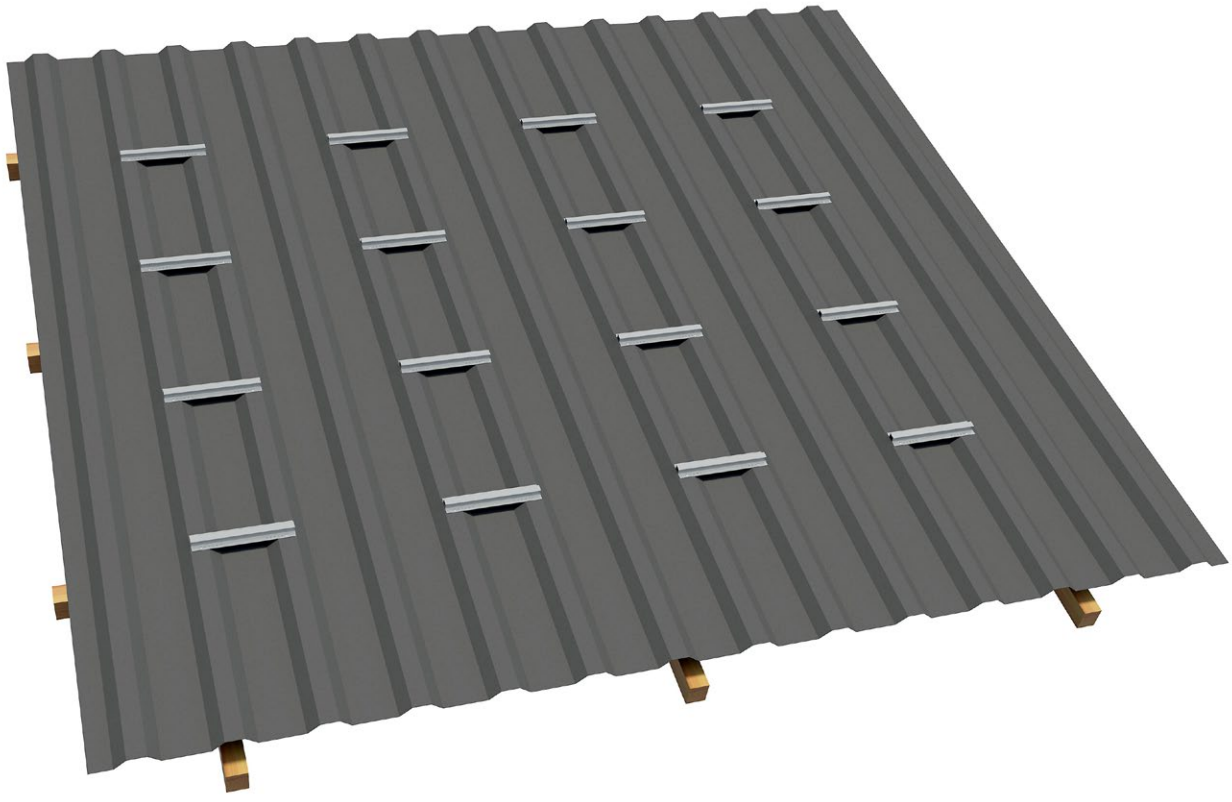
Two self-tapping sheet-metal screws per raised bead or corrugation peak (four screws per trapezoidal sheet-metal rail).

If the module array is longer than 7 m along the eaves, it must be separated from a single-layer substructure by installing an additional trapezoidal sheet metal rail (trapezoidal sheet-metal rail AK complete l=395 / 24) with end brackets.
The trapezoidal sheet-metal rail must be separated in the area between the end clamps (expansion joint).
The arrangement of the expansion joints must be adapted to suit the roof conditions and the respective expansion properties of the materials.

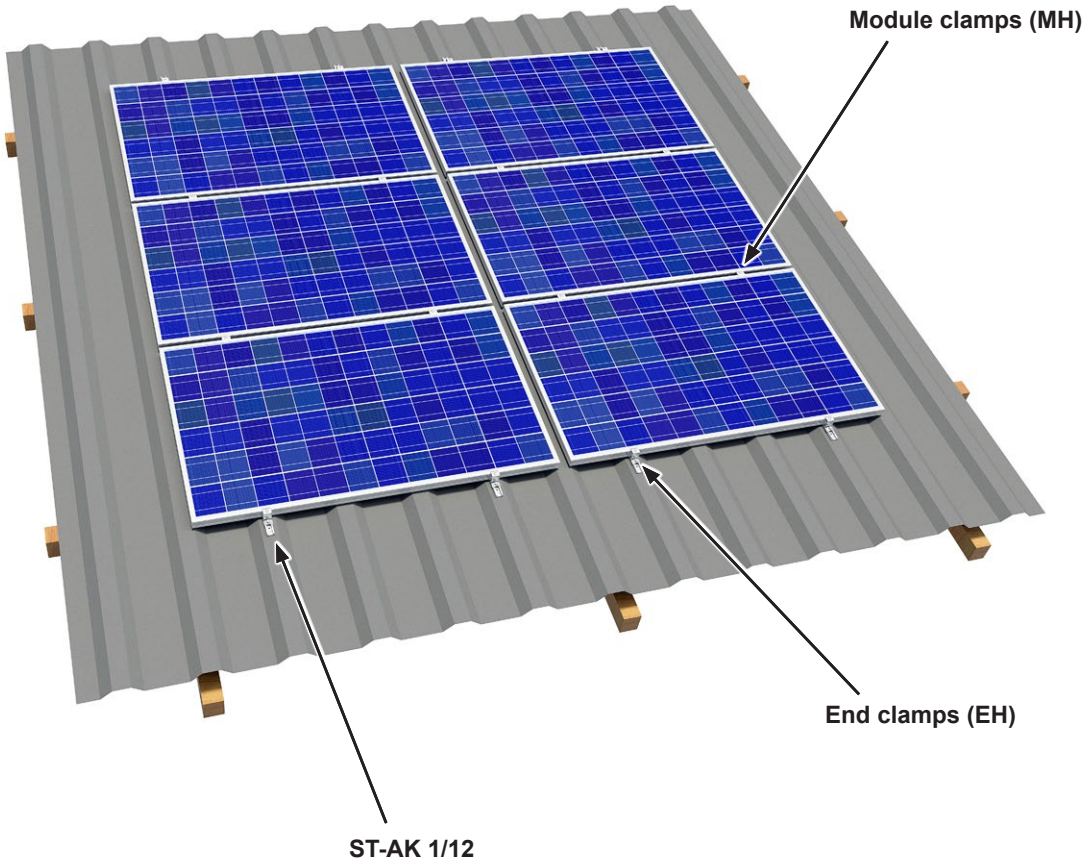
Modules must not be installed over expansion joints.
There is no short-circuit to earth.
This must be created without limiting the operation of the expansion joint.



Completed installation of the mounting-rail layer.



3.6 Single-layer installation with framed PV modules in horizontal mounting



The positioning of the ST-AK 1/12 l=180 (d= 5-8.5) complete must be determined according to the prevailing site requirements and the installation situation. In so doing, it is important to check once again whether the dimensions used in the planning correspond to the actual dimensions on the roof (if necessary, adjustments must be made). For single-layer substructures, the position of the ST-AK 1/12 must be checked with regard to the prescribed clamping distances of the modules.

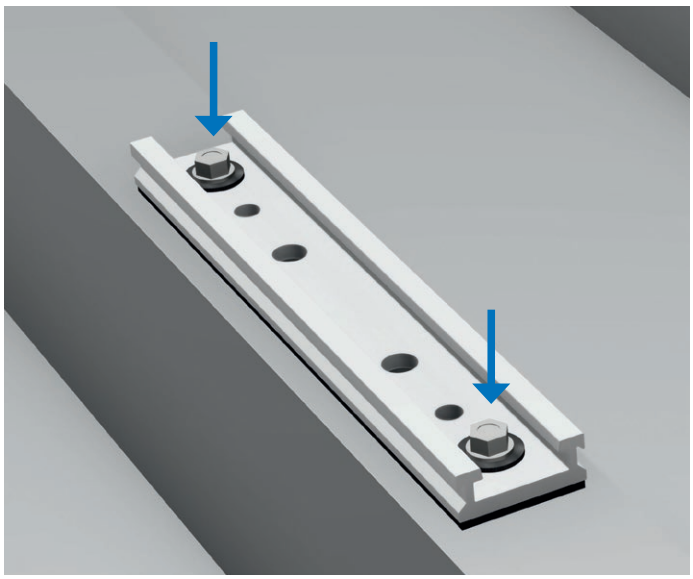
The ST-AK 1/12 must be positioned so that the end clamps and module clamps can later be mounted exactly in the centre between the attachment points (self-tapping sheet-metal screws). This ensures uniform loading of both attachment points.

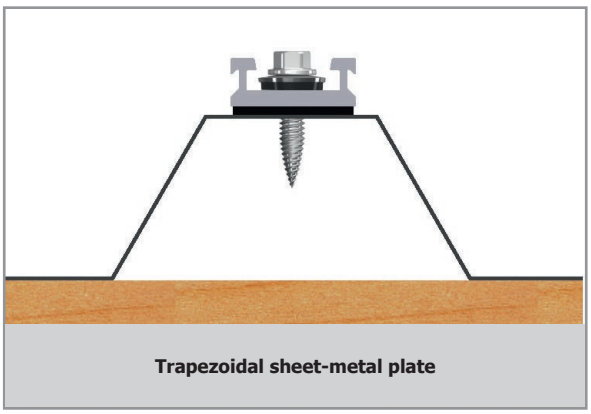
Check the installation plan.

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

Align the ST-AK 1/12 l=180 (d=5–8.5) complete using a guideline.

Mount the ST-AK 1/12 l=180 (d=5–8.5) completely using the self-tapping sheet-metal screws. Use two self-tapping sheet-metal screws per ST-AK 1/12. To prevent water from penetrating between the ST-AK 1/12 and the roof covering, the ST-AK 1/12 must always be mounted on the raised bead/corrugation peak. The underside of the ST-AK 1/12 is covered with EPDM sealing strips.

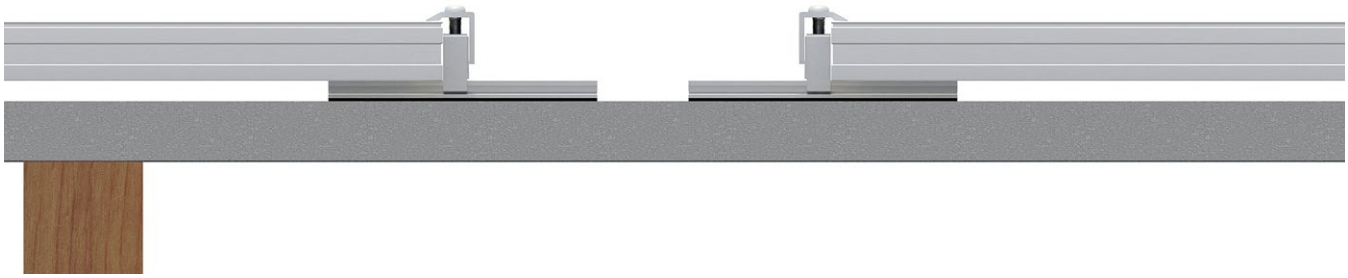




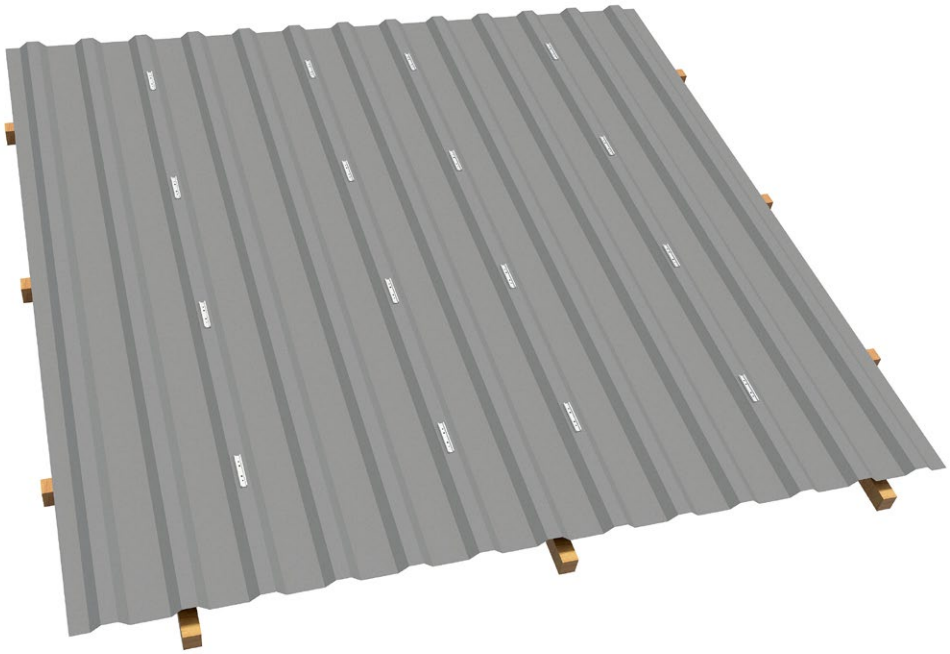
Two self-tapping sheet-metal screws per ST-AK 1/12 l=180 (d=5–8.5) complete.

If the module array is longer than 7 m perpendicular to the eaves, it must be separated from a single-layered substructure by installing an ST-AK 1/12 l=180 (d=5-8.5) complete with end brackets.
The arrangement of the expansion joints must be adapted to suit the roof conditions and the respective expansion properties of the materials.

Modules must not be installed over expansion joints.
There is no short-circuit to earth.
This must be created without limiting the operation of the expansion joint.



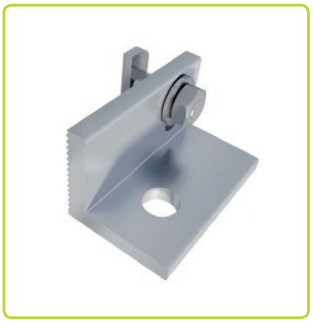
Completed installation of the mounting-rail layer.

