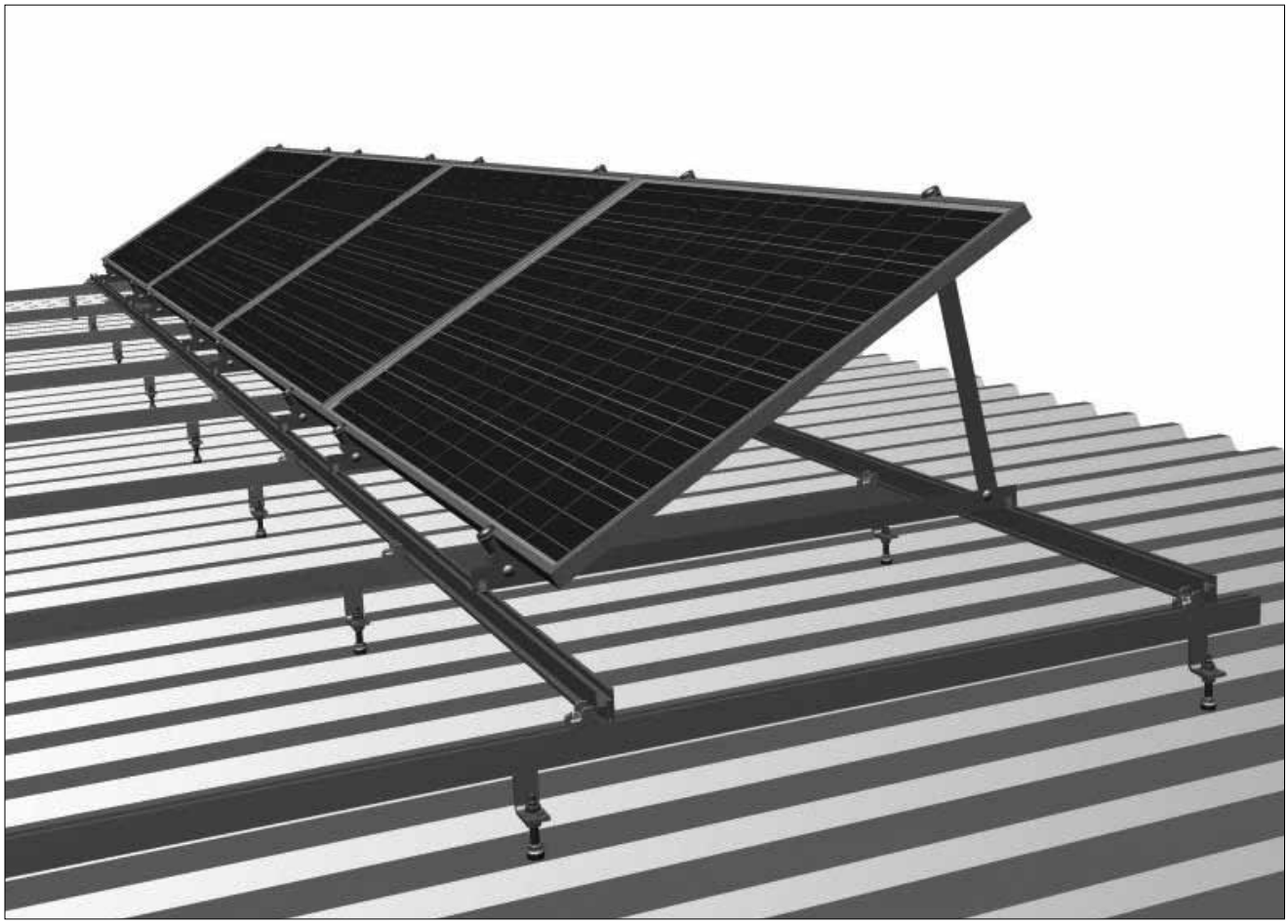
Sunfix plus® from SolarWorld

Mounting system
for solar power systems on flat roofs.
Planning and Implementation.

Translation of the original instruction manual for installers



08/2011

SOLARWORLD

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Proven quality – simply clever

The Sunfix plus flat roof mounting system for solar power systems is a high quality product from the SolarWorld AG product line. The Sunfix plus flat roof mounting system is individually customized to the construction site based on tested dimension tables using a SolarWorld Sunkits solar power kit. The installation area is used optimally and safely in the frame planning.

Only the highest quality components are used in the mounting system in order to ensure trouble-free operation of your solar power system. The following information explains the proper setup of the Sunfix plus flat roof mounting system based on a sample roof to help you install the frame system without any problems. Any unique structural features must be documented so that the unique features of the roof can be taken into account when planning the layout.

Date: 08/2011

Table of Contents

A Safety information

A1 Safety notices

Read the entire instruction sheet and observe the safety information!

Warning symbol, signal word	Warning level
 **DANGER!**	**Warns of immediate risk of death.**
 **WARNING!**	**Warns of possible risk of death and/or severe injury.**
 **CAUTION!**	**Warns of possible personal injury.**
CAUTION	**Warns of possible property damage without possibility of injury.**

Additional notice symbols	
	**Indicates additional important information.**
	**Observe applicable accident prevention regulations during installation.**
	**Do not stand or walk on modules.**

- Ensure that the Sunfix plus is used only as intended. Observe local standards, building codes and accident prevention regulations during installation. Safety information for other system components must also be followed.
- Noncompliance with the following instructions may result in electric shock, fire and/or severe injury.
- Keep this instruction manual in a safe place.

A2 Safety information

DANGER!

Risk of fatal electric shock

- Solar modules generate electricity as soon as they are exposed to light. The voltage of a single module is less than 50 V direct current (DC). When several modules are connected in series, the total voltage can be dangerously high. When several modules are connected in parallel, the currents are cumulative. Although touch protection is provided in the form of the fully insulated plug contacts, the following points must be observed when handling the solar modules to avoid the risk of fire, sparking and fatal electric shock:
- Do not install solar modules and lines with wet sockets and plugs!
- All work on the lines must be carried out with extreme caution!
- High contact voltages can occur in inverters even when disconnected!
- Caution is advised in all work performed on the inverter and lines!

DANGER!

Risk of fatal arcing

- Modules generate direct current (DC) when exposed to light. When breaking a connected string of modules (e.g., when disconnecting the DC line from the inverter under load), a dangerous arc can occur. Observe the following:
- Never remove the solar generator from the inverter while it is still connected to the power grid.
- Ensure that the cable connections are in perfect condition (no cracking, soiling or other contamination)!

WARNING!

Risk of falling

- Risk of falling when working on the roof and when climbing up and down. Observe accident prevention regulations and use suitable fall protection equipment.

WARNING!

Flammable materials

- Modules must not be operated in the vicinity of equipment or spaces in which flammable gases or dust occur or can collect.

CAUTION!

Risk of hand injury

- Hands may be crushed during frame and module installation.
- Work must be carried out by trained personnel only.
- Wear protective gloves!

CAUTION!

Beware of falling objects

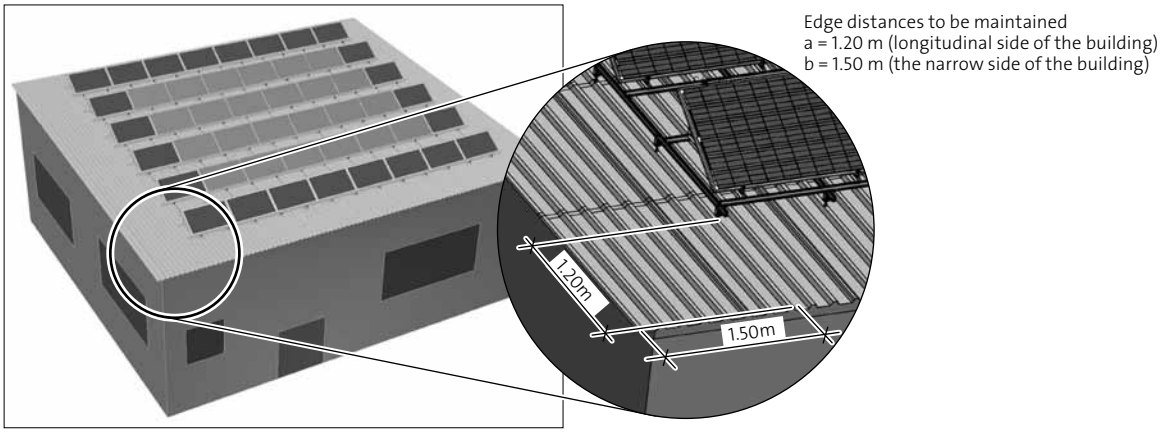
- Tools, mounting materials or modules may fall from the roof during installation and injure persons below.
- Block off the area at risk on the ground before starting installation work and warn persons in the vicinity.

A3 Comments regarding system planning

- Ensure adequate load capacity (based on dimensions, condition and material properties) of the substructure, support structure and other affected layers (such as an insulation layer).
- Make sure that the runoff of rainwater is not impeded.
- Consider physical aspects of the structure (e.g., possible water condensation if insulation is penetrated).
- In case of doubt, consult an expert (e.g. a structural engineer, expert).
- When installing PV systems on fiber cement roofs, you must check whether the roofing materials contain asbestos. Observe applicable laws and regulations!
- Protect cables installed outdoors from weather, UV light and mechanical damage using suitable precautions (such as by using UV-resistant plastic tubes or cable conduits).
- Observe the minimum sections of the wood substructure indicated on the instruction sheet. If the existing wood substructure exceeds these values, it must be properly lined so that a solid cross section with an equal cross section with the required dimensions is created. If there are any doubts, the newly supplemented wood must exhibit the required minimum dimensions.
- When using ballast for position stability, make sure the substructure has sufficient reserve load capacity.
- Check whether the use of protective mats is needed when securing the site of installation with ballast loads.
  - If so, be sure that they are made of suitable materials.
  - If you are certain as to the compatibility of the protective mat and roof flashing materials, we recommend putting in a separating mat layer.
- The friction coefficient between the roof covering and ballast element for the flat roof frame (e.g. concrete element) must amount to $\mu > 0.6$.
- The distance between the module rows is calculated individually from the angle of inclination of the modules and the minimum angle of insolation at your location.

Information about the edge areas

- The corner and edge areas of roofs are subject to air turbulence and are therefore subject to significantly elevated wind loads (please refer to DIN 1055-4 and EC1, Wind loads). Installation of elevated PV systems is not allowed in these areas.
- These areas (1.20 m from the longitudinal side of the building and 1.50 m from the narrow side of the building or h/5) must be kept clear. Deviations to this are only possible after consultation with us.
- In the event that the PV system is fixed to the roof with ballast elements (e.g. concrete elements), then the outer elements are to be loaded with increased ballast weight (dark grey elements, see Fig. A 3-1).



Edge distances to be maintained
a = 1.20 m (longitudinal side of the building)
b = 1.50 m (the narrow side of the building)

Fig. A 3-1

Fire protection

The local fire protection regulations are to be observed during the planning and installation process.

Information about compartment walls and cut-offs

Depending on the respective building, various building laws apply to the design of the PV system (corresponding to the locally applicable building regulations).

In general, the following applies:

1. The functionality of compartment walls and cut-offs may not be impaired.
2. PV modules may not be built over compartment walls and cut-offs.
3. A sufficient gap is to be maintained between PV systems and compartment walls / cut-offs (corresponding to the locally applicable building regulations).

A4 Comments regarding installation

- Observe applicable accident prevention regulations during installation.
- For installation in the roof area, observe all applicable rules, standards and regulations.
- Obey applicable directives, standards and regulations during installation and commissioning.
- All persons who are on the roof of a building of over 3 m tall must use fall protection.
- Use safety equipment to protect persons on the ground below from falling debris.
- Also obey the safety instructions for all other system components (e.g., inverters and modules).
- The system must be connected to the mains power grid by a professional electrician only. The electrician must be certified by the local electric supplier or public utility authority.
- Observe the mounting instructions for modules and inverters included with the product as well as the mounting and wiring diagram.
- Ensure that all threaded connections are fully secured.

System description

B

B1 Proper and improper use

Proper use
The Sunfix plus mounting system is intended to secure solar power modules onto roofs of standard construction and height.

Proper use includes observing the installation manual and following the maintenance and cleaning instructions. The manufacturer accepts no liability for damages resulting from not following the installation manual.

Improper use
This list does not contain all conceivable types of improper use and thus does not make any claim of completeness. It is intended merely to provide examples of improper use:

- The instructions in this installation manual were disregarded.
- The mounting system was:
  - not used properly to secure the solar power modules,
  - not installed according to this installation manual (such as for fastening to a facade)
  - improperly mounted,
  - maintained improperly or not at all,
  - modified
  - exposed to improper loads.
- Repairs were improperly carried out.
- The system was combined with components from other manufacturers.

B2 Technical overview

The Sunfix plus mounting system is a flexible support structure for the elevated installation of solar power modules on flat roofs and low sloped roofs up to 20°. It is custom-built in advance as a complete mounting kit. Information on the existing roof construction and on the static requirements (orientation, snow and wind loads, etc.) at the installation site serve as the basis for the customized planning.

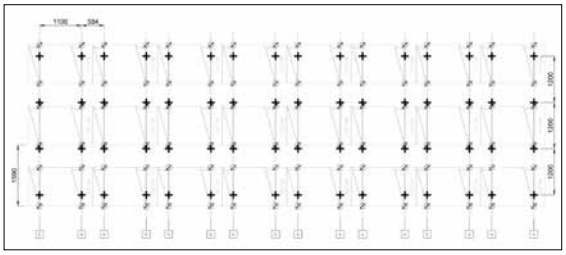


Fig. B 2-1 Sample frame diagram

With each system, you receive a "frame diagram" and a "DC wiring diagram" belonging to your system. These show the arrangement of the attachment points and supporting profiles, as well as the wiring of the modules to the inverters, customized to the roof structure and module arrangement.

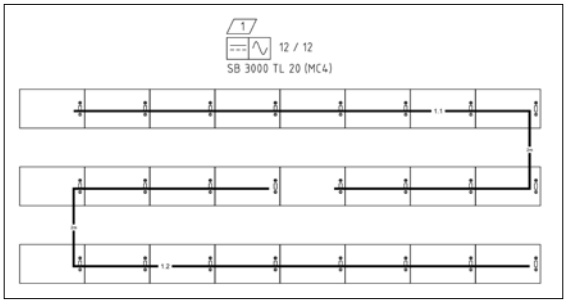


Fig. B 2-2 Sample DC wiring diagram

Sunfix plus mounting system features
▶ Aluminum supporting profiles
▶ Stainless steel or high-grade aluminum mounting and connector components.
▶ Mounting components for practically any standard roof structure and covering (e.g. roof tiles, clay pantile roofing, slate roofs, fibrated cement corrugates sheets, sandwich, Kalzip roof cladding systems and trapezoidal corrugated roofs).
▶ System measured according to the latest snow and wind load standards.
▶ Flat roof frames (FRF) with tilt angles of 15°, 20° and 30° available.
▶ Landscape or portrait orientation of the modules possible.
▶ Arrangement perpendicular to the roof pitch (RP) with FRF type A (horizontal) without stiffening brace up to 5° RP, with stiffening brace < 20° RP possible. With FRF type B (vertical) up to 5° RP possible.
▶ Arrangement to/against the RP with FRF type A and B < 20° RP possible.
▶ Installing the modules of type A (horizontal) possible with only one person.

B3 Flat roof frame (FRF) types

The modules can be mounted in portrait or landscape orientation. In order to do so, two different flat roof frames (type A and B) are used. Both flat roof frame types are available with tilt angles of 15°, 20° and 30°.

