

Installer manual
SOLAR FP215 P/PL

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1 Important information

This manual describes installation and service procedures for implementation by specialists.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

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Symbols



NOTE

This symbol indicates danger to machine or person.



Caution

This symbol indicates important information about what you should observe when maintaining your installation.



TIP

This symbol indicates tips on how to facilitate using the product.

Marking

SOLAR FP215 P/PL is CE marked and fulfils IP21.

The CE marking means that NIBE ensures that the product meets all regulations that are placed on it based on relevant EU directives. The CE mark is obligatory for most products sold in the EU, regardless where they are made.

IP21 means that the product can be touched by hand, that objects with a diameter larger than or equivalent to 12.5 mm cannot penetrate and cause damage and that the product is protected against vertically falling drops.

Warranty

The manufacturer's warranty for solar panels applies for 60 months from the date of delivery to the installer.

For solar panel accessories such as pumps, solar energy controls, expansion tanks, solar energy connection pipes, roof mountings, solar energy tanks, connectors, valves etc. the manufacturer's warranty applies for 24 months from the date of delivery to the installer.

The warranty applies if the installer has filled in and signed the installation protocol supplied and sent it in to NIBE

in the relevant country within 2 months of the installation being completed.

The Installation protocol can be sent via e-mail, fax or letter and the proof of receipt or counterfoil must be saved. This is then signed by NIBE in the country which indicates any measures that need to be made by the installer. The signed copy is then sent to the owner of the system.

The warranty does not apply if the unit has not been installed correctly, or if there has been carelessness with the components, or incorrect sizing, or handling faults or insufficient maintenance, or other fault management according to common practice.

The warranty does not cover damage in or to the building or damage to other equipment or property that has been caused directly or indirectly by faulty solar products. The warranty does not apply in event of incorrect installation or handling.

The warranty does not cover damage caused by fire, water damage, external impact, vandalism or weather related damage such as excessive snow, storms or thunderstorms etc.

NOTE! Warranty faults must be notified within 14 days.

Copyright

The manufacturer retains the copyright for this manual. These instructions may only be distributed, translated or copied with the written permission of the manufacturer. We reserve the right to make changes to the specifications or illustrations in this manual without prior notification.

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For countries not mention in this list, please contact Nibe Sweden or check www.nibe.eu for more information.

2 Delivery and handling

Delivery

Together with the driver, check the delivery immediately for the following:

- Visible damage (compressed packaging etc.)
- That the correct number of packages have been delivered
- That the solar panels in particular are undamaged.

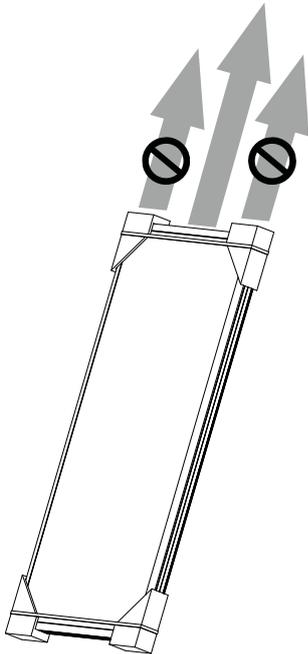
Handling

It is recommended that straps are used when transporting solar panels. The solar panel must not be lifted by straps or the packaging. Avoid shocks and mechanical impact on the solar panel, particularly on the glass surface, the pipe connections and the reverse of the panel.



NOTE

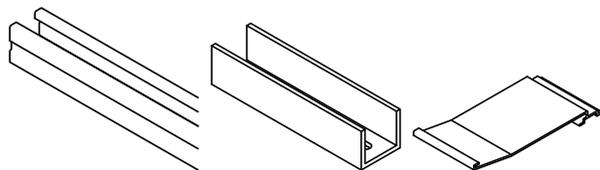
Do not lift the solar panels by the packaging or connectors. Do not place the solar panels on objects that can damage them, nor pull or drag them over anything that can damage them.



Supplied components

Varies depending on the type of roof installation configuration that has been ordered.

SOLAR FP215 P/PL for mounting on roofs



Mounting rail

Joint kit

Profile hook



Fixing wedge, middle



Fixing wedge, external



Wing nut M10



Self locking nut M10

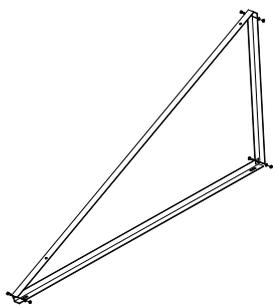


Washer 10.5



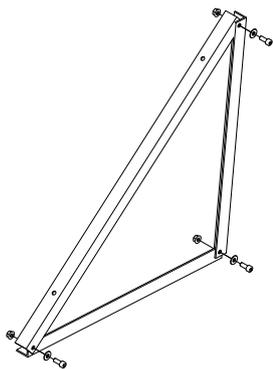
Screw M10x25

SOLAR FP215 P for installation on flat / low pitch roofs



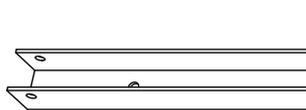
Support stand 25°

SOLAR FP215 PL for installation on flat / low pitch roofs

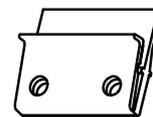


Support stand 45°

SOLAR FP215 P/P for installation on adjustable stands on ground foundation / bitumen roofs



Rail, stand



External locking clamp



Lower Centre lock- Upper Centre locking clamp



Angle joint



Screw M10x10



Screw M10x25



Screw M10x65



Nut M10



Spacer 10.5x20x5

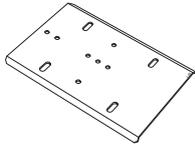


Washer 10.5

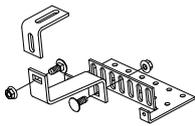


Spring washer B10.2

Underlying roof securing components



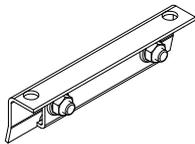
Universal fixing plate and bolt Adapter kit



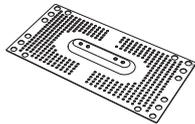
Tile roof bracket



Coach bolt



Standing seam holder



Raised sealing plate

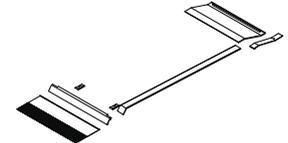
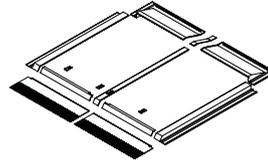


Bolt kit general

SOLAR FP215 P for installation on roofs

SMP-ID2 Basic kit for two solar panels

SMP-ID1 Expansion kit for each subsequent solar panel



Contents:

- 1 x left side piece
- 1 x right side piece
- 1 x right upper piece
- 1 x left upper piece
- 1 x right lower piece
- 1 x left lower piece
- 1 x left lead panel
- 1 x right lead panel
- 1 x intermediate panel
- 1 x upper intermediate panel

Small components:

- 4 x solar panel hooks
- 4 x fixing wedges, external
- 2 x fixing wedges, centre
- 17 x Torx screws M6 x 40
- 12 x nails
- 3 x panel screws
- 1 x panel screw 4.5 x 35
- 2 x foam strips
- 20 x clamps

Contents:

- 1 x right upper piece
- 1 x lower piece
- 1 x lead panel
- 1 x intermediate panel
- 1 x upper intermediate panel

Small components:

- 2 x solar panel hooks
- 2 x fixing wedges, centre
- 9 x Torx screws M6 x 40
- 6 x nails
- 1 x panel screw 4.5 x 35
- 2 x foam strips

3 Installation

General

The installation must only be carried out by competent personnel.

The supplied material is the minimum that is required for use with normal installations, in special cases it may need to be supplemented. If unsure contact the supplier. Before the installation and commissioning of the solar panel system, information must be obtained on the applicable norms and regulations.



NOTE

Installation of a solar panel is an extensive intervention on an existing roof. The roof covering, especially tiles, roof panels or slates - particularly on converted and inhabited loft spaces or where the roof's minimum angle is below size (relative to the covering) - requires further measures against moisture because of wind pressure and drifting snow, this must be evaluated by the installer on a case to case basis. The roof design must be able to handle the wind and snow loading that can occur in the region.

Static load

The installation may only be carried out on roof surfaces or support constructions with sufficient carrying capacity and durability. The static load capacity of the roof and roof construction must if necessary be examined before the solar panels are installed. Great weight should be placed on the condition of wood roof constructions and the possibility of screwing the mounting devices for the solar panels into the construction. The roof construction must be reinforced if necessary. Inspection of the whole solar panel installation in accordance with DIN 1055 parts 4 and 5, or in accordance with country specific regulations is particularly required in areas with snow fall and strong winds. The characteristics of the installation's location (prevailing wind direction, whirl winds etc.) must also be included in the calculation/evaluation of whether these could mean increased loads. The solar panel must be installed so that snow drifts from snow guards or because of special conditions in the installation location cannot occur in the vicinity of the solar panels.

The distance from the outer edges of the roof must be at least 1 m to minimise the risk of wind tearing the solar panel loose.

The installation system according to DIN 1055 part 5 for snow zone II is intended for use up to 400 m above sea level. We recommend that sheet metal roofs are used instead of tiles, which can break more easily and/or the number of brackets are increased at snow loads above 0.75 kN/m² or wind loads exceeding 0.5 kN/m². Sheet metal roofs are always better at resisting snow and wind

loads which is why these are primarily recommended. Stone tiles and slabs can crack more easily from the stresses that occur. If the installation is made on a tiled roof it is recommended that the snow is cleared if it reaches a depth of more than 30 cm on the solar panels. In certain cases the snow can be melted using the force operation with the circulation pump in the solar circuit. In roofs other than tiled a depth of 40 cm is acceptable before the snow must be cleared. (NOTE! If the snow has melted, packed down and then more snow has fallen and so the density has increased, the snow may need to be cleared despite the fact that it is not 30 cm or 40 cm deep.)

If there is a risk that the snow will slide down onto the panels and in particular behind the rear of raised panels, snow guards must be installed to prevent this.

Ensure that the material under the stone roof is sufficiently stable to accept the roof mounting points. Otherwise the roof must be reinforced. The installer must evaluate this and make a decision, if uncertain a structural engineer should be consulted. We recommend that the tiles are cut down so that there are no spot loads between the roof and the brackets. The minimum distance between stone roofs at overlap points and the underside of the brackets is 3 mm, this is in order to allow for the movements in the mountings system in reaction to the loads that occur.

Lightning protection/potential compensation

Principle: Because copper or steel pipes from the solar panel are connected to the solar pump and storage unit, electrical current could reach the electronic components.

Damage from lightning strikes is very rare, in practice systems rarely have lightning protection.

The requirement for lightning protection is stated in DIN EN 62305 (VDE 0185-305) 2006-10. The requirements for grounding are defined in DIN 18104:2007-09.

Internal lightning protection

Both direct lightning strikes and current spikes can damage the electronics in the control system. Therefore the constituent metal pipes and storage tank can be connected to a varistor. This internal lightning protection in conjunction with an external earth gives the installation a secure lightning protection.

External lightning protection

Technical systems on the building roof (for example solar panels, ventilation or parabolic antennas) must be protected by external lightning protection systems. The solar panels and the roof constructions must be integrated so that the solar panel field is protected from a direct lightning strike. The combined solar panel area must be located within the protective area provided by the lightning protection. A safety distance of 0.5 m in all directions

from the solar panel to the periphery of the protected area must be observed.

Solar panel angle/general

The solar panel can be angled between 20° and 70°. If the installation is to have a steeper inclination than 70°, extra measures are required to prevent rain from entering the solar panel's ventilation holes at the solar panel's upper edge. The protection must be designed so that the solar panel's ventilation still functions, for example a protective panel of a suitable shape.

Bear in mind that on steeper pitches and in particular high facades, it is extra important to install snow guards and to also further secure the mountings for the solar panels.

Venting / flushing and filling

If the solar panel is not to be commissioned immediately the protective foil should not be removed. It should remain on the solar panel until the solar panel is started. It protects the seals and the heating medium fluid against overheating. Protective foil or coverage of the solar panel needs to be managed in the event of draining the solar circuit or long term stand still of the empty system.

Damage due to overheating is not covered by the manufacturer's warranty.

Caution

Faulty dimensioning or system shut down for periods with high solar radiation can lead to overheating and steam build up in the system. Heating medium and sealing materials can be damaged during repeated or long term overheating. In the event of risk of long term or frequently occurring stagnation / vaporisation in the solar panels, it is recommended that adequate cooling or heat dissipation is installed.

Check that the glycol/water mixture that is used has the right characteristics for lowest anticipated temperature on the installation place.

Glycol should be checked every other year and filled as necessary. The glycol mixture pH value must be higher than 7. The medium must be replaced if discoloured brown, cloudy or smells bad.

The manufacturer/supplier cannot accept any responsibility for any frost damage.

Installation of sensors

The temperature sensor must be installed in the hottest solar panel submerged tube. To give maximum contact, the gap between the submerged tube and the sensor must be filled with suitable heat conducting paste such as silicone grease with heat tolerance up to approx. 210 C. Good temperature tolerance also applies to insu-

lation, cables and other items that can be exposed to high temperatures.

To prevent damage caused by rodents or birds a bite resistant sock can be threaded over the sensor cable and insulation.

Operating pressure

The maximum operation pressure is 0.6 MPa (6 bar).

Maintenance of the solar panel

The solar heating system must be visually checked regularly with regard to diverse damage, leakage; the inspection and date must be documented in the maintenance schedule.

For further information about maintenance, see page 64.

Safety instructions

- Applicable safety regulations for working on roofs and similar constructions must be followed.
- Barriers to protect against falling parts must be installed. This is particularly important for high buildings and locations where a lot of people pass below the roof/under the building.
- Personal safety equipment or scaffolding must be used when working on roofs, according to the applicable regulations.
- Adequate measures must be taken during the installation so that the solar panel does not come loose and fall.
- Do not fill the unit in strong sunlight. There is a risk of injury from steam.
- If necessary, cover the solar panels and/or wait until after sunset.
- Never fill the unit with water and never pressure test it when there is a risk of frost.
- Observe the safety distance to the current conducting cables.

Pipe connections

General

Pipe routing

Plan pipe routing before you start the installation of pipes and make any holes in walls and roofs (consider the durability). Ducts and chimney flues that are not used can be used to route lines from the solar circuit on the roof to solar tank. If an unused chimney flue is used, the chimney sweep must be informed of this in advance.

If the solar circuit pipes are routed outdoors, they must be protected against wind and rain. Consider the UV resistance when calculating the insulation.

Because the frost protection is used in the solar panel, and because the system can become very warm, several points must be observed. In principle two materials can be used for pipe-routing: copper pipes or stainless steel. Copper pipes can be connected with high quality Vatette type compression ring couplings, always use support sleeves with Vatette compression ring couplings (for extra safety apply high temp thread adhesive to the compression rings), press couplings with suitable high temperature O-rings, or hard soldered. Stainless steel flexible pipes must be installed with the couplings provided.

Suitable Teflon tape or high temperature thread adhesive (at least 230 °C) can be used in any thread connections in the solar circuit. However, linen or hemp are unsuitable for use in solar circuits.

Venting

The solar circuit must be completely filled with a mixture of glycol and water at the highest point.

It must be possible to bleed the solar panel system properly, avoid air bubbles as far as possible. Normally air bubbles can be flushed during the filling process. If vents require fitting only use manual vents, never automatic. Bear in mind that any venting devices must be able to tolerate high temperatures.

In larger systems with several rows the vents must be installed at the end of each row, at the solar panels's advance. Suitably plugged with a high temperature tolerant ball valve or a compression ring T-pipe with compression plug that is used at any supplementary "seeping" which may be necessary after running the system with a "filling barrel" / solar filling station. The direction of flow must be considered here.



NOTE

Professional filling equipment must be equipped with a dirt filter in such a way that the system is cleaned during filling and the venting process.

Miscellaneous

The solar panel must be designed as a closed system, because the inhibitors in the antifreeze are quickly consumed by penetrating atmospheric oxygen.

The system must not be equipped with a galvanised heat exchanger, heat accumulators, tanks or pipes, because zinc can be replaced by 1,2-propylene glycol.

It is important that all sealing and binding materials are heat tolerant to the maximum stagnation temperature that can occur in the solar power system.

No external electrical potentials may occur between the components in the system that are in contact with the anti-freeze. On the other hand a limited external potential (around 1.5 volt) can occur in copper system components.

The system and its components must be protected against penetrating dirt and water during installation and before filling.

Starting

Fill in the commissioning protocol on page 67 in conjunction with commissioning.

Insulation

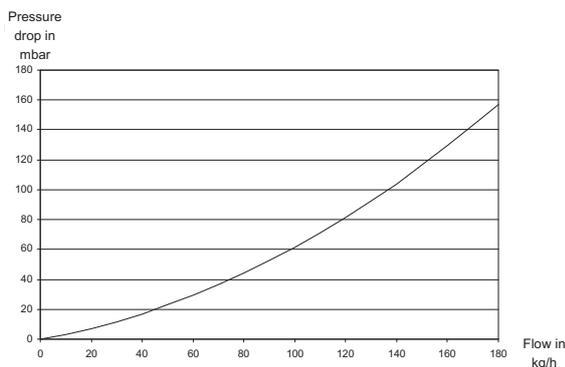
The pipes must be insulated to minimise heat losses.

Insulate the pipes according to national norms and practice.

A very high heat tolerance must be guaranteed for pipes and pipe insulation in the solar circuit, because temperatures of up to 200 C can occur in the circuit. Appropriate insulation must therefore be used in the solar circuit.

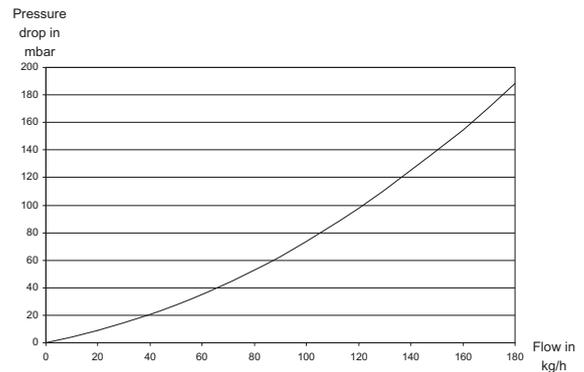
Pressure drop diagram

Pressure drop diagram for water:



With glycol mix heating medium the relevant correction parameters must be observed.

If Tyforop L is used with 44 % glycol, the following pressure drop curve applies:



Pipe connection option

In general, the connection of the individual rows in larger solar heating systems should be according to the Tichelmann principle. With several rows, the return connection between the junction and solar panel must be equipped with a ball valve or adjustment valve with high heat tolerance. This must be insulated after commissioning. But it must be marked to show that there is a possible shut off valve under the insulation! This is in order to be able to vent row by row and to adjust the flow if necessary.



NOTE

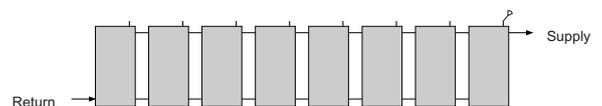
The solar panel's safety valve must never be able to be switched off from the solar panel.

Recommended flow:

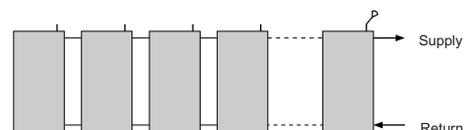
Min flow: 0.35 minute litres / m²

Max flow: 0.75 minute litres / m²

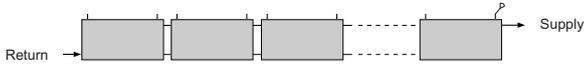
Parallel two sided connection of vertical solar panels



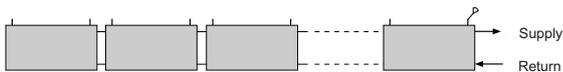
Parallel single sided connection of vertical solar panels



Parallel two sided connection of horizontal solar panels



Parallel single sided connection of horizontal solar panels



Dimensioning of pipes with 6 m standard pump

Pipe dimensions	Max number of solar panels
10-15 m x16mm	7 (two sided connection)
20-25 m x16mm	6 (two sided connection)
10-15 m x16mm	6 (single sided connection)
20-25 m x16mm	5 (single sided connection)
10-15 m x20mm	8 (two sided connection)
20-25 m x20mm	7 (two sided connection)
10-15 m x20mm	7 (single sided connection)
20-25 m x20mm	6 (single sided connection)

Dimensioning of pipes with 8 m pump

Pipe dimensions	Max number of solar panels
10-15 m x16mm	8 (two sided connection)
20-25 m x16mm	7 (two sided connection)
10-15 m x16mm	7 (single sided connection)
20-25 m x16mm	6 (single sided connection)
10-15 m x20mm	12 (two sided connection)
20-25 m x20mm	10 (two sided connection)
10-15 m x20mm	9 (single sided connection)
20-25 m x20mm	8 (single sided connection)

Recommended pre-pressure in solar expansion tank & system pressure in solar circuit

Initial pressure NOTE! Check before filling the system!	2.5 Bar for a low building, single story house type (5 m between tank and solar panel) 3.0 Bar for a taller building (10 m)
Operating pressure NOTE! With cold piping!	3.0 Bar (5 m) 3.5 Bar (10 m)

4 Mounting

General

SOLAR FP215 P/PL available in 2 versions:

- NIBE Solar FP215P (Vertical solar panel)
- NIBE Solar FP215PL (Horizontal solar panel)

Roof mounting components are available in 3 basic variants with sub-variants:

1. Mounting on roof:
 - Tiled roof, horizontal rows (P), page 13
 - Tiled roof, vertical rows (PL), page 27
 - Tiled roof, horizontal rows and 25° stand (P), page 21
 - Tiled roof, horizontal rows and 45°stand (PL), page 35
 - Corrugated iron roof, horizontal rows (P / PL), page 13
 - Corrugated iron roof, vertical rows (PL), page 27
 - Corrugated iron roof, horizontal rows and 25°stand (P), page 21
 - Corrugated iron roof, horizontal rows and 45°stand (PL), page 35
 - Seamed sheet metal roof (P), page 13
 - Seamed sheet metal roof, vertical rows (PL), page 27
 - Seamed sheet metal roof and 25° stand (P), page 21
 - Seamed sheet metal roof and 45° stand (PL), page 35
 - Bitumen roof, horizontal rows (P / PL), page 13
 - Bitumen roof, horizontal rows (PL), page 34
 - Bitumen roof, horizontal rows and 25°stand (P), page 21
 - Bitumen roof, horizontal rows and 45°stand (PL), page 35
 - Bitumen roof, horizontal rows and adjustable stand 42-65° (P), page 51
 - Coach bolt (universal), horizontal rows (P), page 13
 - Coach bolt (universal), horizontal rows and 25°stand (P), page 21
 - Coach bolt (universal), horizontal rows and 45°stand (PL), page 35
2. Inset installation:
 - Certain tiled roofs (P), page 42
3. Mounted on adjustable stands on bitumen roof or on ground/concrete foundation
 - Adjustable stand 42-65° (P), page 51

Installing vertical solar panels (P) in horizontal rows

The different installation variants that are covered here are:

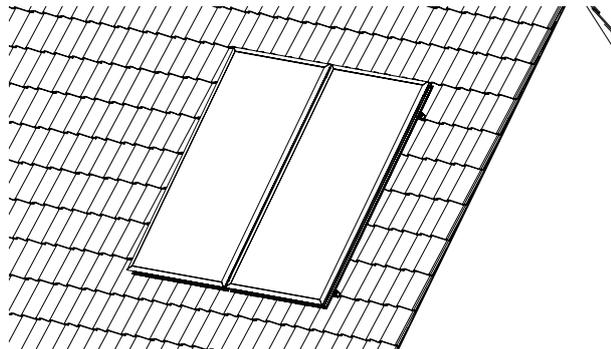
- Tiled roof, horizontal rows (P)
- Corrugated metal roof, horizontal rows (P)
- Seamed sheet metal roof (P)
- Bitumen roof, horizontal rows (P)
- Coach bolt (universal), horizontal rows (P)

The principle shown is installation on a tiled roof.