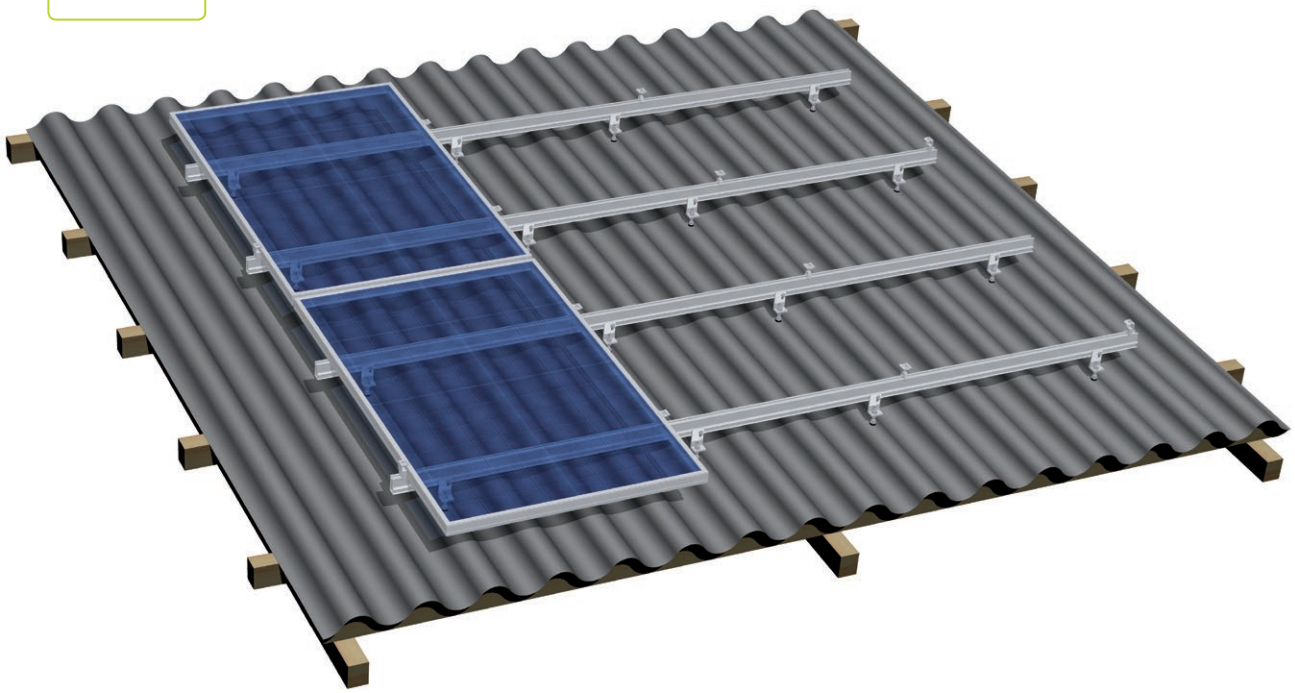


This concludes the installation process for the substructure.
A description of the subsequent module assembly can be found in **section 6**.

4 MOUNTING WITH HANGER BOLTS

For roof-parallel PV systems on industrial roofs
with trapezoidal and corrugated sheet metal, corrugated
fibre-cement and sandwich profiles





4.1 Installation

The S:FLEX PV mounting system for industrial roofs with trapezoidal and corrugated sheet metal, corrugated fibre-cement and sandwich profiles is a frame system for mounting PV modules. It consists of hanger bolts, brackets, mounting rails and all the necessary small parts for attaching the PV modules, interconnecting the components and fastening the system to the roof substructure.

With the S:FLEX PV mounting system, both vertical and horizontal mounting of the modules is possible. It is also possible to install single-layered and double-layered systems.

The S:FLEX PV mounting system for industrial roofs is characterised by a very high degree of pre-assembly.
In addition, the use of our patented and proven Click technology further reduces the required installation time.

All components are made from aluminium or stainless steel. Their high level of corrosion resistance guarantees the longest possible service life and means they can be completely recycled.

The installation recommendation describes the installation of the S:FLEX PV mounting system on roofs made of trapezoidal or corrugated sheet-metal as well as corrugated fibre-cement boards. The installation recommendation are intended for people with relevant qualifications who have been instructed by the operator of the PV system.

Installation of the S:FLEX PV mounting system on trapezoidal and corrugated sheet-metal roofs, as well as roofs consisting of corrugated fibre-cement boards and sandwich profiles, requires extensive expertise on the part of the installer. It is therefore advisable have installations of this kind carried out by a specialist roofing company.
In particular, before installing PV systems on roofs with corrugated sheet coverings, the permissibility of the installation must be ensured and, if necessary, any relevant additional health and safety regulations must be observed.

**When working on corrugated fibre-cement roofs, there is a risk of falling through the roof.
A fall may result in injury or death.
Appropriate fall-through protection (e.g. safety nets) must be provided.**

4.2 About this document

The S:FLEX PV mounting system for industrial roofs allows the installation of roof-parallel and elevated PV systems on industrial roofing.

With industrial roofs, a distinction can essentially be made in terms of the roofing materials between trapezoidal/ corrugated sheet-metal and sandwich profiles. The S:FLEX PV mounting system includes suitable components to ensure easy attachment to the existing roofing and roof substructure.
Here again, a distinction can be made between:

1. Direct roof connection (self-tapping sheet-metal screws). These can be used on:

   – *trapezoidal and corrugated sheet metal*
   – *if necessary, sandwich profiles (subject to the manufacturer's approval)*

For more information, refer to our system solution for **trapezoidal sheet-metal installation**.

2. Connection to the roof substructure via hanger bolts. These can be used on:

- *trapezoidal and corrugated sheet metal*
- *corrugated fibre-cement boards*
- *sandwich profiles*
- *flat roofs with bitumen or shingles*

The connection is made directly to the roof substructure, usually at the purlins. In special cases, the connection can be made to the rafters.

This installation recommendation describes the installation process using hanger bolts. This is possible for the above-mentioned roofing materials.

It must be ensured that only current and complete installation recommendations are used for the installation.

When installing PV systems on roofs with corrugated sheet-metal coverings, the permissibility of the installation must be ensured and, if necessary, additional waterproofing measures in the area of the connection to the roof cladding must be ensured.

4.3 System components

Components for roof fastenings

Hanger bolt M10 x 200 pur

Bracket 60 mm M10 complete

Sets

Article no. 0020271095

Hanger bolt M10 x 200, wood, 2 pcs.

Component	Qty.
Hanger bolt M10 x 200	2

Article no. 0020228539

Hanger bolt M10 x 200, wood, 10 pcs.

Component	Qty.
Hanger bolt M10 x 200	10

Article no. 0020271096

Universal adapter for aluminium rail, 2 pcs.

Component	Qty.
Bracket 60 mm, M10	2
Hexagon head screw M10x40	2
Washer M10	2
Self-locking nut M10	2

Article no. 0020228540

Universal adapter for aluminium rail, 10 pcs.

Component	Qty.
Bracket 60 mm, M10	10
Hexagon head screw M10x40	10
Washer M10	10
Self-locking nut M10	10

4.4 Mounting with hanger bolts

Connection to the roof substructure using hanger bolts

Hanger bolts can be used for direct connection to the roof substructure for the following roofing materials:

- *trapezoidal and corrugated sheet metal*
- *corrugated fibre-cement boards*
- *sandwich profiles*
- *flat roofs with bitumen or shingles*

Hanger bolts are used on roof substructures made of wood. Hanger bolts cannot be used on metal roof substructures. We recommend these fastenings for pitched roofs up to max. 20° roof pitch.

The positioning of the hanger bolts must be determined according to the prevailing structural requirements and installation situation. In so doing, it is important to check once again whether the dimensions used in the planning correspond to the actual dimensions 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 bead/corrugation peak, and the hanger bolts must be attached to the rafters or purlins, depending on the roof substructure. It must be ensured that the seals or calottes are pressed flush against the roof membrane. For flat roofs with artificial slate, bitumen shingles or sheet metal shingles, Multi-Solar sheet must be used to seal the roof covering. However, these fastenings are not included in the scope of delivery.

It is important to ensure that the hanger bolts are able to transfer the forces that arise safely into the roof structure, and to maintain the leak-tightness of the roof covering. The load capacity of the hanger bolts must be verified.

Regulations for the installation of M10 x 200 hanger bolts (based on Eurocode 5: design of timber structures)

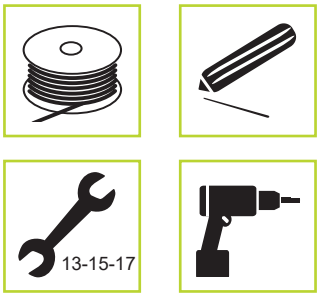
The wooden substructure must be pre-drilled for the installation of wood screws > d = 6 mm.
Pilot hole diameter: 0.7 x d
Screw depth: at least 7 x d (screw 70 mm thread to the shaft)
Purlin mounting, top and bottom edge clearance: at least 4 x d each (40 mm)
Purlin mounting, minimum timber width: 8 x d (80 mm)
Rafter mounting, lateral edge clearance: at least 3 x d (30 mm)
Hole spacing in grain direction: at least 7 x d (70 mm)
Rafter mounting, minimum timber width: 6 x d (60 mm)

Check the installation plan.

Align the hanger bolts using a guideline.

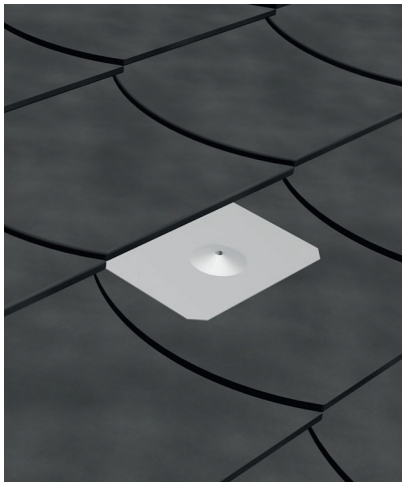
Position the hooks in accordance with the structural requirements and installation situation.

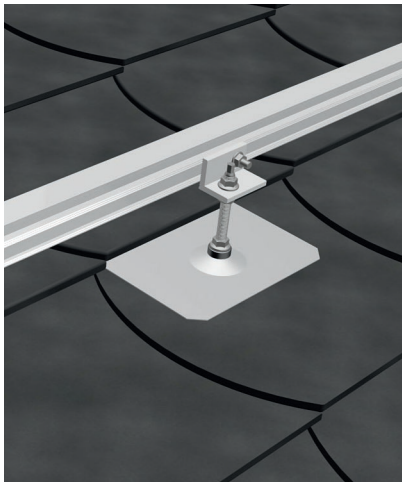
Observe edge clearances and screw-in depth.

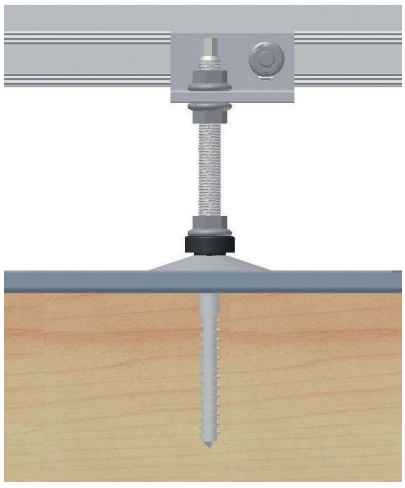


Installing hangar bolts with Multi-Solar sheets

The Multi-Solar sheet is inserted between the individual shingled layers above the rafter. Pre-drill the rafters through the hole in the raised area, then screw in the hanger bolt. The hanger bolt's gasket should rest firmly on the raised area, but must not be crushed.







Installing complete brackets

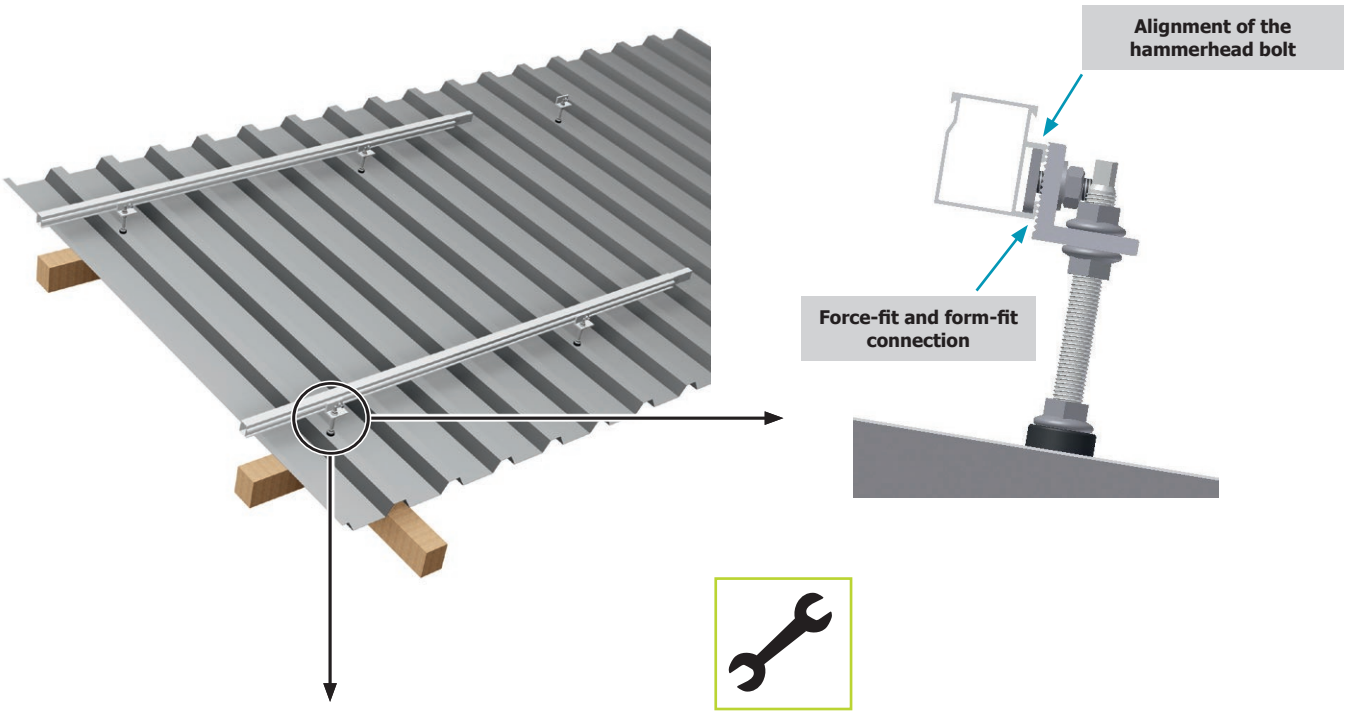
After the hanger bolts have been positioned, brackets are attached to the hanger bolts. For 10 x 200 hanger bolts, 60 mm M10 brackets complete are used. The load capacity of the hanger bolts is designed for the maximum clearance between the bracket and the roof surface. The maximum clearance between the installed bracket and the roof surface must not exceed 40 mm.

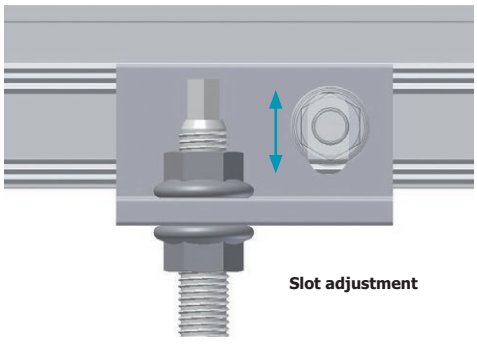
To fix the bracket to the hanger bolt, remove the top nut and tooth lock washer, place the bracket set on the hanger bolt and secure it with the nut and tooth lock washer (tightening torque M10: 20–25 Nm). The maximum clearance between the bracket and the roof covering must be observed.