① Solar power module
② Flat roof frames
③ Threaded connection
④ Clamp
⑤ Roof construction, existing
⑥ Reinforcement strut (opt.)
⑦ Clamp layer (Type B only)
⑧ Supporting profile frame layer
⑨ Fastening to roof structure

Flat roof frames **type A** (for landscape mounting of the modules):

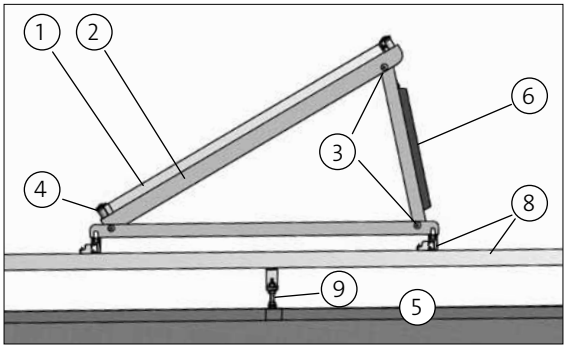


Fig. B 3-1 side view flat roof frames type A

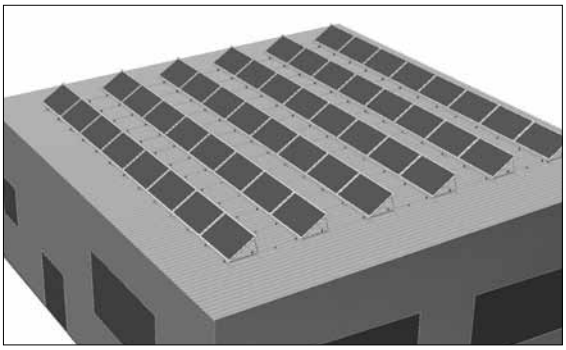


Fig. B 3-2 example system with flat roof frames type A

Flat roof frames **type B** (for portrait mounting of the modules):

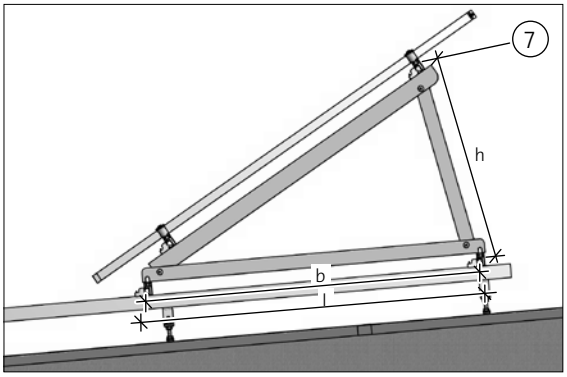


Fig. B 3-3 side view flat roof frames type B

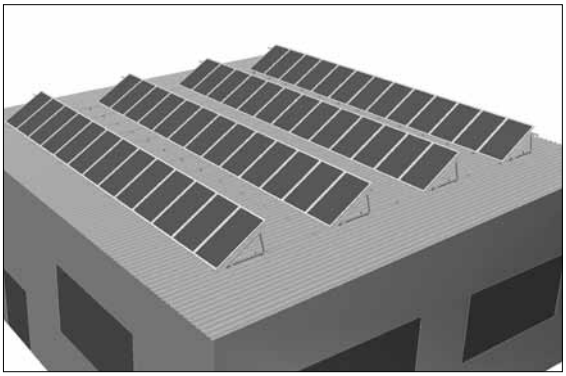


Fig. B 3-4 example system with flat roof frames type B

Dimensions of flat roof frames

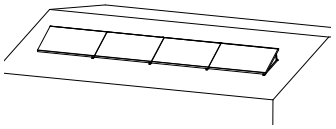
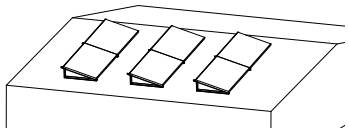
	Angle	Height h [mm]	l [mm]	Drilled hole spacing b [mm]
Type A	15°	≈320	≈1070	1035
	20°	≈405	≈1070	1035
	30°	≈560	≈1070	1035
Type B	15°	≈405	≈1244	1210
	20°	≈500	≈1244	1210
	30°	≈680	≈1244	1210

The maximum distance between the flat roof frames and the maximum projection of the profiles depends on the building height, the expected regional snow and wind loads, the terrain conditions and the installed height above sea level. For this reason, it is not possible to make general recommendations as to these dimensions. Please refer to the system planning information for precise values relating to your system.

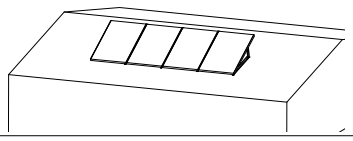
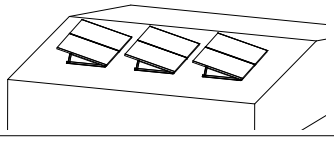
B4 External boundary conditions

All of the external boundary conditions to be maintained are summarized in the following tables:

Boundary conditions flat roof frames type A (Modules landscape)

	Direction of elevation	
	to/against the roof pitch 	**perpendicular to the roof pitch** 
Wind load [kN/m²]	≤ 1,20	
Snow load [kN/m²]	≤ 4,00	
Height above sea level [m]	≤ 1000	
Building height [m]	≤ 25	
Allowable roof pitch [°]	≤ 20	
Reinforcement strut	not necessary	necessary from 5° roof pitch (1 strut per module)
Frame spacing [m]	1.10 m (2 frames per module)	
Custom solutions are available on request in order to accommodate individual system plans!		

Boundary conditions flat roof frames type B (Modules portrait)

	Direction of elevation	
	to/against the roof pitch 	**perpendicular to the roof pitch** 
Wind load [kN/m²]	≤ 1,20	
Snow load [kN/m²]	≤ 4,00	
Height above sea level [m]	≤ 1000	
Building height [m]	≤ 25	
Allowable roof pitch [°]	≤ 20	≤ 5
Reinforcement strut	not necessary	
Frame spacing [m]	freely selectable, depending on the system plan	
Custom solutions are available on request in order to accommodate individual system plans!		

ℹ Ballasted systems are only permissible for roof pitches up to 5°!

B5 System arrangement

Type A

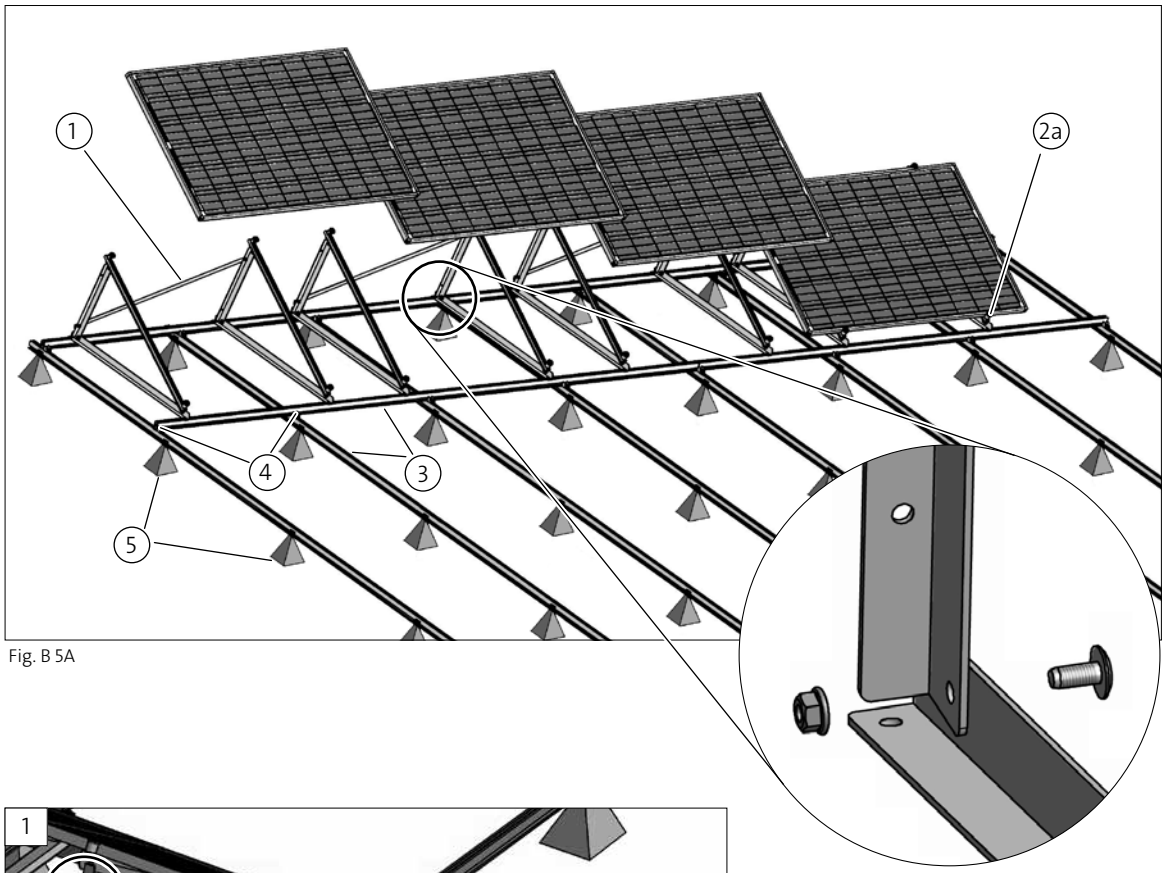


Fig. B 5A

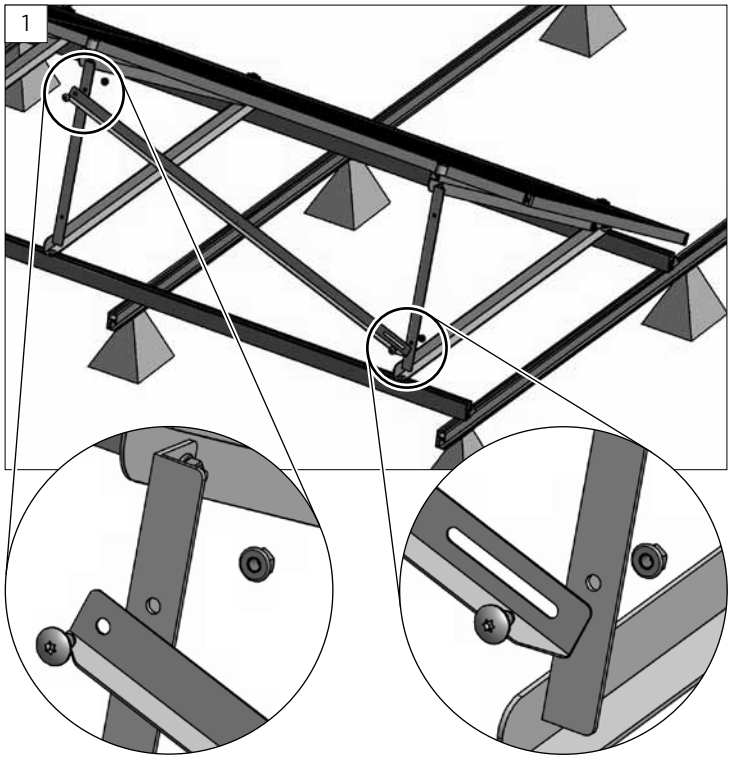


Fig. B 5-1 Detail 1

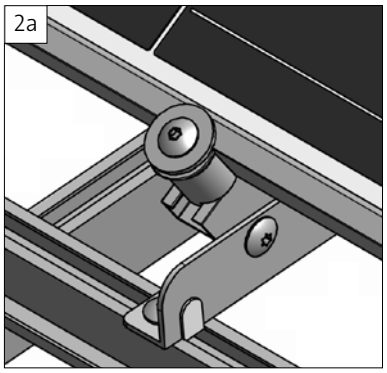


Fig. B 5-1 Detail 2

Type B

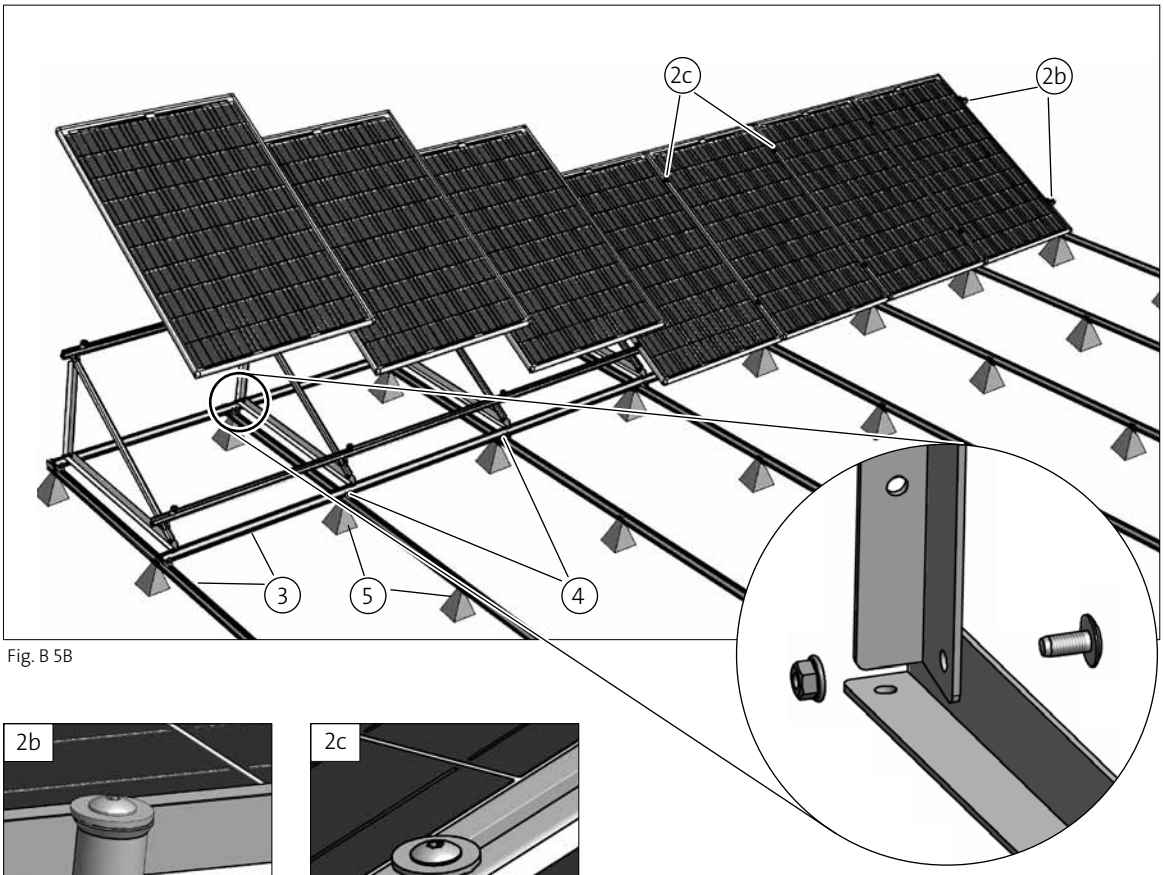
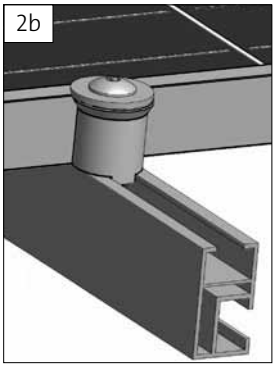
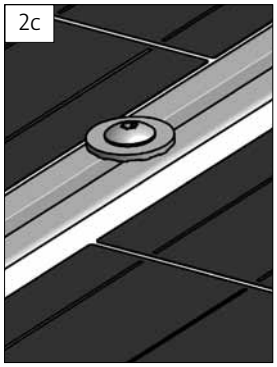
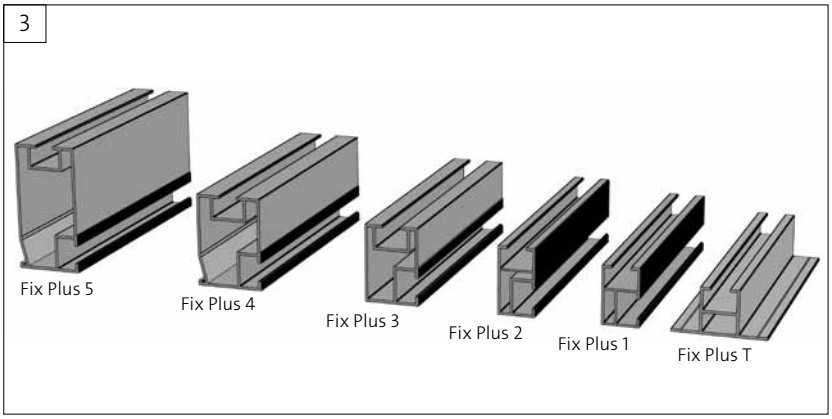
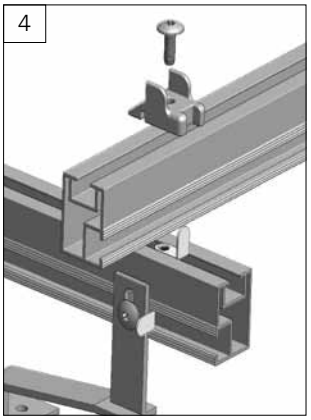


Fig. B 5B









Fastening to roof structure (examples):

5a

Hanger bolts + double flange (e.g. for mounting on trapezoidal corrugated roofs)

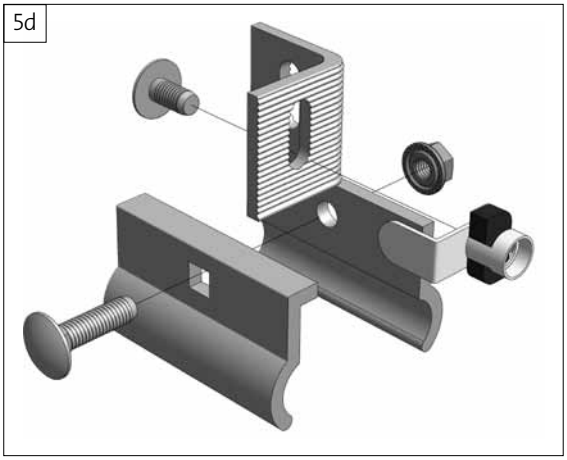
5b

Roof hook (for mounting on clay tile roofs)

5c

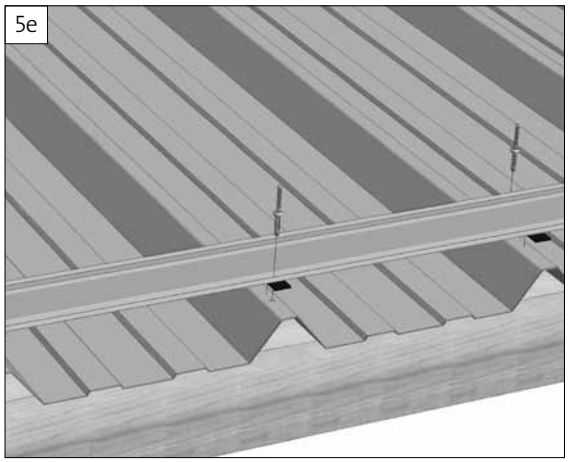
Hanger bolt + angle flange (e.g. for mounting on trapezoidal corrugated roofs)

5d



Kalzip clamp (for mounting on Kalzip roofs)

5e



Fastening with rivets (alternate installation of rivets)

5f

Solar fastener + angle flange (e.g. for mounting on sandwich roofs)

B6 Supporting profiles

B6.1 Frame layer

Type A

Required supporting profile layers
The supporting profiles can be installed in single or dual layers. The design is dependent on the roof construction.