Overview

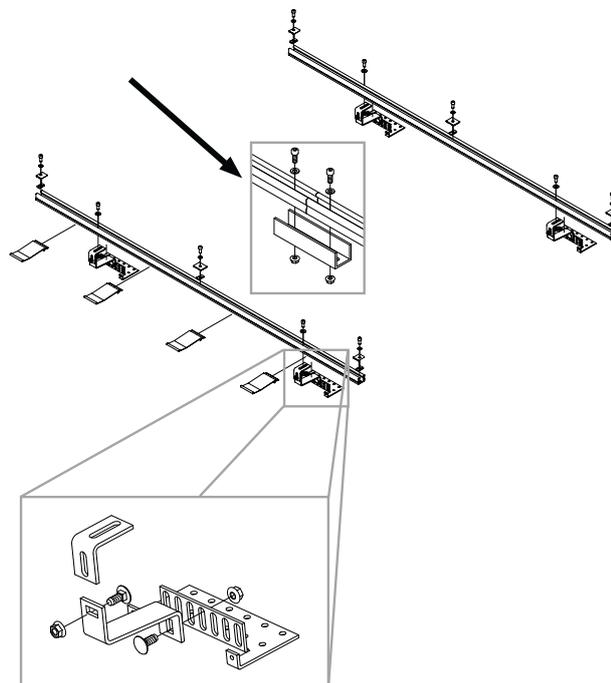
The stand can be installed on a number of different roof types, the image beside illustrates when the panels and mounting rails are installed on mounting components for tiled roofs (tiled roof brackets).

How the different mountings should be installed is described in Roof mountings on page 57.



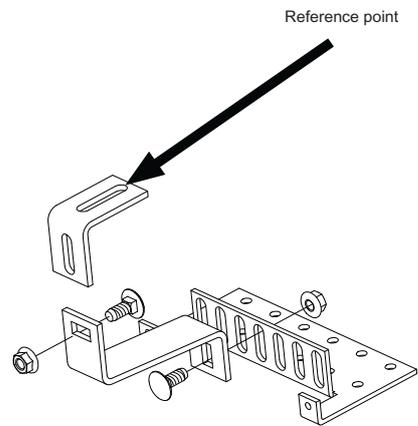
A joint kit for mounting rails is always required if several mounting kits are to be combined.

The brackets must be adjusted for the roof according to the local conditions.



1. Mark out the solar panels intended location and mounting points

Mark the desired position on the roof using chalk before you install the solar panels. The reference point is the mounting rail on the bracket.



If there is not a sufficiently stable substructure such as tongue and groove or trusses to allow a durable installation the roof must be reinforced.



NOTE

The minimum number of mounting points only cover a part of the potential wind and snow load.

Mounting points are adapted to the local conditions.

The distance between the solar panels is 24 mm.

The brackets are always positioned where the roof tile is lowest.

Size:

A: 150 mm

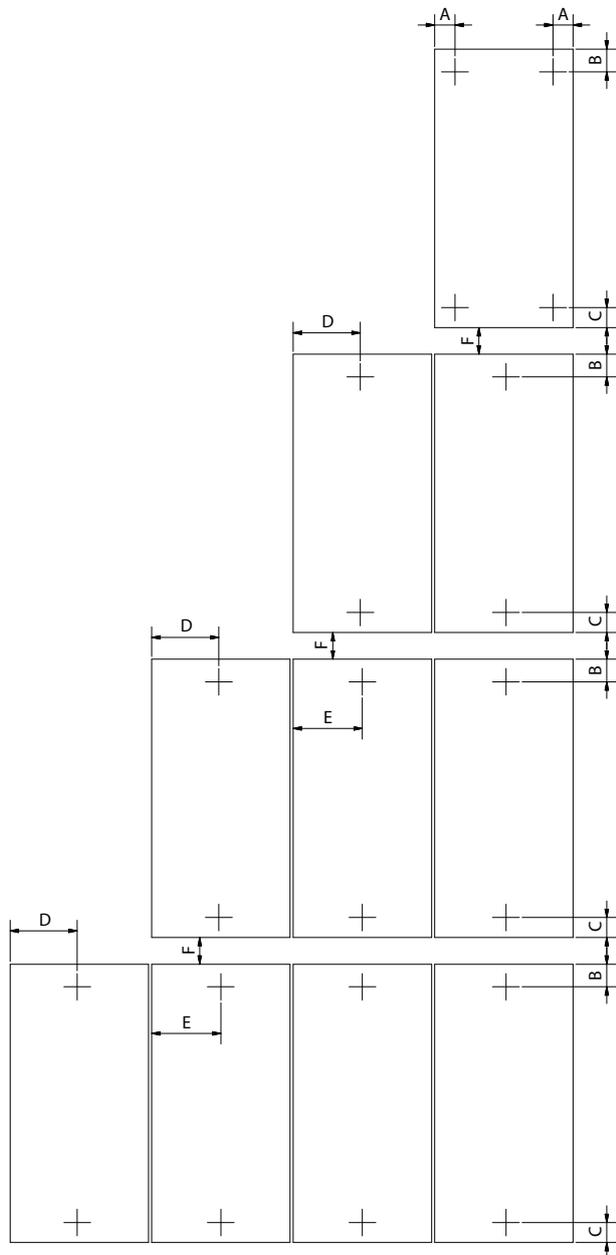
B: min. 170 mm

C: 150 mm

D: max. 500 mm

E: 540 mm

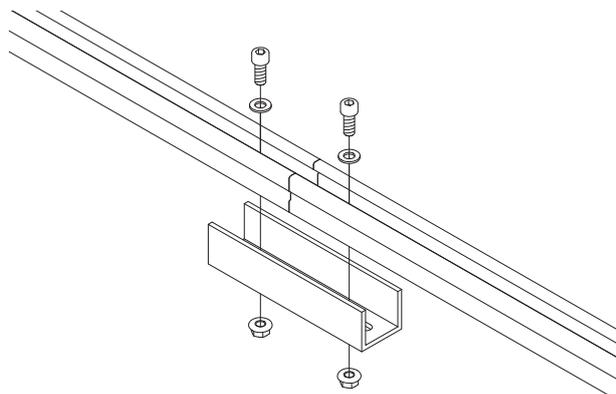
F: 200 mm



2. Joining rails

If several mounting rails are used each rail must be locked with the appropriate joint kit before mounting to the brackets.

The mounting rails are locked to each other with 1 joint kit, 2 screws M10 x 25, 2 washers and 2 self locking nuts.



3. Installing the mounting rails

The mounting rails are screwed into place in the different types of roof mounting, the following is an example of how the mounting rail is secured into the different alternatives.

(a1) Mounting rails on the tiled roof bracket (tiled roof)

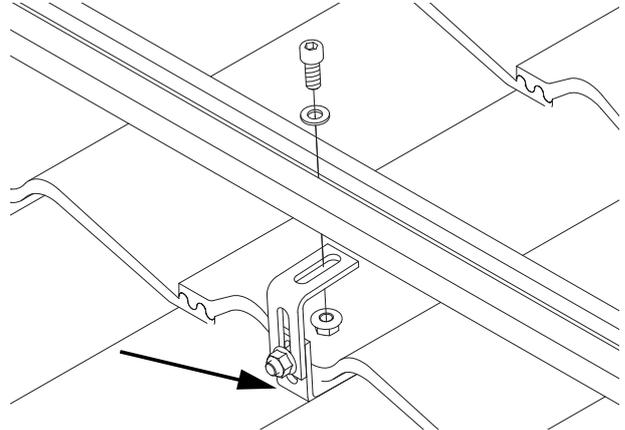
Mounting rails are secured in the brackets with screws M10 x 25, washer and self locking nut.

Also see Mounting on tiled roofs on page 57.



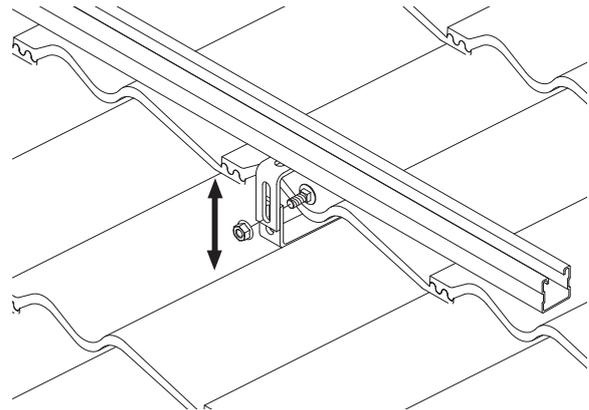
NOTE

There must be at least 3 mm between the underside of the bracket and the lower tile at the overlap point.



(a2) Adjusting the height of the rail

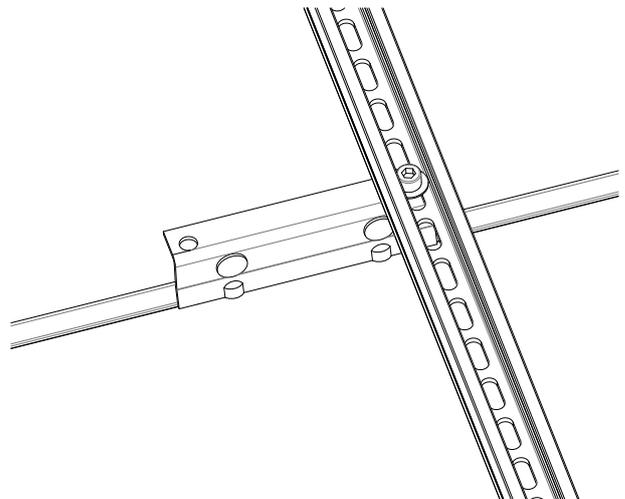
The rails must be adjusted for the local conditions as illustrated.



(b) Mounting rail on standing seam holder (seamed sheet metal roof)

The mounting rails are secured in the roof mountings with screws M10 x 25, washer and nut.

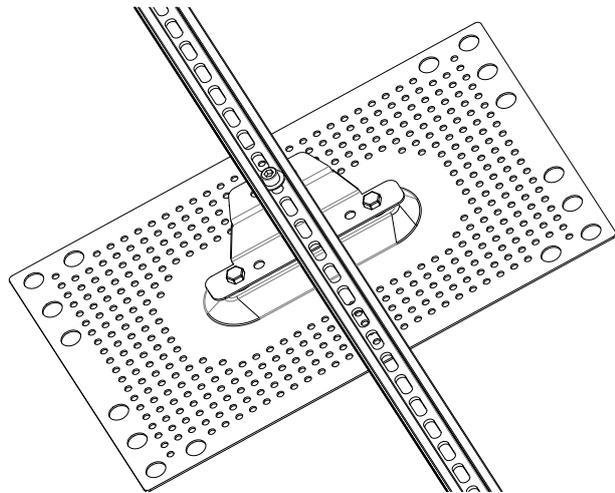
Also see Mounting for double seamed sheet metal roofs on page 58.



(c) Mounting rails on raised sealing plate (bitumen roofs)

The mounting rails are secured in the roof mountings with M10 bolts and a rubber gasket between the raised sealing plate and the adapter.

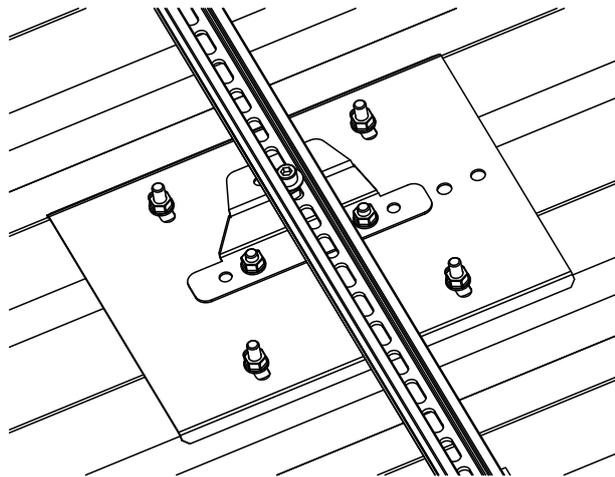
Also see Mounting raised sealing plate (bitumen roof) on page 60.



(d) Mounting rails on universal fixing plate (corrugated metal roof)

The mounting rails are secured in the roof mountings with screws M10 x 25, washer and self locking nut.

Also see Universal fixing plate for corrugated metal roof on page 59.



(e) Mounting rails on coach bolts (universal plus slate roofs)

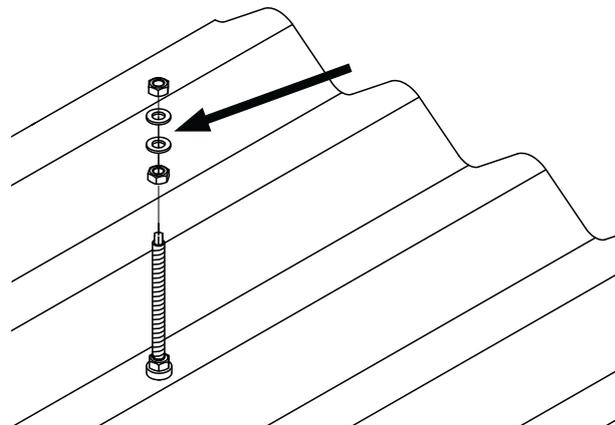
Correct conditions are required for this variant.

The mounting rails are set on pin bolts that are fixed with the upper and lower nuts, the arrow indicates where the mounting rail should be.



Caution

The coach bolt should only be used if the base it is to be screwed into is substantial and strong. This must be established by the installation company.

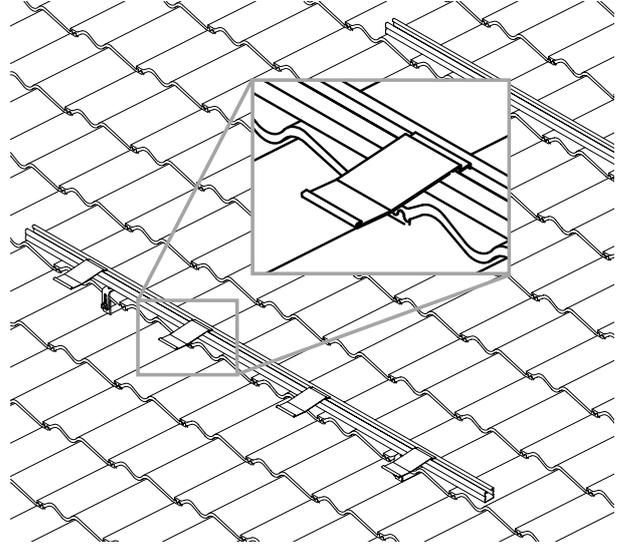


The installer must evaluate if the moisture protection is sufficiently secure, this is based on factors such as roof pitch in relation to the rubber seal's position against the roof base, the smoothness of the roof base also has an impact.

Also see Universal fixing with coach bolt on page 62.

4. Profile hooks

The profile hooks must be positioned so that each solar panel is held by 2 profile hooks.



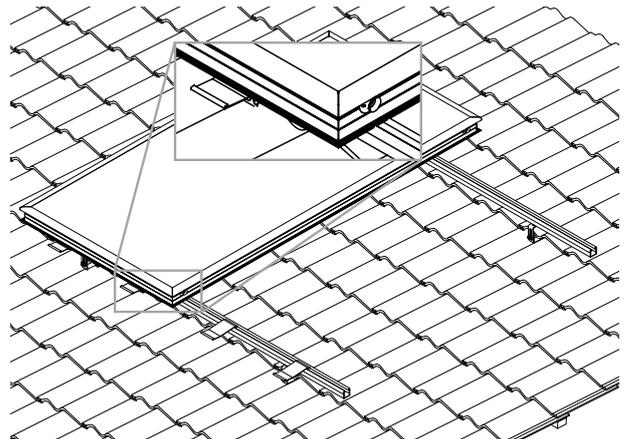
5. Install the first solar panel



NOTE

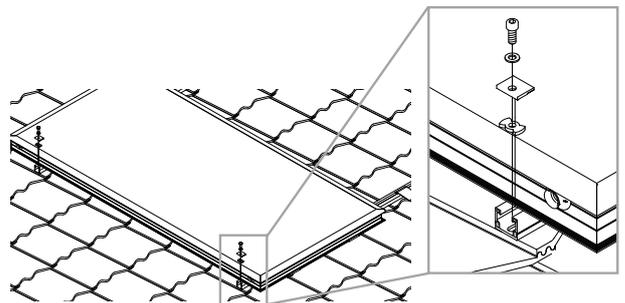
Before the first solar panel is aligned, check that all the mounting components are tightened and that the roof is sealed.

The solar panel must always be positioned **with the submerged tube for the temperature sensor upwards**. Check that the solar panel locates in both profile hooks during alignment. Then remove the corner protection.

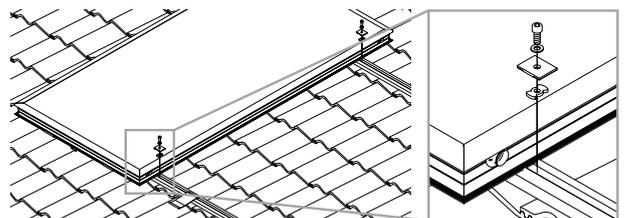


6. Secure the first solar panel

Secure the outer side with a screw M10 x 25, washer, external fixing wedge and wing nut in the respective mounting rail. The nut wings must lock in the mounting rail. The fixing wedge teeth must lock in the solar panel profile.



Install the centre fixing wedge with M10 x 25 Allen screw, washer and wing nut. **Do not tighten!**



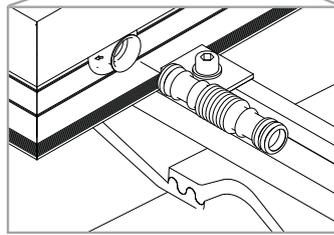
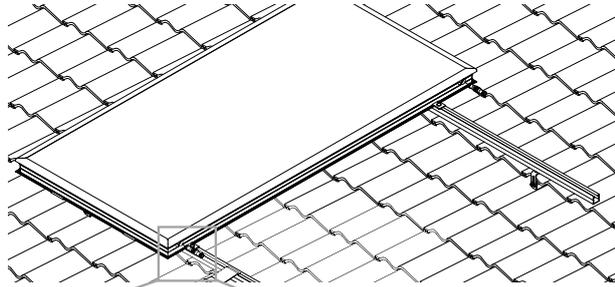
7. Installing the quick coupling/compensator

Carefully twist the quick coupling / compensator into the solar panel.



NOTE

The O-rings in the quick coupling are treated with special high temperature grease. No further lubrication is needed. Further lubrication can reduce the service life and invalidate the warranty!



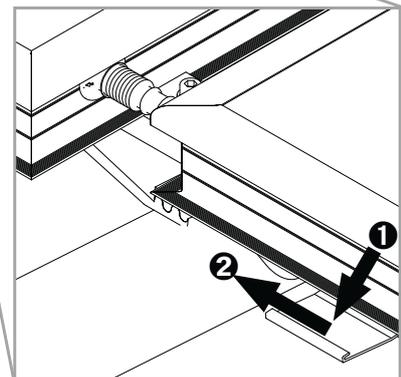
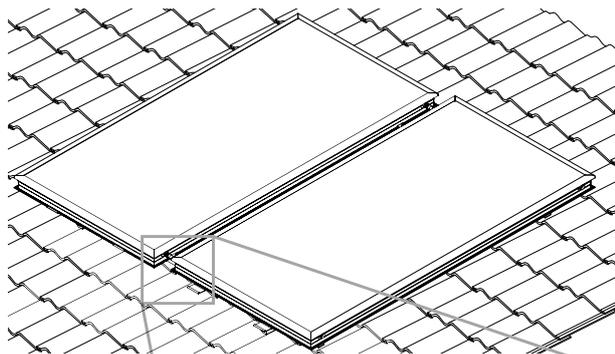
8. Install and secure the remaining solar panels

Install the second solar panel on the profile hooks (1) and remove the corner protection and slide it together with the first solar panel (2). The submerged tube for the temperature sensor must always be pointed upwards. The distance between the solar panels must be 24 mm. Tighten the centre fixing wedges with an Allen key.