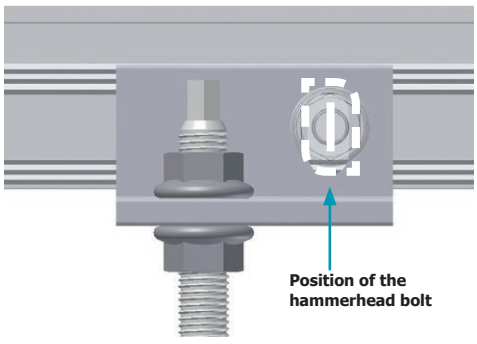
4.5 Installing the mounting rails

If the mounting rails are installed as a single layer or as a lower horizontal layer (parallel to the eaves), the mounting rails must be positioned with the hammerhead channel facing downwards. The bracket must always be attached to the eaves side.

The PV modules can be mounted directly on the horizontal rail layer in vertical orientation. This is dependent on the appropriate spacing of the mounting rails, which is determined by the purlin layer on purlin roofs, and is freely selectable on rafter roofs.
The horizontal mounting rails can also be selected as the lower rail layer for a double-layered installation (horizontal module orientation).







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

Use the corrugation and slot for adjustment.

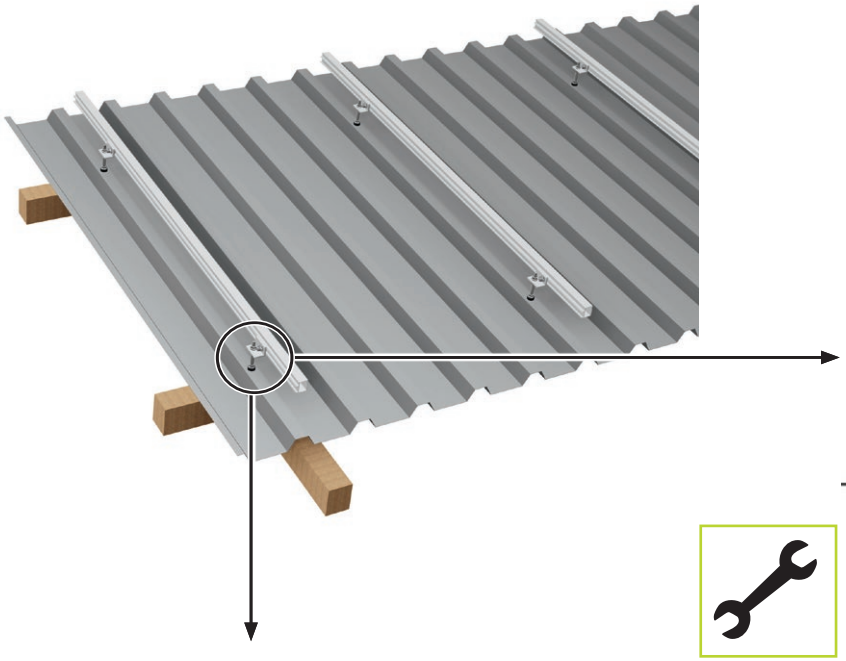
Create a force-fit and form-fit connection.

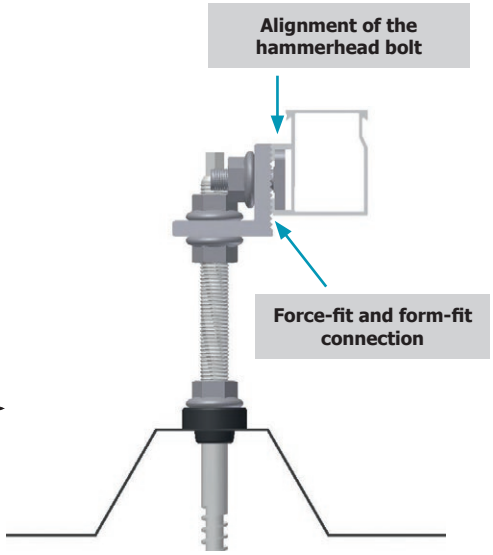
Ensure correct orientation of the rails.

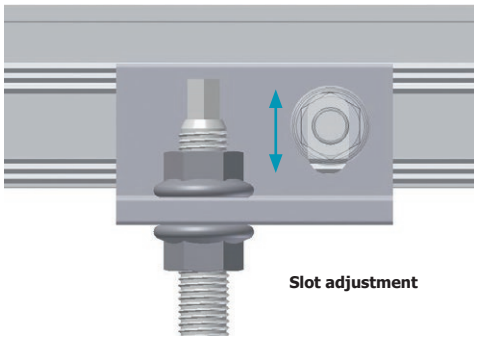
If the mounting rails are installed in one layer or vertically as a lower layer (parallel to the verge), it is necessary to ensure alternating alignment for the adjacent rails, i.e. the first bracket is connected on the left of the rail, the second on the right of the respective adjacent rail.

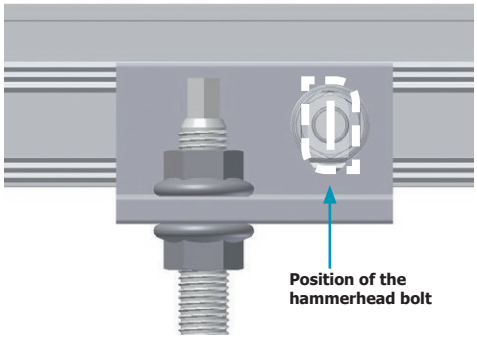
The PV modules can be mounted directly on the vertical rail layer in horizontal orientation. This is dependent on the appropriate spacing of the mounting rails, This is variably selectable on purlin roofs, and is defined by the location of the rafters on rafter roofs.

The vertical mounting rails can also be selected as the lower rail layer for a double-layered installation (vertical module orientation).









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

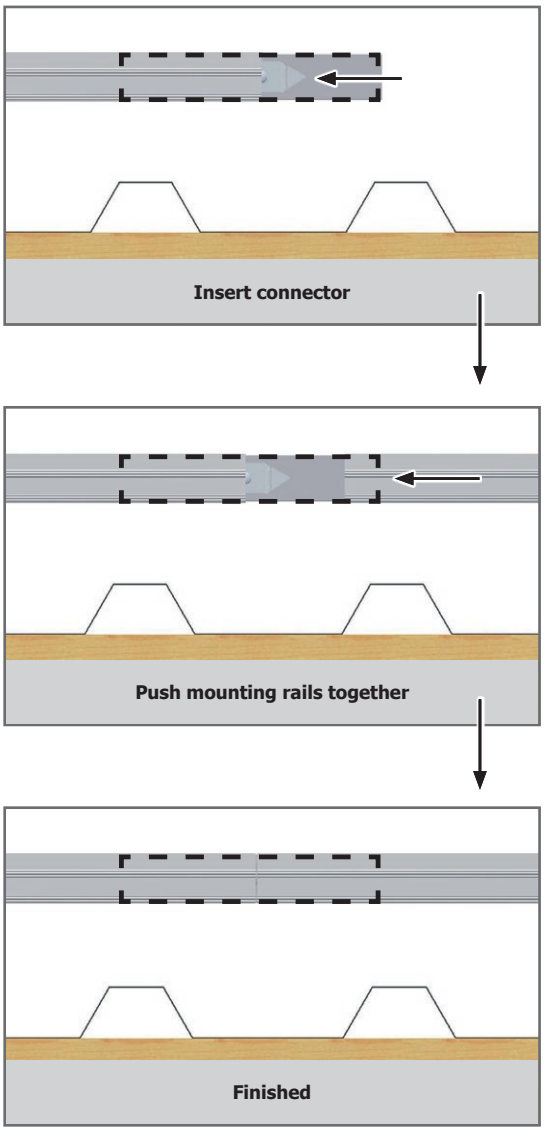
Use the corrugation and slot for adjustment.

Create a force-fit and form-fit connection.

Ensure correct orientation of the rails.

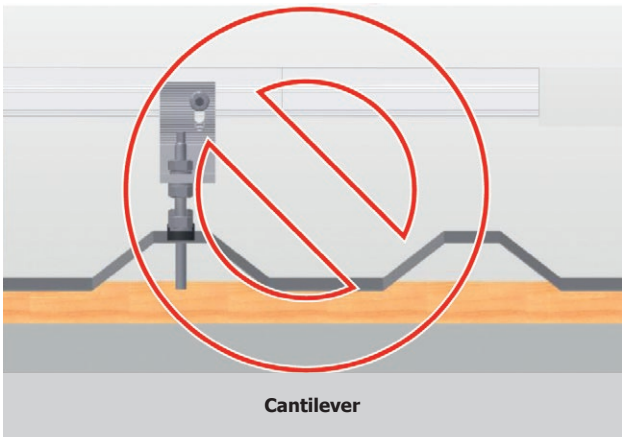
To align several mounting rails, push the connector, which has the same static values as the mounting rails, halfway into the already installed rail. Then slide the other mounting rail onto the connector.
The connection is completed.
Attach the newly installed mounting rail as described.

Horizontal and vertical mounting rails on the bottom and top rail layer can be interconnected via a connector.

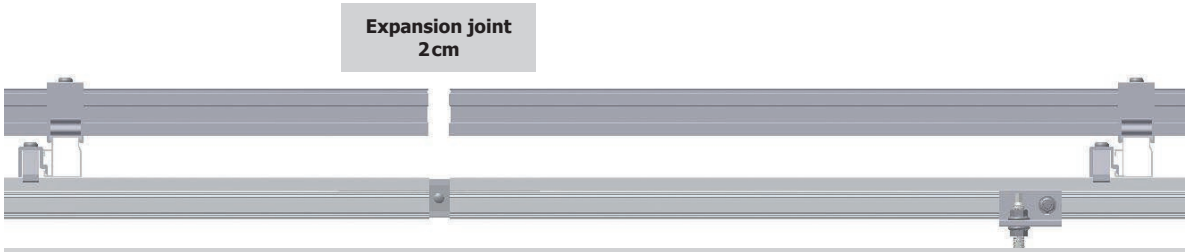


Insert connector.

Do not create cantilevers with connectors. Position connectors so that they are between two brackets, two adapter rails or two mounting rail intersections.



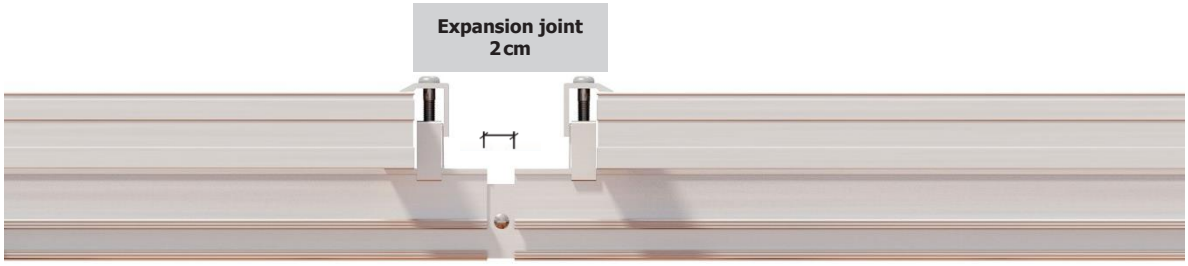
For double-layered substructures, expansion joints are arranged in both layers. If the lower mounting rail is longer than 12.00 m, it must be separated and connected by means of a connector so that a length compensation of 2 cm is possible (expansion joint).
The arrangement of the expansion joints must be adapted to suit the roof conditions and the respective expansion properties of the materials.
Modules must not be installed over expansion joints.



Expansion joint in lower layer

Expansion joint for the upper layer (for double-layer and single-layer substructures):

If the mounting rail is longer than 12 m, the module array must be separated by attaching two end clamps. In the area between the end clamps, the mounting rail must be separated and connected by means of a splice so that a length compensation of 2cm is possible (expansion joint).
The arrangement of the expansion joints must be adapted to suit the roof conditions and the respective expansion properties of the materials.
Modules must not be installed over expansion joints.



Expansion joint in upper layer

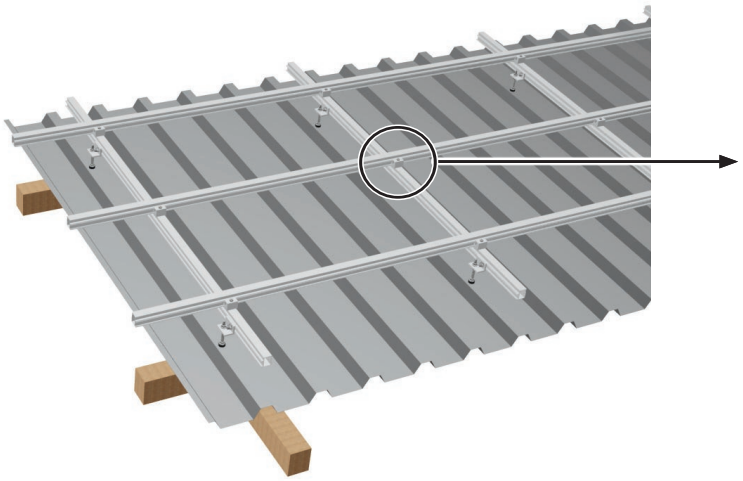
Cross adapters

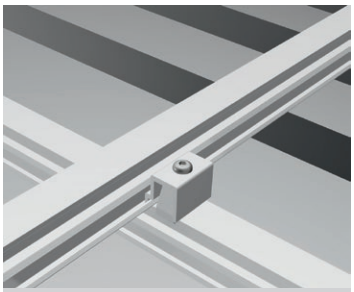
Connecting points between the lower and upper rail layers can be created quickly and safely using cross adapters.

Install the upper mounting rail using cross adapters on the lower mounting rails. Click the cross adapter onto the lower mounting rail and use it to secure the upper mounting rail. If the upper rail layer runs horizontally, the cross adapter must always be fastened to the eaves side (below the upper mounting rail).

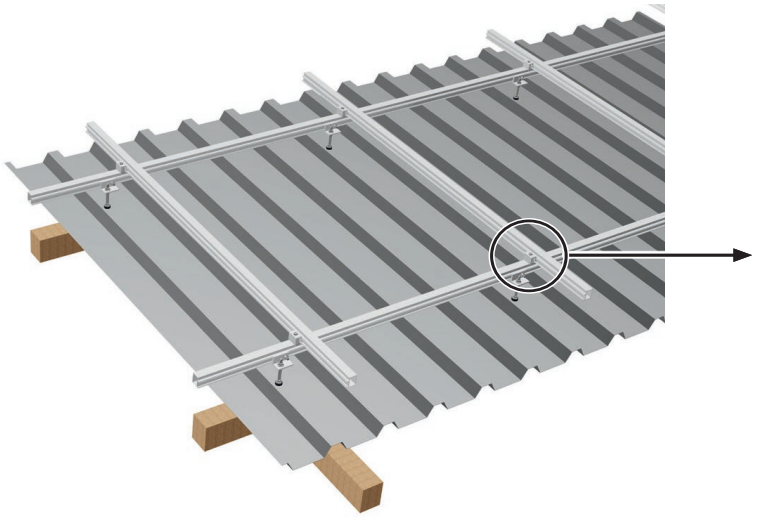
Check that the spacing between the upper mounting rails corresponds to the specified clamping distances for the modules. Ensure that the cross adapter is clicked in properly and tighten the screws (tightening torque 8–10 Nm).