Dual-layer installation
The systems are double-layer mounted as standard. This arrangement allows for the maximum flexibility regardless of the substructure.

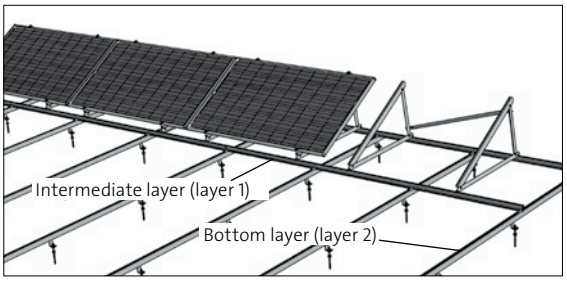


Fig. B 6.1-1a

Type B

Required supporting profile layers
The supporting profiles can be installed in double or triple layers. The design is dependent on the roof construction.

Triple-layer installation
The systems are triple-layer mounted as standard. This arrangement allows for the maximum flexibility regardless of the substructure.

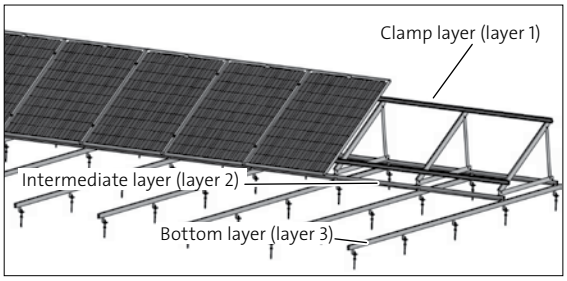


Fig. B 6.1-1b

Single-layer installation
A single-layer subframe is also possible with a suitable substructure.

The following boundary conditions apply:
- Suitable only with flat substructures
- Because the number of possible attachment points is limited, this type of installation is not always possible due to the mechanical loads.

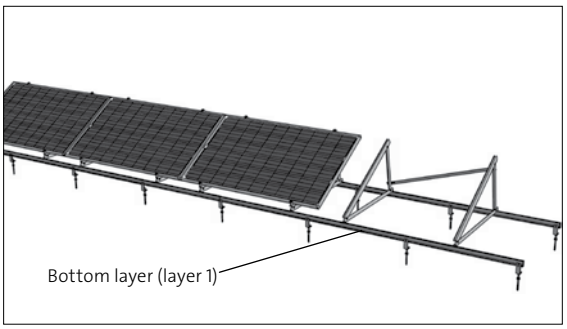


Fig. B 6.1-2a

For single-layer mounting, we recommend a technical feasibility check.

Dual-layer installation
A double-layer subframe is also possible with a suitable substructure.

The following boundary conditions apply:
- Suitable only with flat substructures
- Because the number of possible attachment points is limited, this type of installation is not always possible due to the mechanical loads.

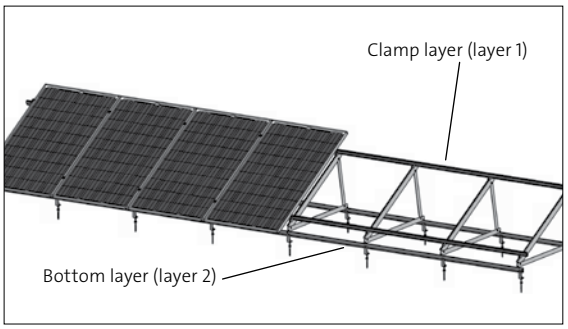


Fig. B 6.1-2b

We recommend a technical feasibility check for double-layer mounting.

There are various supporting profiles available depending on the spacing of the substructure, the design loads (snow, wind) and the type of mounting. All of these profiles can be individually combined with one another. The profiles are already cut to length at the factory and so only in rare cases need to be modified at the installation site.

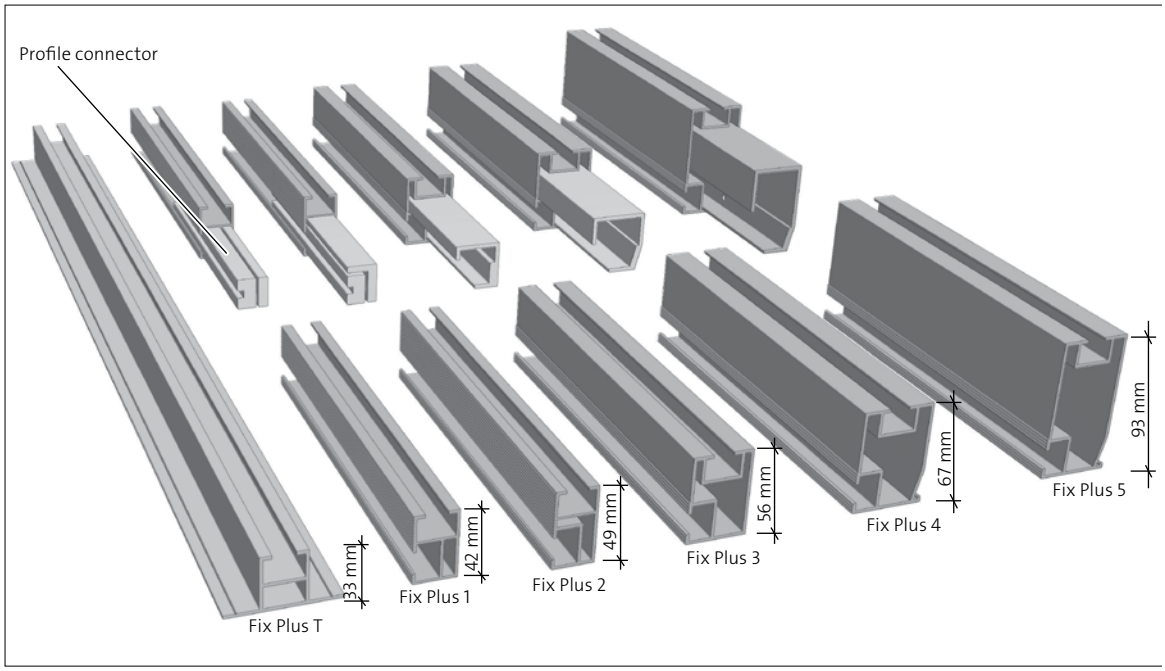


Fig. B 4-5 Overview of supporting profiles and profile connectors

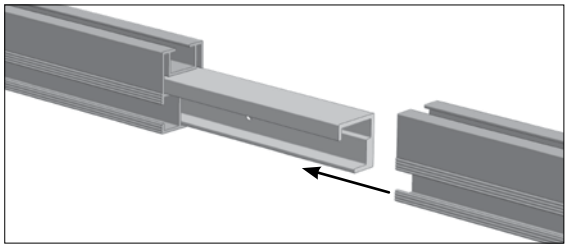


Fig. B 4-6 Supporting profile Fix Plus 3 and profile connector 3

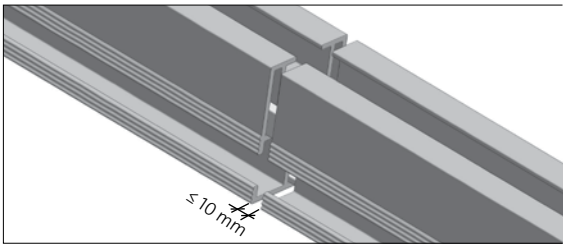


Fig. B 4-6a

The individual supporting profiles are joined to one another lengthwise using profile connectors.

The small Fix Plus 1 and Fix Plus 2 profiles are installed using two profile connectors per connection. The additional profile connector is inserted in the side groove as usual.

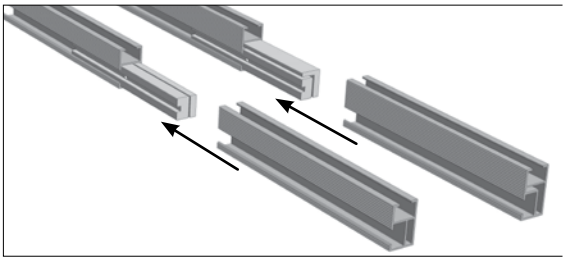


Fig. B 4-7 Profile connector 1 and 2, side assembly

In special cases (e.g., if a roof hook is fastened in this area) the additional rail splice connector can also be inserted in the top groove.

ℹ Maximum distance of the supporting profiles in the joint area ≤ 10 mm

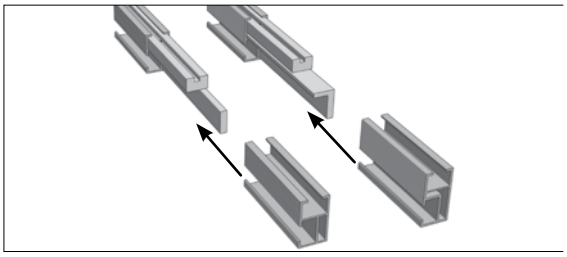


Fig. B 4-8 Supporting profile Fix Plus 1 and 2 Profile connector 1 and 2, side and top assembly

According to the framing plan, each profile requires at least 2 fasteners to the roof construction

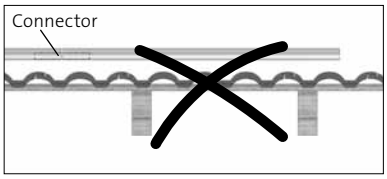


Fig. B4-8 Detail1
Profile without direct fastening not possible!

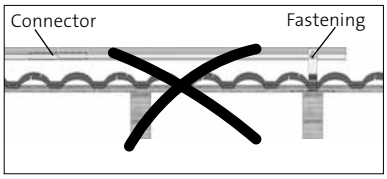


Fig. B 4-8 Detail2
Frame with 1 fastener - not possible!

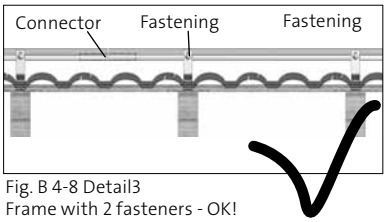


Fig. B 4-8 Detail3
Frame with 2 fasteners - OK!

Two frame layers are joined using the aluminum clamps.

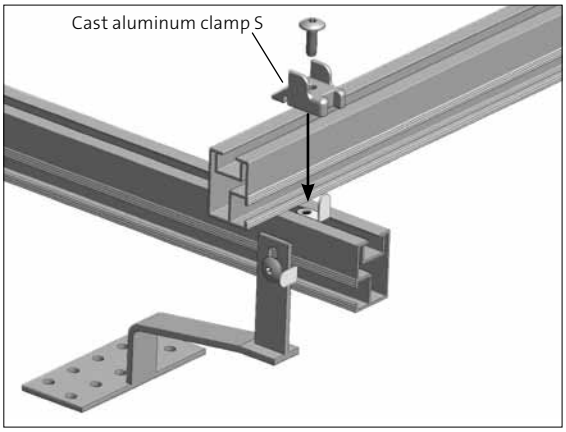


Fig. B 4-9 Cast aluminum clamp S

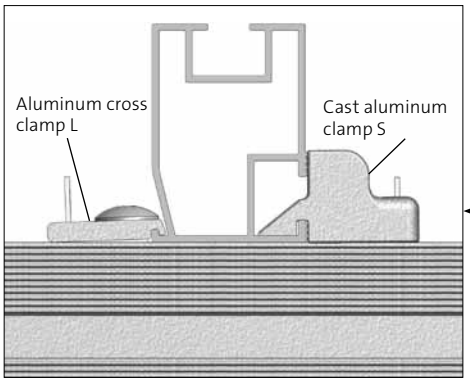


Fig. B 4-11

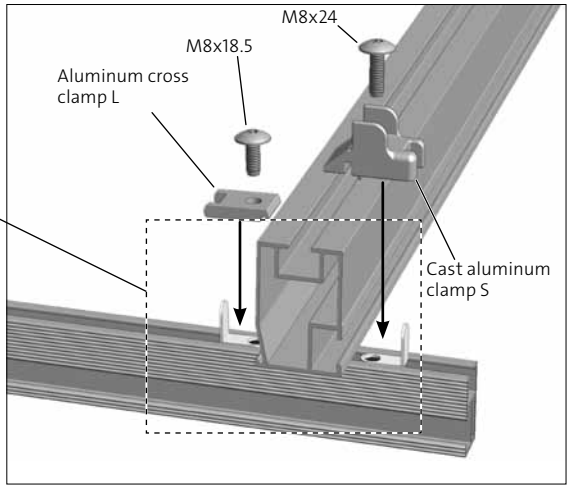


Fig. B 4-10 Aluminum cross clamp L and cast aluminum clamp S (for area with very high wind loads)

The additional aluminum cross clamp for wind suction is used in cases of high loads on the clamp connection. This is only true for high wind loads in addition to large support spans of the mounting system.
The clamp is mounted in the edge area of the system and is only necessary in exceptional cases. For more information, see the specific system plan.

Condition for the use of aluminum cross clamp L (additional clamp)

- 1. Layer (clamp layer) Fix Plus 4 or 5

B6.2 Clamp layer modules

Type A
Clamp layer not necessary.

Type B

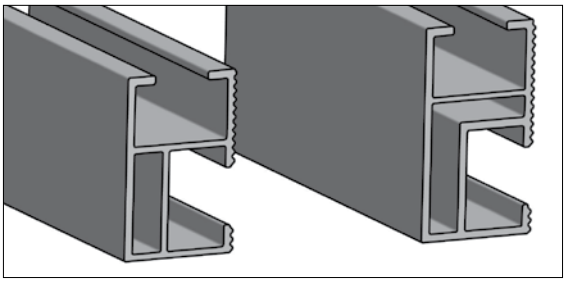


Fig. B 6.2-1

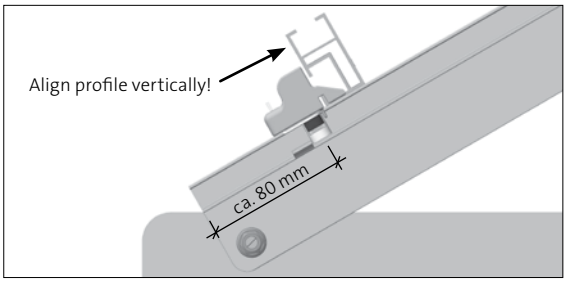


Abb. B 6.2-6

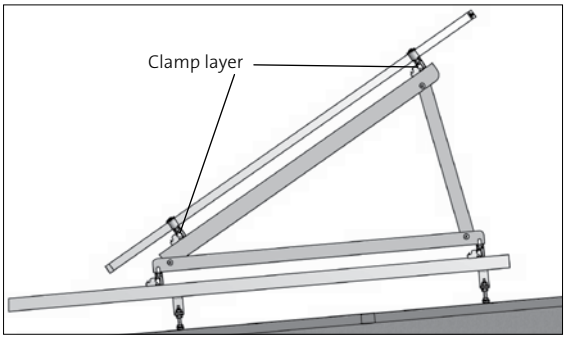


Fig. B 6.2-2

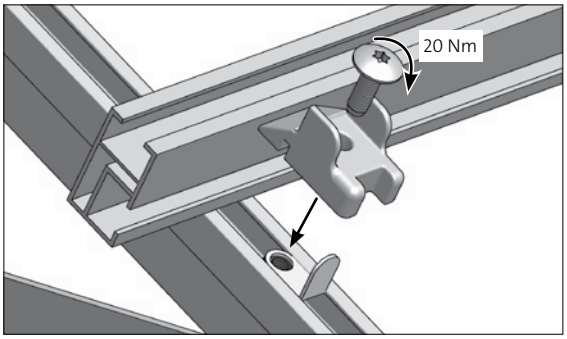


Fig. B 6.2-3

Torque M_A= 20 Nm

The individual supporting profiles are joined to one another lengthwise using connectors.