NOTE

When you slide the solar panels together make sure that the compensators are kept straight and are not knocked or stubbed.



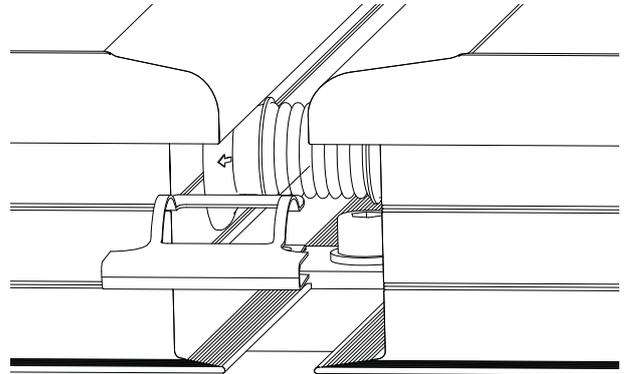
9. Installing the compensator clamps

Press the compensator clamps over the solar panel's absorber pipe. If necessary slide the absorbing unit into place, so that the compensator clamp grips the solar panel's compensator pipe.



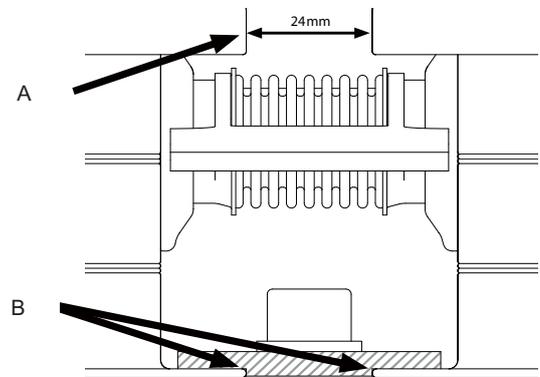
NOTE

Check that the compensator clamp is correctly located!



Check the distance (A) between the solar panels(24 mm)!

Check that the fixing wedges (B) in the centre are firmly located!



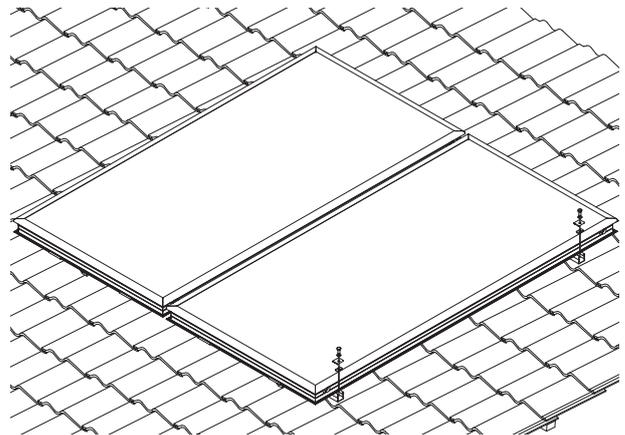
10. Installing the outer fixing wedges on the remaining solar panels



NOTE

Check that the fixing wedge is correctly located. The fixing wedge must lock in the solar panel profile.

Secure the outer side of the row's remaining / last solar panel with a screw M10 x 25, washer, outer fixing wedge and wing nut in the relevant mounting rail.



11. Connect the couplings and install the temperature sensor

How the pipe connectors should be installed is described in Installing the quick couplings on page 62.

How the temperature sensor should be installed is described in Installing the solar panel's temperature sensor on page 63.

Installing the vertical solar panels (P) on 25° support stands in horizontal rows

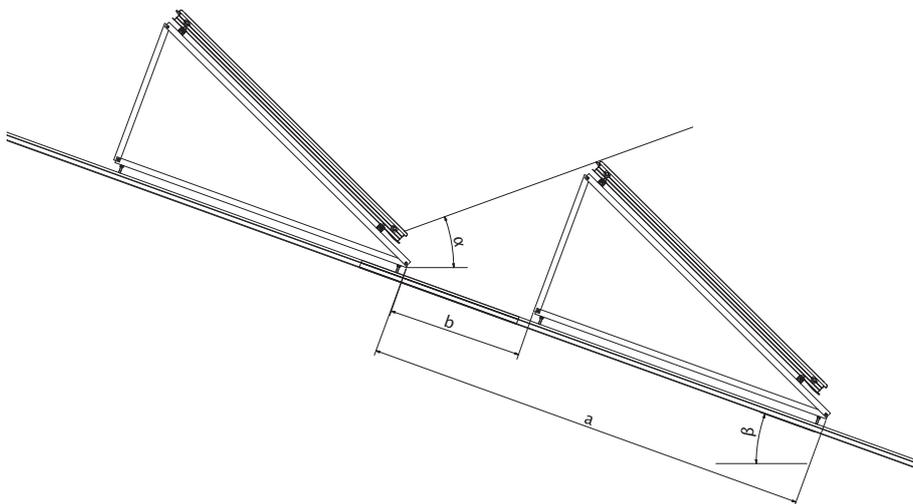
The different installation variants that are covered here are:

- Tiled roof, horizontal rows and 25° stand (P)
- Corrugated metal roof, horizontal rows and 25° stand (P)
- Seamed sheet metal roof and 25° stand (P)
- Bitumen roof, horizontal rows and 25° stand (P)
- Coach bolt (universal), horizontal rows and 25° stand (P)

The solar panels can be mounted on a number of different roof types.

The support stand is mounted between the roof mounting components and mounting rails shown previously.

How the different roof mountings should be installed is described in Roof mountings on page 57.



Row distance

The distance between the solar panels (a) depends on the shadow angle α and the pitch of the roof β .

If two or more rows with solar panels are to be placed in parallel, the optimum distance between the rows is calculated from the shadow angle according to the following:

$$\text{Row distance } a = \left(\frac{850 \text{ mm}}{\tan (\text{roof pitch } \beta + \text{solar radiation angle } \alpha)} \right) + 2000 \text{ mm}$$

If the shadow angle is 20° (the most common incidence) the following row distance is used:

Roof pitch β	Row distance a
0°	4340
10°	3480
20°	3020
30°	2720
40°	2500

During the winter a certain permanent shadowing of the lower solar panels occurs.

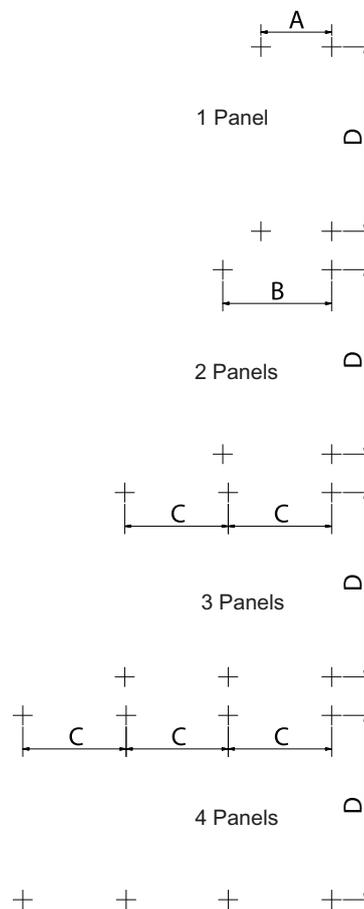
1. Mark up the position of the solar panels

If there is not a sufficiently stable substructure such as tongue and groove or trusses to allow a durable installation the roof must be reinforced.

NOTE

The minimum number of mounting points only cover a part of the potential wind and snow load.
Mounting points are adapted to the local conditions.

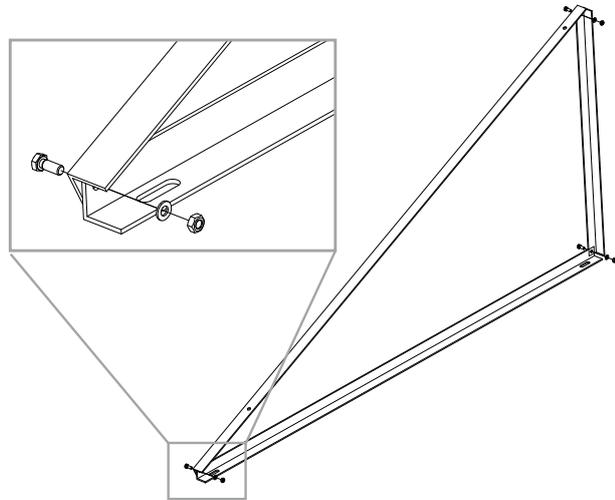
- Dimensions
 A: 730 mm
 B: 1130 mm .. 1500 mm
 C: 1070 mm
 D: 1920 mm



2. Pre-install the support stand

The stand is pre-installed and delivered folded. The illustration shows the stand in the installed position. The stands should be prepared before mounting on the roof.

The foot rail has 2 oblong holes.



3. Installing the support stand

The mounting of the stand is shown on a sheet metal roof with coach bolts for securing in the substructure.



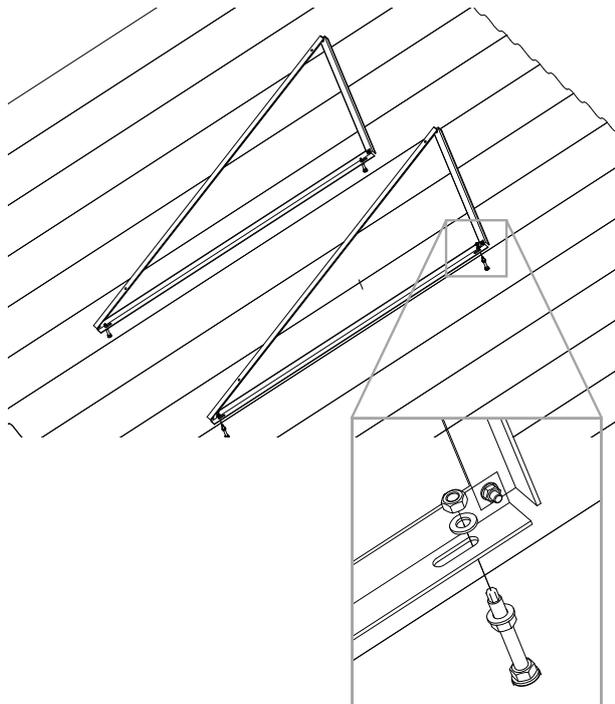
NOTE

This requires that the substructure is sufficiently solid and that the surface coating is flat enough to seal against the rubber gasket.

This must be determined by the installer from case to case.

The support stands are set on coach bolts that are fixed with the upper and lower nuts.

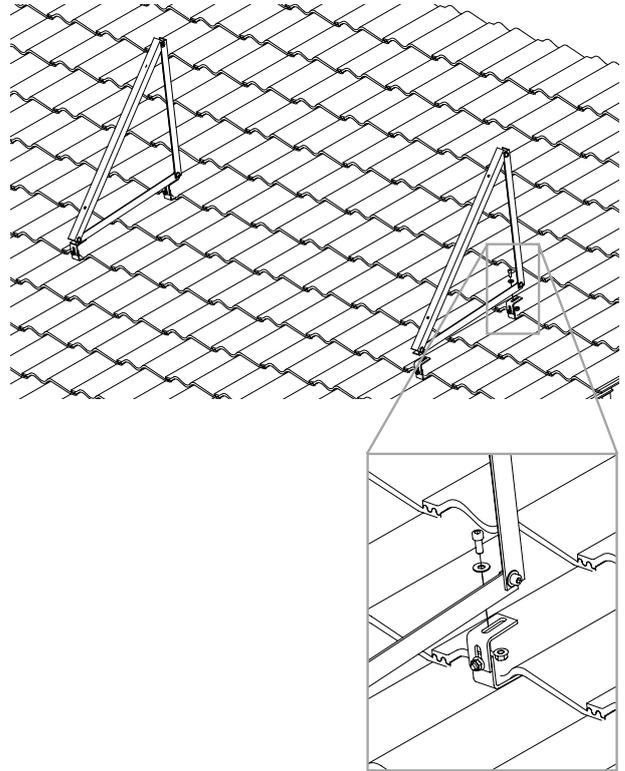
Additional coach bolts can be ordered if necessary.



This shows the mounting of a stand on a roof with tiles and tiled roof bracket.

Depending on what mounting components are used other variations are possible. The following step displays how other alternatives are installed.

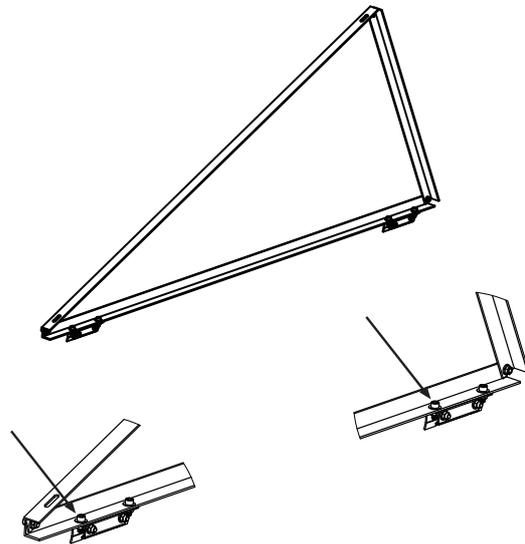
Secure the stand with the supplied screws, washers and nuts.



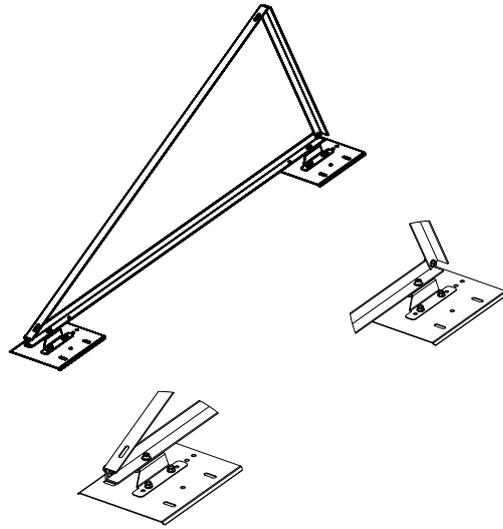
(a) Other roof mounting alternatives

Installed according to the images to the side.

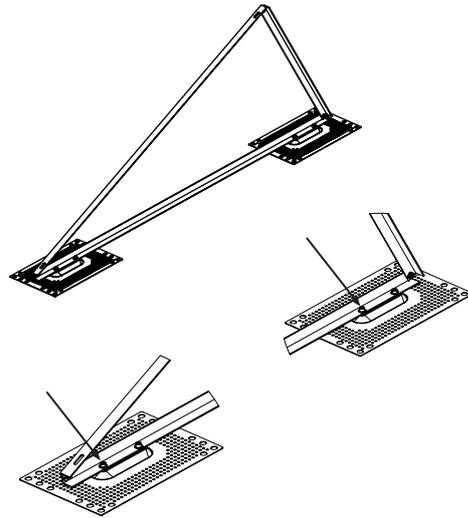
The arrows mark where holes must be drilled.



Standing seam holder for double seamed sheet metal roofs.



Universal fixing plate for corrugated metal roof.

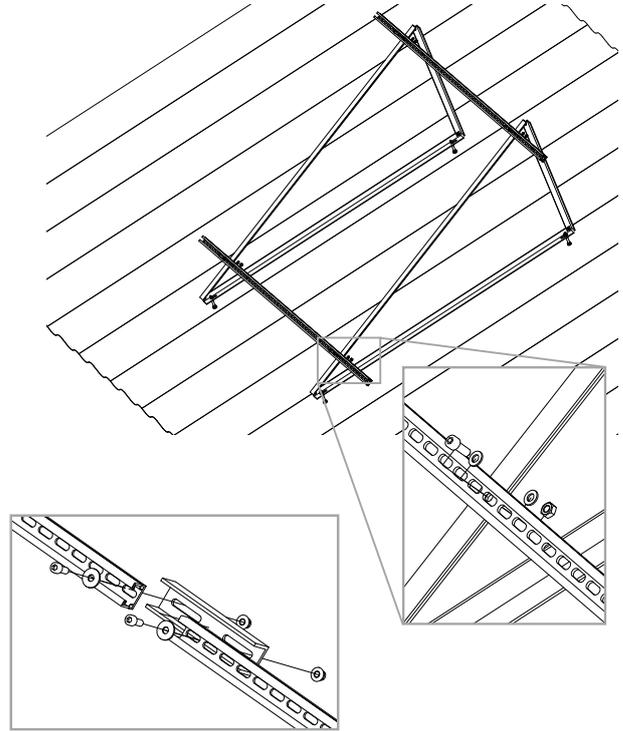


Raised sealing plate for bitumen roof.

4. Installing the mounting rails

After the support stands have been installed the mounting rails can be mounted on the stands.

The mounting rails must be fixed in each support stand. The rails should be installed parallel. In large installations where more than one installation rail is used, the mounting rails must be bolted together with the joint kit provided and levelled in relation to the ground/base.



5. Continued installation of solar panels according to previous instructions, see page 18.

Installing horizontal solar panels(PL) in vertical rows

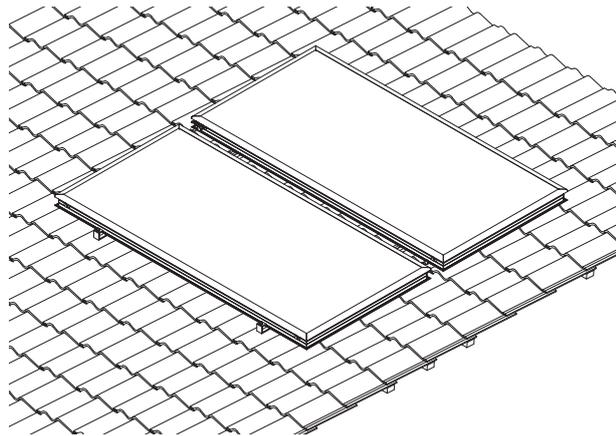
The different installation variants that are covered here are:

- Tiled roof, vertical rows (PL)
- Corrugated metal roof, vertical rows (PL)
- Seamed sheet metal roof, vertical rows (PL)

Only suitable where both horizontal and vertical rows are combined according to the dimensions table on page 27. The solar panels are connected on the short sides as several horizontal rows

This installation method requires fewer mounting rails but is more stable. It can be the optimal solution if the number of m² is to be maximised on a given roof surface.

Bear in mind that in most cases it is better to use vertical solar panels (P) in several horizontal rows.



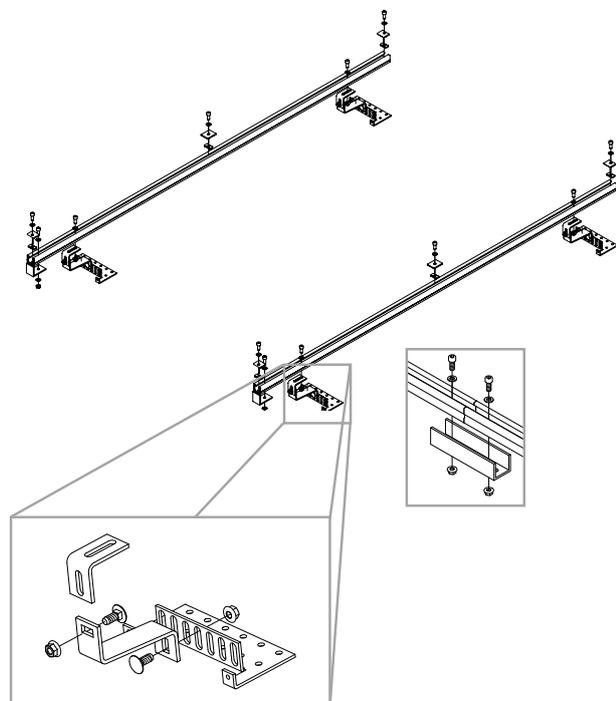
As described previously, the solar panels can be mounted on a number of different mounting points, brackets / roof types.

How the different mountings should be installed is described in Roof mountings on page 57.

Overview

A joint kit for mounting rails is always required if several mounting rails are to be combined.

The brackets must be adjusted for the roof according to the local conditions.



1. Mark up the position of the solar panels



NOTE

The minimum number of mounting points only cover a part of the potential wind and snow load.

Mounting points are adapted to the local conditions.

The distance between the solar panels is 24 mm. The brackets are always positioned where the roof tile is lowest.