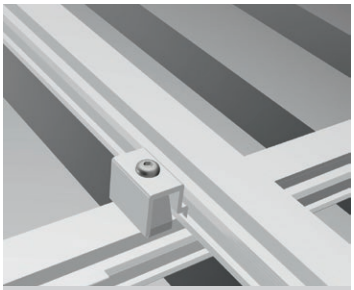
Horizontal upper rail layer:





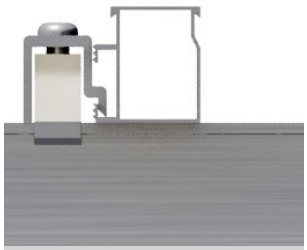
Cross adapter on one side



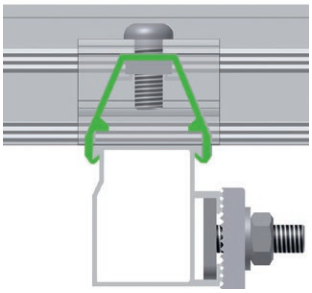


Cross adapter on one side

The mounting rails are attached with one cross adapter at each intersection.



Cross adapter in the lateral hammerhead bolt channel



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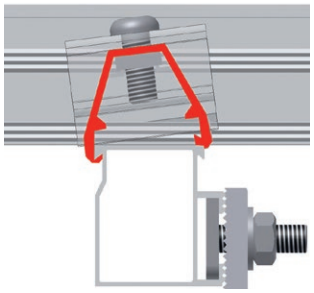

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This concludes the installation process for the substructure.
A description of the subsequent module assembly can be found in **section 6**.

5 MOUNTING THE S:FLEX DELTA TRIANGLE

For flat and slightly inclined roofs

5.1 Installation

The S:FLEX PV mounting system for flat roofs with the Delta Triangle is a frame system for mounting PV modules. The Delta Triangles allow elevated mounting of the PV modules with the desired angle of inclination. Installation is possible on flat roofs and slightly inclined roofs (less than 5° roof pitch).

The following installation options are available: direct connection to the roof substructure with hanger bolts, or to the roof covering on trapezoidal sheet-metal roofs, as well as ballasted installation. Another option is direct connection to the roof on concrete roofs.

both vertical and horizontal mounting of the modules is possible with the S:FLEX mounting system.

The S:FLEX PV mounting system for flat roofs is characterised by a very high degree of pre-assembly. In addition, the use of our patented and proven Click technology further reduces the required installation time.

All components are made from aluminium or stainless steel. Their high level of corrosion resistance guarantees the longest possible service life and means they can be completely recycled.

The installation recommendation are intended for people with relevant qualifications who have been instructed by the operator of the PV system.

Installation of the S:FLEX PV mounting system on flat roofs with various roofing materials requires extensive expertise on the part of the installer. It is therefore advisable have installations of this kind carried out by a specialist roofing company.

5.2 About this document

The S:FLEX flat-roof PV mounting system with the Delta Triangle enables the installation of elevated PV systems on flat and slightly sloping roofs.

This installation recommendation describes the installation process using Delta Triangles. These can be used on:

- *trapezoidal and corrugated sheet metal*
- *corrugated fibre-cement*
- *foil and bituminous roofs*
- *concrete roofs*
- *roofs with gravel coverings*

When installing PV modules on flat roofs, the permissibility of the installation must be checked with regard to the load reserve and the compressive strength of the insulation. This is especially important for ballasted installations. A building permit may be required for elevations.

5.3 System components

Triangles

S:FLEX Delta Triangle AK 1230 15°

S:FLEX Delta Triangle AK 1230 35°

Optional:

Delta reinforcement AS 1180mm

Hammerhead bolt M8x25

Self-locking nut M8

Connectors

Hanger bolt M10 x 200 pure

Bracket 60 mm M10 complete

Anchor bolt SP-BOZ A4 10,0X10/90

Sets

Article no. 0010045489

Elevated frame 15°/ 2, 2 pcs.

Component	Qty.
Delta Triangle AK 1230 15°	2

Article no. 0010045491

Elevated frame 35°/ 2, 2 pcs.

Component	Qty.
Delta Triangle AK 1230 35°	2

Article no. 0020271153

Anchor bolt for concrete, 4 pcs.

Component	Qty.
Anchor bolt M10x90 A4	4
Self-locking nut M10 A2	4

Article no. 0020271095

Hanger bolt M10 x 200, wood, 2 pcs.

Component	Qty.
Hanger bolt M10x200	2

Article no. 0020228539

Hanger bolt M10 x 200, wood, 10 pcs.

Component	Qty.
Hanger bolt M10x200	10

Article no. 0020271096

Universal adapter for aluminium rail, 2 pcs.

Component	Qty.
Bracket 60 mm, M10	2
Hexagon head screw M10x40	2
Washer M10	2
Self-locking nut M10	2

Article no. 0010030584

Brace set for elevated frame

Component	Qty.
Delta AS 1180 mm 1x9	1
Self-locking nut M8 A2	2
Hammerhead bolt M8x25 A2	2

Article no. 0020228540

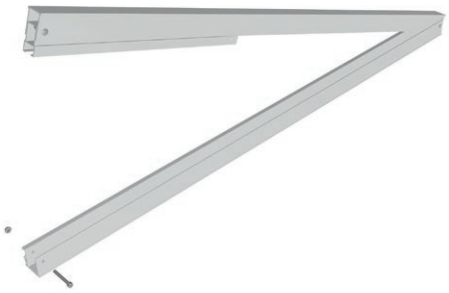
Universal adapter for aluminium rail, 10 pcs.

Component	Qty.
Bracket 60 mm, M10	10
Hexagon head screw M10x40	10
Washer M10	10
Self-locking nut M10	10

5.4 Structure of the Delta Triangle

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

Open the Delta Triangle, loosen the DIN 912 5x40 bolt and nut and remove it from the bottom rail.



Fold out the back support and insert the lower end into the bottom rail so that the holes overlap.

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

5.5 General installation instructions for the Delta Triangle

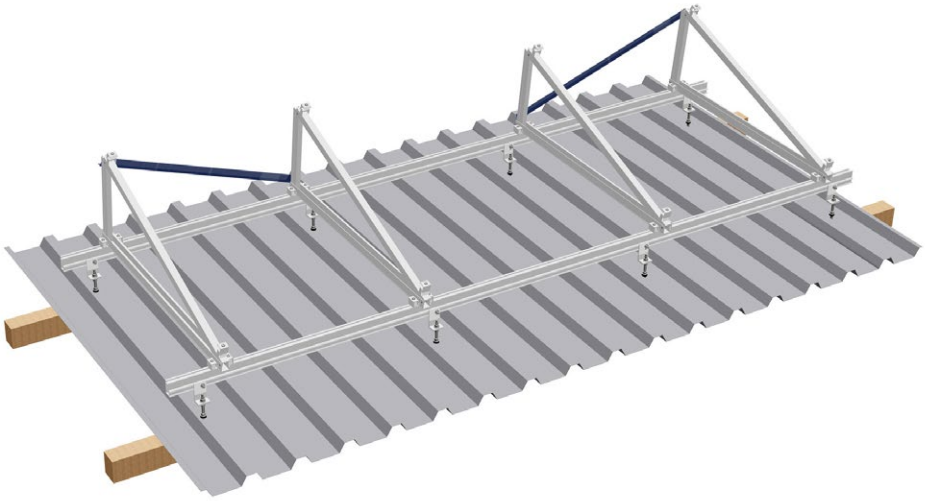
In the next sections, the common installation variants for elevated mounting with the Delta Triangle are shown. There are also other options. These can be planned on a project-specific basis and the installation process can be described for each individual case. The S:FLEX Delta Triangle mounting system offers the option of mounting the PV modules both horizontally and vertically. The selected module orientation depends on the available roof area, shade distance and the structural conditions, taking into account the expected wind and snow loads.

Horizontal module installation

For horizontal installation, each module is directly mounted on two Triangles. The spacing of the Triangles is specified in the installation instructions for the PV modules (observe prescribed clamping areas!).

Optional: additional reinforcements

Depending on the wind and snow loads, it may be necessary to mount additional reinforcements (diagonal braces) on the rear of the Triangles. Observe the information in the project report.
The diagonals are installed in opposite directions. They are connected to the back supports on the Triangles using hammerhead bolts and self-locking nuts.

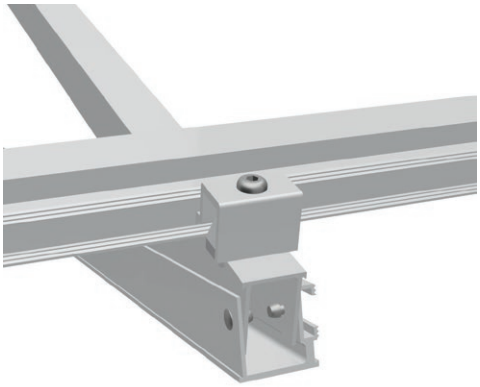


Vertical module installation

For vertical installation, two rows of mounting rails are mounted horizontally on the Delta Triangles.
The mounting rails must be connected to each Triangle via one cross adapter per attachment point. The cross adapter must always be mounted below the mounting rail.

When installing the mounting rails, an expansion joint must be created at a maximum length of 12 m.
Modules must not be installed over expansion joints.

The mounting rails must be arranged within 50 mm of each end of the Delta top profile.



Pay attention to expansion joints when installing the base rails and mounting rails.

5.6 Mounting with hanger bolts

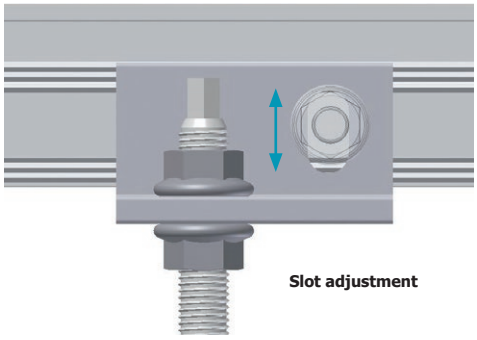
Hanger bolts allow direct mounting on the purlins or rafters. This creates a stable connection between the building substructure and the PV mounting system. This type of mounting is particularly advantageous in regions with high wind loads. Hanger-bolt mounting is possible for trapezoidal and corrugated sheet-metal roofs, sandwich roofs and corrugated fibre-cement roofs.

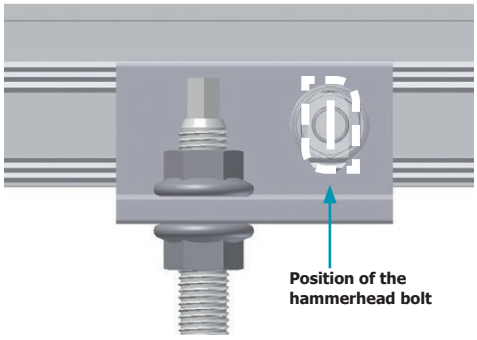
When mounting the hanger bolts, brackets and mounting rails, please follow the instructions (mounting with hanger bolts) in section 4.5 of this installation manual.

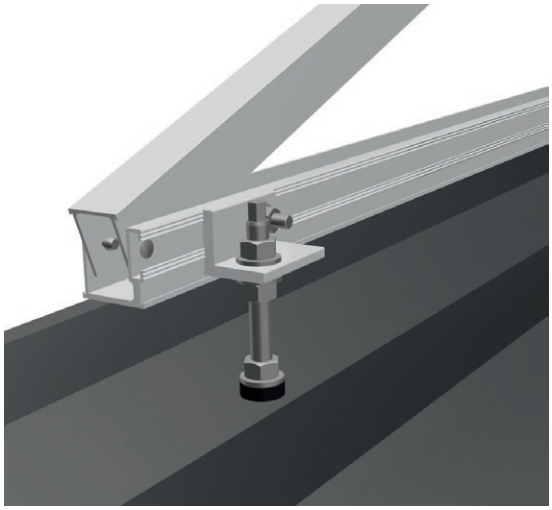
The distances between the Delta Triangles and the number of required attachment points are based on the information in the project report. If the attachment points are in the area of the roof substructure (purlins or rafters), the Triangles can be mounted directly on the hanger bolts.

The Delta Triangles are attached to the hanger bolts via brackets. The height adjustment can be performed via 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, additional attachment points per Triangle may be necessary.

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







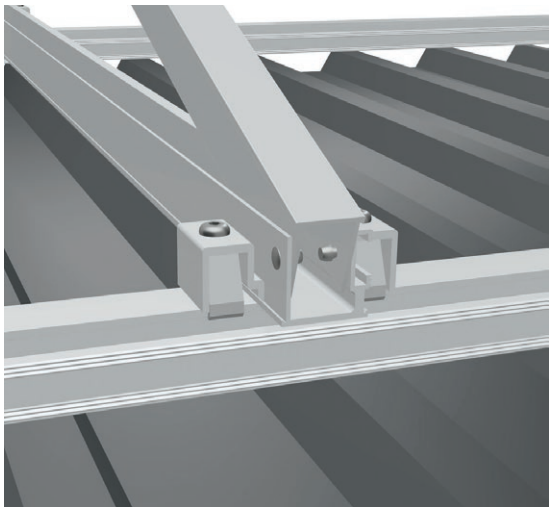
Check the alignment of the hammerhead bolts. The hammerhead bolt is only correctly mounted if the notch is visible vertically.

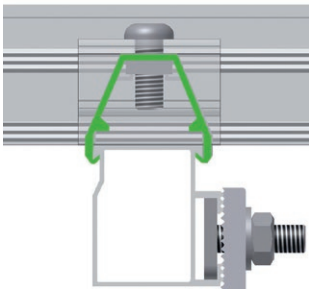
Alternatively, the Delta Triangles can be mounted on a base rail. This means that the positioning of the connection points may vary in accordance with the project report. The mounting rail is used as the base rail. The height adjustment is performed via the brackets on the hanger bolts.

The Triangles are fixed to each attachment point with two crossbar connectors.

Each Triangle must be attached to at least two base rails. Depending on the information in the project report, additional base rails may be necessary.
The base rails must each be mounted within a distance of 0 – 200 mm from the end of the Delta Triangle's bottom rail.

When mounting the base rail, an expansion joint must be created at a maximum length of 12 m. The expansion joint must not be overlaid with modules or mounting rails and must be created in the same way as for pitched roof installation.