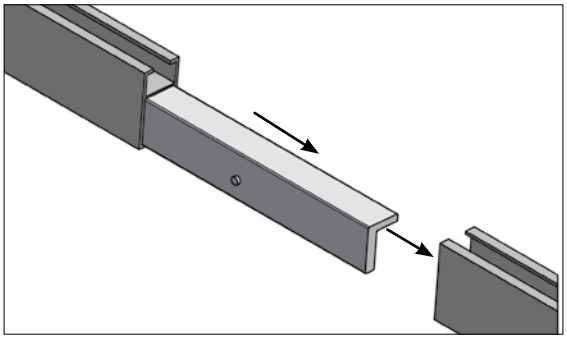


Fig. B 6.2-4

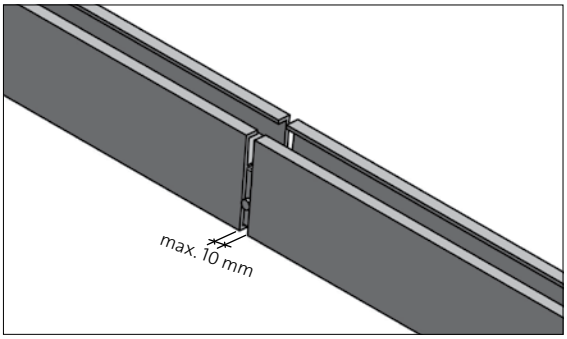


Fig. B 6.2-5

B7 Frame layer threaded connections

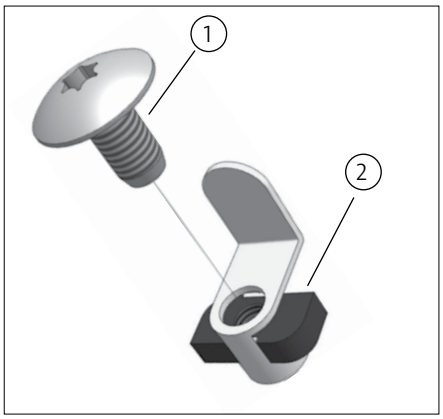


Fig. B 7-1

The connections between the mounting components (e.g. roof hooks, angle flange, etc.) and the supporting profiles as well as between the supporting profiles are threaded connections with M8 screws and slot nuts with plastic tabs.

① M8x16 mm or 18.5 mm screw with T40 driver

② Fastener set yellow (slot nut with yellow plastic tab)

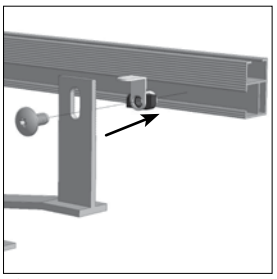


Fig. B 7-2

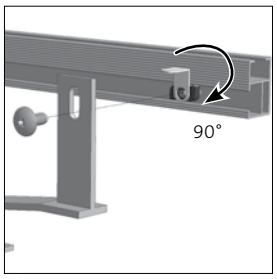


Fig. B 7-3

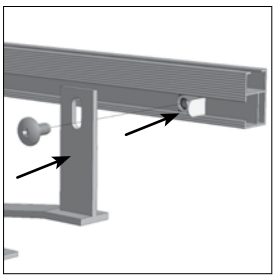


Fig. B 7-4

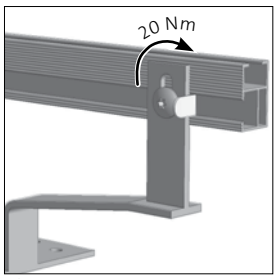


Fig. B 7-5

Assembly:

1. Use of fastener set yellow.

2. Turn the assembly tool 90° using the plastic tab.

3. Position the fastener set yellow on the mounting parts using the plastic tab.

4. Screw in and tighten the M8 screw.

☑ Torque M_A= 20 Nm

B8 Module clamp

Type A

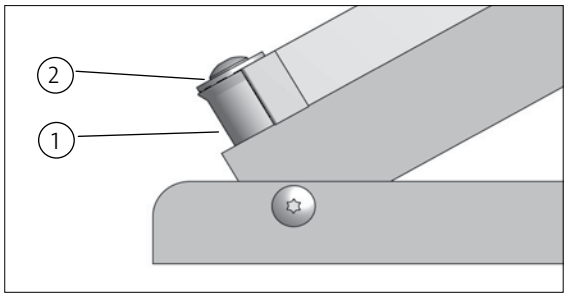


Fig. B 8-1a

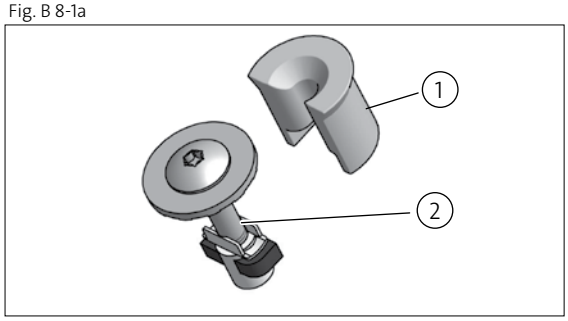


Fig. B 8-1b

The module is fastened by clamping. A torque wrench is recommended to ensure the required force.

- Firmly tightened stainless steel screws may gall, and therefore become impossible to remove without destroying them. Carefully align and position the modules before tightening the screws with the indicated torque!

- Spot-check the screws annually for required torque!

- Torque M_A = 15 Nm
  Driver for module clamp: T40

① End piece
② Module clamps

Bottom mounting

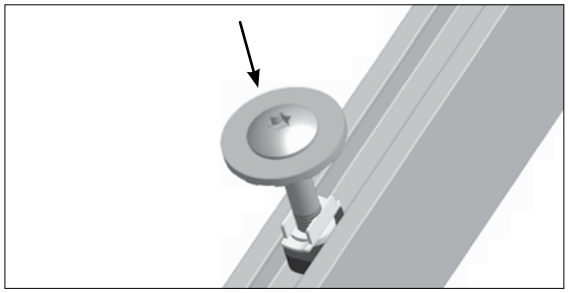


Fig. B 8-2a Insert module clamp

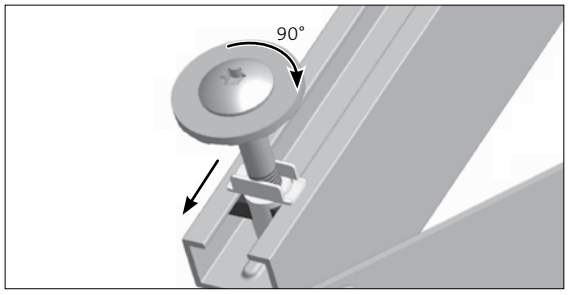


Fig. B 8-2b Twist in module clamp and push on to embossing

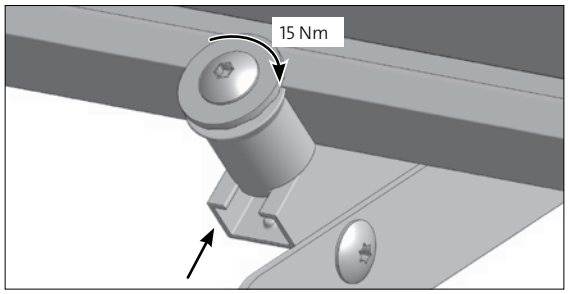


Fig. B 8-2c Place module, slide on end piece and tighten screw

Top mounting

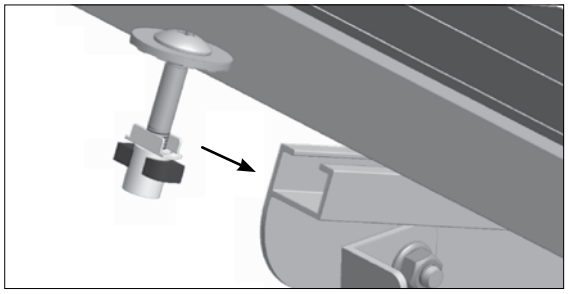


Fig. B 8-2d Push on module clamp

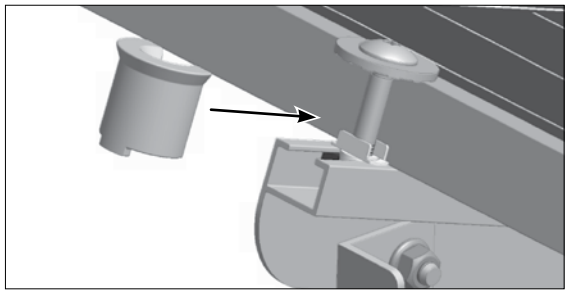


Fig. B 8-2e Slide on end piece

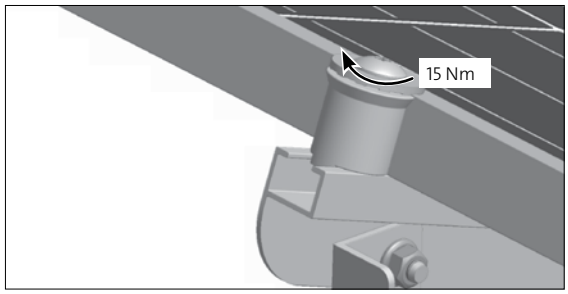


Fig. B 8-2f Tighten screw

Type B

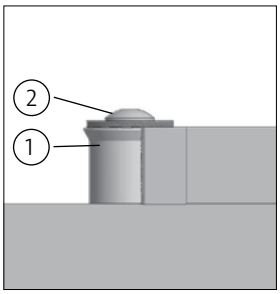


Fig. B 8-3a

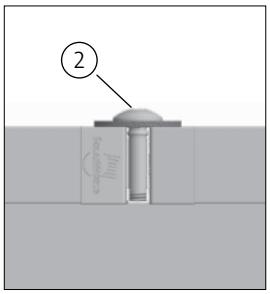


Fig. B 8-3b

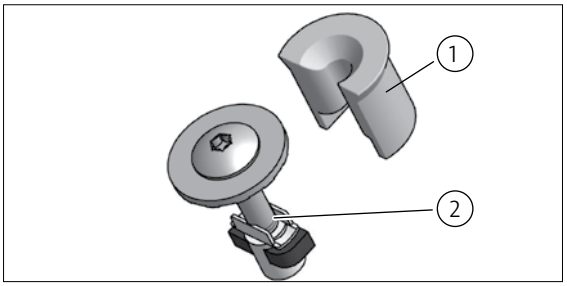


Fig. B 8-3c

The module is fastened by clamping. A torque wrench is recommended to ensure the required force.

- Firmly tightened stainless steel screws may gall, and therefore become impossible to remove without destroying them. Carefully align and position the modules before tightening the screws with the indicated torque!

- Spot-check the screws annually for required torque!

- Torque M_A = 15 Nm
  Driver for module clamp: T40

① End piece
② Module clamps

End-clamp mounting

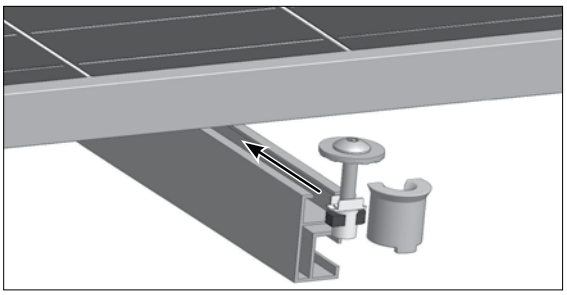


Fig. B 8-4a Slide module clamp

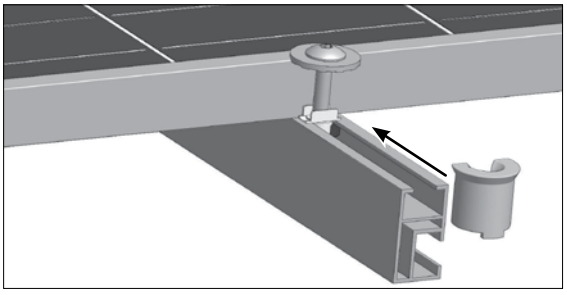


Fig. B 8-4b Slide on end piece

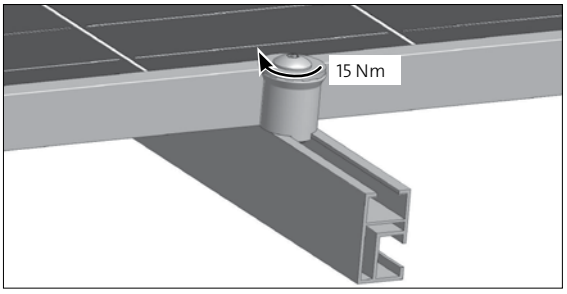


Fig. B 8-4c Tighten screw

Mid-clamp mounting

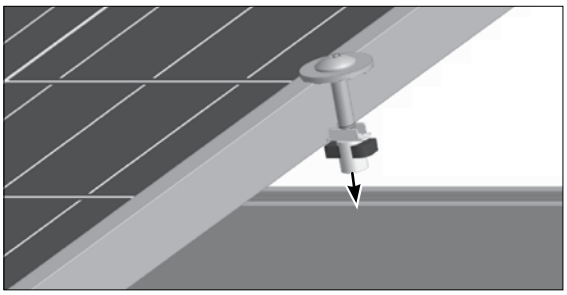


Fig. B 8-5a Insert module clamp

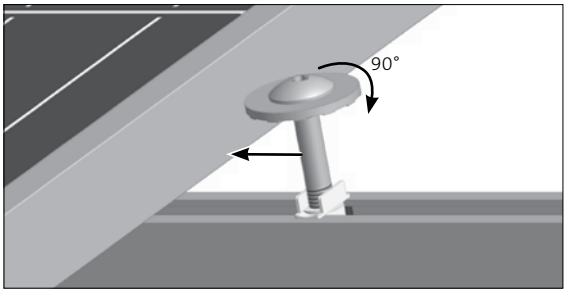


Fig. B 8-5b Twist in module clamp

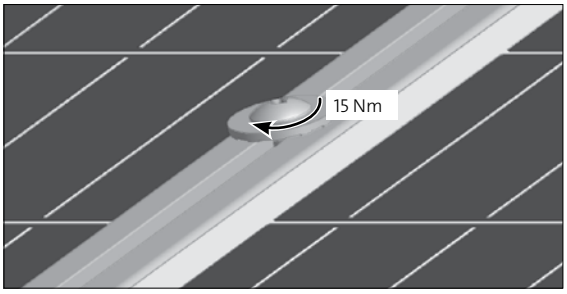


Fig. B 8-5c Place second module, tighten screw

B9 Mounting components

B9.1 Roof hook fastener set

The roof hook fastener set is suitable for most common types of roofing tiles, such as Frankfurt pan tile, interlocking tile, etc.

① Supporting profile
② M8 screw
③ Fastener set yellow
④ Roof hook
⑤ Wafer-head screw
⑥ Rafters
⑦ Counter battens
⑧ Roof battens

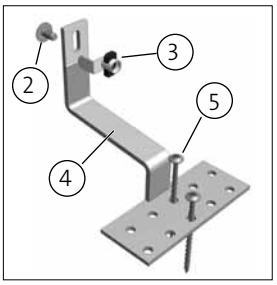


Fig. B 9.1-1 Roof hook 0°

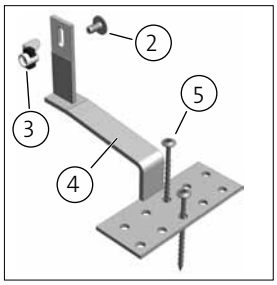


Fig. B 9.1-2 Roof hook 90°

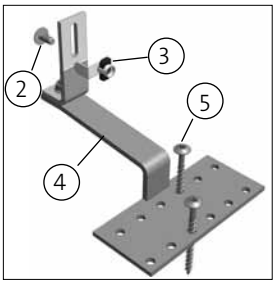


Fig. B 9.1-2a UNI roof hook

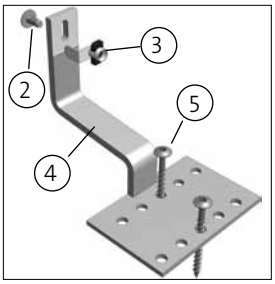


Fig. B 9.1-2b MAX 0° roof hook

At maximum load, the roof hook lies directly on the roof covering. The distance between the roof hook and tiles must be ≥ 5 mm in the unloaded state.