Dimensions

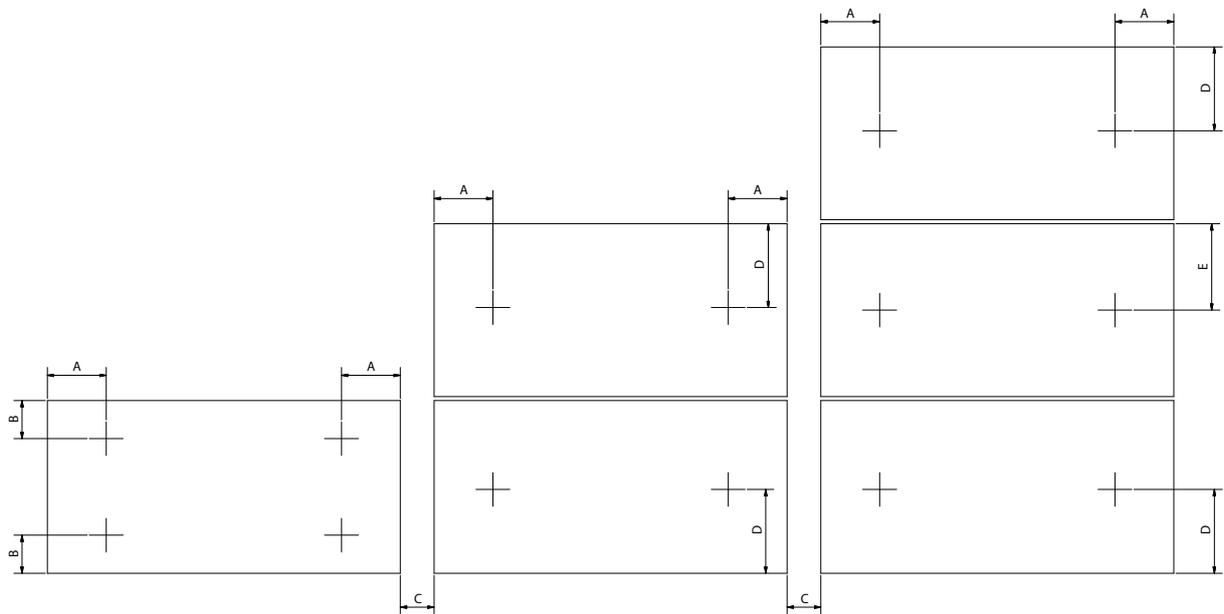
A: 170 mm

B: 270 mm

C: 24 mm

D: max. 500 mm

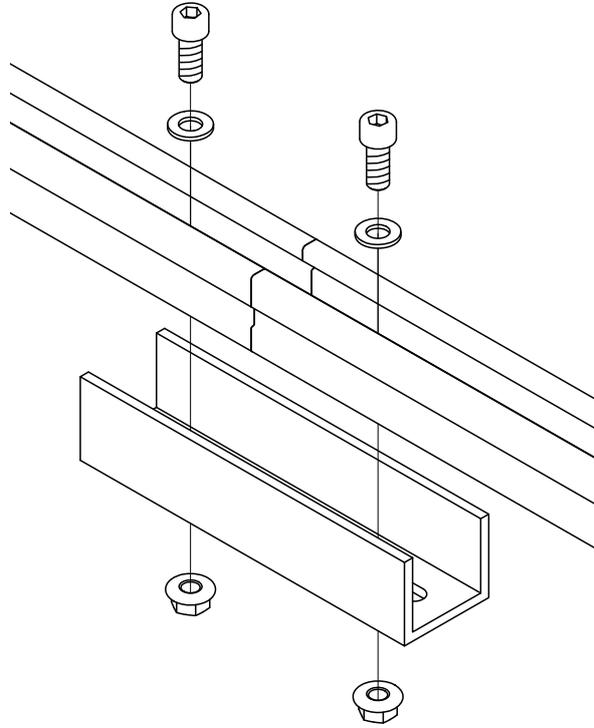
E: 515 mm



2. Fixed rails

If several mounting rails are used each rail must be locked with the appropriate joint kit before mounting to the brackets.

The mounting rails are locked to each other with 1 rail joint, 2 screws M10 x 25, 2 washers and 2 self locking nuts.

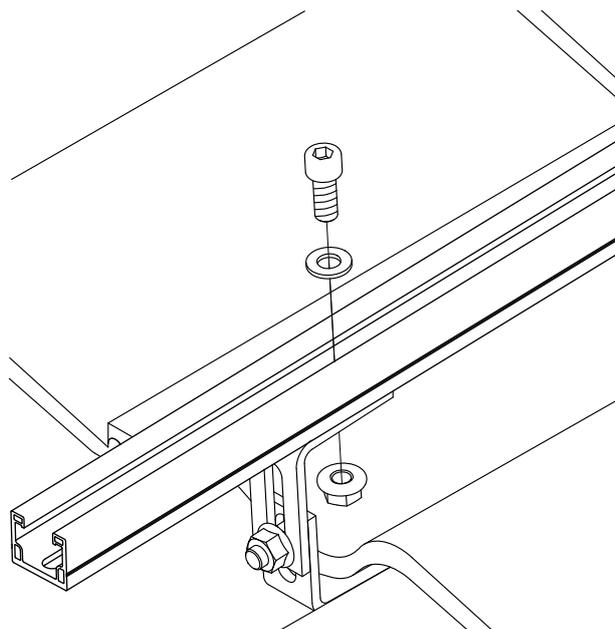


3. Installing the mounting rails

The mounting rails are screwed into place in the different types of roof mounting, the following is an example of how the mounting rail is secured into the different alternatives.

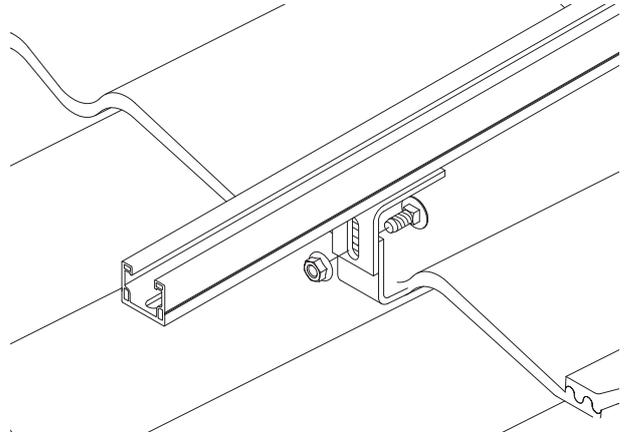
(a1) Mounting rails on the tiled roof bracket (tiled roof)

Mounting rails are secured in the tiled roof brackets with screws M10 x 25, washer and self locking nut.



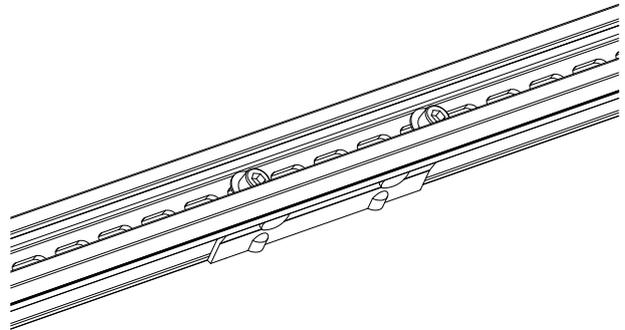
(a2) Adjust the height of the rail

The rails are adapted to the local conditions by slackening off the rail as illustrated, and then moving to the correct height.



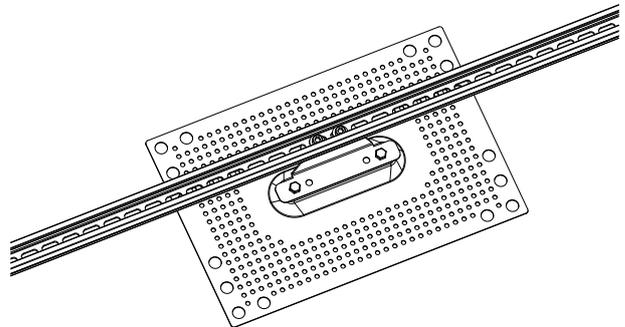
(b) Mounting rail on standing seam holder (seamed sheet metal roof)

The mounting rails are secured in the standing seam holders with screws M10 x 25, washer and self locking nut.



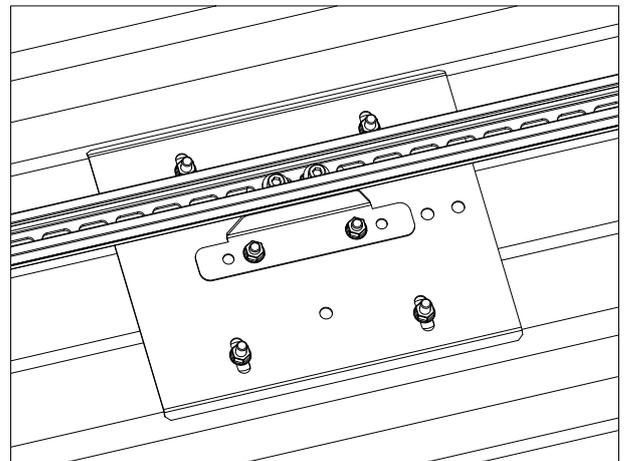
(c) Mounting rails on raised sealing plate (bitumen roofs)

The mounting rails are secured in the raised sealing plate with screw M10 x 25, washer and self locking nut.



(d) Mounting rails on universal fixing plate (corrugated metal roof)

The mounting rails are secured in the universal fixing plates with screws M10 x 25, washer and self locking nut.



(e) Mounting rails on coach bolts (universal plus slate roofs)

Correct conditions are required for this variant.

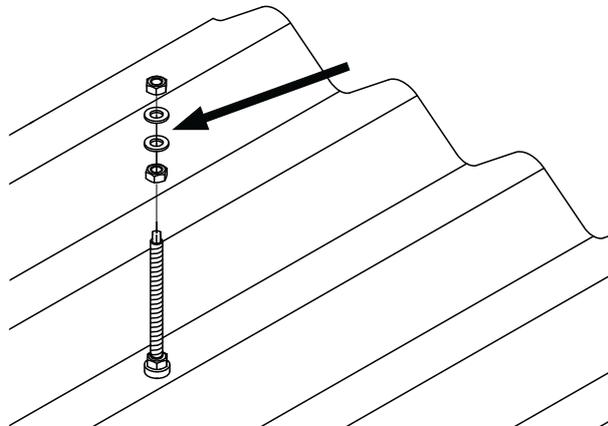
The mounting rails are secured on coach bolts that are fixed with the upper and lower nuts. The arrow indicates where the mounting rail should go in.



Caution

The coach bolt should only be used if the base it is to be screwed into is substantial and strong. This must be established by the installation company.

The installer must evaluate if the moisture protection is sufficiently secure, this is based on factors such as roof pitch in relation to the rubber seal's position against the roof base, the smoothness of the roof base also has an impact.

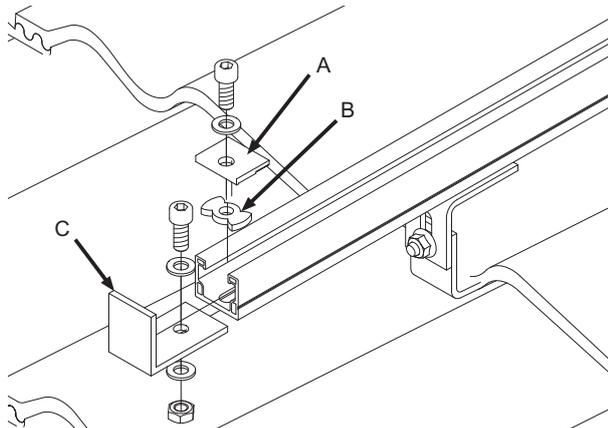


4. Install the stop lug

The stop lug must be installed in the end of lower rails so that the lower fixing wedges are secured.

Secure the fixing wedge (A) loosely in the rail using screw M10 x 25, wing nut (B) and washer.

Then secure the stop lug (C) on the underside of the rail with screws M10 x 25, washers and nut.



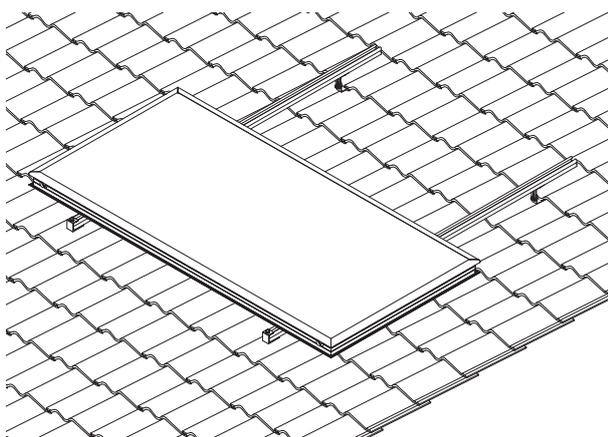
5. Align the first solar panel



NOTE

Before the first solar panel is aligned, check that all the mounting components are tightened and that the roof is sealed.

The solar panel must always be located with the temperature sensor pointed upwards. Check that the solar panel is positioned under both fixing wedges. Then remove the corner protection.



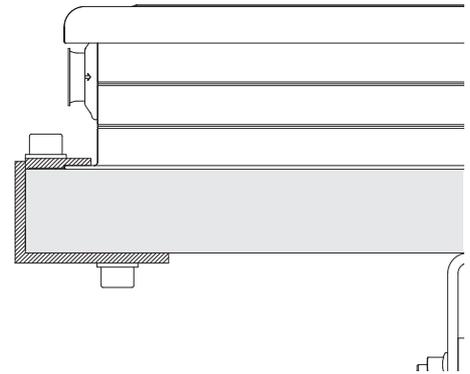
6. Secure the solar panel

When the solar panel has been pressed under the fixing wedges, the screws must be tightened.

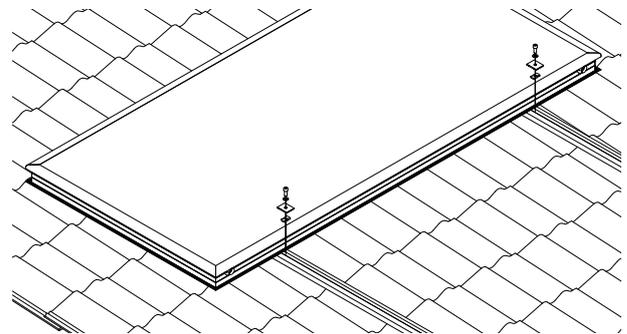


NOTE

Stop lug, fixing wedge and solar panel must be seated together without any gaps!



Install the centre fixing wedge with M10 x 25 Allen screw, washer and wing nut. **Do not tighten!**



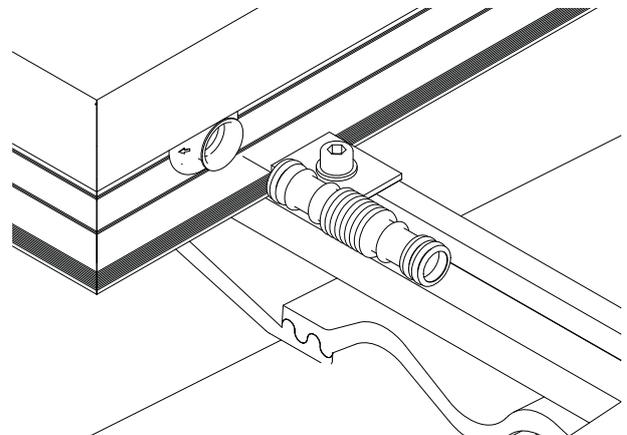
7. Installing the quick coupling/compensator

Carefully twist the quick coupling / compensator into the solar panel.



NOTE

The O-rings in the quick coupling are treated with special high temperature grease. No further lubrication is needed. Further lubrication can reduce the service life and invalidate the warranty!



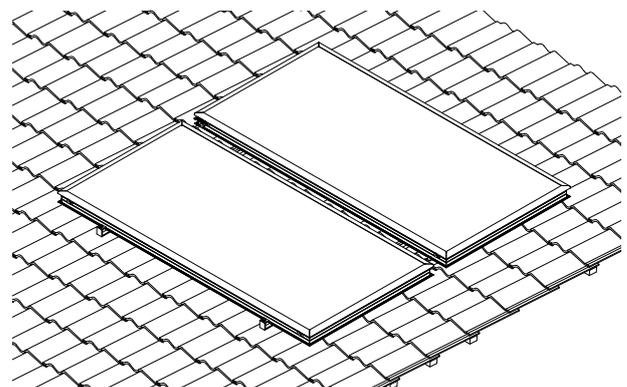
8. Install and secure the remaining solar panels

Install the second solar panel with the lower centre fixing wedges on the mounting rails, remove the corner protection and slide it together with the first solar panel. The submerged tube for the temperature sensor must always be pointed upwards. The distance between the solar panels must be 24 mm both laterally and vertically. Tighten the centre fixing wedges with an Allen key.



NOTE

When you slide the solar panels together make sure that the compensators are kept straight and are not knocked or stubbed.



9. Connect the couplings and install the temperature sensor

How the outer connections should be installed is described in Installing the quick couplings on page 62.

How the temperature sensor should be installed is described in Installing the solar panel's temperature sensor on page 63.

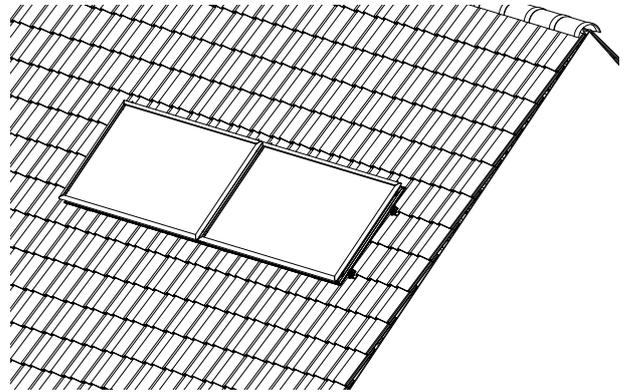
Mounting horizontal solar panels (PL) in a horizontal row

The different installation variants that are covered here are:

- Bitumen roof, horizontal rows (PL)

As described previously, the solar panels can be mounted on a number of different mounting points, brackets / roof types.

How the different mountings should be installed is described in Roof mountings on page 57.



1. Installing the mounting rails

Roof mounting of landscape solar panels (PL) is carried out in the same way as with horizontal standard solar panels (PL). The width of the solar panel means that it is installed with 2 metre rails. The diagram for mounting points is therefore changed as follows:

Dimensions

- A: 2000 mm
- B: 1875 mm
- C: 1825 mm
- D: 300 mm
- E: 600 mm, 770 mm



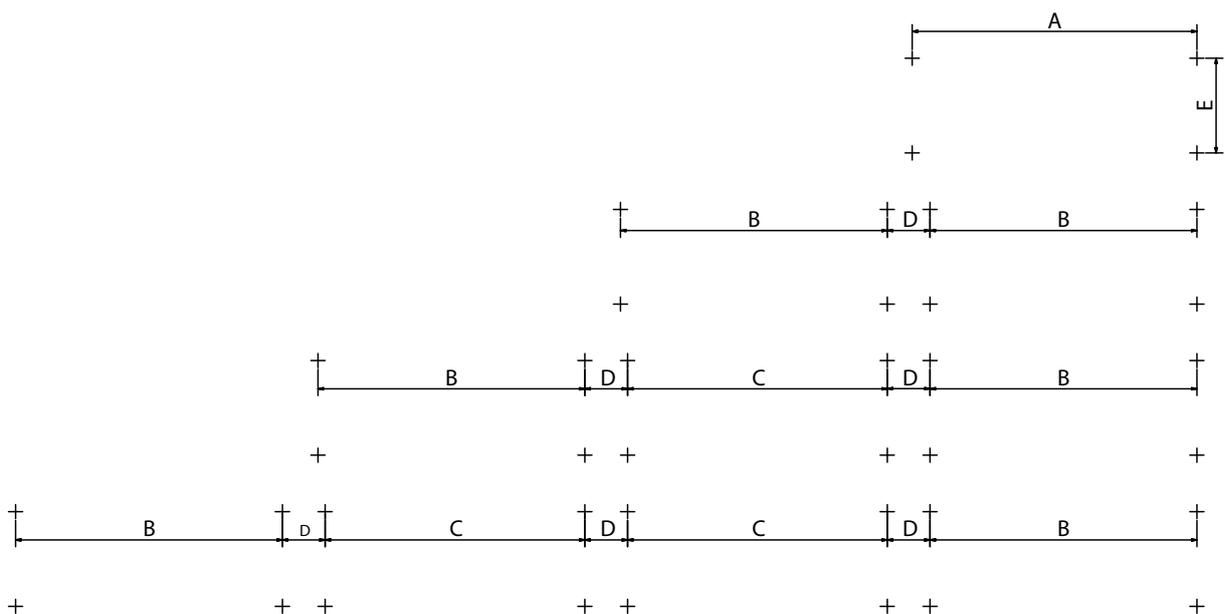
NOTE

The minimum number of mounting points only cover a part of the potential wind and snow load.

Mounting points are adapted to the local conditions.

The mounting system must be installed as illustrated. Otherwise the mounting rail joint connections and brackets can collide.

If a connection cannot be made where the solar panel should sit in the installation, the mounting rail and the joint connections should be pre-installed and aligned before they are mounted on the roof.



2. Continued installation of solar panels according to the principles of the previous instructions, see page 18.

Mounting horizontal solar panels(PL) on 45° support stands in a horizontal row

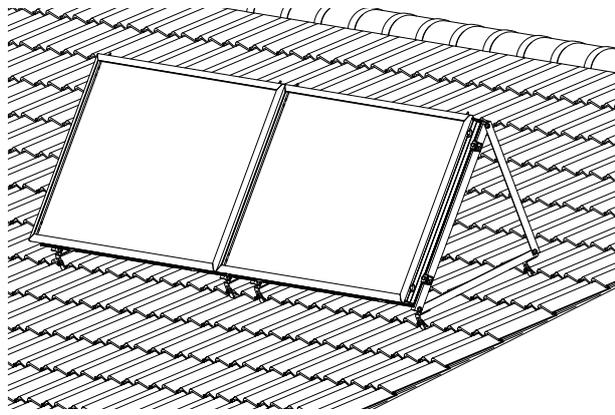
if necessary, the support stand can be cut down to 25°

The different installation variants that are covered here are:

- Tiled roof, horizontal rows and 45°stand (PL)
- Corrugated metal roof, horizontal rows and 45°stand (PL)
- Seamed sheet metal roof and 45° stand (PL)
- Bitumen roof, horizontal rows and 45° stand (PL)
- Coach bolt (universal), horizontal rows and 45° stand (PL)

As described previously, the solar panels can be mounted on a number of different mounting points, brackets / roof types.

How the different mountings should be installed is described in Roof mountings on page 57.



1. Dimensions for the solar panel's mounting

Mounting of roof connections is carried out in the same way as previously.