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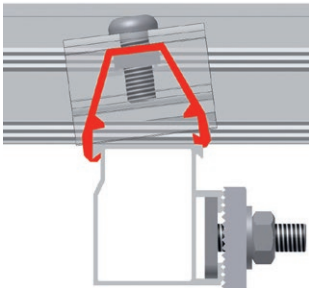

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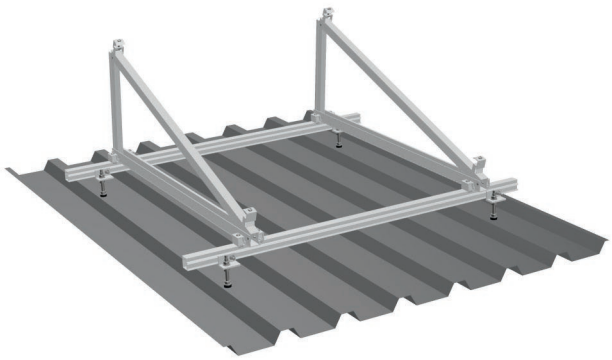
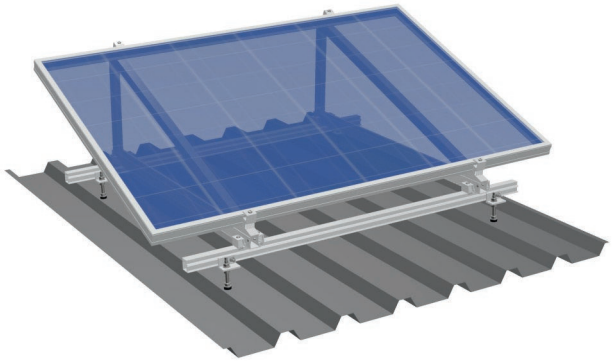
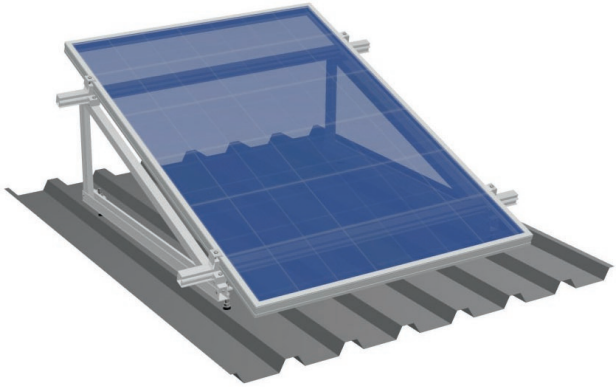
Example 1 – Illustration of installation with hanger bolts:
Modules mounted horizontally, Delta Triangles mounted with base rail.





Example 2 – Illustration of installation with hanger bolts:
Modules mounted vertically, Delta Triangles attached directly to hanger bolts.



5.7 Mounting on trapezoidal sheet metal

The installation of Delta Triangles on trapezoidal sheet-metal rails allows direct attachment to the roofing material. Installation with trapezoidal sheet-metal rails is possible for trapezoidal and corrugated sheet-metal roofs.

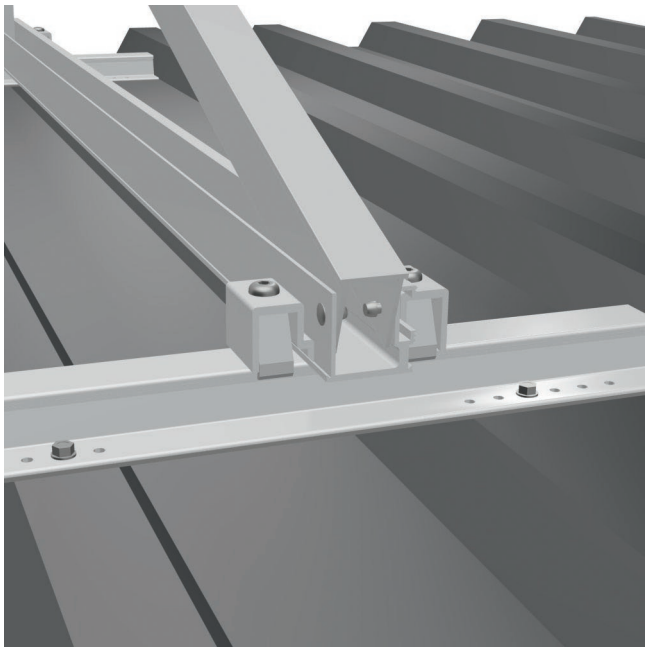
When mounting the trapezoidal sheet-metal rails, please follow the instructions (mounting on trapezoidal sheet metal) in section 3.5 of this installation manual.

Before mounting on a trapezoidal sheet-metal roof, check whether the trapezoidal sheet metal is sufficiently connected to the roof substructure in order to be able to absorb the expected loads.

The Delta Triangles are attached to each trapezoidal sheet-metal rail with two crossbar connectors. The attachment points must be located at the screw connections between the trapezoidal sheet-metal rail and the trapezoidal plate.

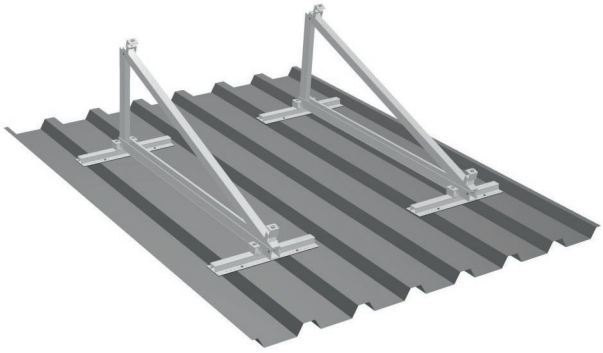
Each Triangle must be attached to at least two trapezoidal sheet-metal rails. Depending on the information in the project report, additional trapezoidal sheet-metal rails may be required per Triangle.

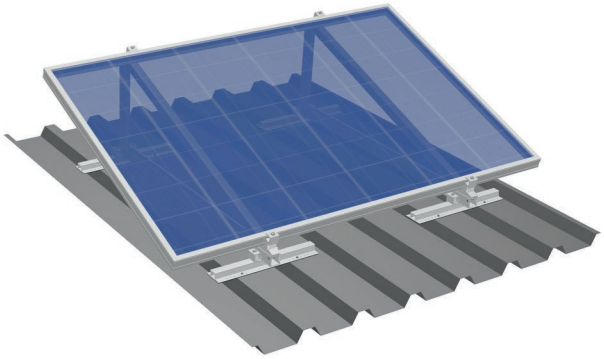
The trapezoidal sheet-metal rails must each be mounted within a distance of 0 – 200 mm from the end of the Triangle's bottom rail.



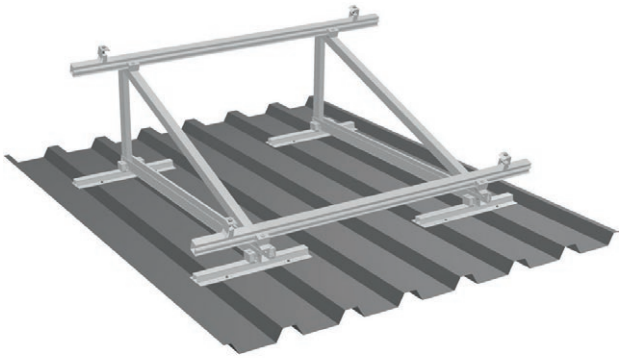
Pay attention to expansion joints when installing the mounting rails.

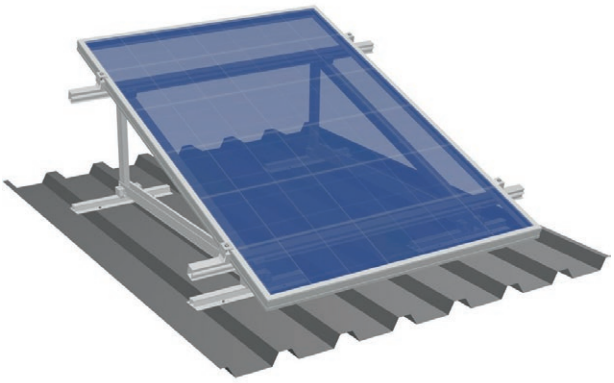
Example 1 – Illustration of mounting on trapezoidal sheet metal:
Modules mounted horizontally, Delta Triangles attached to trapezoidal sheet-metal rails.





Example 2 – Illustration of mounting on trapezoidal sheet metal:
Modules mounted vertically, Delta Triangles attached to trapezoidal sheet-metal rails.





5.8 Mounting with ballast

If roof penetration is not possible or desired, there is the option of ballasting the PV system. For this purpose, the Delta Triangles are attached to ballast blocks.

Ballasted installation is possible on foil and bituminous roofs, concrete roofs and roofs with a gravel covering. On concrete roofs, the Triangles can also be mounted directly on the concrete layer. This requires sufficient concrete strength and is subject to on-site approval. The Triangles are mounted in the same way as when mounting them on ballast blocks.

For this type of installation, the roof is ballasted with additional weight. Before installation, the permissibility of the installation must be checked with regard to the load reserve and the compressive strength of the insulation. It is important to ensure that the ballast blocks do not damage the roofing. For this purpose, a suitable protective fleece or building protection mats can be placed underneath them. Especially with foil roofs, the compatibility of the protective fleece and the roof covering must be checked. Ballast blocks and protective fleeces are not included in the S:FLEX scope of supply.

Before bringing up the ballast, check the load-bearing capacity of the roof and the compressive strength of the insulation. Check the compatibility of the protective fleece and roofing.

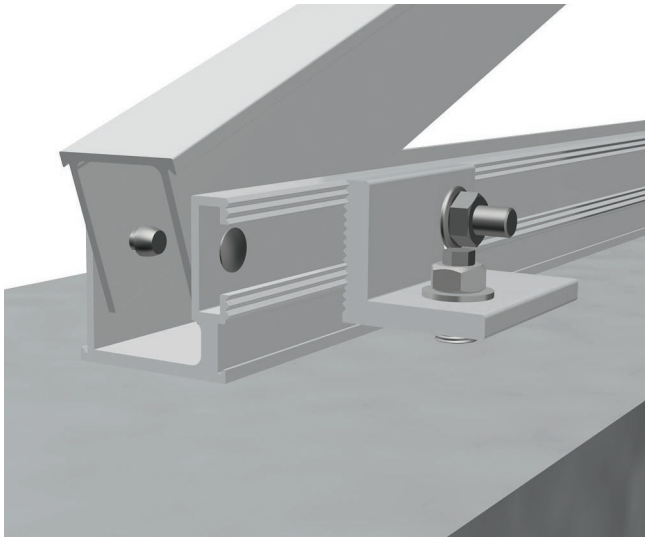
The distances between the Triangles and the number of required attachment points are based on the information in the project report. Note the ballast specifications per Triangle.

The Delta Triangles can be mounted directly on the ballast blocks. To do so, fasten the brackets to the side of the bottom rail. These brackets are fixed to the ballast blocks with anchor bolts.

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

Each Delta Triangle must be attached to at least two brackets with anchor bolts. Depending on the information in the project report, additional attachment points per Triangle may be necessary.

The outer brackets must each be mounted within a distance of 0 – 200 mm from the end of the Delta Triangle's bottom rail.

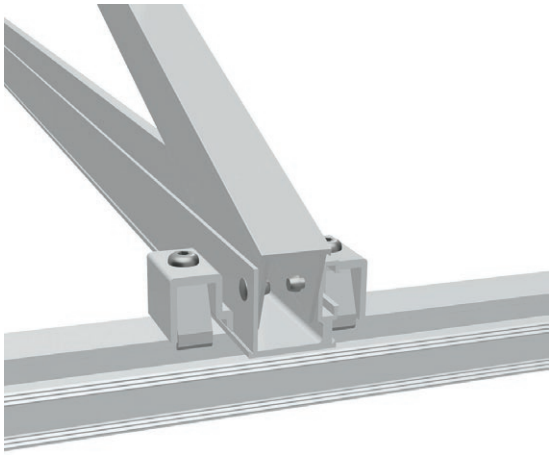


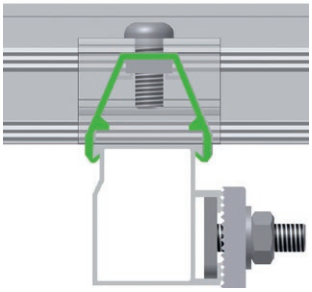
Alternatively, the Delta Triangles can be mounted on a base rail. The ballast blocks are connected to a base rail (mounting rail). For this purpose, brackets are attached to the side of the base rail. These brackets are fixed to the ballast blocks with anchor bolts.

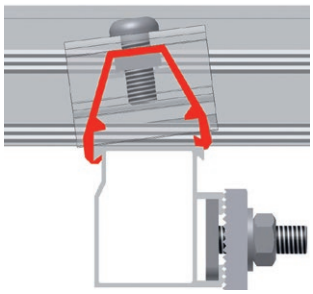
The Triangles are fixed to each attachment point on the base rails with two cross adapters.

Each Triangle must be attached to at least two base rails. Depending on the information in the project report, additional base rails may be necessary.
The base rails must each be mounted within a distance of 0 – 200 mm from the end of the Delta Triangle's bottom rail.

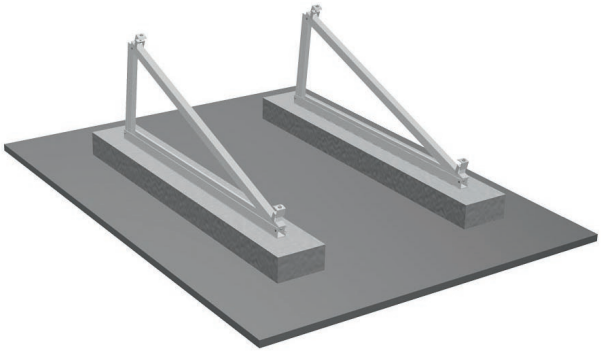
When mounting the base rail, an expansion joint must be created at a maximum length of 12 m. Modules or mounting rails must not be installed over expansion joints.

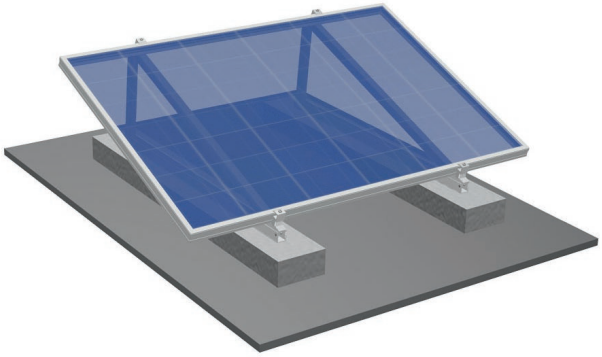




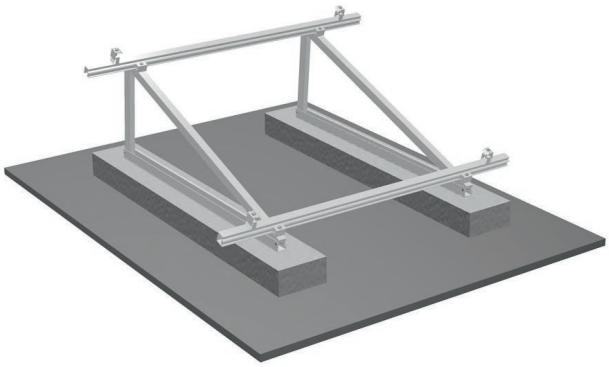


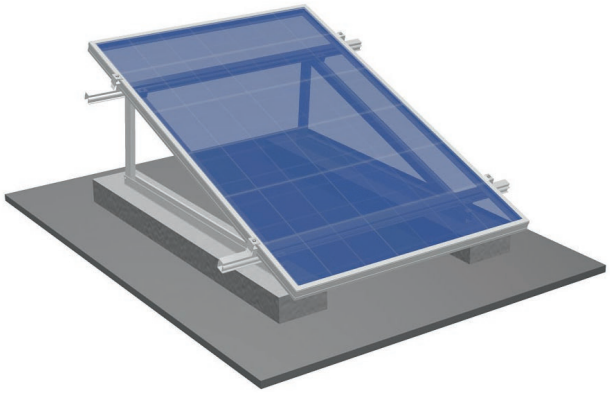
Example 1 – Illustration of ballasted installation:
Modules mounted horizontally, Delta Triangles mounted directly on ballast blocks.