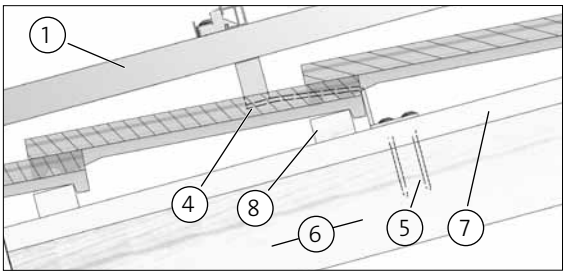


Fig. B 9.1-3

Roof hook technical data

Possible dimensions of roof battens	30x50mm ("Standard") 24x48mm ("Short") For larger battens, the base plate of the roof hook must be underlaid (e.g. hardwood/plastic tabs).
Fastening to wood substructure	Wafer-head screws 8x100mm (standard) Up to 8x300mm on request for rooftop insulation
Req. Embedment depth of wafer-head screws in the Wood substructure	60 mm
Minimum wood rafter dimensions w x h	60x100mm (wafer-head screws 8x100mm)
Fastening angle to frame	0° and 90° (see fig.)
Types	MEDIUM (height adjustable 14 mm) MAX (for high loads, such as high snowfall areas, height adjustable 14 mm) UNI (height adjustable 31 mm)
Driver for wafer-head screw	T40

Assembly:

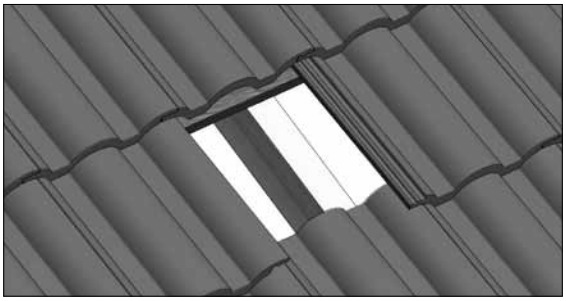


Fig. B 9.1-4

1. Remove the tile above the hook location

Fig. B 9.1-5

2. Position arm of roof hook at the bottom of the tile space and fasten to rafter with 2 screws. There must be ≥ 5 mm space between tile and hook. The base plate can be underlaid if necessary.

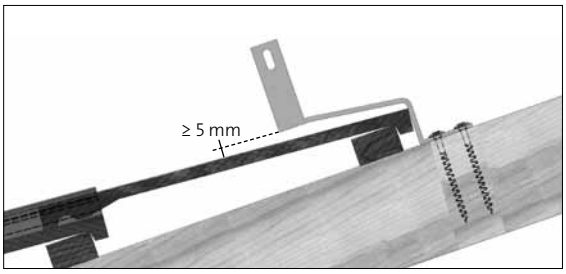


Fig. B 9.1-6

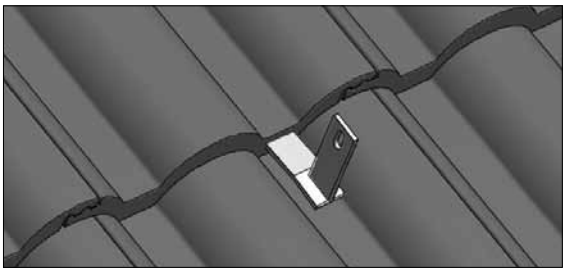


Fig. B 9.1-7

3. Grind out back of tile and replace on roof. With interlocking tiles, the tile below must also be recessed.

B9.2 Slate/shingle roof hook fastener set

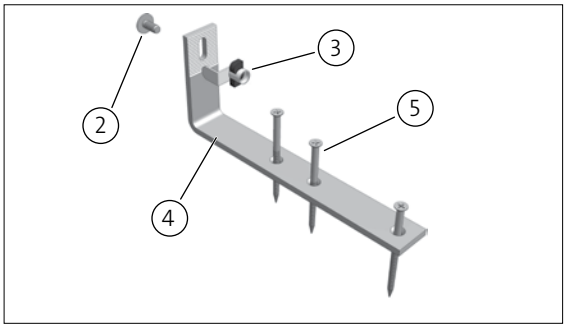


Fig. B 9.2-1 Slate roof hook 0°

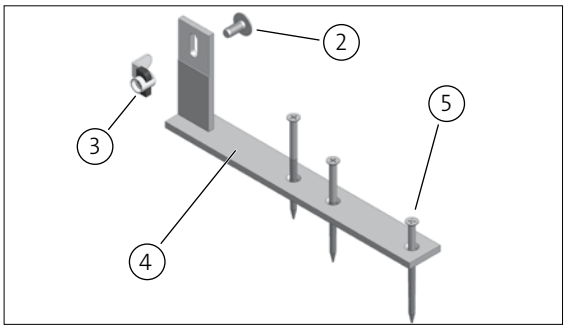


Fig. B 9.2-2 Slate roof hook 90°

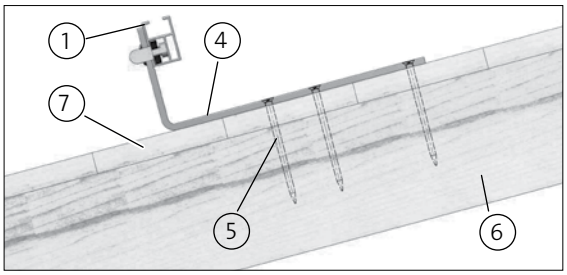


Fig. B9.2-3 Installed state

The slate/shingle roof hook fastener set is suitable for shingle roofs as well as bitumen roofs (e.g., bitumen shingles).

① Supporting profile
② M8 screw
③ Fastener set yellow
④ Slate roof hooks
⑤ M6 countersunk wood screw
⑥ Rafters
⑦ Formwork

The roof hook must lie directly on the supporting substructure. Because of the sealing, a plate must always be laid under the roof hook. (To be provided on site, plates not included in the kit).
When mounting on bitumen roofs, the hook must be sealed again afterwards.

When mounting on shingle and bitumen roofs, we recommend calling in a roofer to ensure that the structure is properly sealed.

Slate/shingle roof hook technical data

Fastening to wood substructure	Countersunk screws 6x100mm 6x180mm
Req. Embedment depth of countersunk screws in the wood substructure	60 mm
Minimum wood rafter dimensions w x h	50x100mm
Fastening angle to frame	0° and 90° (see fig.)
Driver for countersunk screw	T25

B9.3 Hanger bolt fastener set

The hanger bolt fastener set is suitable for mounting on roofs with fiber cement corrugated panel and trapezoidal corrugated covering with wood substructure.

There are several fastening options for hanger bolts. One or two hanger bolts may be used depending on requirements. An angle flange is used with the hanger bolt. The "double flange" fastener set with two M10 or M12 hanger bolts is used for special requirements.

The metric thread can be used to even out the height between the hanger bolts.

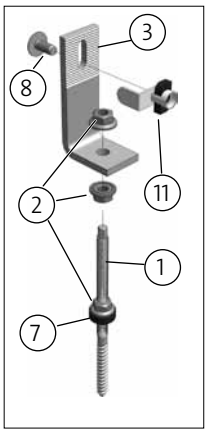


Fig. B 9.4-1

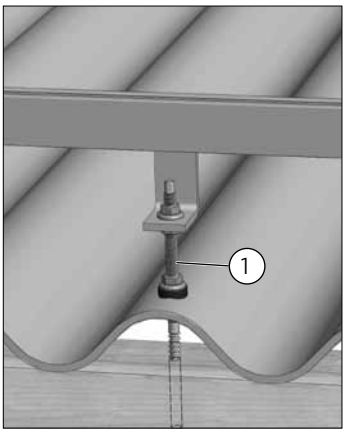


Fig. B 9.4-2

① M10/12 hanger bolt
② M10/12 flange nut
③ Angle flange
④ Double flange
⑤ L-angle
⑥ M8 coach screw
⑦ EPDM seal
⑧ M8 screw
⑨ M8 flange nut
⑩ Wood substructure
⑪ Fastener set yellow

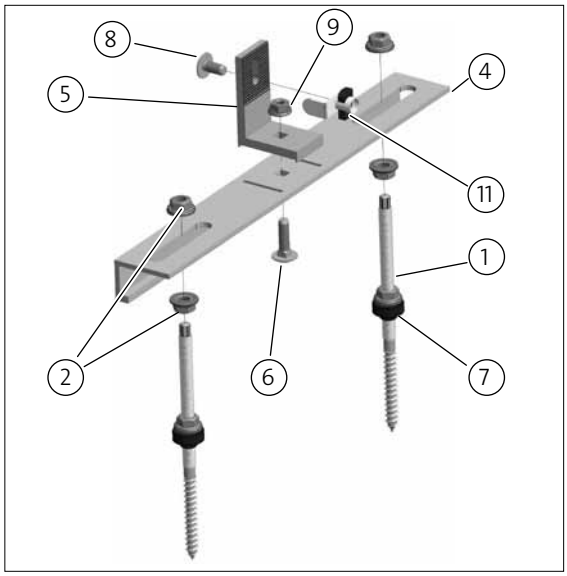


Fig. B 9.4-3

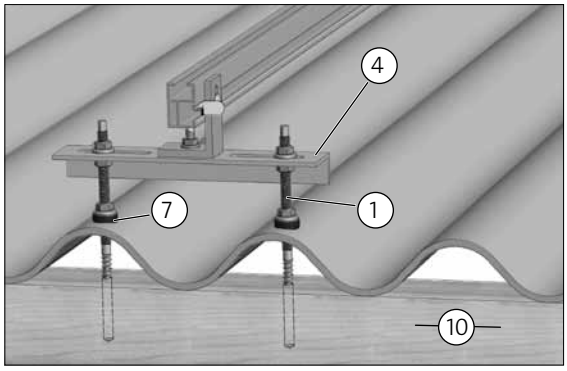


Fig. B 9.4-4

Hanger bolt fastener set technical data

Fastening to supporting profile	Angle flange (with 1 hanger bolt) Double flange (with 2 hanger bolts)
Hanger bolt diameter	M10 (L = 190-350 mm) M10 (L = 90-270 mm)
Req. Embedment depth of hanger bolt in the wood substructure	70 mm
Minimum wooden beam dimensions w/h	70/70 mm for M10 84/70 mm for M12
Pilot hole diameter in roof covering	d_s + 2 mm (d_s = screw shank diameter)
Pilot hole diameter in wood substructure	0.7 x d_s
Driver for hanger bolt	Hex

Assembly:

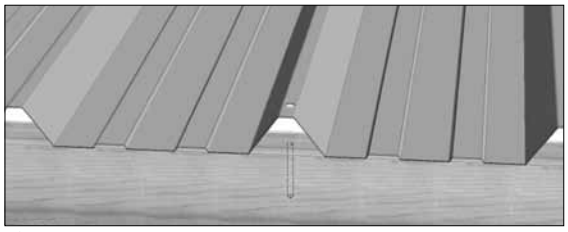


Fig. B 9.4-5

1. Drill pilot hole in wood substructure and roof covering.

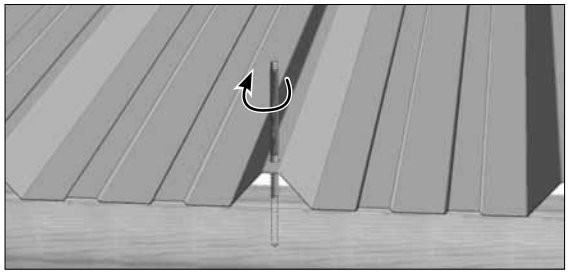


Fig. B 9.4-6

2. Screw in hanger bolt.

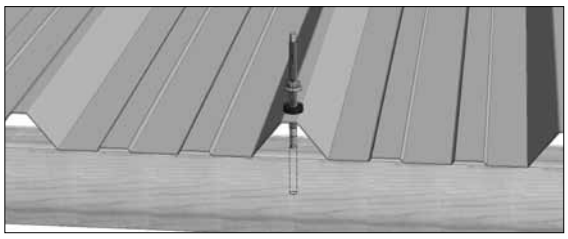


Fig. B 9.4-7

3. Place rubber seal and spacer, screw nut on and tighten (rubber seal should be slightly compressed).

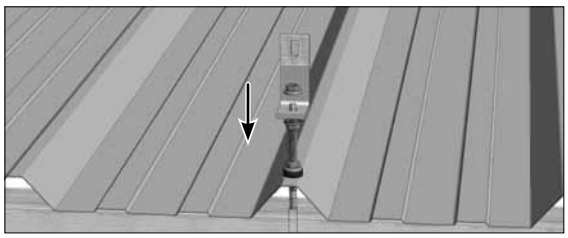


Fig. B 9.4-8

4. Mount angle flange.

B9.4 Solar fastener set

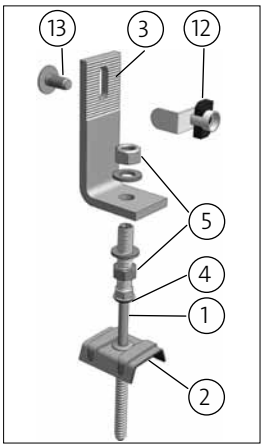


Fig. B 9.5-0 Solar fastener with storm washer and angle flange

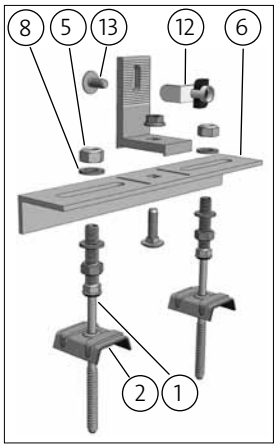


Fig. B 9.5-0a Solar fastener with storm washer and double flange, short

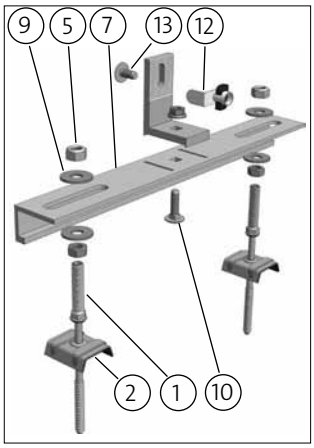


Fig. B 9.5-0b Solar fastener with storm washer and double flange, long

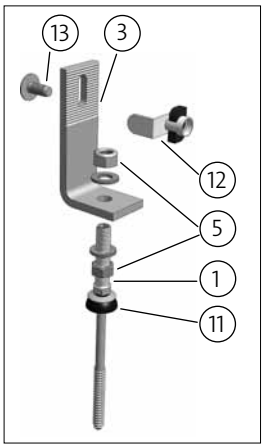


Fig. 9.5-0c Solar fastener with FZD seal and angle flange

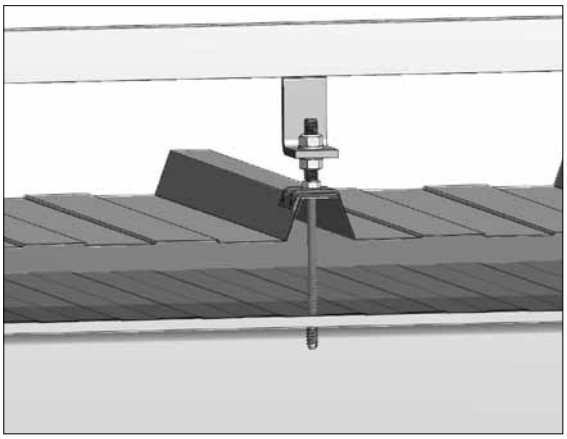


Fig. B 9.5-1 Solar fastener in steel substructure

① Solar fastener
② Storm washer
③ Angle flange
④ Seal
⑤ M10 nut
⑥ Double flange
⑦ Long double flange
⑧ Flat washer
⑨ Large flat washer
⑩ M8 screw
⑪ FZD seal
⑫ Fastener set yellow
⑬ M8 screw

The solar fastener is a mounting part for installing solar power systems onto sandwich roofs. It is available in several types and is screwed into the substructure of the roof (wood or steel). A storm washer is included to ensure stability and water proofing. The solar fasteners can also be used with trapezoidal and sinusoidal corrugated roofs.

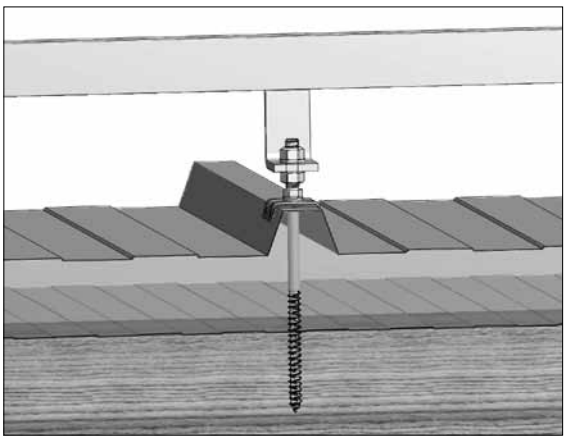


Fig. B 9.5-1a Solar fastener in wood substructure

Important points regarding solar fastener mounting:

- The solar fastener is always anchored in the substructure.
- Both steel and wood purlins are suitable for the substructure.
- The manufacturer's approval EJOT R Z.14.4-532 must be observed.

Recommended procedure for installing the solar fasteners:

1. Select the pilot hole diameter according to the table.
2. Select the bit length and hole depth depending on the screw length.
3. Drill the hole.

The hole depth must be at least 10 mm greater than the screw penetration depth.

The hole must be drilled perpendicular to the surface.