The drilling diagram for mounting points for up to 4 solar panels is as follows:

Size:

- A: 2000 mm
- B: 1875 mm
- C: 1825 mm
- D: 300 mm
- E: 582 mm, 642 mm



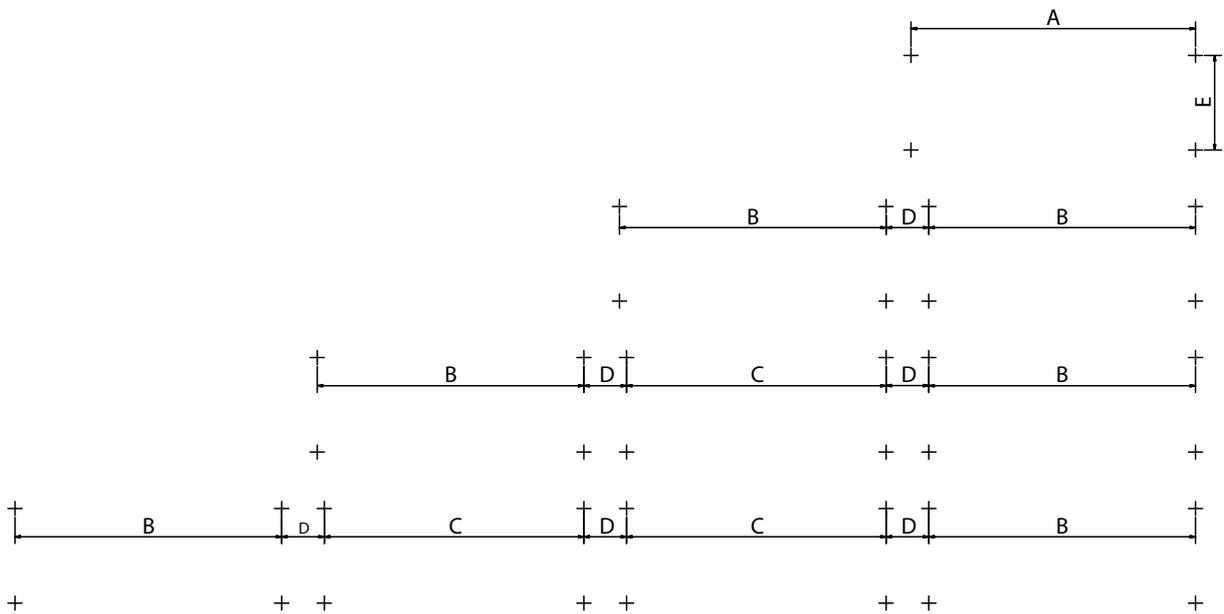
NOTE

The minimum number of mounting points only cover a part of the potential wind and snow load.

Mounting points are adapted to the local conditions.

The mounting system must be installed as illustrated. Otherwise the mounting rail joint connections and brackets can collide.

If a connection cannot be made where the solar panel should sit in the installation, the mounting rail and the joint connections should be pre-installed and aligned before they are mounted on the roof.

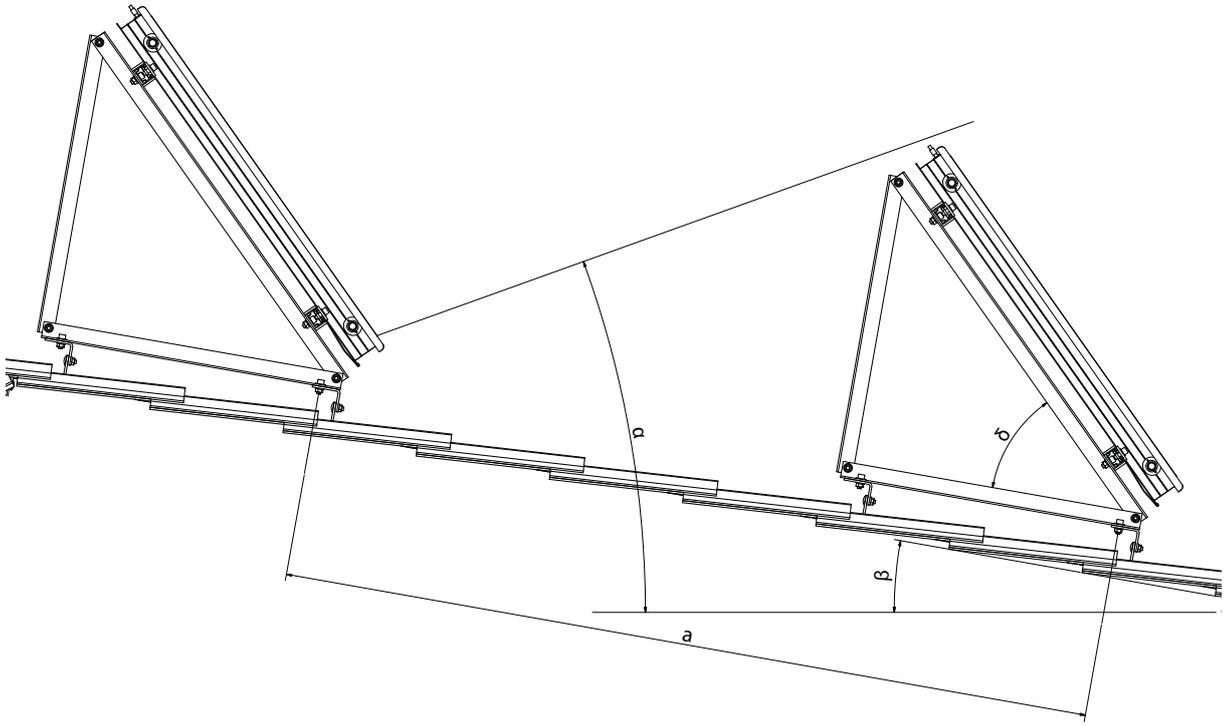


Row distance

The distance between the solar panels (a) depends on the shadow angle α and the pitch of the roof β and the pitch angle δ .

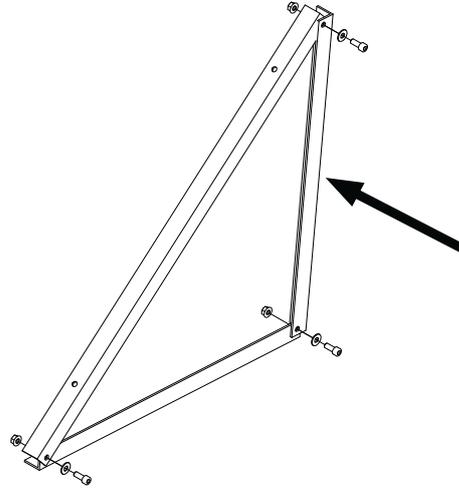
If two or more rows of solar panels are to be placed directly behind each other and if the shadow angle is constant 20° , the optimal distance between the rows can be read off in the following table:

Roof pitch β	Row distance a		
	Stand angle $\delta = 45^\circ$	Stand angle $\delta = 35^\circ$	Stand angle $\delta = 25^\circ$
0°	3700 mm	3350 mm	3200 mm
10°	2700 mm	2500 mm	2550 mm
20°	2150 mm	2100 mm	2190 mm
30°	1800 mm	1800 mm	1950 mm
40°	-	-	1880 mm



2. Pre-installing the support stand

The stand is pre-installed and delivered folded. The illustration shows the stand in the installed position. The stands should be prepared before mounting on the roof.



For other pitches (less than 45°) the support rail on the rear side must be shortened.

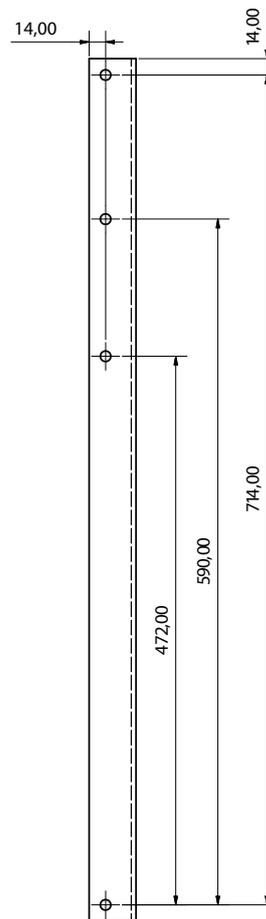
45° = standard length (742 mm combined length, 714 mm cc drill holes)

35° = 590 mm cc drill holes

25° = 472 mm cc drill holes

Drill diameter: 9 mm

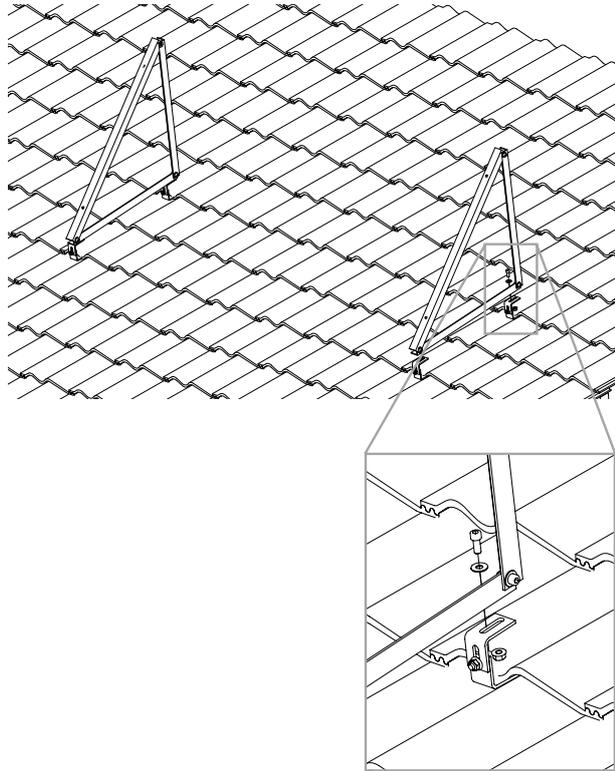
In all cases, the edge distance is 14 mm to the side and upward. The support rails must be shortened after drilling according to the dimensions in the illustration.



3. Mounting the support stands

This shows the mounting of a stand on a roof with tiles and tiled roof bracket.

Secure the stand with the supplied screws, washers and nuts.



The mounting of the stand is shown on a sheet metal roof with coach bolts for securing in the substructure.



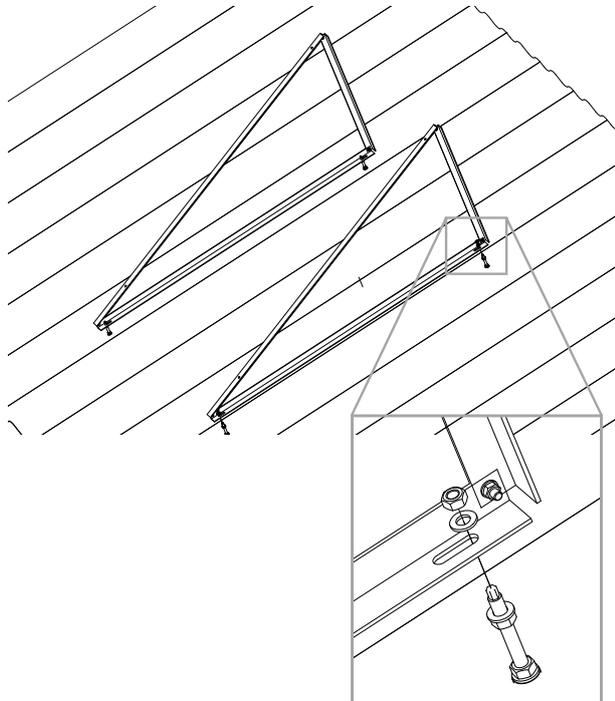
NOTE

This requires that the substructure is sufficiently solid and that the surface coating is flat enough to seal against the rubber gasket.

This must be determined by the installer from case to case.

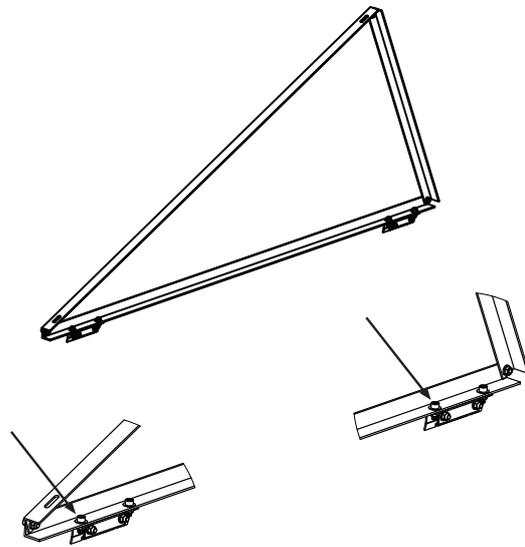
The support stands are set on stud bolts that are fixed with the upper and lower nuts.

Depending on what mounting components are used other variations are possible. The following step displays how other alternatives are installed.

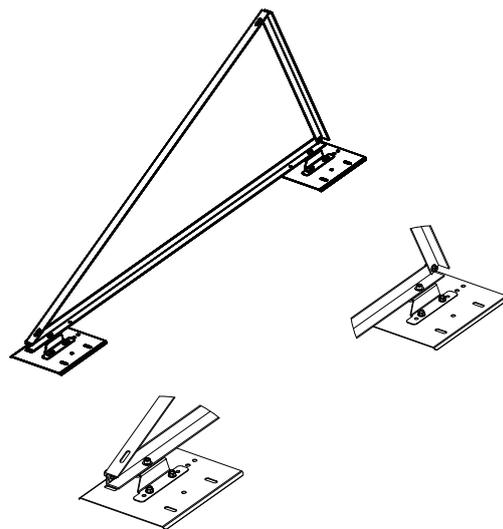


(a) Other roof mounting alternatives

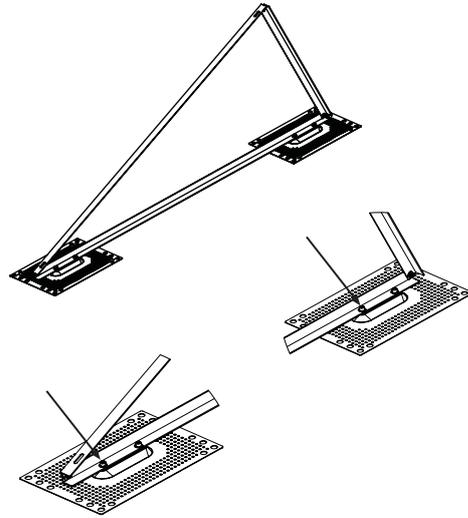
Installed according to the images to the side.
The arrows mark where holes must be drilled.



Standing seam holder for double seamed sheet metal roofs.



Universal fixing plate for corrugated metal roof.



Raised sealing plate for bitumen roof.

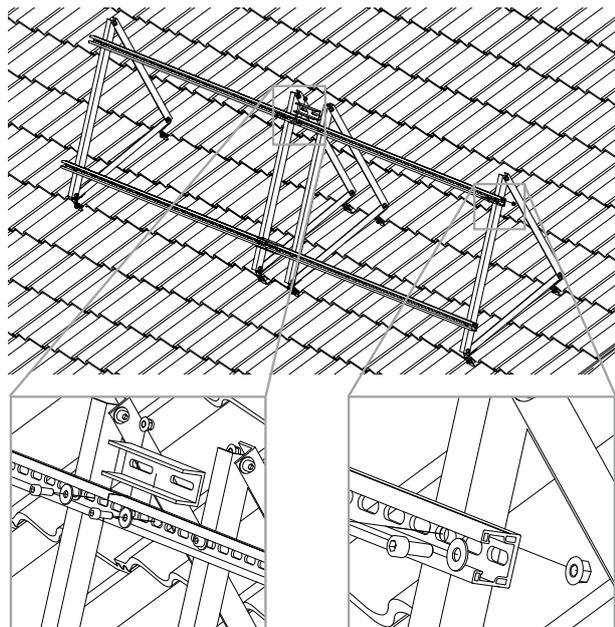
4. Installing the mounting rails

After the installation of the support stand the mounting rails can be mounted.

The mounting rails must be fixed in each support stand.

The rails should be installed parallel.

The mounting rails must be bolted together with the joint kits provided and levelled in relation to the ground /roof.



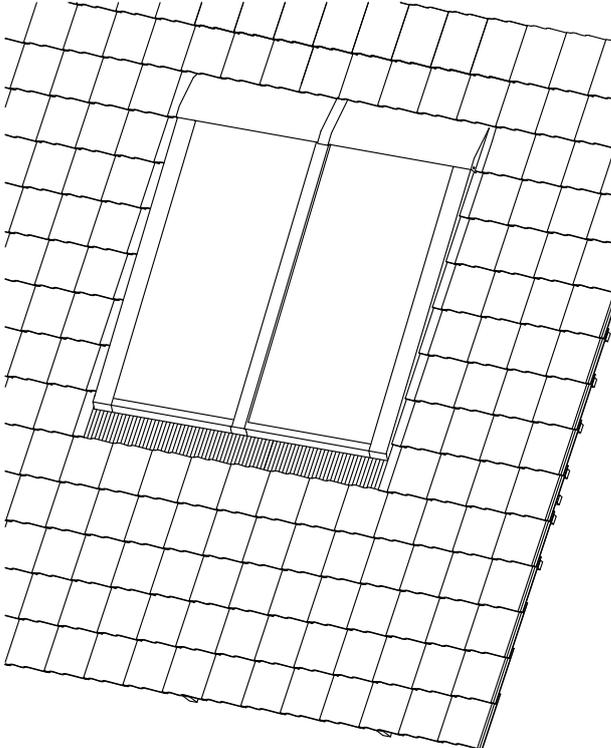
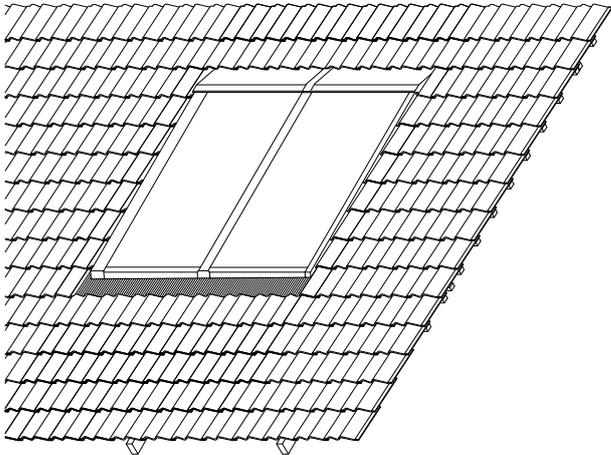
5. Continued installation of solar panels according to the principles of the previous instructions, see page 18.

Mounting inset vertical solar panels (P)

The different installation variants that are covered here are:

- Certain tiled roofs (P)

 **Caution**
This type of mounting is intended for standard tiled roofs.



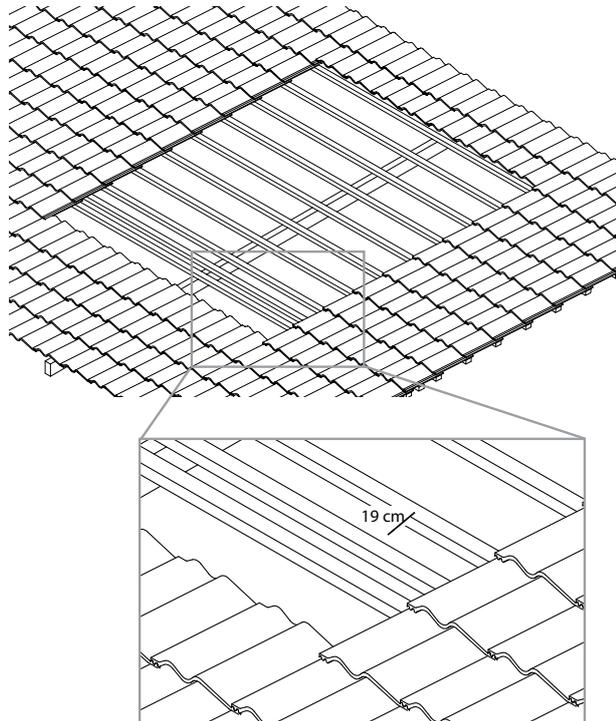
1. Remove the roof tiles and install the support rails

The solar panel system that is mounted inset in the roof replaces the roof tiles and therefore requires more space. Count on 50 cm extra on each side of the solar panels.

For the weight bearing capacity to be sufficient an additional supportive batten must be installed 19 cm from the last batten. A wider and thicker board or sheet can also be installed to provide greater stability.

A sealing membrane underneath the inset panel is recommended, especially when the roof is such that the solar panel system cannot easily be inspected from the inside.

The sealing membrane must cover at least 0,5 m outside both the solar panel's sides and upper side. At the bottom edge the sealing membrane must overlap the bottom fixing plate by at least 10 cm.

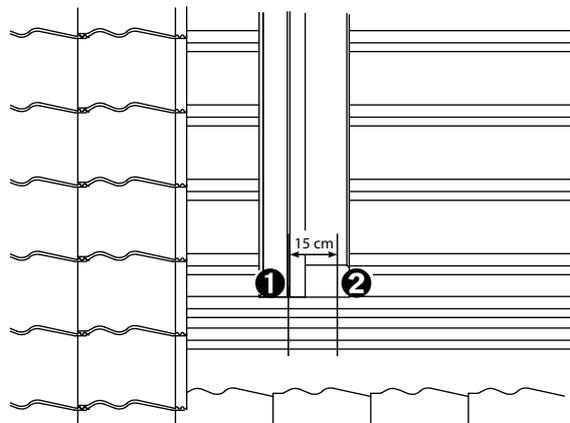


NOTE

The sealing membrane is extra important for low pitch roofs and where the roofing felt under the battens is poor.

2. Measure out and determine the location of the solar panels

When you decide where the solar panel is to be located, the left side piece must be positioned on the batten in such a way that roof tiles cover it. Two lines must therefore be drawn. Line (1) goes under the kink in the panel, line (2) goes 15 cm to the right of the kink in the panel. Line (2) is in the same place as the solar panel's left edge.