Example 2 – Illustration of ballasted installation:
Modules mounted vertically, Delta Triangles attached directly on ballast blocks.

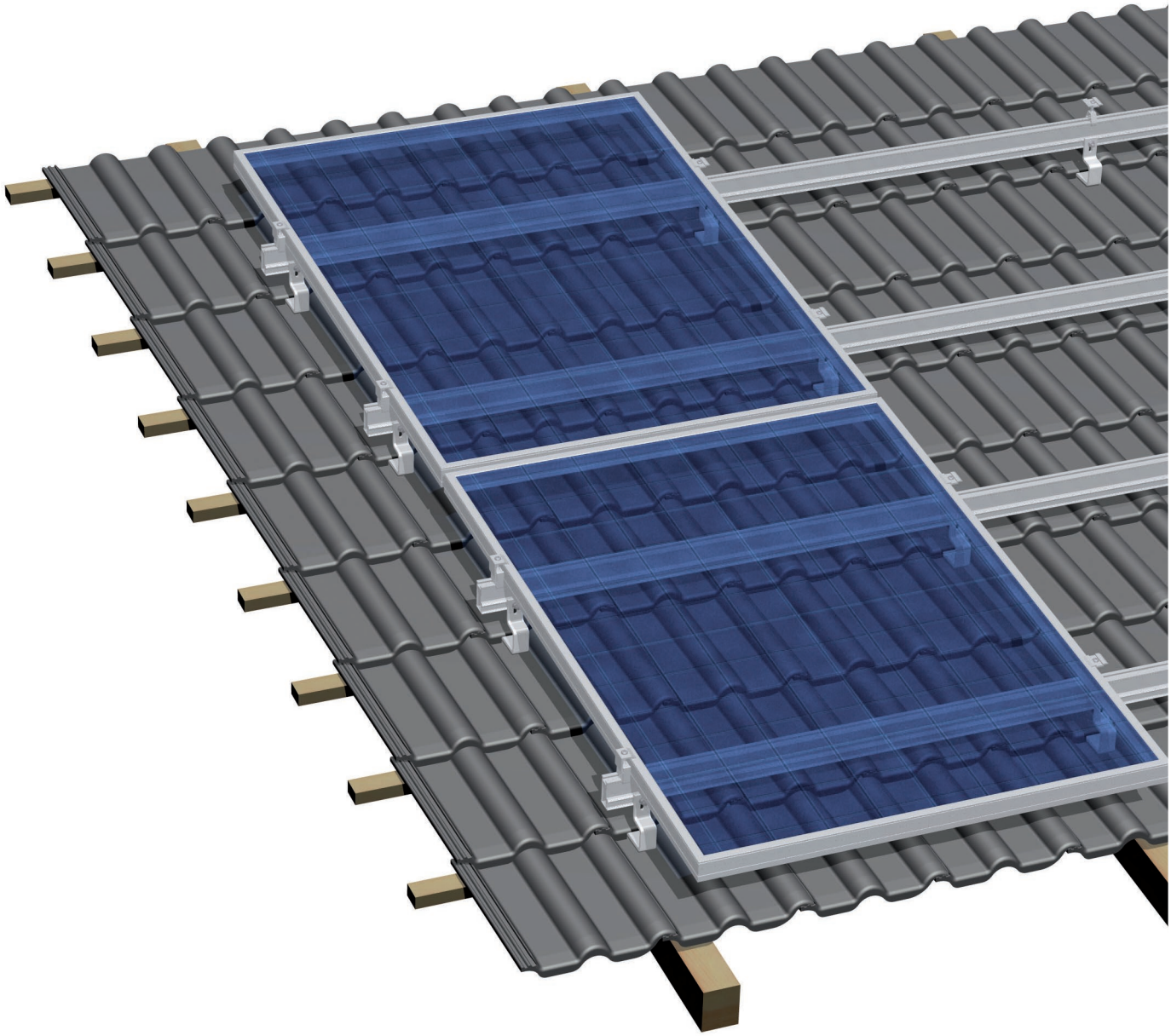




This concludes the installation process for the substructure.
A description of the subsequent module assembly can be found in **section 6**.

6 MODULE INSTALLATION

Vertical and horizontal installation



6.1 General information for module installation

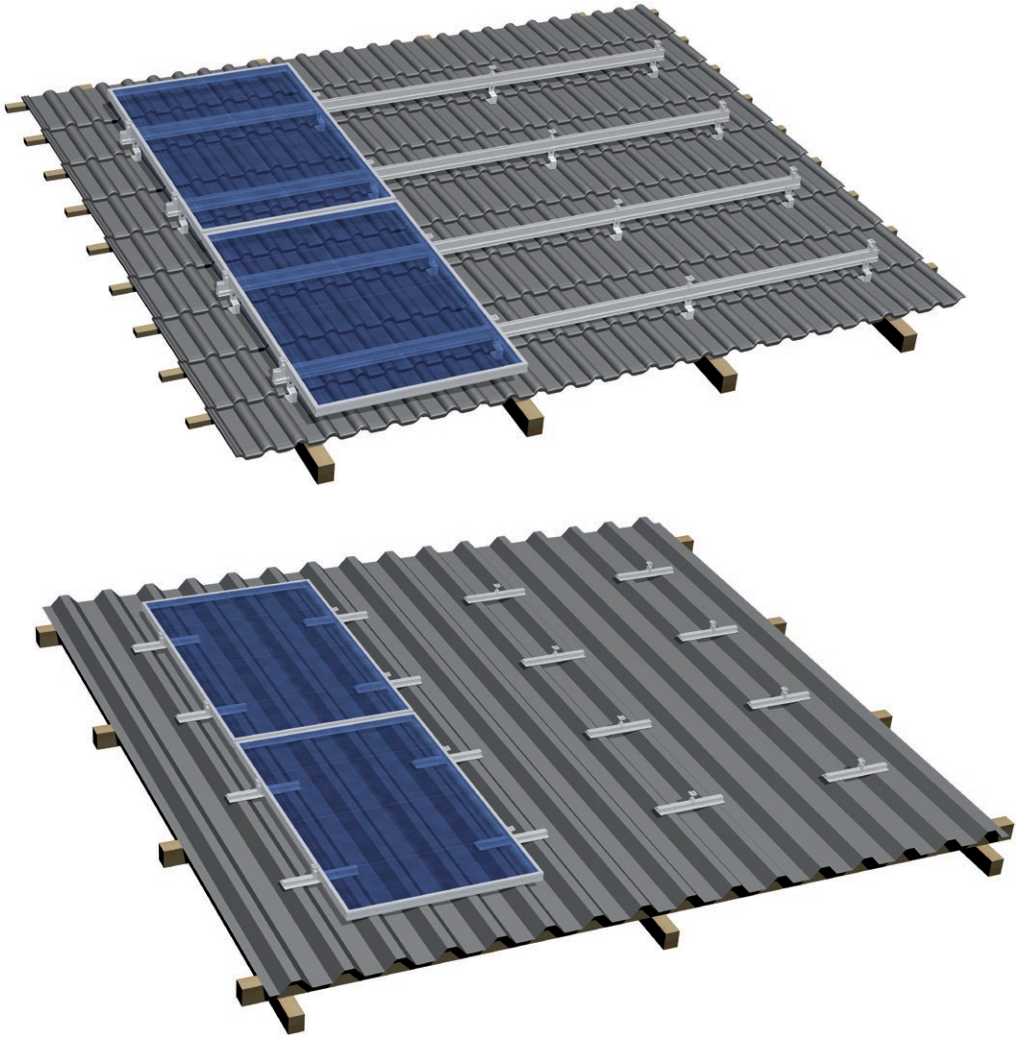
Before installing the PV modules, ensure that you read the installation instructions provided by the module manufacturer. The module manufacturer's installation instructions, especially regarding clamping surfaces and clamping areas, must be observed. S:FLEX GmbH accepts no liability for damage to the modules and all other consequences resulting from non-compliance with the module manufacturer's installation instructions.

6.2 Vertical installation with framed PV modules

The following pages explain the installation process for vertical mounting of the PV modules. Vertical mounting is used for installation with mounting rails and trapezoidal sheet-metal rails.

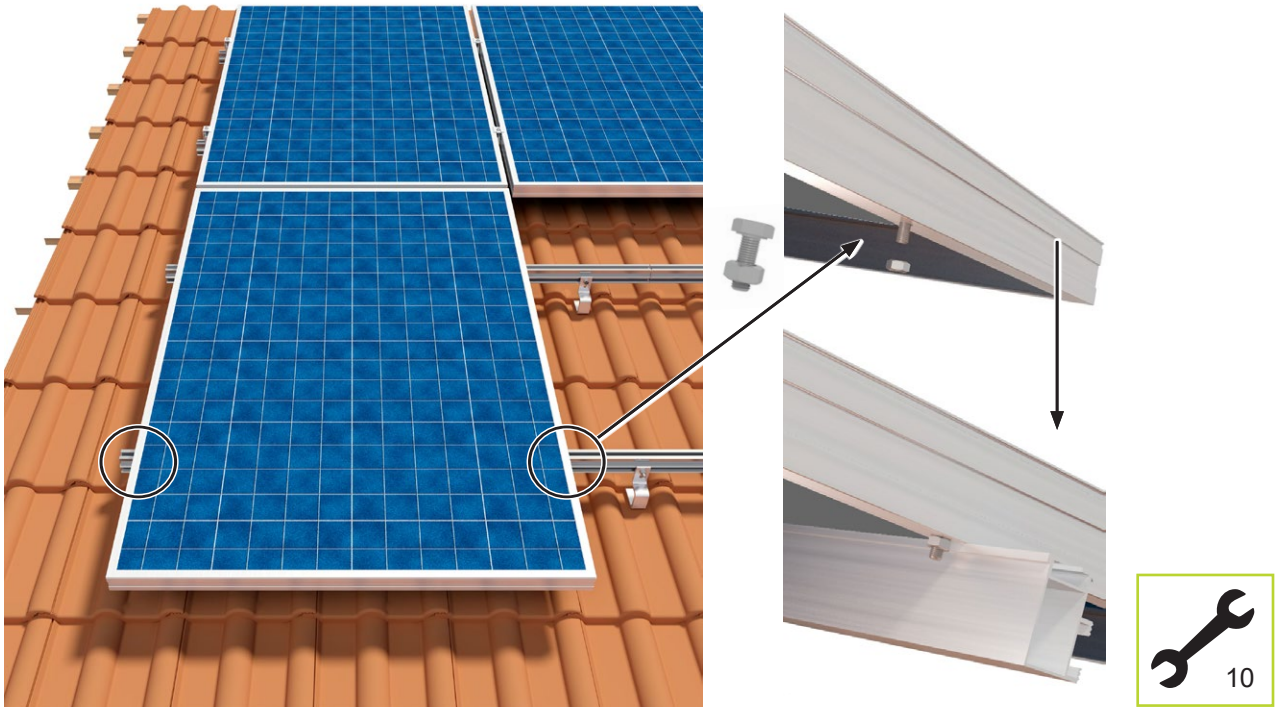
Installation options with mounting rails:
Pitched-roof installation (single-layered), hanger-bolt mounting (single-layered or double-layered), mounting on Delta Triangles

Example illustration of pitched-roof installation with mounting rails:

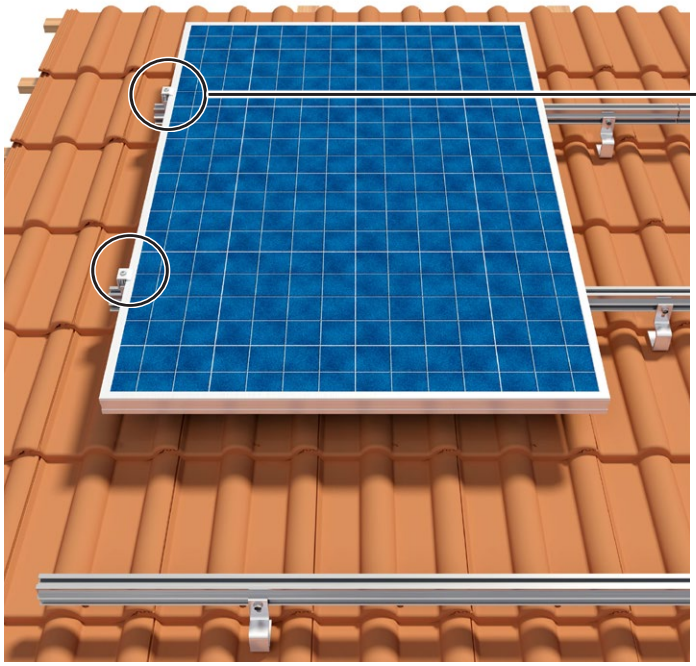


For roof pitches greater than 5°, the anti-slip set must generally be installed on the modules in the bottom row. The same applies to modules which do not have any modules directly below them (modules above obstructions such as windows, chimneys, etc.).

Fix two M6 x 20 bolts (with the shank downward) with M6 nuts 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, use a larger (8 mm) bolt.

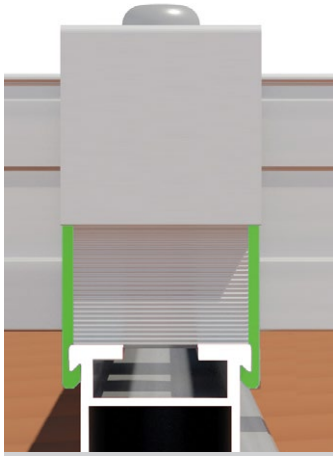


Place the module on the mounting rails. Install the end clamps. Click each end clamp onto the mounting rail and push it onto the module. Ensure that the end clamp is clicked in on both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (tightening torque 8–10 Nm). Ensure that the end bracket clamps the module's frame on the clamping surface defined by the module's manufacturer.
The distance between the module frame and the rail end must be at least 40 mm.