4. Remove bore chips from the surface.
5. Place storm washer.
6. Screw in the solar fastener with a screwdriver and suitable bit (see table) at n ≤ 100 rpm.

The sealing discs should not be compressed more than 25% (nearly flat).

Table of solar fasteners

Screw	Designation	Substructure [mm]	Pilot hole diameter	Driver for Thread rod	Screw length/ Screw-in depth [mm]
	JZ3-SB-8.0xL-E16/8 + Storm washer	Steel 1.5 ... < 5.0 5.0 ... < 7.5 7.5 ... < 10 ≥ 10 mm	6.8 7.0 7.2 7.4	SW 5	Screw length: Sandwich element thickness or trapezoidal profile height + 20 mm
	JZ3-SB-8.0xL-FZD				
	JA3-SB-8.0xL-E16/8 + Storm washer	Wood	5.5	SW 5	32/-96
	JA3-SB-8.0xL-FZD		5.5		32/-96

Additional measures in case of transverse load on solar fasteners

If the solar fasteners are loaded crosswise to the profiled sheets (this is only the case with standoffs perpendicular to the roof pitch), the profiled sheets must be fastened to the substructure at the same height in the neighbouring troughs (see B 9.5-2). These fastening elements must be designed so that the shear forces are transferred from the solar fasteners to the substructure. In the case of shear forces from the solar fasteners in the longitudinal direction of the profiled sheets, more remote connections of the corresponding profiled sheet with the substructure are also permitted to be included for the load transfer.

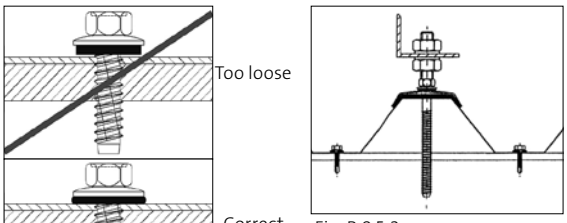


Fig. B 9.5-2

Fig. B 9.5-3

The following Ejot screws (or equivalent screws*) can be used:
Wood substructures

Screws	JT3-2-6.5 x L with 22 mm diam. sealing disc
Length L	Thickness of sandwich profile in wave valley + 50 mm
Pilot hole diameter	No pilot hole

Steel substructures

Screws	JZ3-6.3 x L with 22 mm diam. sealing disc	
Length L	Thickness of sandwich profile in wave valley + 20 mm	
Pilot hole diameter	Depends on the thickness of the steel element	
	Thickness of steel element [mm]	Pilot hole diameter [mm]
	2.0 ≤ d < 5.0	5.3
	5.0 ≤ d < 7.0	5.5
	d ≥ 7.0	5.7

*Screws sold separately!

B9.5 Trapezoidal roof fastener set

The trapezoidal roof fastener set is suitable for fastening to steel trapezoidal corrugated sheets.
Bulb-tite blind rivets are used for the fastening. The number and spacing of the rivets depends on the static conditions.

☑ The Fix Plus T profiles must be mounted perpendicular to the raised beads of the trapezoidal sheet! Profile connectors are not necessary.

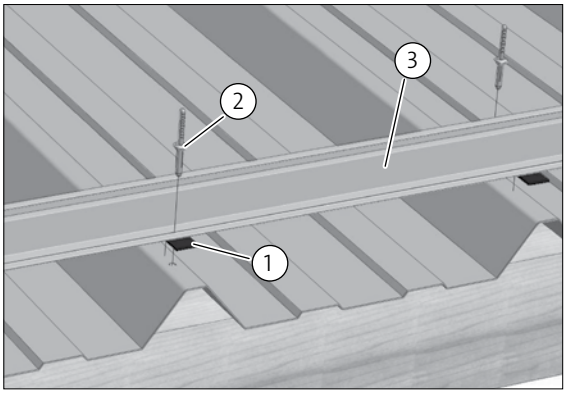


Fig. B 9.6-1

① EPDM rubber
② Bulb-tite blind rivet
③ Fix Plus T profile

Trapezoidal sheet fastener set technical data

Minimum sheet thickness, trapezoidal sheet	Steel	t ≥ 0.63 mm
	Aluminum	t ≥ 0.70 mm; R_m ≥ 165 N/mm²
Fastening	Bulb-tite blind rivet	
Pilot hole diameter	5.4 mm	
Profile spacing (profile joint)	5 – 7 mm	

Assembly:

For the required number and arrangement of the rivets, see your system planning information.

1. Affix EPDM rubber to the rivet points of the trapezoidal sheet.
2. Place frame.
3. Drill rivet pilot holes (arrange first and last rivet on the frame ends above the supporting profile bracket, then place all following rivets alternating above and below).
4. Install rivets.

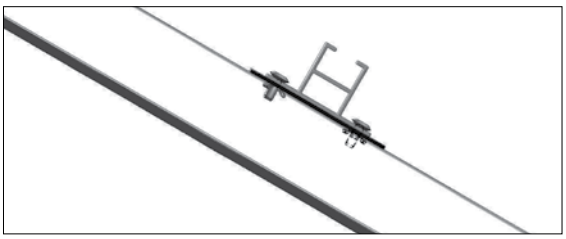


Fig. B 9.6-2 cross section

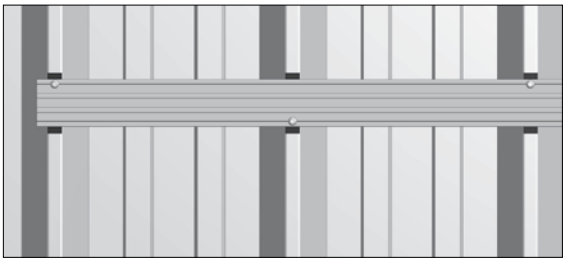


Fig. B 9.6-3 top view

B9.6 Kalzip roof fastener set (seam clips)

The seam clip is suitable for Kalzip profiled sheet roof coverings

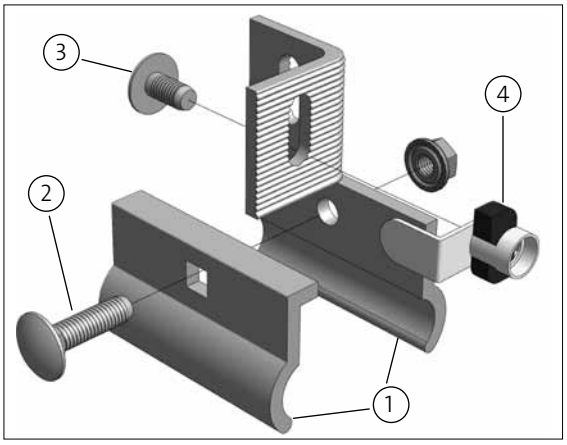


Fig. B 9.7-1

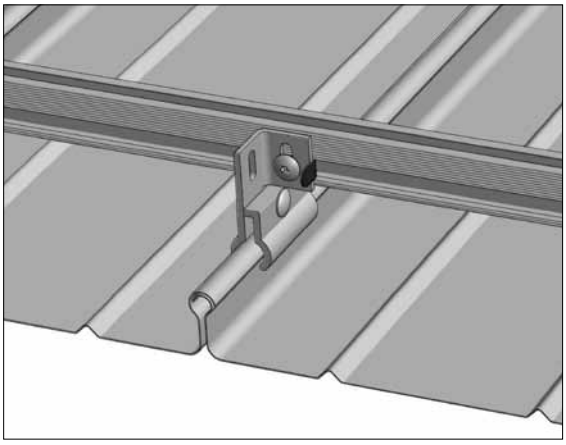


Fig. B 9.7-2

① Seam clip
② M8 screw with square neck
③ M8x30 screw
④ Fastener set yellow

Kalzip roof fastener set (seam clips) technical data

Minimum sheet thickness, Kalzip Sheet	Aluminum	t ≥ 0.80 mm
Req. Clip distance, Kalzip Sheet		e ≤ 2.00 m

Installation notes:

- The seam clips should be arranged so that as many profiled sheets as possible are uniformly stressed.
- The customer must ensure the load transmission from the covering to the substructure.

B10 Bonding/grounding

☑ Professional grounding is the responsibility of the installation company.

No exterior lightning protection
Functional grounding recommended for jig. Connect all electrically conductive parts to one another by suitable means and connect them to the main grounding rail (equipotential bonding strip) with at least 6 mm² (copper).

Exterior lightning protection present
PV module frame and jig must be included in the protection concept for direct lighting strikes. Consult a lightning protection professional if needed.

B11 Required ballast load (optional)

If the frames are not directly connected to the roof, then they must be equipped with ballast, in relation to the external conditions. This serves to avoid lifting, toppling or shifting of the system as a result of wind loads. These are to be determined individually for each system in relation to the building and location.

The following table details an example installation for buildings in wind load zone 1 with a module inclination of 30° (based on wind loads according to EN 1991-1-4).

Building height [m]	**Wind load q [kN/m²]**	**Minimum required ballast for module inclination 30° [kg]**			
		per m² module area		**per module 1001x1675 mm²**	
		Perimeter area	Interior area	Perimeter area	Interior area
0/-10	0.50	121	61	202	101
10/-18	0.65	161	81	270	135
18/-25	0.75	187	94	314	157

Other values apply for differing angles of elevation and wind load zones. The required loads are a component part of any system planning process and are determined individually for each system.

Mounting example

C

The following describes an example installation of a PV-system on a trapezoidal corrugated roof with wood substructure. Hanger bolts and the stainless steel angle flange are used for fastening to the substructure. The modules are elevated with Type A flat roof frames (modules with landscape orientation).

C1 Determining the system position and attachment points

Determine the position of the system on the roof and mark it. Observe the edge distances indicated in the plan. Position the supports according to the enclosed mounting plan, adapted to the local conditions (hanger bolts shown in example).

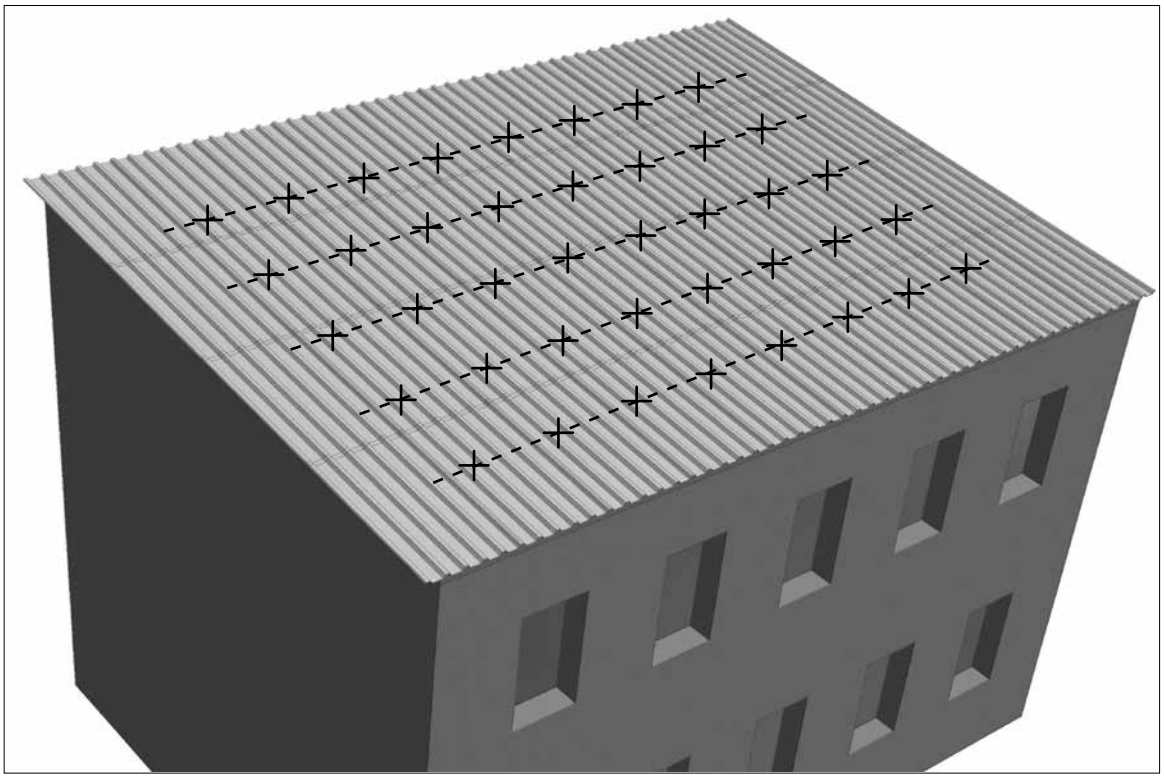


Fig. C 1-1

C2 Installing the mounting components

The hanger bolts and angle flange are to be installed at the pre-determined positions.

Please refer to chapter B9 – Fastening Options.

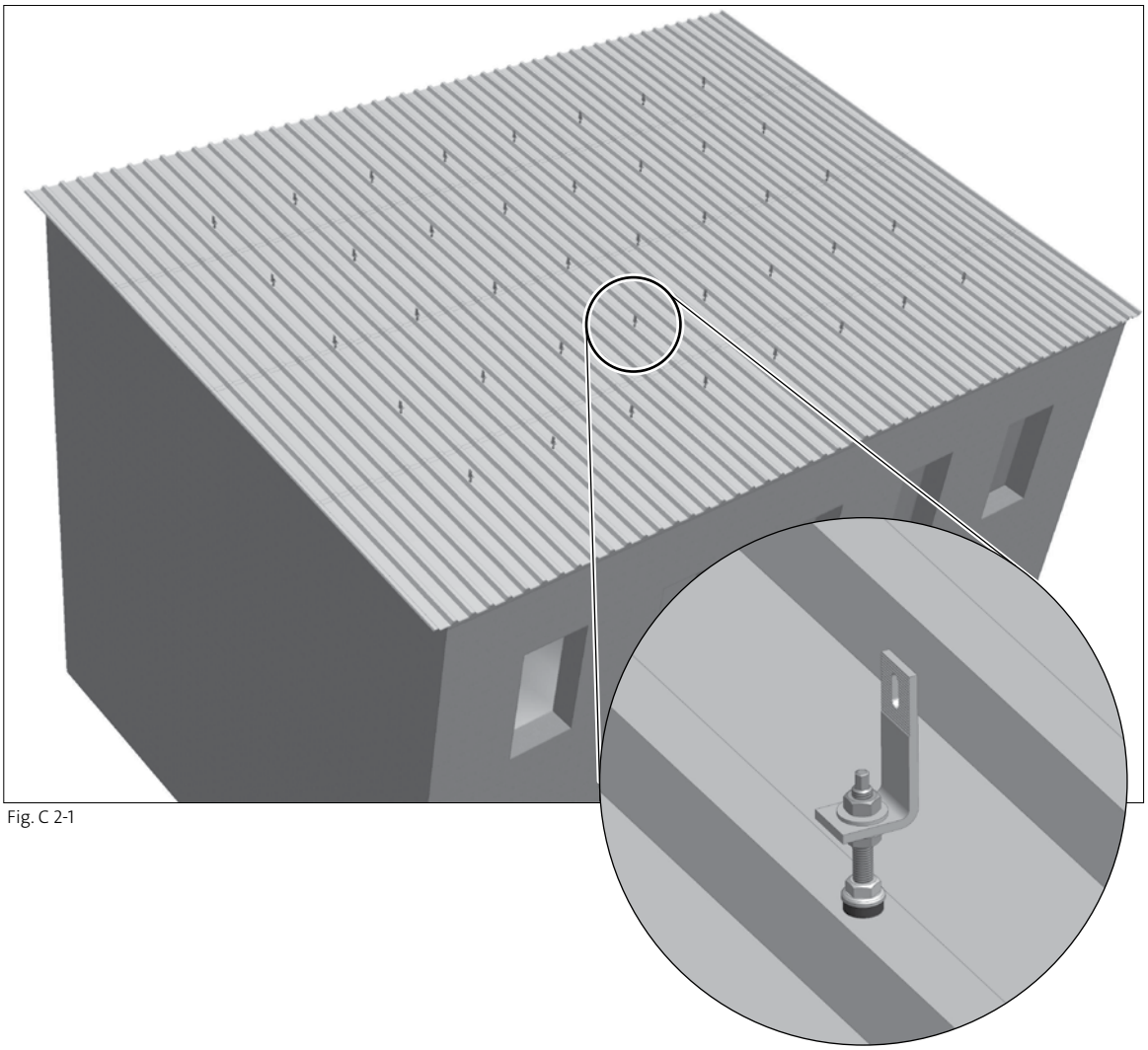


Fig. C 2-1

C3 Installing the supporting profiles

Mounting the bottom profile layer

Align the vertical supporting profiles on the top and bottom in a row and fasten to the angle flange using one M8 Torx screw each with slot nut.

If necessary: Insert profile connector between the profiles.