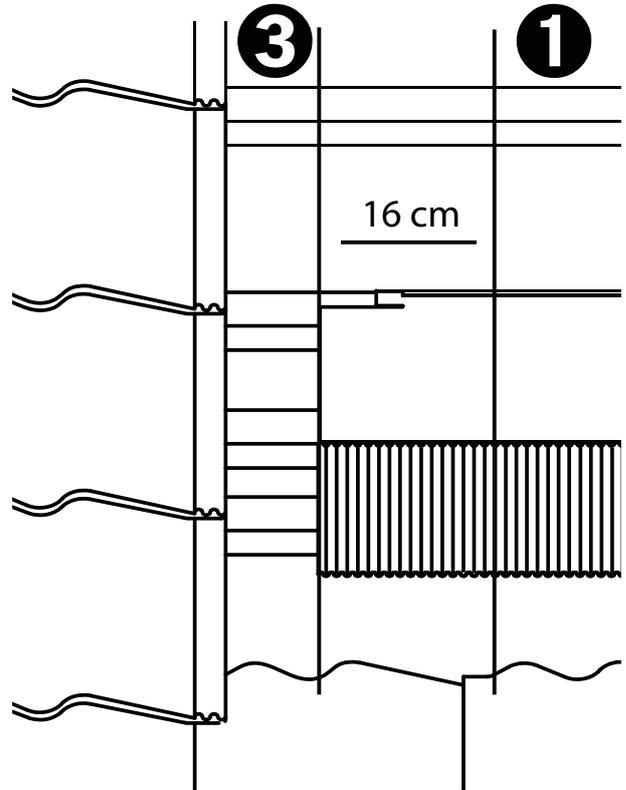


3. Mounting the left bottom fixing plate

When you decide the position of the bottom fixing plate a line (3) should be drawn 16 cm to the left of line (1).

Remember that it is very important that the bottom fixing plate is positioned correctly! The bottom fixing plate can have larger dimensions to the left.

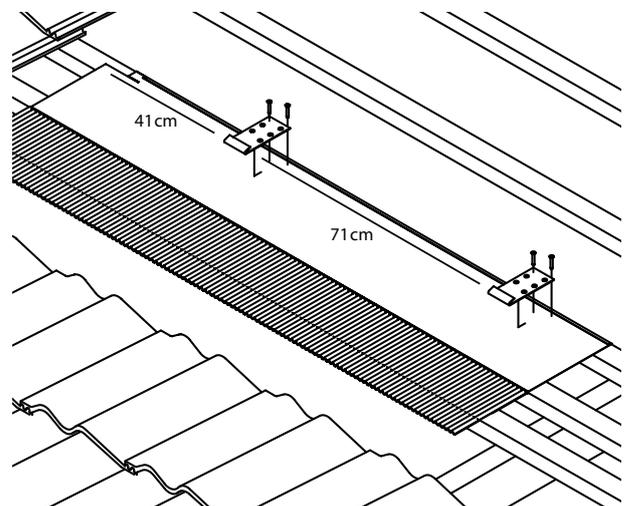
The bottom fixing plate must be secured with the solar panel holders.



Because the solar panel holders also bear the solar panel's weight it is important that they are placed in the right line.

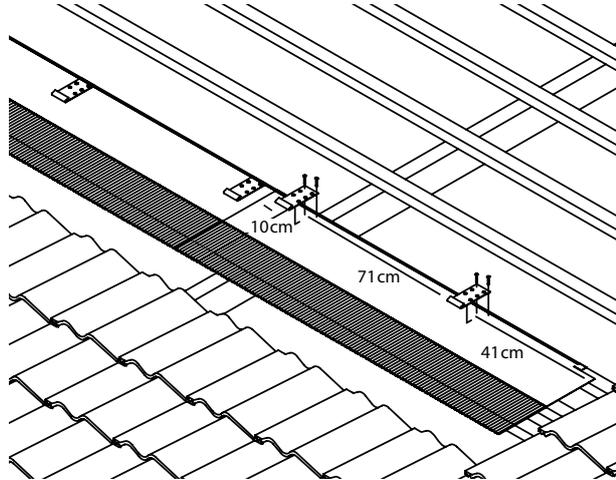
It is also important that the underlying board is sufficiently stable. Reinforce if necessary!

Each solar panel hook must be secured with Spax screws through the bottom fixing plate upper edge as illustrated. The distance between the holders must be 71 cm, and 41 cm to the edge of the bottom fixing plate.



4. Mounting the right bottom fixing plate

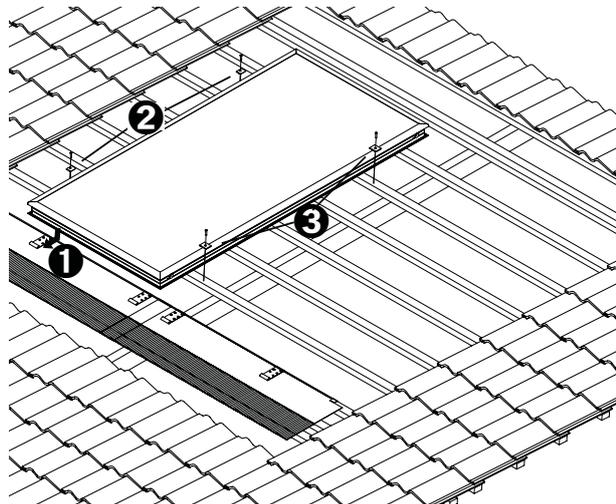
Position the next bottom fixing plate over the installed one with a 10 cm overlap and secure the solar panel holders. The distance between the holders must be 71 cm, and 41 cm to the edge of the lead plate.



5. Position solar panel 1

Position the solar panel in the holder to the left (1). Ensure that the sensor submerged tube is on the upper side! Adjust the solar panel in relation to line (2).

Secure the first solar panel in the 2 external fixing wedges with Spax screws. The centre fixing wedges must just be set in the right position and secured, but do not tighten completely (3).



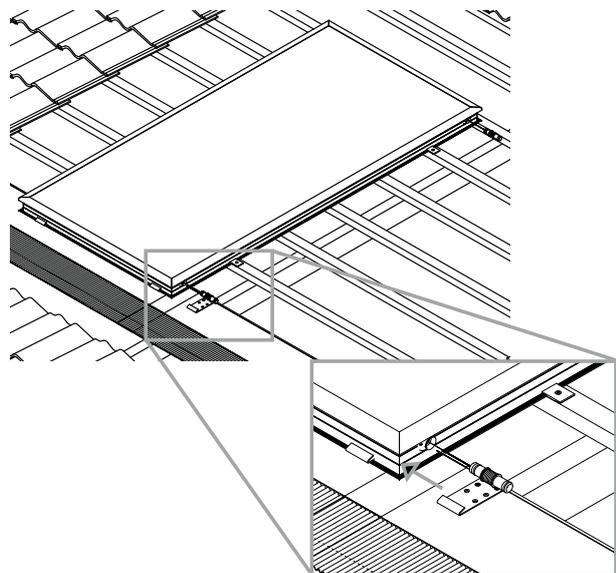
6. Install the quick coupling



NOTE

The O-rings in the quick coupling have already been treated with special high temperature grease. No further lubrication is needed. Further lubrication can reduce the service life and invalidate the warranty!

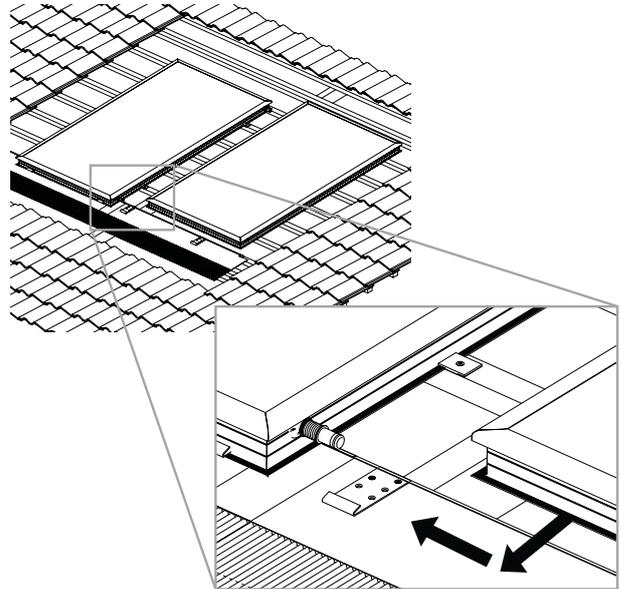
Remove the protection from the quick coupling and insert the quick coupling straight into solar panel 1. Carefully insert the quick coupling.



7. Secure solar panel 2

Position solar panel 2 in the holders. The temperature sensor must be pointed upwards.

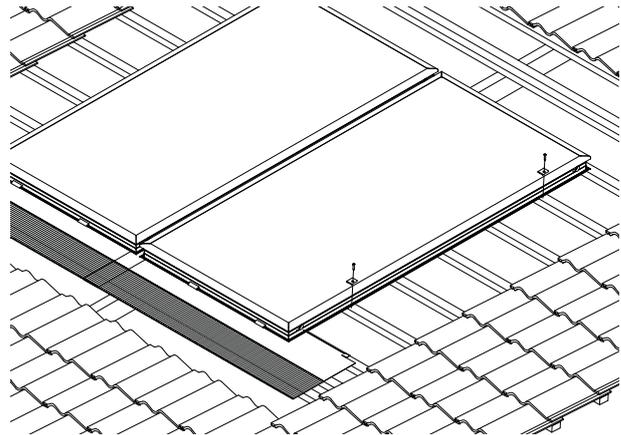
Press solar panel 2 towards solar panel 1, until the frame section's teeth are under the centre fixing wedge. Check that the quick coupling has been pushed into the pipe properly. The distance between the solar panels must now be 24 mm. Tighten the centre fixing wedges with the torx screws.



8. Secure the second solar panel

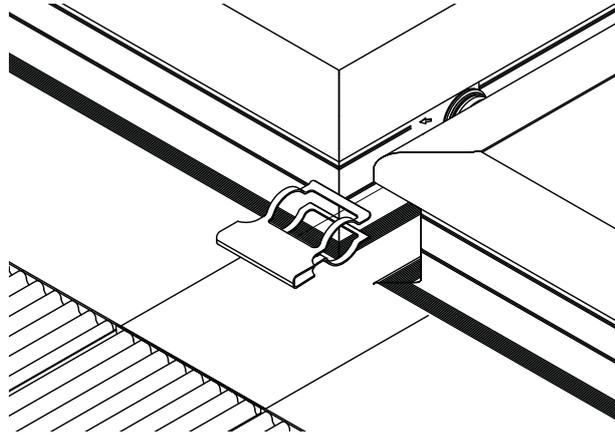
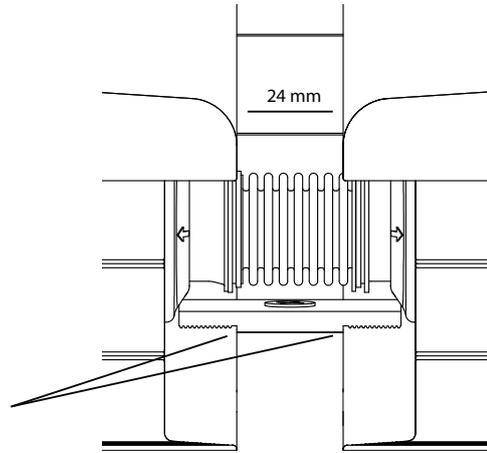
Secure the first solar panel in the 2 external fixing wedges with Spax screws.

Check the distance between the solar panels. Adjust if the distance is not 24 mm.



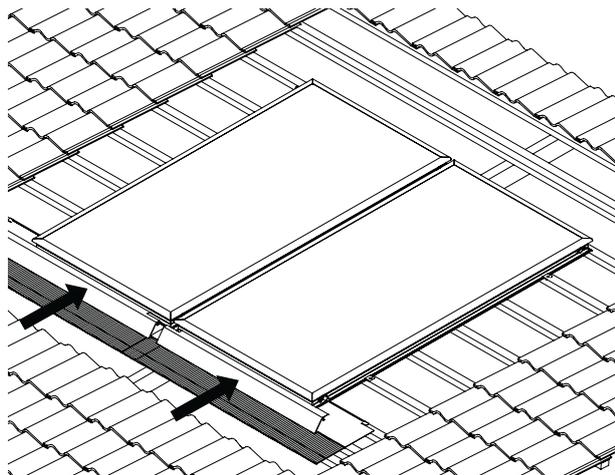
Press the compensator clamps over the solar panel's absorber pipes. If necessary, slide the absorbing unit into place, so that the compensator clamp grips the compensator pipes.

Check that the internal stop lugs grip the solar panel frame.

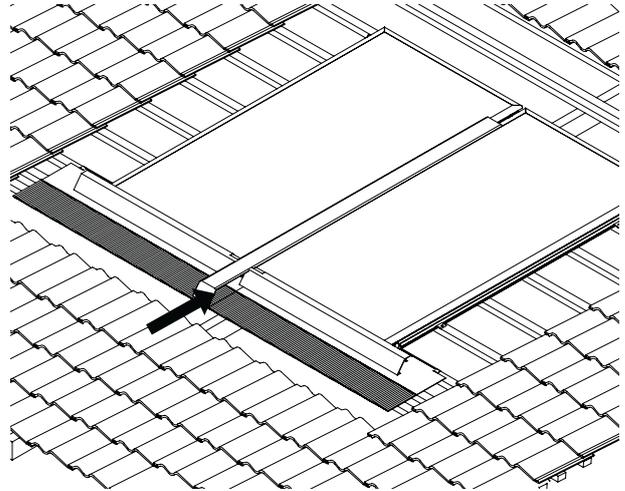


9. Install the lower piece

Move both the lower pieces on the solar panel's underside and check that the seam goes over the rounded edge of the solar panel.



Insert the intermediate piece between the solar panels and check that it reaches the right position.



10. Connect the couplings and install the temperature sensor



NOTE

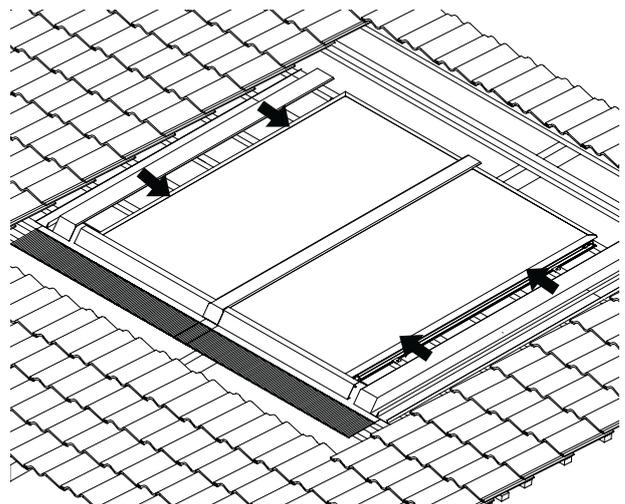
The pipe lead-ins in the roof must be made professionally to prevent the risk of rain water leakage.

How the outer connections should be installed is described in Installing the quick couplings on page 62.

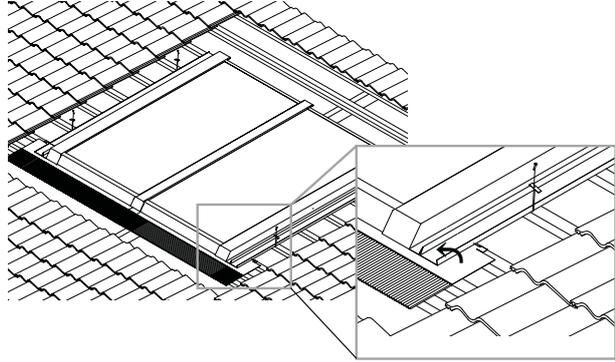
How the temperature sensor should be installed is described in Installing the solar panel's temperature sensor on page 63.

11. Mounting the side pieces

Position the side pieces on the edges of the solar panel's rounded profiles. Check that the rounded edges of the solar panel's profiles are covered. The solar panel frame must be fully covered by the side pieces.

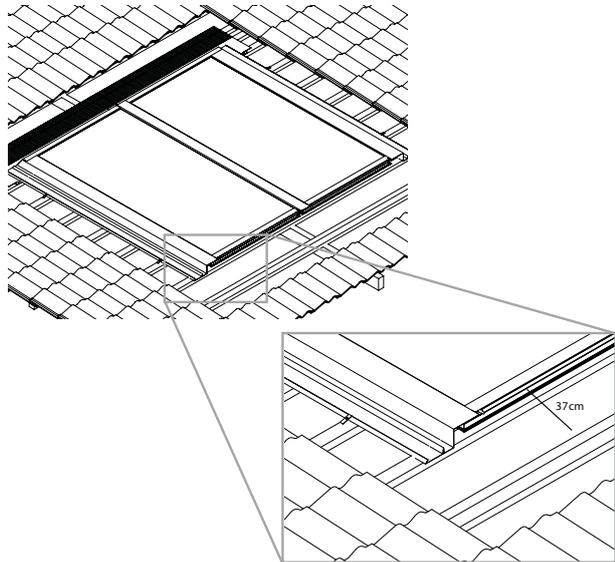


Mounting the side pieces with lock clamps.



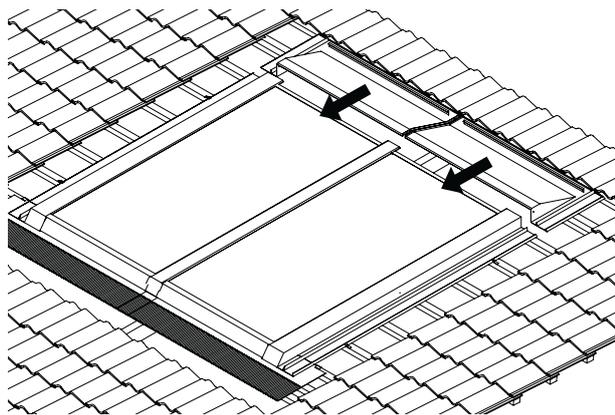
12. Install the extra support upper batten

An additional support batten is recommended as support for the upper piece. The batten should sit 37 cm from the solar panel round profile edge upwards.



13. Mounting the upper pieces

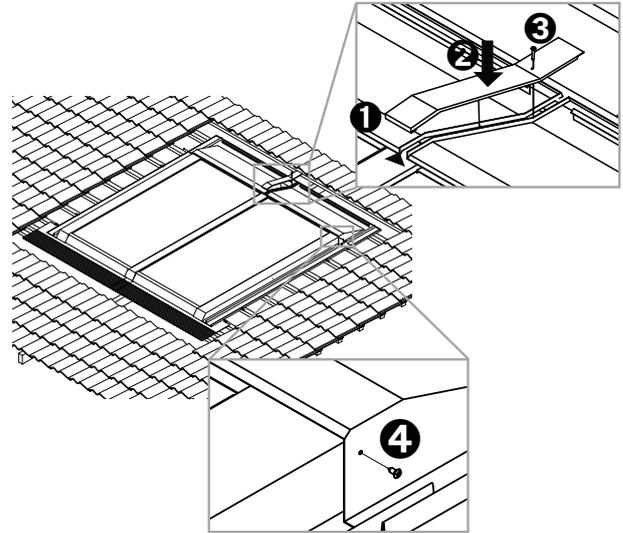
The upper pieces must sit above the side pieces. The inset pieces must sit above the frame.



14. Installing the intermediate panel

The foam strips must be bonded to the intermediate panel. The intermediate panel is then placed on the upper pieces (1)+(2)+(3) and secured.

The upper pieces are then screwed into place in the side pieces with panel screws from each side (4).

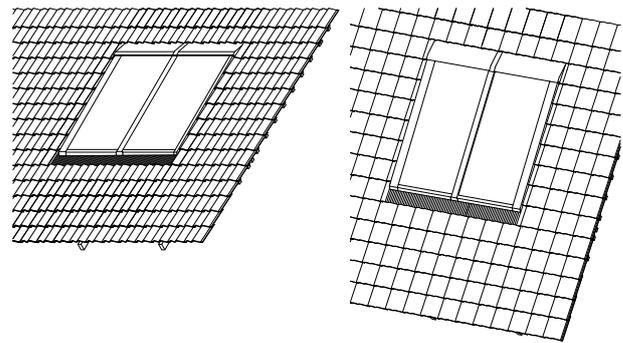


15. Complete the installation

Cover the roof with roof tiles.

In some cases the tiles need to be cut to fit.

Finally, shape the lead plate according to the shape of the roof tile.



Mounting vertical solar panels (P) on adjustable stands 42-65°

The different installation variants that are covered here are:

- Mounting on bitumen roofs, horizontal rows and adjustable stand 42-65° (P)
- Mounting on ground foundation, horizontal rows and adjustable stand 42-65° (P)

For mounting on flat and low pitch (bitumen) roofs, also for ground mounting.

How raised sealing plates mountings for bitumen roofs are to be installed is described on page 60.

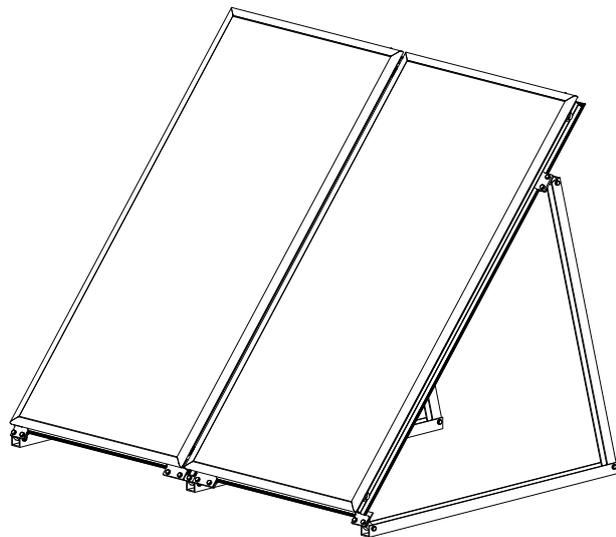
A condition of the adjustable stands is that exactly the right position can be selected when securing the stand

When installing on a foundation the stand must be anchored in a professional manner.