Click in end clamp, push onto module and tighten

Install end clamps



CORRECT
- Clicked in on both sides -

INCORRECT

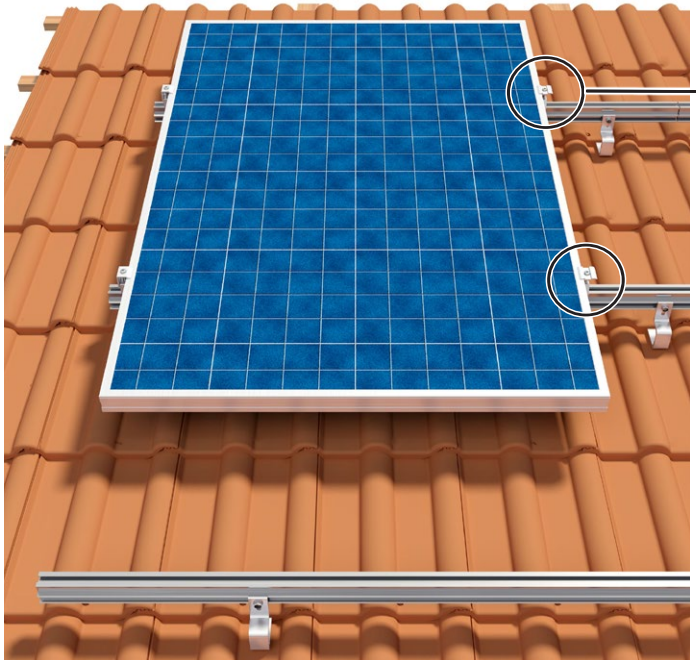
CORRECT
- defined clamping surface -

INCORRECT

Check that the end clamp is properly clicked in.

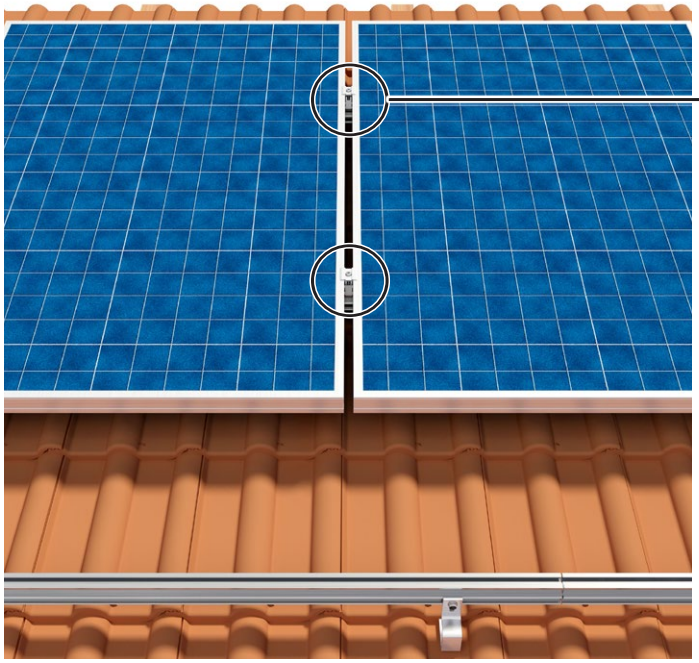
Check the clamping surface defined by the module manufacturer, observe the instructions in section 1.5 (and observe the module manufacturer's specifications).

Now install the module clamps. The earthing plate must be installed (if required) before mounting the module clamp. The earthing plate is inserted laterally into the module clamp between the "clamp" and the "top" (see **section 1.5**). Click each module clamp onto the mounting rail and push it onto the module. Ensure that the module clamp is clicked in on both sides of the mounting rail.
Ensure that the module clamp clamps both of the module frames at the clamping area defined by the module manufacturer. When using the earthing plate, the module must be positioned between the plate and the "top" of the module clamp. The earthing plate is pressed against the mounting rail from the underside of the module frame.



Click module clamp onto the module and push it flush

Align the upper row of modules using a guideline or level.
Now slide the next module under the module clamp, adjust the module clamp to the height of the module frame and tighten the screw (tightening torque 8–10 Nm).

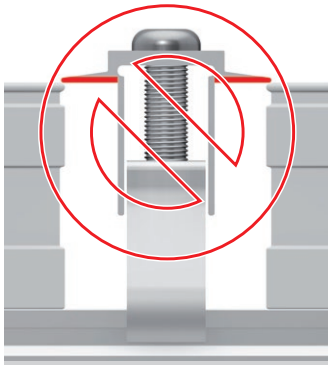


Push the module under the module clamp and tighten

Install module clamps.

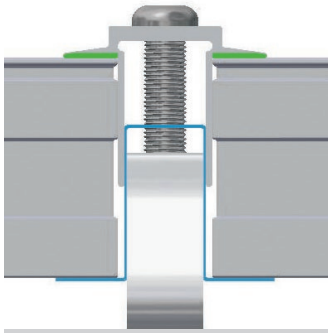
Ensure that the module clamp clamps both of the module frames at the clamping area defined by the module manufacturer.

CORRECT
- defined clamping surface -

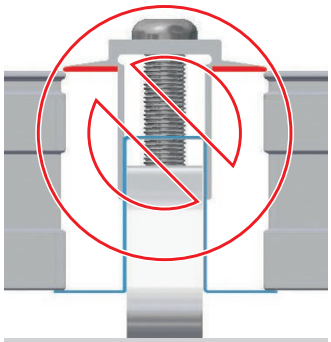


INCORRECT

Mounting with earthing plate:

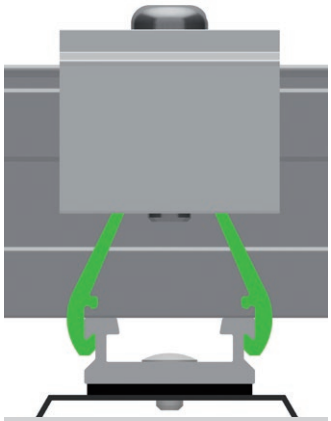


CORRECT
- defined clamping surface -

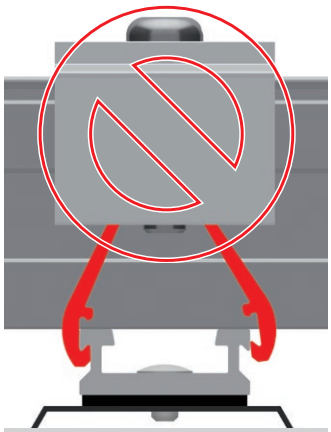


INCORRECT

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



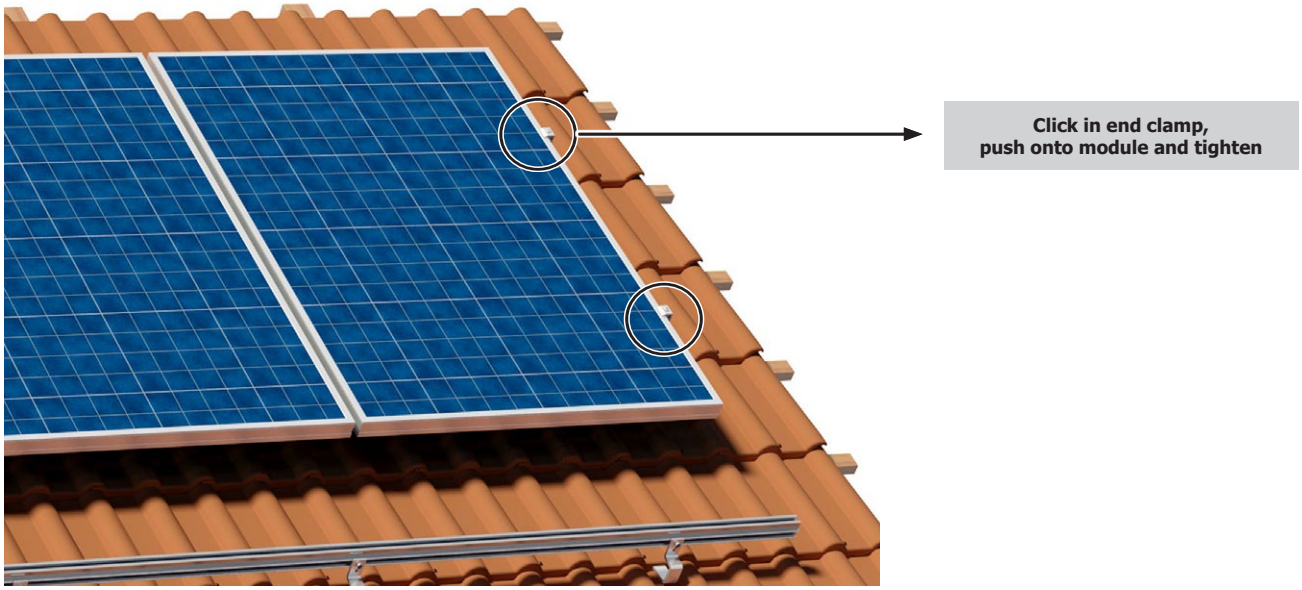
CORRECT
- clicked in on both sides -



INCORRECT

Check that the module clamp is properly clicked in.

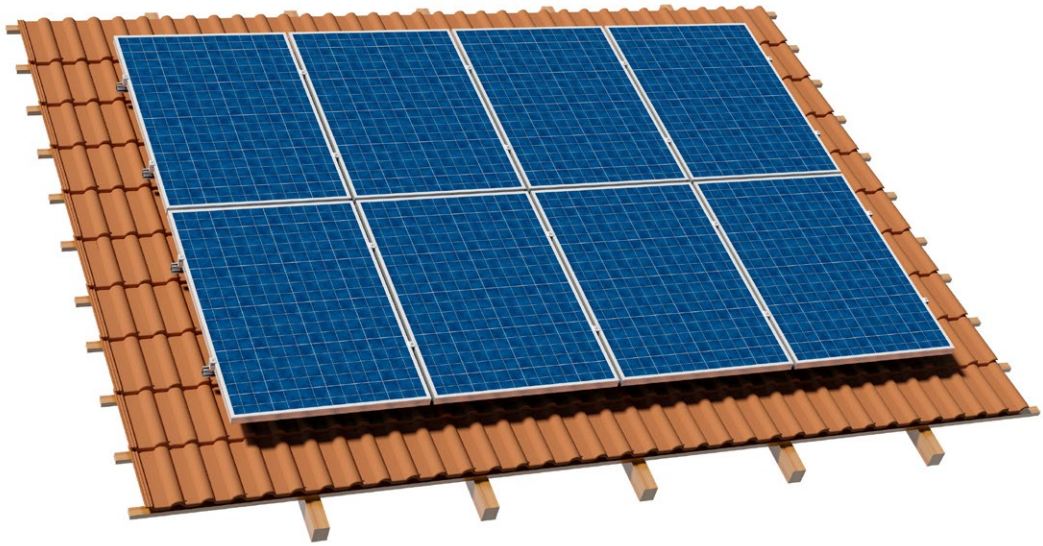
End clamps must be installed on the last module in each row (and if applicable, on expansion joints). Click each end clamp onto the mounting rail and push it onto the module. Ensure that the end clamp is clicked in on both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (tightening torque 8–10 Nm).
Ensure that the end bracket clamps the module's frame on the clamping surface defined by the module's manufacturer.
Shorten overhanging rails parallel to the module frame. The distance between the module frame and the rail end must be at least 40 mm.



Mount the end clamp on the last module.

5

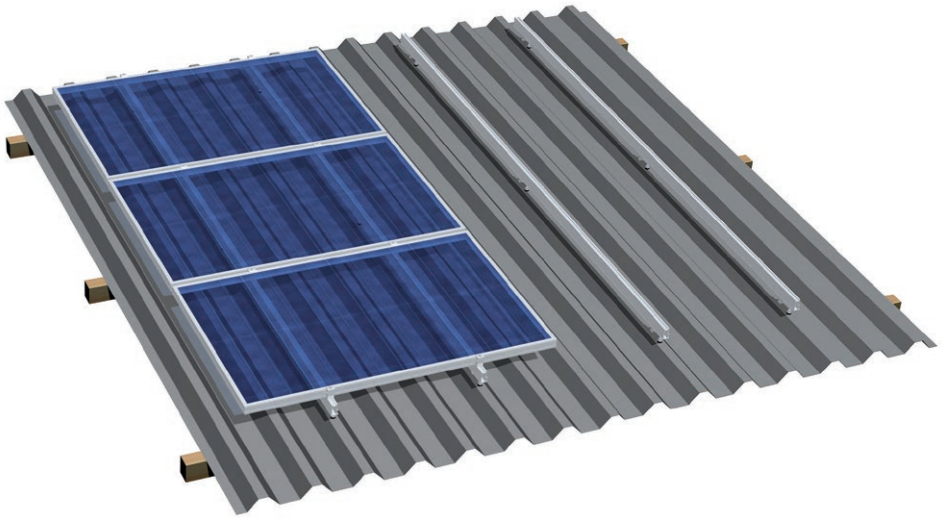
Proceed as described for the subsequent rows.



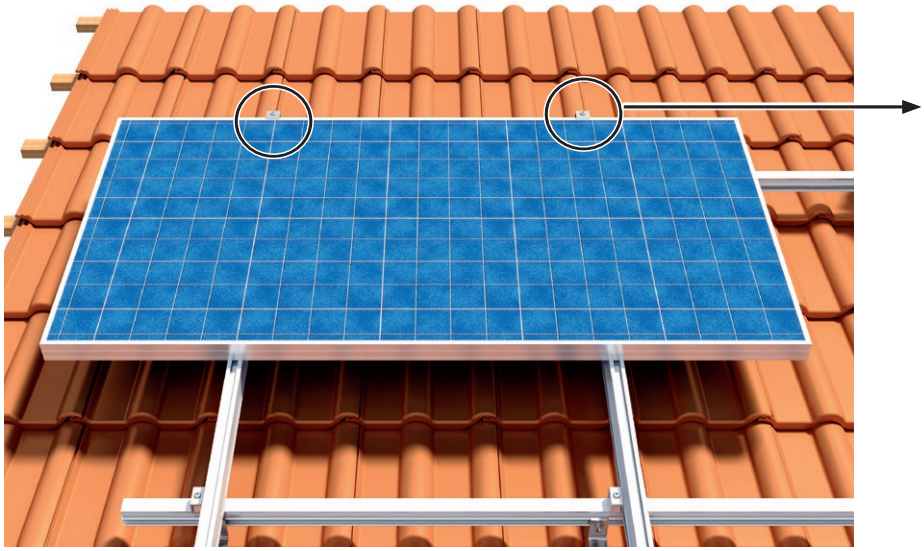
6.3 Horizontal installation with framed PV modules

The following pages explain the installation process for horizontal mounting of the PV modules. Horizontal installation is used for double-layered installation with mounting rails, mounting with trapezoidal sheet metal with ST-AK 1/12, and direct mounting on Delta Triangles.

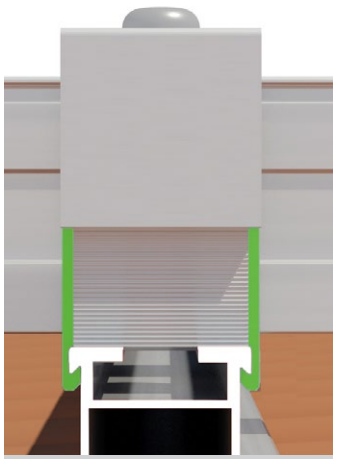
Example illustration of pitched-roof installation with mounting rails:



Place the module on the mounting rails. Install the end clamps. Click each end clamp onto the mounting rail and push it onto the module. Ensure that the end clamp is clicked in on both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (tightening torque 8–10 Nm). Ensure that the end bracket clamps the module's frame on the clamping surface defined by the module's manufacturer.
The distance between the module frame and the rail end must be at least 40 mm.