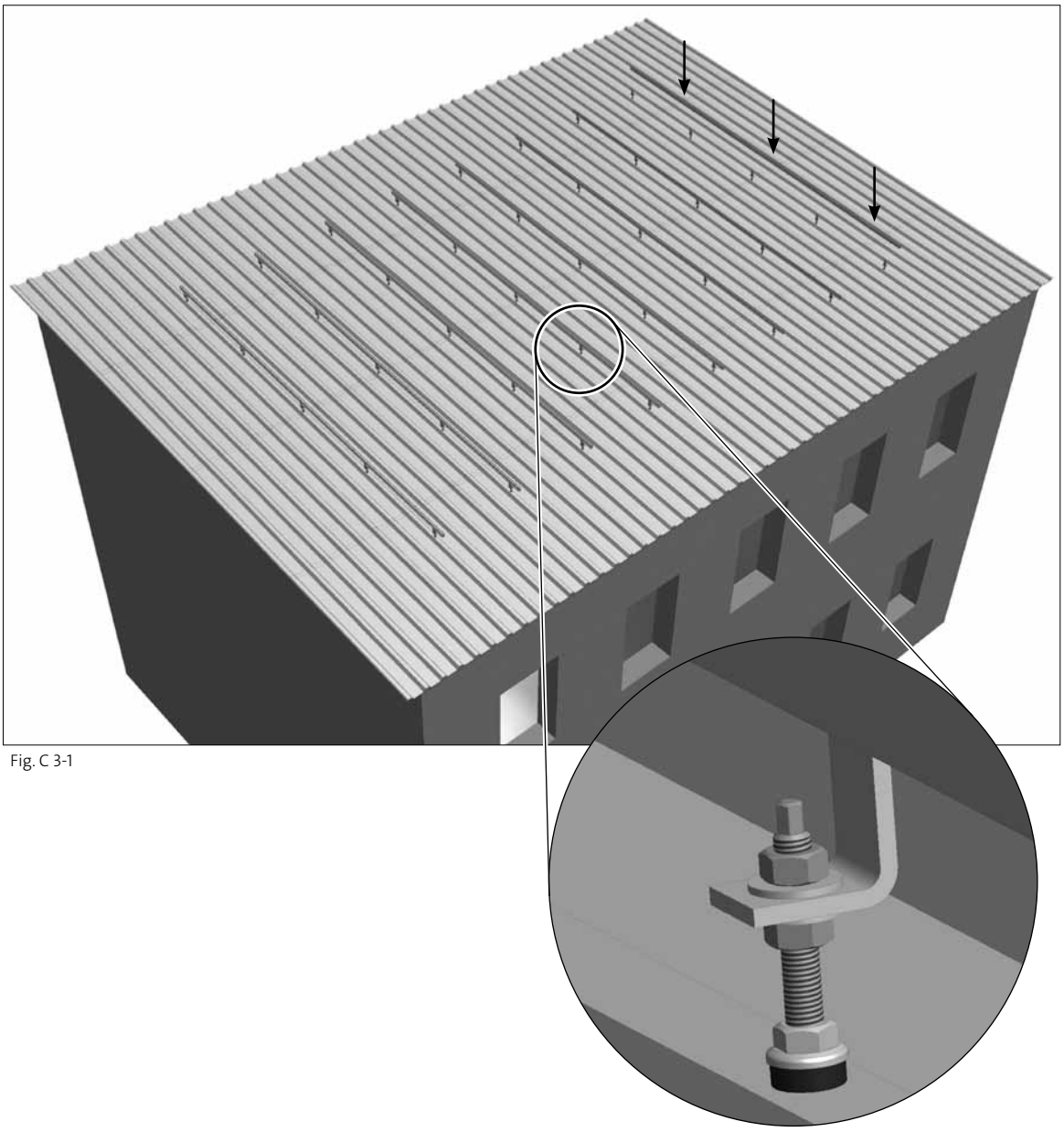


Fig. C 3-1

Mounting the upper profile layer

Mount the horizontal supporting profile by means of aluminum clamps. If necessary: Insert profile connector for connections in lengthwise direction between frames.

- Install upper profile layer with the groove in the direction of the eaves.
- Distance of the profile layer:
  Type A approx. 1035 mm
  Type B approx. 1209 mm

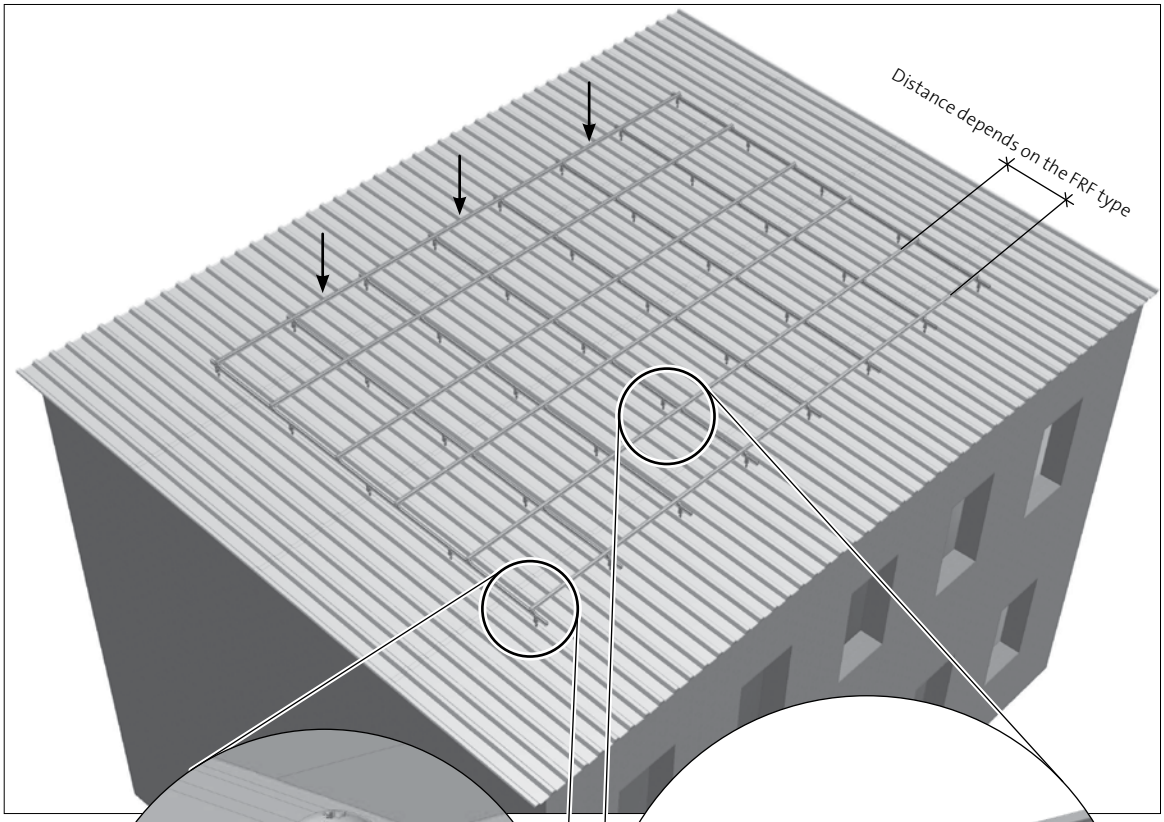


Fig. C 3-2

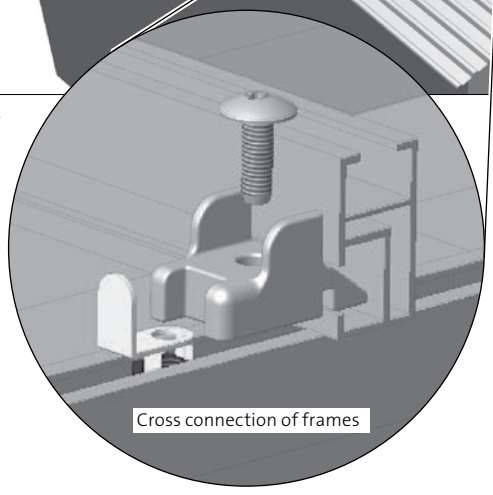


Fig. C 3-2 Detail 1

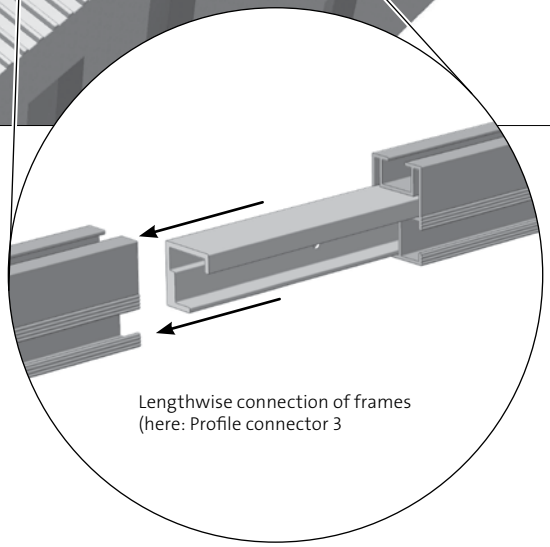


Fig. C 3-2 Detail 2

C4 Installation of the flat roof frames

C4.1 Threaded assemblies for flat roof frames

Screw the pre-assembled frames together.

Torque M_A = 20 Nm for M8 screws

Type A

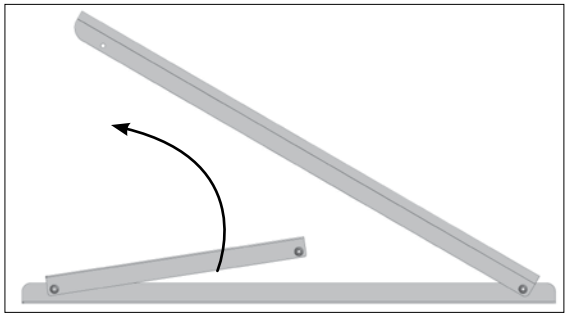


Fig. C 4.1-1a

Type B

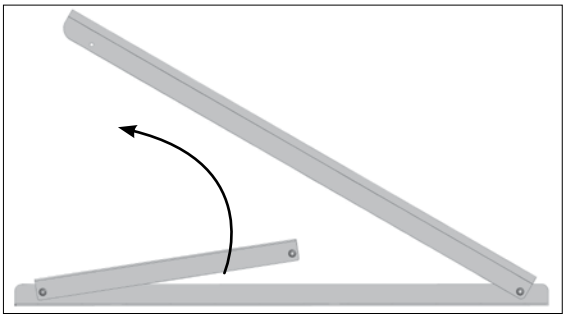


Fig. C 4.1-1b

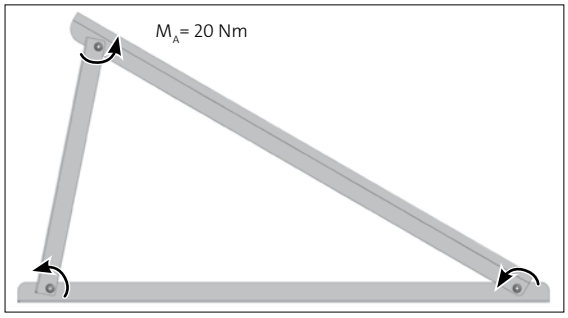


Fig. C 4.1-2a

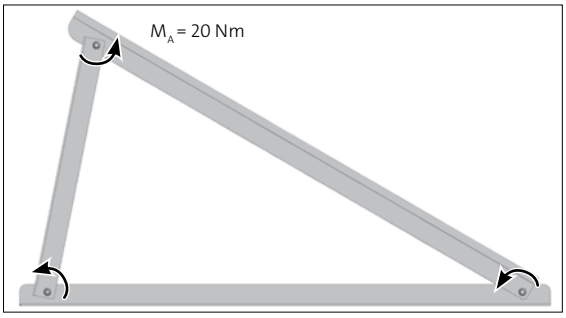


Fig. C 4.1-2b

C4.2 Fastening of flat roof frames

Mount flat roof frames with the specified spacing.

Type A

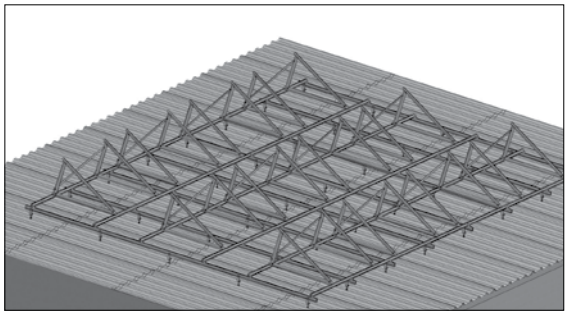


Fig. C 4.2-1

Type B

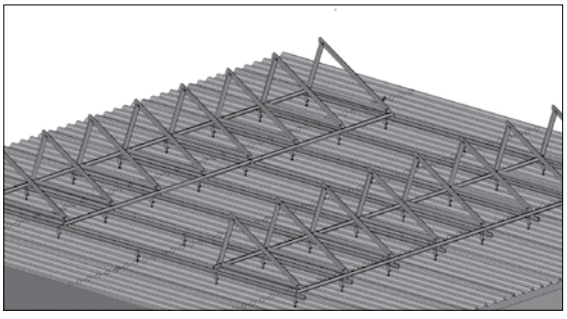


Fig. C 4.2-2

C5 Installing the clamp layer

Type A
Clamp layer not necessary.

Type B
Screw the supporting profile clamp layer to the flat roof frames. If necessary, mount profiles with connectors. Install profiles on end! Install clamp positioned underneath (see detail)!

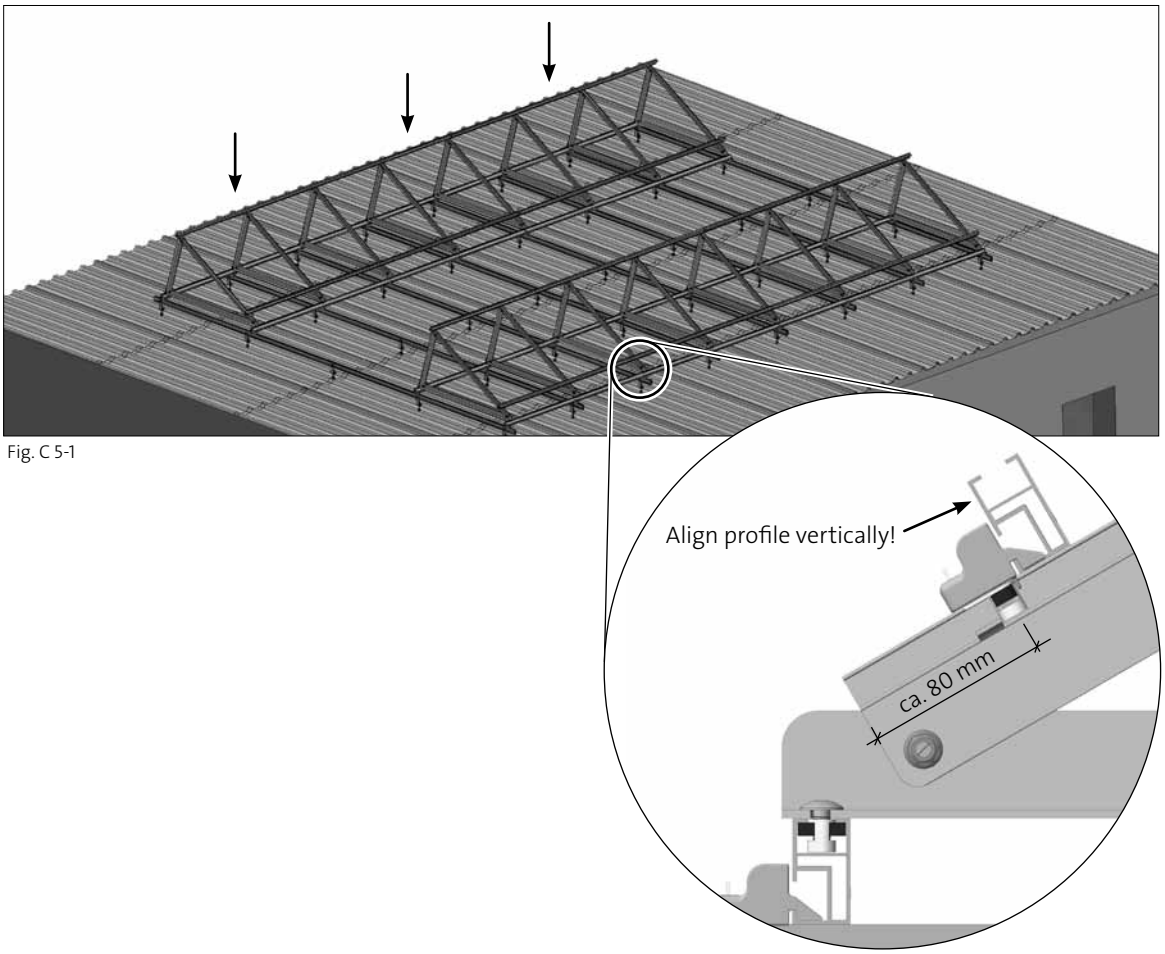


Fig. C 5-1

C6 Installing the modules

Type A

Install the modules in accordance with chapter B8

- ▶ Read the module instructions provided with the modules.