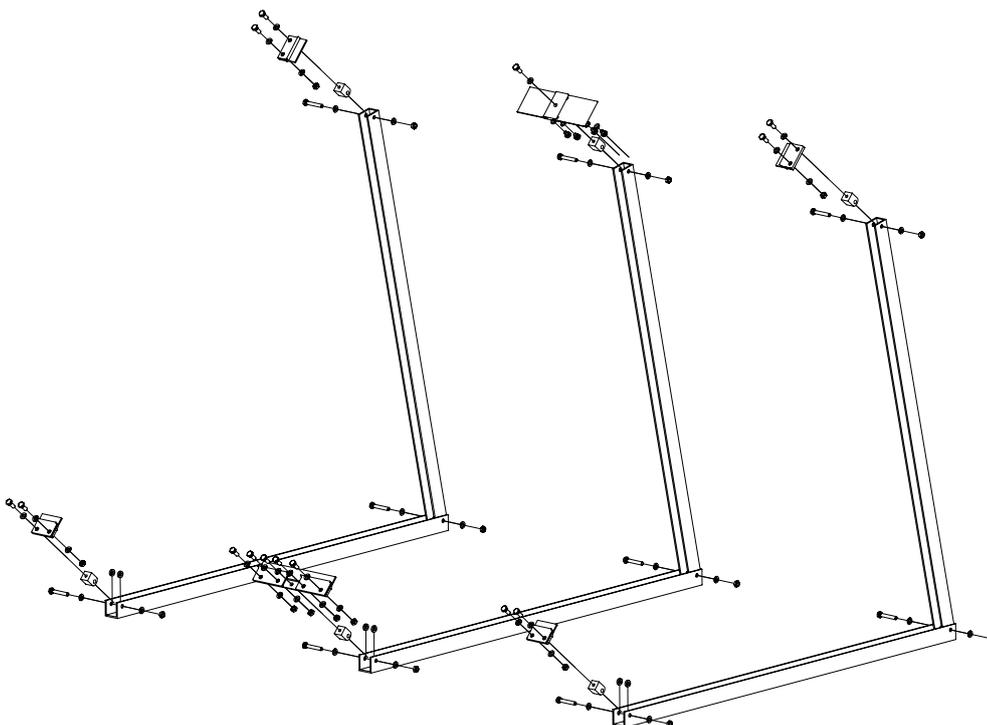


NOTE

It is extra important that the stand is well anchored in the base for this type of installation, with reference to the solar panel generating higher wind loads at steeper angles. The installer must determine whether the roof must be reinforced.



Overview



1. Mark up the position of the solar panels

Size:

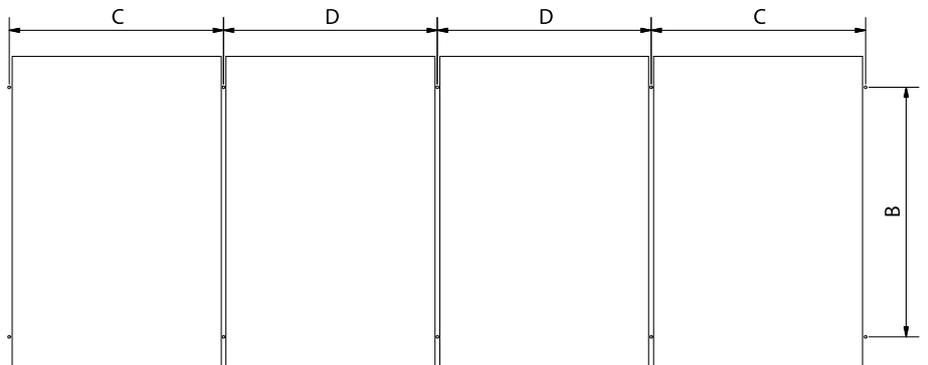
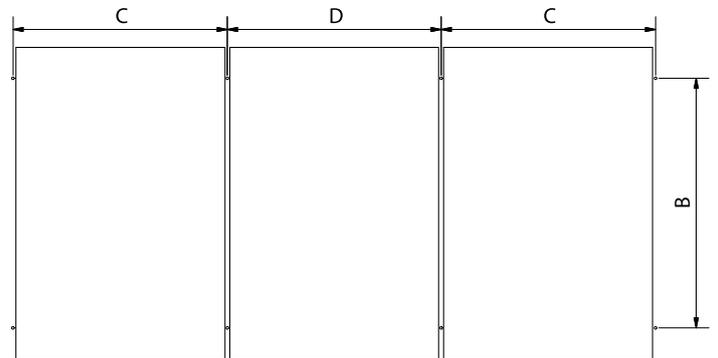
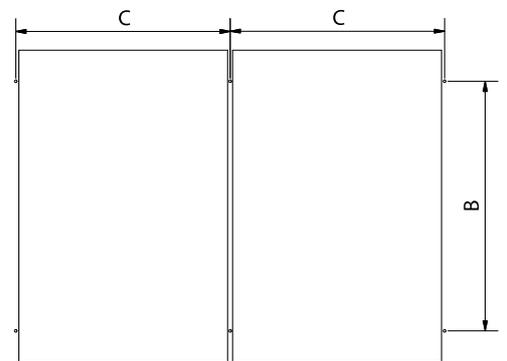
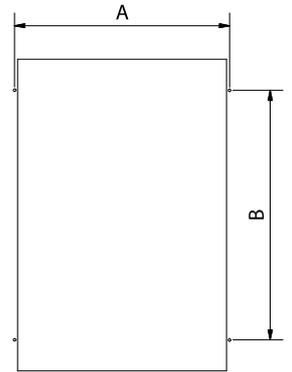
A: 1 060 mm

B: 1 240 mm

C: 1 057 mm

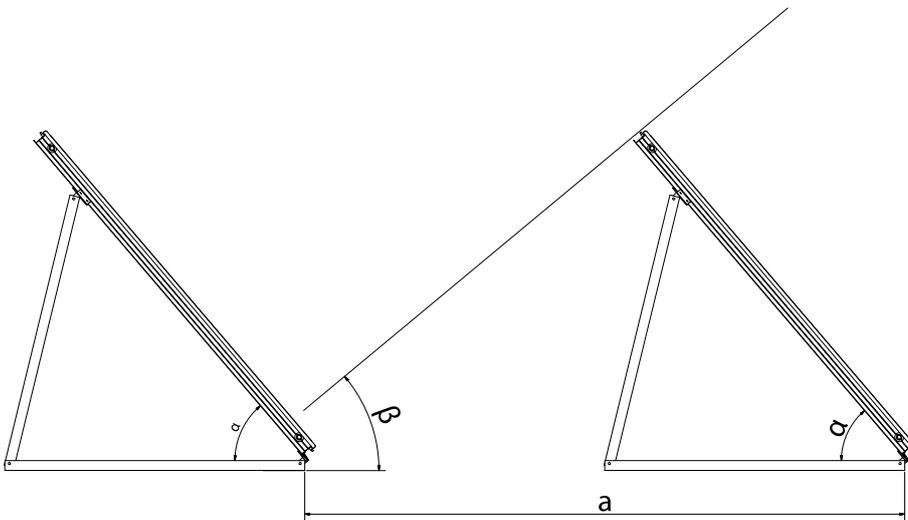
D: 1 054 mm

The rails protrudes 130 mm outside the hole pattern.



**NOTE**

The distance (a) between the adjacent rows depends on the angle (α) and the solar radiation angle (β). The distance between the rows must be between 5 m and 11 m depending on local conditions. (The distance can be reduced if a greater shadow angle is acceptable.)

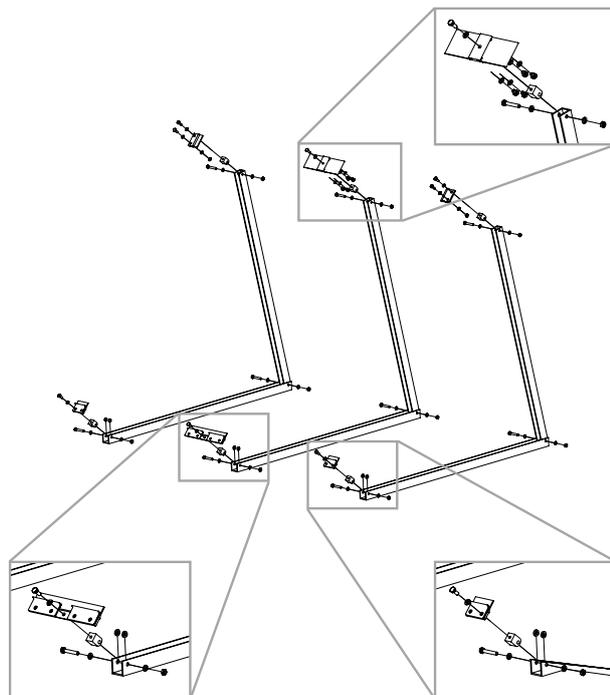
**2. Assemble the stand**

Secure the bottom rails in the base according to the stand's hole pattern. Then secure the stand with M10 x 65-screws, nuts and washers in the rear edge of the bottom rail. Then secure using lock clamps according to the illustration.

Install the centre lock clamp on the stand with M10 x 65-screws, washers and M10-nuts. Then secure the lower centre locking clamp in the lower rail with M10 x 25 and washer. Screw in 4 M10 x 12 with locking washer from underneath.

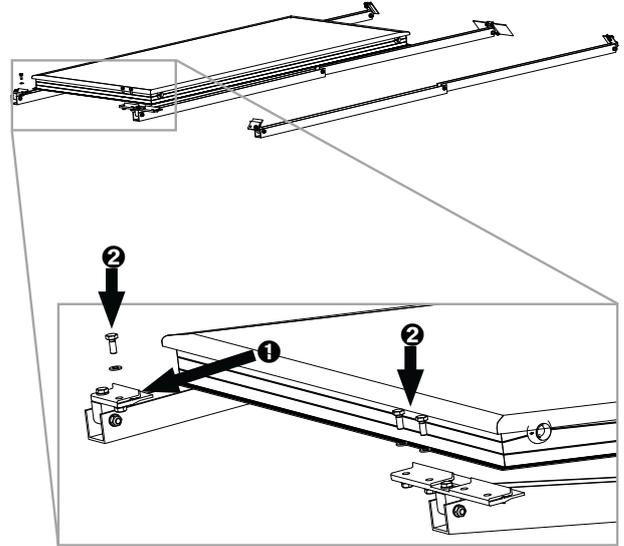
**NOTE**

Lightly tighten the outer locking clamps screws so that the clamps are not deformed. Do not press the locking clamps together. Only screw the M10 x 12-screws in the middle in lightly, and leave room for the solar panel.

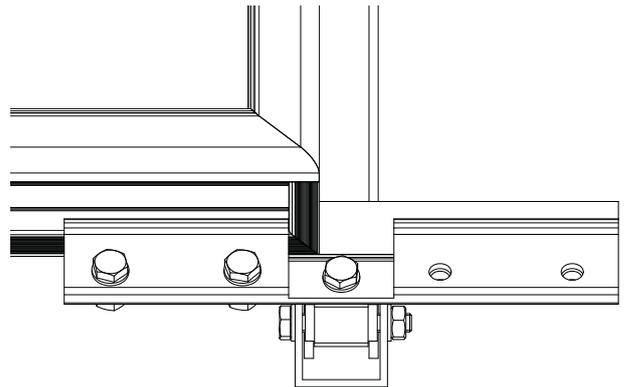


3. Installing the first solar panel

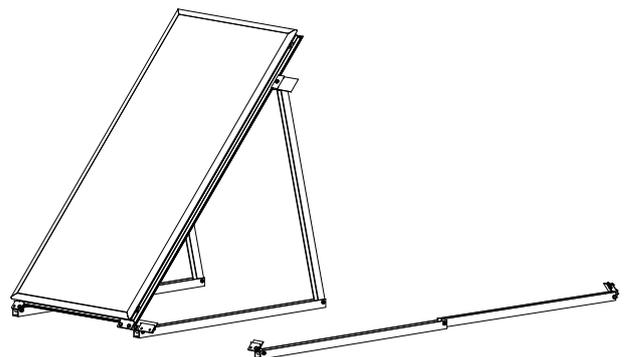
Remove the transport protection from the corners, position solar panel 1 on the rails and (1) slide it into the lower external locking clamps. (2) Then secure the solar panel in position with the outer locking clamps. Screw the external locking clamps and the centre locking clamps together with M10 x 25-screws, washers and M10-nuts.



The inside of the centre locking clamp must close level with the solar panel.



Then lift the solar panel and secure it using the upper centre locking clamps when the desired angle is reached. Secure M10 x 25-screws with washers and M10-nuts on the outer locking clamp and tighten the clamp. Tighten 2 M10 x 12-screws on the centre locking clamp.



4. Install the quick coupling

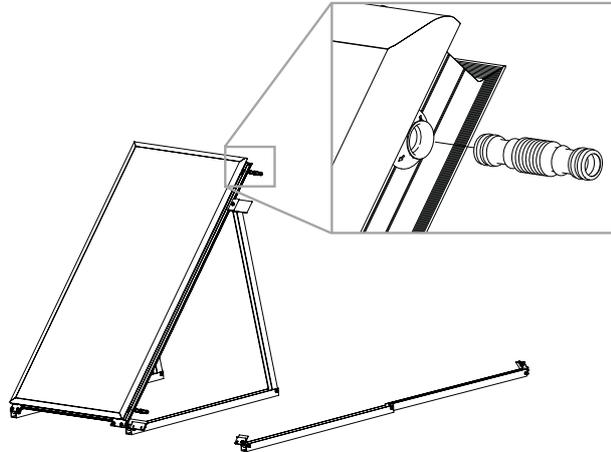
Press the quick coupling straight into solar panel 1.



NOTE

The O-rings in the quick coupling have already been treated with special high temperature grease. No further lubrication is needed.

Further lubrication can reduce the service life and invalidate the warranty!



5. Mount solar panel 2

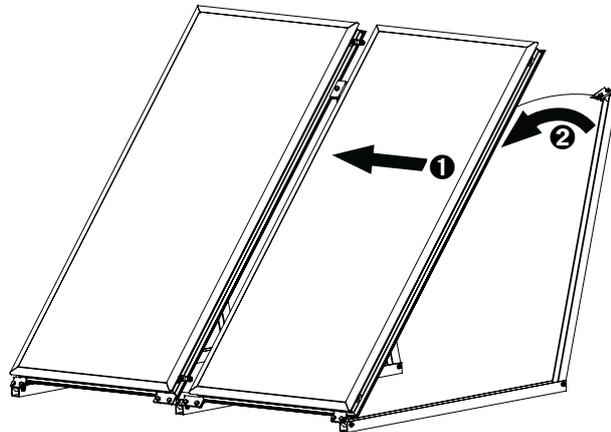
The bottom rail's free locking clamp for the next stand must be moved to the corresponding position for installation of the second solar panel. Then position the solar panel on the locking clamps, secure from behind and press in the quick coupling (1). Connect the next stand to the solar panel (2). Assemble the locking clamp with M10 x 25- screw, washer and M10-nut.



NOTE

Check that the quick couplings are correctly located when the solar panels are connected. They must not be crooked!

Check the distance between the solar panels (24 mm)!

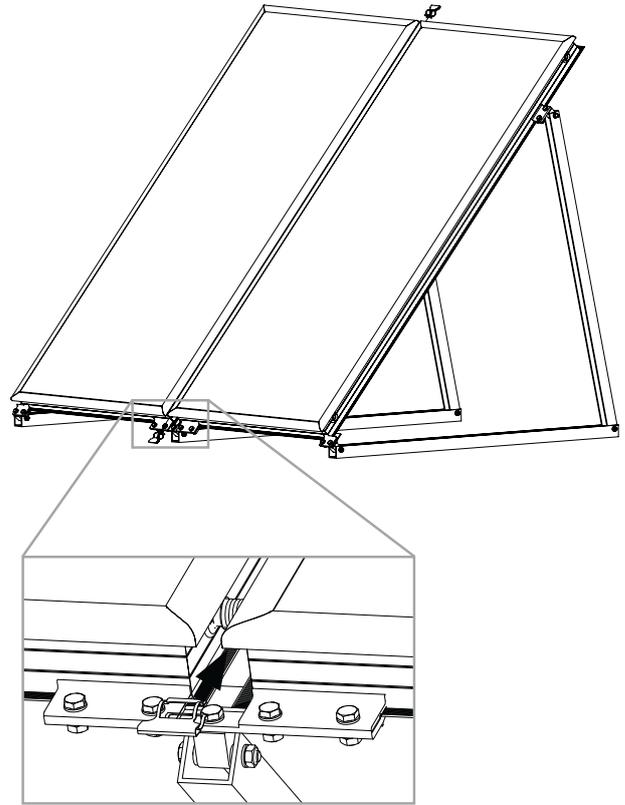


6. Insert compensator clamps



NOTE

Check that the compensator clamp is correctly located!



7. Connect the couplings and install the temperature sensor

How the outer connections should be installed is described in Installing the quick couplings on page 62.

How the temperature sensor should be installed is described in Installing the solar panel's temperature sensor on page 63.

Common instructions

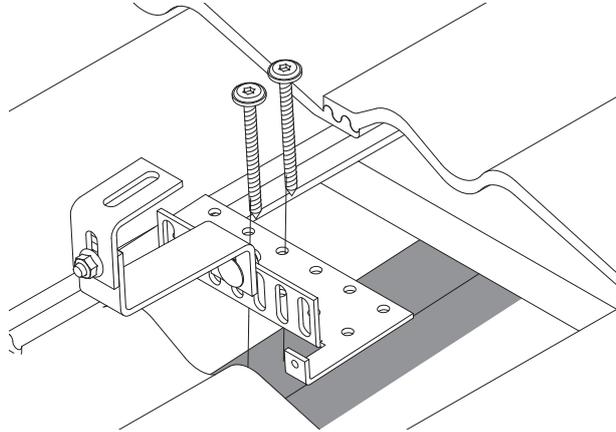
Roof mountings

Mounting on tiled roofs

NOTE
Read through the installation section before starting mounting.

Typical German tiled roof

When securing the brackets, remove the roof tiles, the brackets are then screwed into the trusses with at least 2 screws with flat heads. If necessary, the screw holes must be pre-drilled.

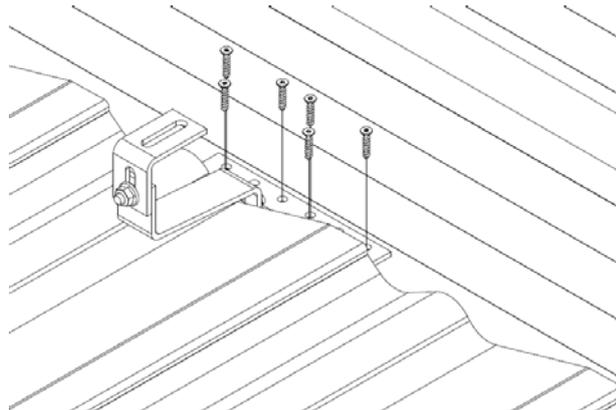


Installing tiled roof brackets on roofs with sufficiently stable tongue and groove between roof trusses and roof tiles

Typical Swedish tiled roof

If the roof's outer layer consists of roof tiles then tiled roof brackets must be used. If there is tongue and groove between the roof tiles and the roof trusses at least half a screw kit (Part no. 057039) must be used to achieve a stable mounting of the bracket.

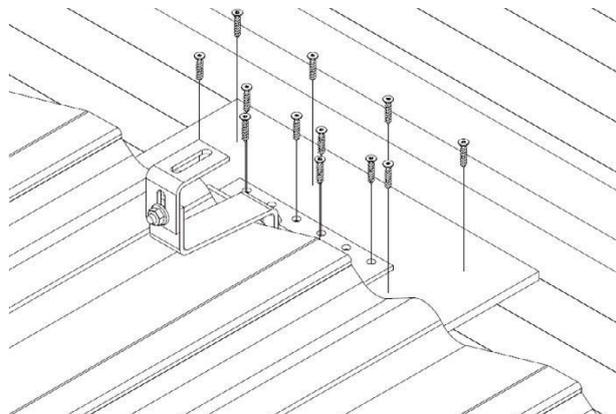
NOTE
The installer must determine how many screws are required to achieve a stable mounting from case to case.



Installing tiled roof brackets on roofs with tongue and groove that requires reinforcement. Or where the tile battens are higher than the adjustment range of the brackets

A suitable method is to screw a marine plywood sheet 13 mm x ca 350 x 350 mm or as large a sheet as can be installed into place.

Use at least 9 screws from the screw kit (Part no 057039). The installer must judge from case to case if it is sufficient or whether more screws must be used to achieve sufficient stability to prevent flexing tiled roof brackets breaking roof tiles in event of snow or other loads.

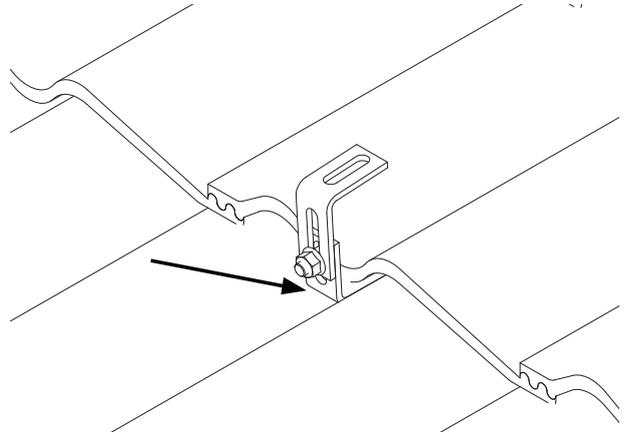


Roof tiles must be cut so that the bracket can be between the tiles without touching the lower tiles. Then cover the roof again.



NOTE

There must be at least 3 mm between the underside of the bracket and the lower tile at the overlap point.



Mounting for double seamed sheet metal roofs



NOTE

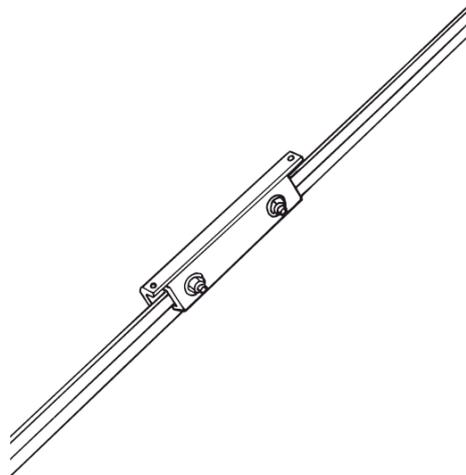
Read through the installation section before starting mounting.