Install end clamps.



CORRECT
- clicked in on both sides -

INCORRECT

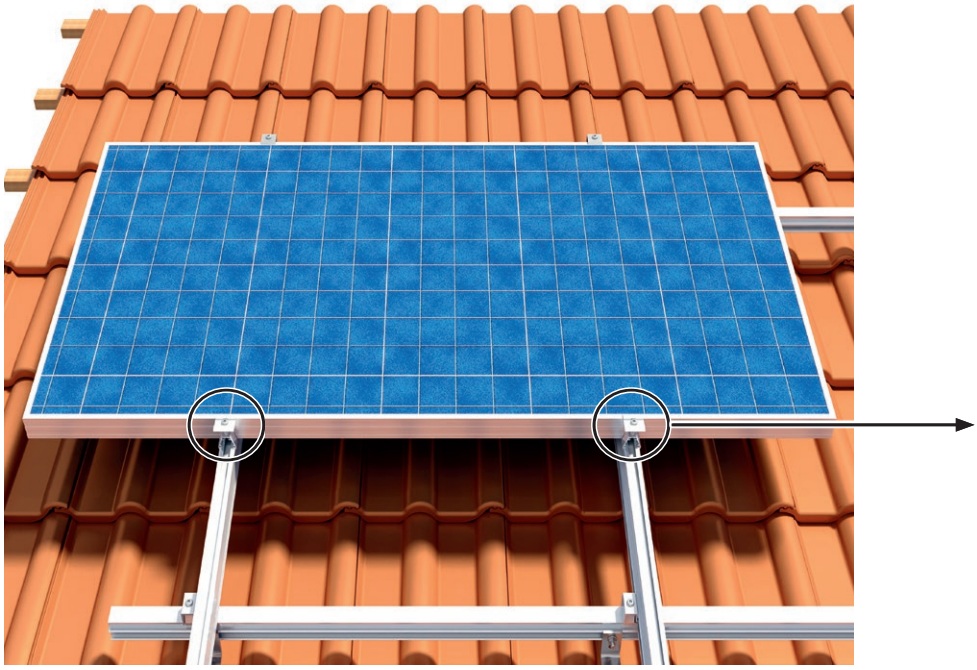
CORRECT
- defined clamping surface -

INCORRECT

Check that the end clamp is properly clicked in.

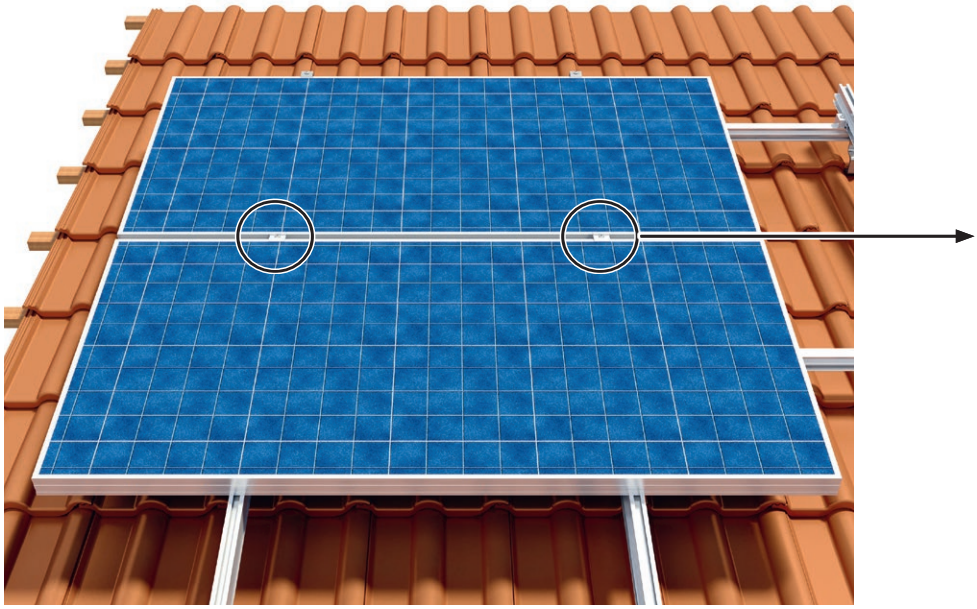
Check the clamping surface defined by the module manufacturer, observe the instructions in section 1.5 (and observe the module manufacturer's specifications).

Now install the module clamps. The earthing plate must be installed (if required) before mounting the module clamp. The earthing plate is inserted laterally into the module clamp between the "clamp" and the "top" (see **section 1.5**). Click each module clamp onto the mounting rail and push it onto the module. Ensure that the module clamp is clicked in to both sides of the mounting rail.
Ensure that the module clamp clamps both of the module frames at the clamping area defined by the module manufacturer.



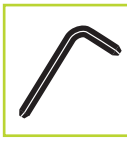
Click module clamp onto the module and push it flush

Now slide the next module under the module clamp, adjust the module clamp to the height of the module frame and tighten the screw (tightening torque 8–10 Nm).



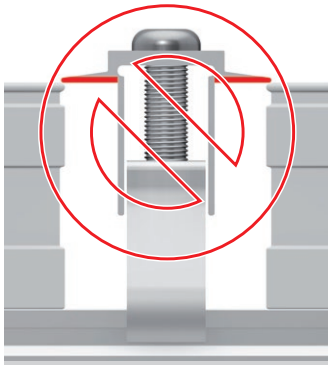
Push the module under the module clamp and tighten

Install module clamps.



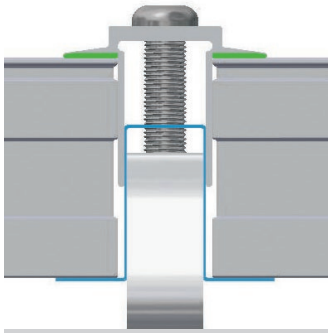
Ensure that the module clamp clamps both of the module frames at the clamping area defined by the module manufacturer.

CORRECT
- defined clamping surface -

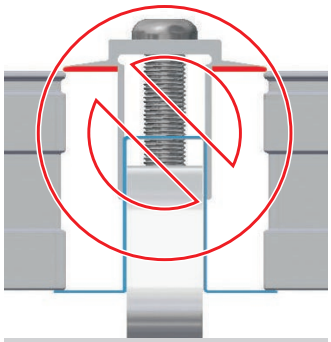


INCORRECT

Mounting with earthing plate:

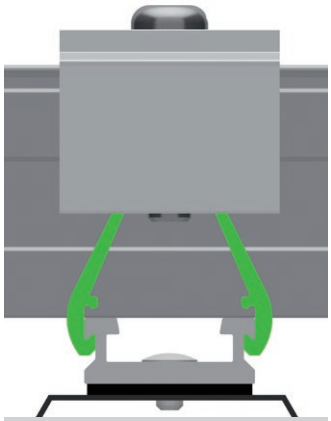


CORRECT
- defined clamping surface -

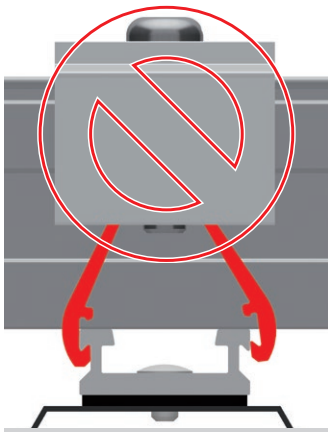


INCORRECT

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



CORRECT
- clicked in on both sides -

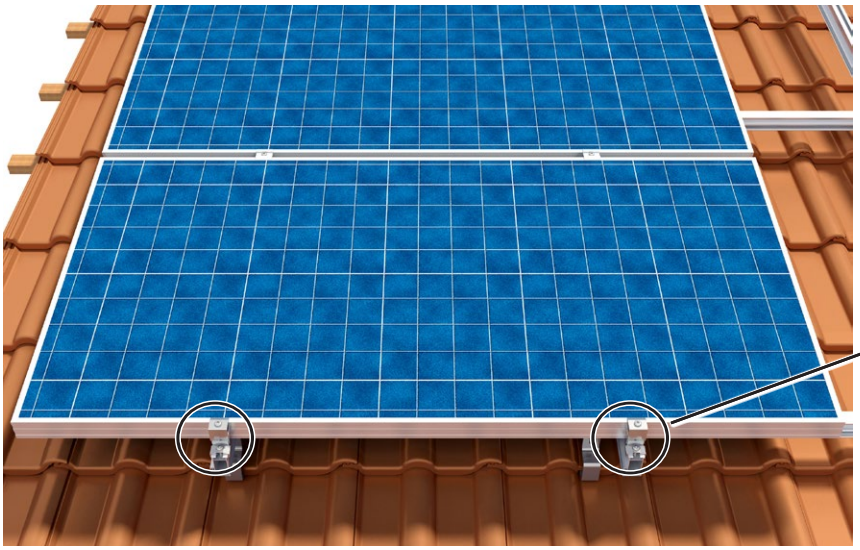


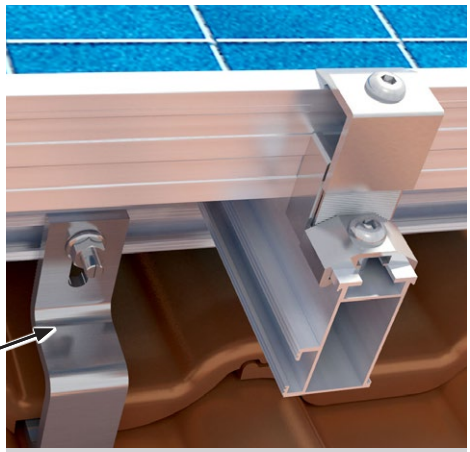
INCORRECT

Check that the module clamp is properly clicked in.

End clamps and locking clips (anti-slip protection) must be installed on the last module in each row (if applicable, on expansion joints). Click each end clamp onto the mounting rail and push it onto the module. Ensure that the end clamp is clicked in on both sides of the mounting rail. Now adjust the end clamp to match the height of the module and tighten the screw (tightening torque 8–10 Nm).

Ensure that the end bracket clamps the module's frame on the clamping surface defined by the module's manufacturer. Push the locking clip onto the mounting rails from below as far as the end bracket and secure it (tightening torque 8–10 Nm).
The distance between the module frame and the rail end must be at least 60 mm.

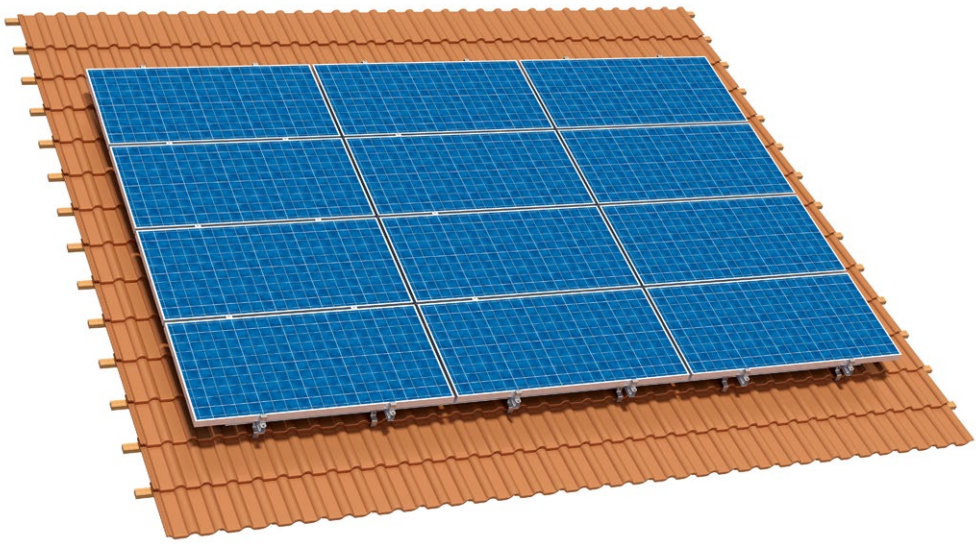




Install end clamp and locking clip

Mount the end clamp and locking clip on the last module.

Proceed as described for the subsequent rows.
It must be ensured that all end clamps are fastened in a horizontal line.
Align the upper row of modules using a guideline or level.



7 DISASSEMBLY AND DISPOSAL

7.1 Disassembly

Disassembly of the S:FLEX mounting system may only be carried out by appropriately trained specialists. The same safety instructions, standards and guidelines as for installation must be observed.

The disassembly steps always mirror the installation steps, except in reverse order.

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.

Improper disassembly may result in damage to the modules.

Remove the modules and store them safely.
Disassemble the frame system and store all parts safely.
Check the roof surface and roof covering for damage. Any damage must be repaired professionally to avoid water ingress and consequential damages. Damaged tiles must be replaced, holes in sheet metal must be sealed and openings in the roof cladding must be closed.

Replace damaged tiles.
Seal holes drilled in sheet metal.
Any holes in the roof must be professionally sealed.

7.2 Disposal

The S:FLEX mounting system consists of aluminium, stainless steel and steel components. These can be recycled after disassembly.

Disposal of the frame system must be performed by a specialist waste management company. Observe the applicable national standards and guidelines.

8 USER AGREEMENT AND WARRANTY

8.1 User agreement for the solar panel mounting system

We wish to point out that the mounting system is sold under a purchase agreement.

Installation/processing of the system or its acquisition by third parties does not take place on account of, or on behalf of, S:FLEX GmbH.
Installation of the system must be carried out by appropriately qualified personnel in strict adherence to the installation instructions.

The design and planning of the system must be carried out using the S:FLEX software (Solar.Pro.Tool). S:FLEX GmbH is not responsible for the project-related structural analysis of the roof structure, nor for obtaining and documenting the consent of the roof manufacturer for use of the respective fasteners on the roof in question (in the context of warranties), nor for the professional execution of the installation.

S:FLEX GmbH accepts no liability for faults and damage and/or a restricted or limited operational capability of the system resulting from defective 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 improper installation of the system, the buyer's right to assert claims for material defects shall expire.

The system warranty is only valid if all system components are purchased from S:FLEX GmbH.

8.2 Warranty / disclaimer

The instructions for dimensioning contained in this manual are merely suggestions based on prior experience. Binding structural requirements for the mounting frame 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. The company S:FLEX GmbH is not liable for the dimensioning instructions contained in commercial system quotations.
As an installation company, you are responsible for ensuring the mechanical durability of the installed interface connections to the building envelope, and in particular for their leak-tightness. The components supplied by S:FLEX GmbH are designed in accordance with the expected loads and the current technological state of the art.
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.).

The company S:FLEX GmbH shall not be liable for improper handling of the installed parts.
Use of the system near the sea must be clarified directly with S:FLEX GmbH 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 the time of the 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. Further information can be found in the separate warranty conditions.
This applies in the context of the generally prevailing weather and environmental conditions.