Torque M_A = 15 Nm
The distance between the modules is a = 9 mm

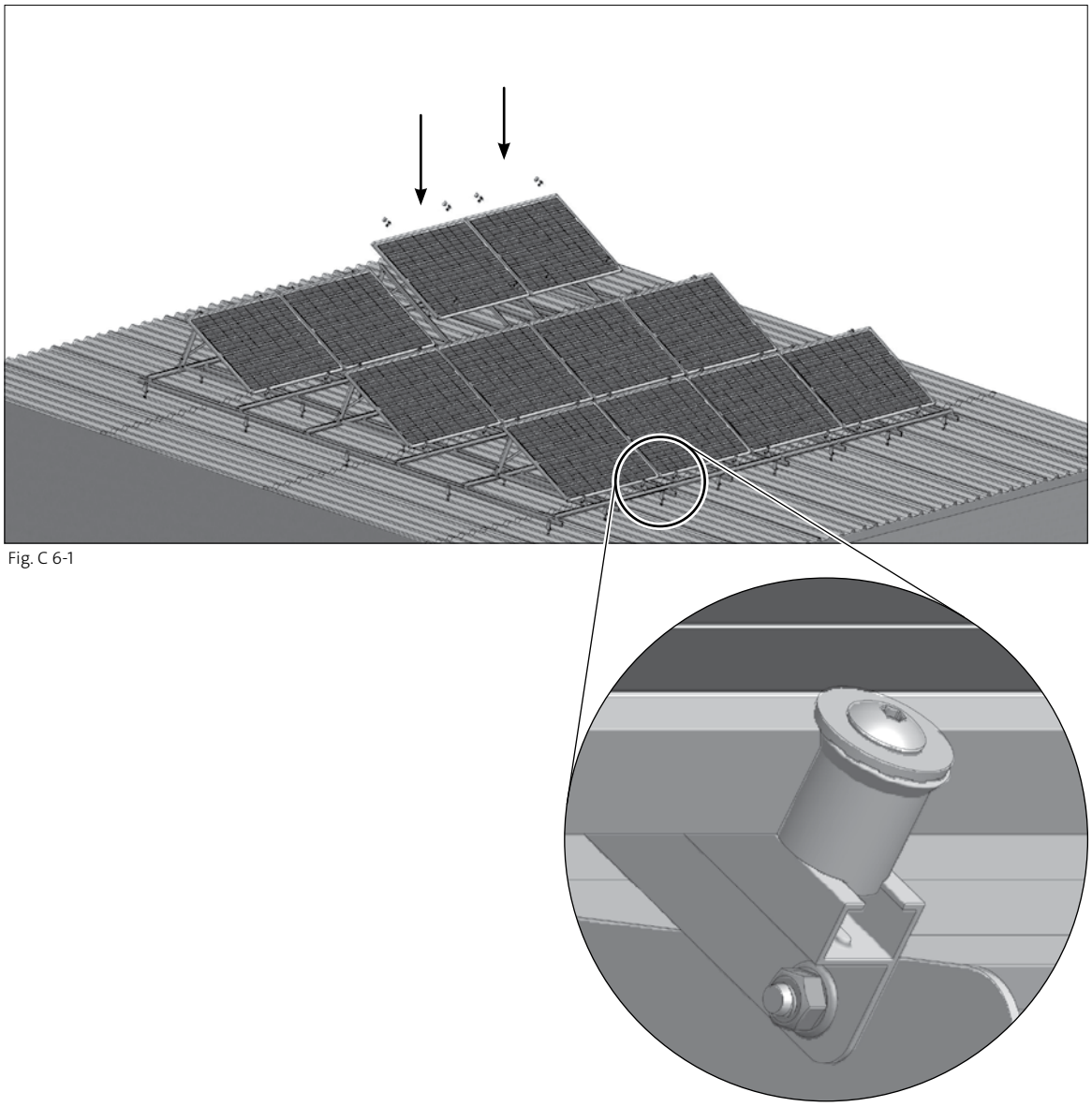


Fig. C 6-1

Type B

Install the modules in accordance with chapter B8

- ▶ Read the module instructions provided with the modules.

☑ Torque M_A = 15 Nm
The distance between the modules is a = 9 mm

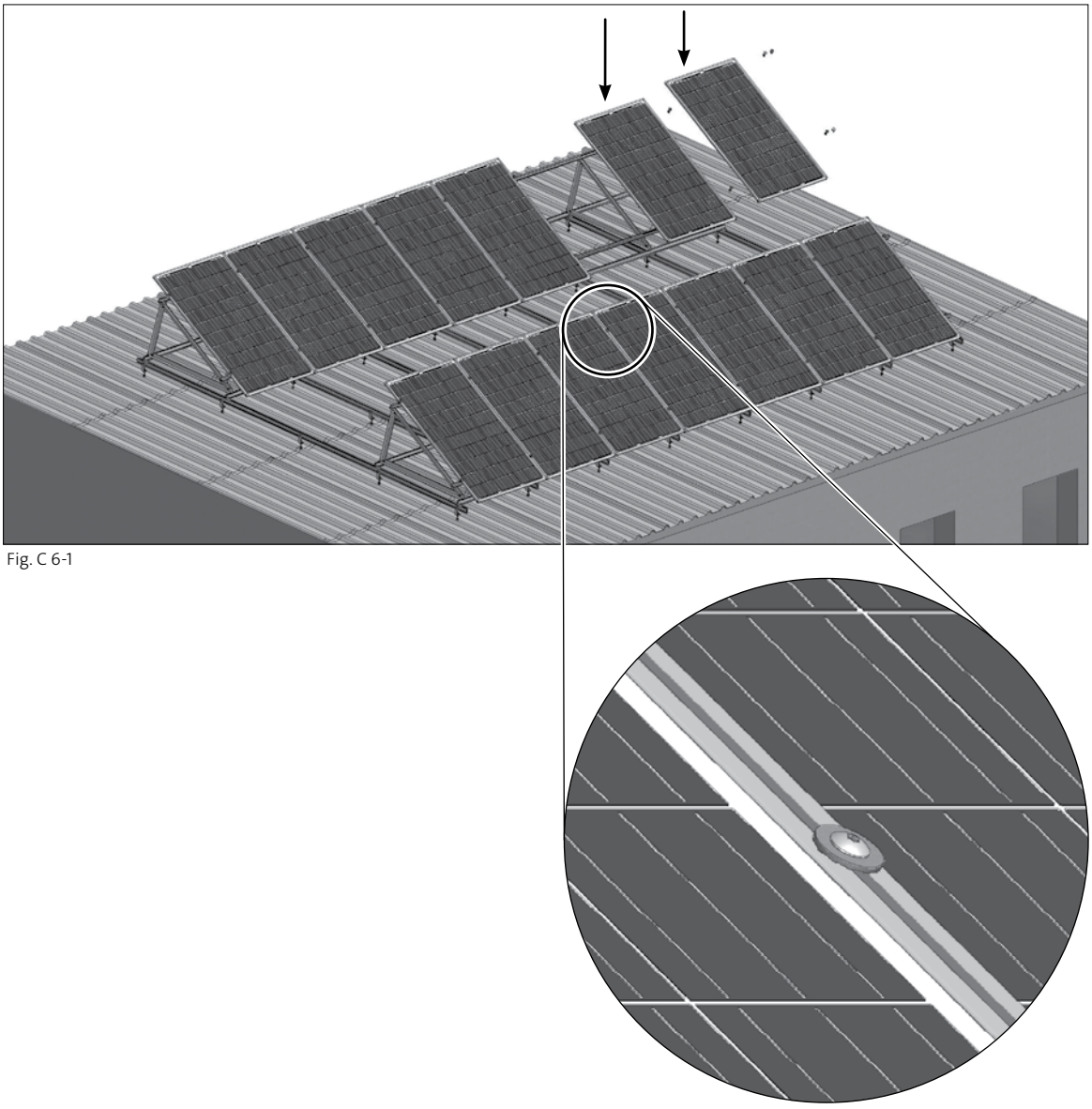


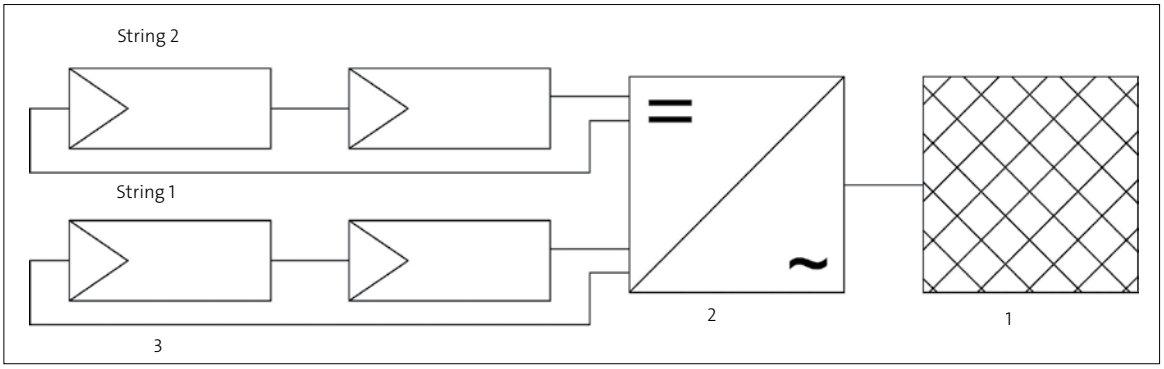
Fig. C 6-1

C7 Module wiring

⚠ DANGER!

Lethal voltage

- Connecting modules in series can cause lethal voltages!
- Never connect the inverter for testing.
- The solar system may be connected to the public grid and isolated only by a certified electrician.
- The technical instructions enclosed with the unit shall be strictly adhered to for the installation, electrical connection and operation of the grid-connected inverter.



1 Power supply
2 Inverters
3 Solar power generator

1. Wire the modules according to the wiring diagram.
   - Adhere strictly to the specifications of the wiring plan (distribution of the strings, any separating filters, cable groups). Improper wiring can destroy the inverter and/or modules.
   - In order to minimize inductive coupling in case of lightning strike current, the outgoing and return lines (+/-) of the string must be laid as close to one another as possible (while avoiding looping).
   - Do not under any circumstances allow less than the minimum bending radius (5x the cable diameter).
   - Do not mount or install modules at temperatures below -5°C.
   - Keep sockets and plugs dry during installation.
2. Lay the cable group.
3. Fasten the cables to the supporting profile with UV-resistant cable ties.
4. Mount and wire the next module rows. making sure of correct polarity.

Testing

1. Check that the multistring solar generator is correctly connected by measuring the open circuit voltage of the individual strings.
2. Compare the measured values with the specifications.

Deviations are a sign of a wiring error.

C8 Example installation with ballast (shown here: type A)

- Required ballast in accordance with framing plan
- Ballast is to be provided on site by the customer (e.g. concrete columns)
- Please refer to chap. B11 for sample ballast specifications

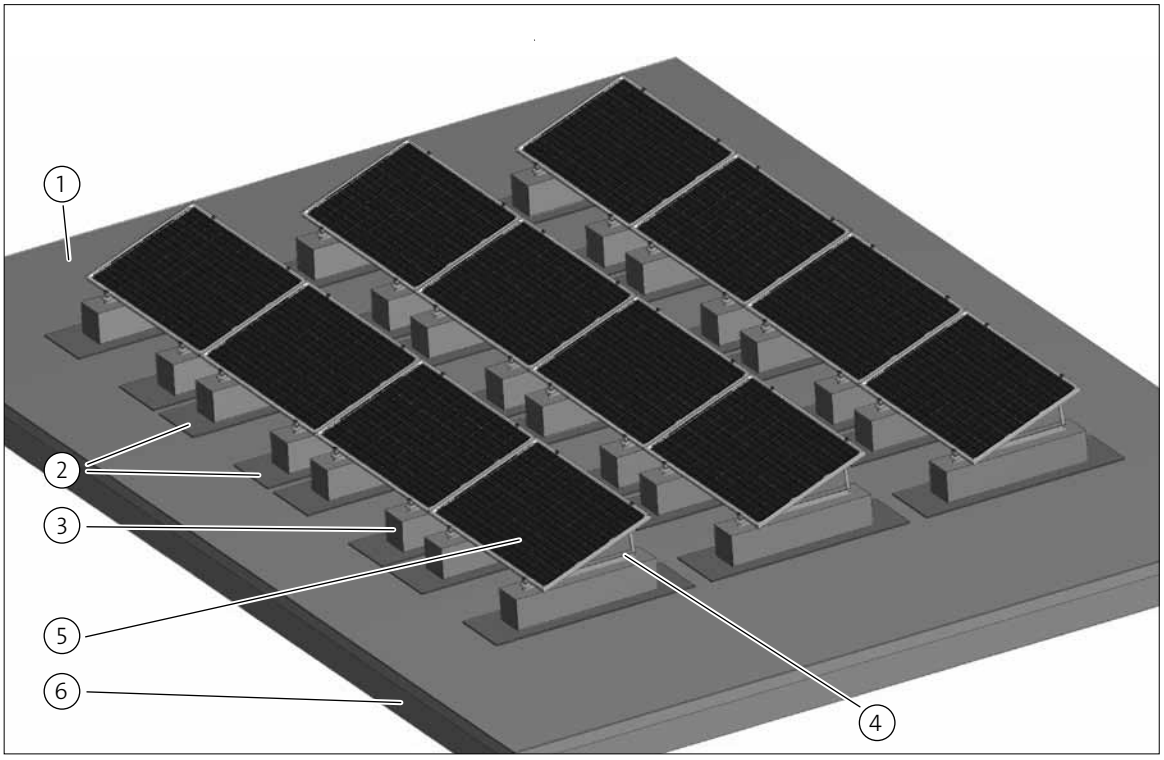


Fig. C 8-1

① Roof covering
② Protective mat
③ Ballast (to be provided by the customer)
④ Flat roof frames
⑤ Solar power module
⑥ Existing flat roof (e.g. reinforced concrete floor with insulation)

Maintenance and cleaning

D

CAUTION!

- For repairs, use original factory spare parts only!
- The use of other spare parts can cause serious personal injury and property damage!

- Do not stand or walk on modules.

- With a roof pitch of >15°, it is generally not necessary to clean the modules, as rainfall will have a self-cleaning effect.
- In case of heavy soiling (reduced performance), we recommend cleaning with large amounts of water (using a hose) and a gentle cleaning tool (sponge). Under no circumstances may the dirt be scraped or rubbed off dry, as this may cause micro scratches that would impair module performance.
- The generator array should be inspected at regular intervals for flawless condition (visual inspection, connection check).

PV system maintenance

The system should be inspected annually for the following:

- All fasteners secure and free of corrosion
- All cable connections secure, clean and free of corrosion
- Cables and front glass intact

Liability

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- Since it is not possible to check or monitor compliance with the installation manual and the conditions and methods of the installation, operation, use and maintenance of the Sunfix plus mounting system from SolarWorld, SolarWorld AG can accept no liability for damage arising due to improper use, installation, operation or maintenance. Liability on the part of SolarWorld is further excluded if SolarWorld, its representatives or vicarious agents are not at fault due to gross negligence or intent. The preceding limitations shall not apply to damage due to loss of life, physical injury or health damage or in cases in which liability is mandated by law, e.g. in liability for acceptance of a warranty, liability under the German Product Liability Law or in cases of culpable violation of essential contractual obligations (cardinal obligations).
- The preceding limitations of liability notwithstanding, liability on the part of SolarWorld for patent law violations or violations of the rights of third parties arising due to the use of the modules and the mounting system is excluded unless required by law.
- The text and images in this installation manual correspond to the state of the art upon printing. Subject to change.

Notes

Notes

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Solar Factory/Freiberg, Germany
Sunicon/Freiberg, Germany
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Sales

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SolarWorld AG
Martin-Luther-King-Str. 24
53175 Bonn, Germany
Germany

SolarWorld Ibérica, S.L.
C/La Granja 15,
Bloque B-1°B
28108 Alcobendas, Madrid
Spain

SolarWorld Americas LLC.
4650 Adohr Lane
Camarillo, CA 93012
USA

SolarWorld France SAS
Hôtel de l'Entreprise, Petite Halle, Bouchayer-Viallet
31, rue Gustave Eiffel
38000 Grenoble
France

SolarWorld Africa Pty. Ltd.
20th Floor
1 Thibault Square
Cape Town, 8001
South Africa

SolarWorld Asia Pacific Pte. Ltd.
72 Bendemeer Road
#07-01, Luzerne
Singapore 339941
Singapore

SolarWorld AG
Martin-Luther-King-Str. 24
53175 Bonn, Germany
Germany
Phone: +49 228 55920 0
Fax: +49 228 55920 99
service@solarworld-global.com

www.solarworld.com

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