The standing seam holder is installed so that the lugs on the standing seam holder go under the upright seam.

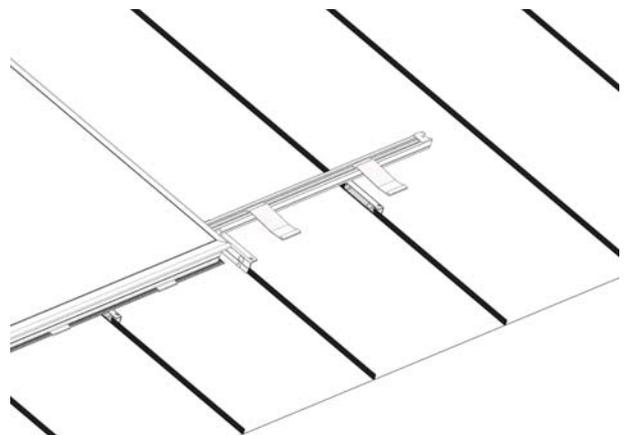


NOTE

Minimum tightening torque 20 Nm



The standing seam holders must be installed following the principle that left hand seam holder is followed by a right hand seam holder and vice-versa.



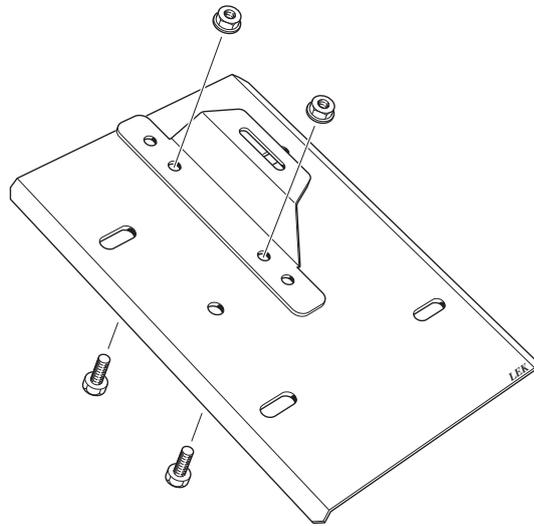
Universal fixing plate for corrugated metal roof



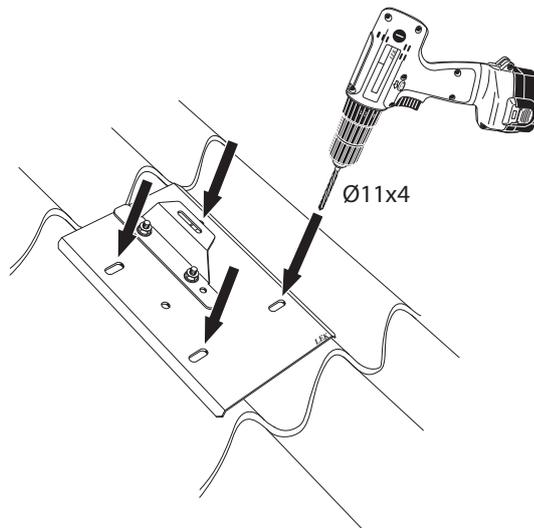
NOTE

Read through the installation section before starting mounting.

1. Install the adapter on the mounting plate, use M10 x 25 screws and M10 flange nuts.



2. Mark out and drill 11 mm holes for the mounting plate.

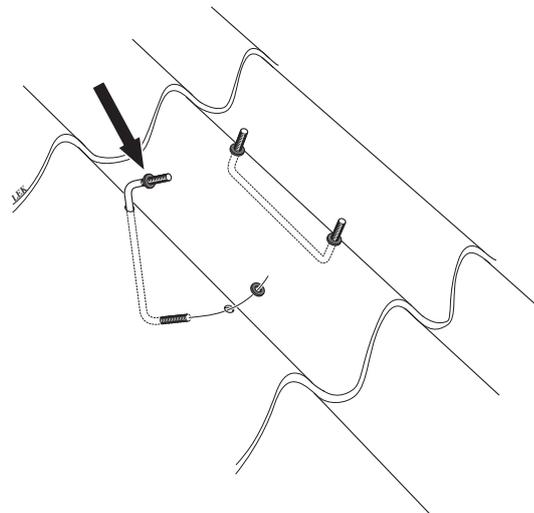


3. Thread the bracket bolt from the hole and lock it using the rubber gaskets and a nut so that it does not slide into the hole during assembly.



NOTE

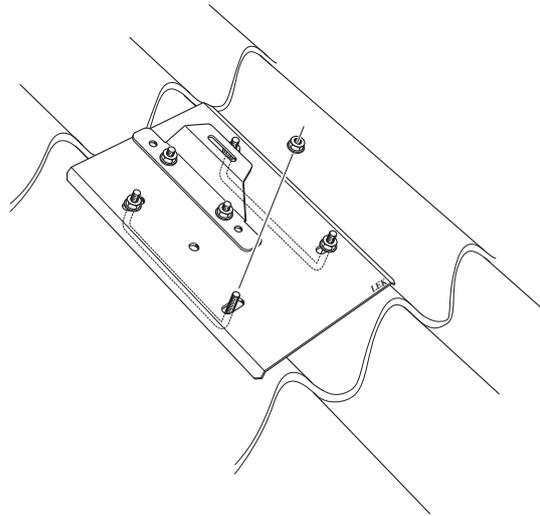
Do not forget the rubber gaskets!



4. Screw the mounting plate into place, use M10 flange nuts.

Continue with the mounting rail and solar panel according to the principles illustrated previously.

If support stands are to be used, install these on the adapter and the mounting rail above the stands.



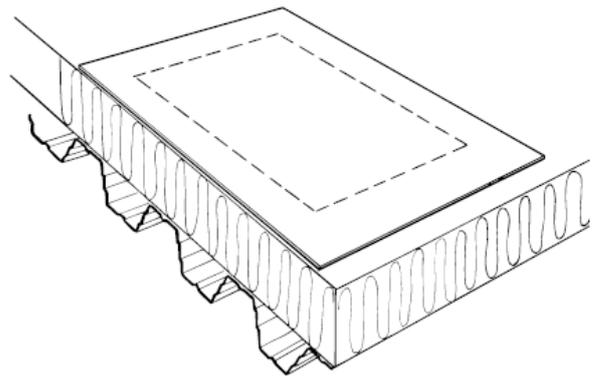
Mounting raised sealing plate (bitumen roof)



NOTE

Read through the installation section before starting mounting.

1. Lay out the felt (larger than the panel) with the under side (adhesive side) upwards where the sealing plate is to be installed.

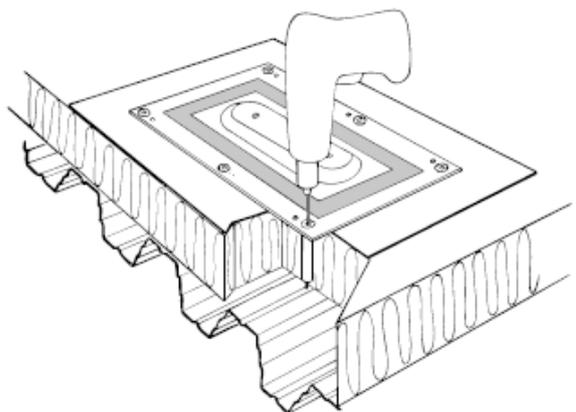


2. Position the sealing plate in the desired position and look for a wave peak in the roof panel. Screw the sealing plate into place with a least (4) screws.

If the felt is resting on insulation in most cases spacers must be used, for example: hot dip galvanised pipe spuds approx: 10-12 mm in diameter.

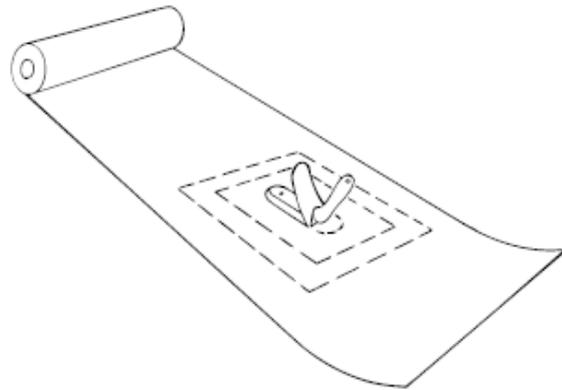
Bear in mind that if the solar panel risks major wind loads (particularly applies to raised panels) the sealing plate needs to be screwed into place with many more screws. The installer must evaluate this from case to case based on the conditions, including:

1. Is the position of the solar panel near the outer edges of the roof?
2. How well do the screws tighten in the under panel (depends on type of base surface and type of screw used)?
3. Will the solar panel be raised?
4. Is the installation in a windy area?
5. Is the installation in a snow rich area?



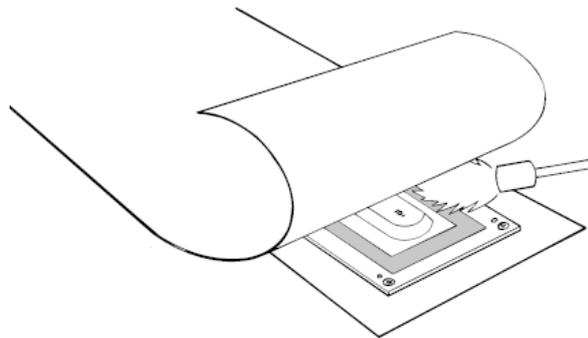
3. Roll out the roofing felt (full roll) and cut out for the bulge, alternatively for the screws in the sealing plate.

On existing roofs: Mechanical mounting with a minimum of 4 screws and a new covering lip with the minimum format 1,0 x 1,5 m.



4. Heat the roofing felt through the perforation in the sealing plate so that it melts together with the underlying felt.

This procedure should be carried out by a professional (bitumen roofing specialist).



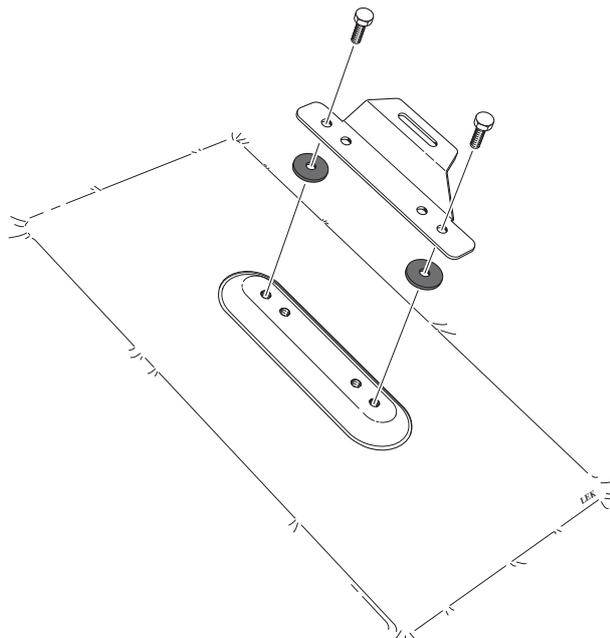
5. Install the mounting against the sealing plate.

NOTE
Do not forget the rubber gasket under the adapter.

Clean tar or anything else off the raised surface in order to achieve the best possible rain seal.

Continue with the mounting rail and solar panel according to the principles illustrated previously.

If support stands are to be used, install these on the adapter and the mounting rail above the stands.



Universal fixing with coach bolt



NOTE

Read through the installation section before starting mounting.

The installer must establish from case to case whether it is appropriate to use coach bolts. Remember that it is possible to order extra coach bolts if it is necessary to increase the stability. (The base should be stable and permit thorough tightening of the coach bolt.)

Mark and pre-drill, seal the hole using a gasket (A). Position the mounting rail between the top washers (B).

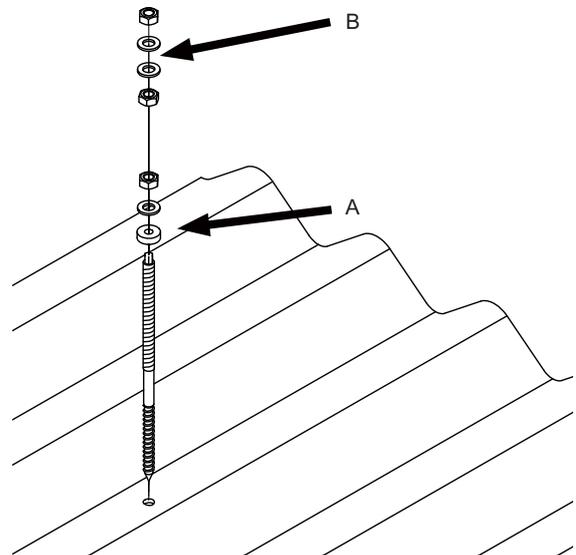
If the coach bolt is used on a shingle roof or bitumen roof try to hit the roof trusses. Use a sophisticated stud detector.

Remember to scrape the grit off the surface of the roofing felt away so that the rubber seal can seal against a SMOOTH surface!

Rainworthiness can be further achieved by using a suitable sealant between the rubber seal and the roof base.

Continue with the mounting rail and solar panel according to the principles illustrated previously.

If support stands are to be used, install these on the adapter and the mounting rail above the stands.



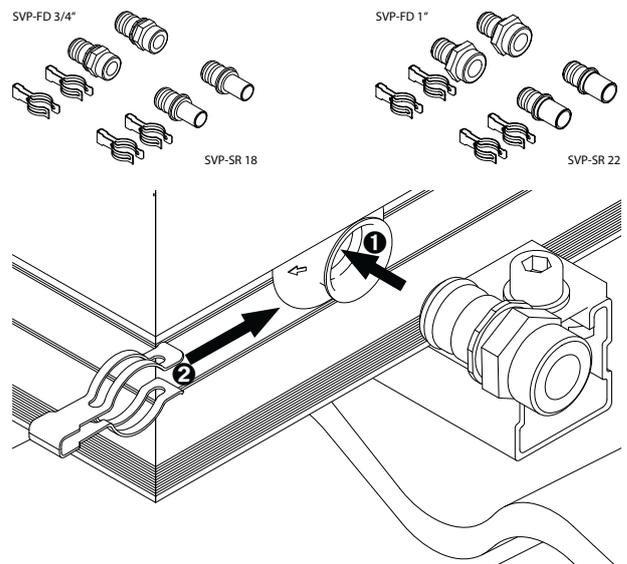
Installing the quick couplings

Insert the couplings in the relevant connection in the solar panel (1) and secure using a locking clamp (2).



NOTE

Check the position of the clamp. The locking clamp must not be crooked. Always check that the safety clamp is secure around the absorber pipe! Never weld or solder the couplings. The warranty is invalidated by welding the couplings.



Installing the solar panel's temperature sensor



NOTE

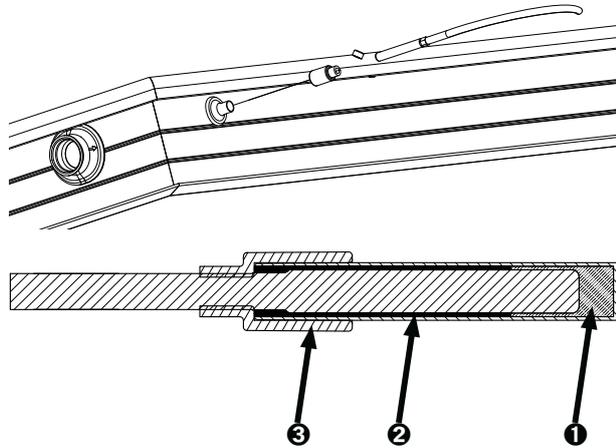
The temperature sensor must always be located in the last solar panel in the direction of flow.

Remove the rubber cap from the submerged tube, cut off the narrow end and thread the rubber cap over the sensor cable. Then place the rubber cap on the submerged tube.



NOTE

For best results, apply heat conducting paste to the submerged tube.



5 Maintenance

The solar panel must be regularly inspected/maintained. This ensures that the system functions correctly for the whole service life. Routine maintenance is a condition of any warranty claims.



NOTE

The system must be shut off during maintenance work. If the sun is shining, all work on the solar panel system's components must be carried out with the solar panels covered, otherwise there is a risk of damage to the equipment or personal injury.

If the system is maintained by a specialist he or she will acknowledge maintenance of the system with a signature. In this case the following table only need be used for any warranty claims.

If a filled solar heating system is not used over a longer period of time and no significant energy is withdrawn from the heat store, the solar panels must be covered to prevent recurring stagnation / boiling.

The following maintenance items must be carried out regularly:

Solar panels

Annual check of mountings. Look for signs of corrosion in the mounting frame and the threaded connections. In addition, the insulation of the connections and the roof lead-ins must be checked. Check also for damage from birds. The solar panels may need cleaning if the roof pitch is low or if there are lots of trees nearby.

Freeze prot

Under normal operating conditions the frost protection and medium's freezing point should be checked every 24 months. In extra ordinary operating conditions it should be checked every 12 months. (Including over-dimensioned systems or too low set value for max tank temp or other reason that has created abnormal large numbers of boiling/stagnation incidents.)

The freezing point must be at least -25 °C so that the solar panel does not freeze during winter. Check the system pressure on the pressure gauge. If the liquid needs to be filled the correct ratio of water and glycol must be observed.

Control

Check that the values from the temperature sensors correspond to the actual temperatures in the automatic controller annually. Check that the pump's speed setting is according to the recommended flow range. (Remember that if the pump is in speed controlled mode the flow may be momentarily lower.)

- Checking the safety valve's function
- Check if the solar pump station's air trap needs to be bled. If necessary carefully release until fluid runs out.
- Check that all electrical connections and cables are ok
- Enter information in the maintenance log

Regular maintenance of the system is a condition of any warranty claims.

6 Troubleshooting

If actual system faults or defects occur these must be rectified. On the other hand not every deviation is an indication of abnormal function in the system, for example in the following instances:

- Directly after start there are often pressure fluctuations in the system. These are due to residual air in the solar circuit. Stable pressure is achieved after further venting.

- Vapour build up in the solar panel is usually due to moisture that penetrates during storage and transport. Moisture build up usually disappears after a couple of weeks operation through the moisture disappearing through the integrated ventilation holes.

The following table can be used for analysis of faults and selection of suitable remedial action.

Check the general operating conditions. Are the stated values fulfilled?

Fault	Cause	Solution
The pump starts late and stops early.	Solar controller's on / off temperatures are set too high.	Reduce the temperature difference.
The pump starts late and stops shortly thereafter. This is repeated several times, until the system has been run through. The same thing happens in the evening.	The available amount of sunlight is not sufficient to heat the whole pipe network	Check for possible faults when there is more solar radiation.
	Unusually high flow (the pump is set too high)	Reduce the pump's efficiency level.
	Too little difference between dt on and dt off in relation to the length of the solar culvert (longer distance to solar panel = greater dt on).	Increase the difference between dt on and dt off.
	The pipe network is not fully insulated.	Insulate the pipes.
	Solar sensor in the tank located too low.	Change the position or compensate with higher value dt on and dt off.
The system pressure drops.	Pressure drops are normal shortly after filling up the system, because air still disappears from the circuit. If a pressure drop occurs later, it may be because an air bubble released itself later. In addition the pressure varies by 0.2–0.3 bar during normal operation depending on the system's temperature. If the pressure continues to fall it may be because there is a leak somewhere in the solar circuit	<ul style="list-style-type: none"> ▪ Automatic air valve blocked? ▪ Check the couplings and connections. ▪ Check that the expansion tank is complete and the membrane seal.
	Fluid losses because the safety valve opens.	Check the tank size. Check the expansion tank air pre-pressure at an unpressurised state.
	Damage to the solar panel (leakage) and frost damage because of too little anti-freeze	Check the anti freeze and the pH value. Replace/supplement as necessary.
Noise from pump.	There is air in the pump	Vent the pump.
	Insufficient pressure in the system.	Increase the system pressure.
Noise from the system. Normally in the first days after filling. If the noise occurs later there are several possible causes:	The system pressure is too low. The pump draws in air through the vent valve.	Increase the system pressure. Tighten the vent valve harder to close it.
	The pump capacity is set too high.	Change to a lower speed and check the flow meter with the adjustment valve

Fault	Cause	Solution
The pump starts late and stops early. Or: The temperature display on the control unit shows no temperature, or the values are outside the normal operating range.	In event of short circuits or open circuits.	<ul style="list-style-type: none"> ■ Follow the control unit description. ■ Check the cable connections. ■ Check the disconnected sensor's resistance at known temperatures and compare with the manufacturer's specifications. ■ Check that the cables are not damaged.
The accumulator cools in the evening and during the night. When the pump has been switched off the supply and return have different temperatures. The solar panel's temperature at night is markedly higher than the outdoor temperature.	The non-return valves do not close.	<ul style="list-style-type: none"> ■ Check the adjustment lever and thermometer shut off position, should be completely open. ■ Check if there is scrap in the non-return valves located in the pump station's shut-off knob. ■ In certain cases it may be necessary to install strong heat restrictors in the form of large U bend routing. If necessary a 2-way valve that opens in parallel with the pump is installed.
	Single pipe circulation (double circulation) in shorter pipe systems with low pressure drop.	Installation of a non-return valve in the supply or heat barrier loop. See the response in the box above.
With solar radiation the inside of the glass fogs over a period of time.	The solar panel's ventilation holes are not sufficient in relation to the prevailing conditions.	Clean the air valves. In extreme cases the valves may need to be "buckled out".
The accumulator cools too much.	Defective or incorrectly installed insulation.	Check the insulation and insulate the connections to the accumulator.
	Supplementary heat source settings.	Check the control settings for supplementary heat source.
	The hot water circulation is run too often and/or at night.	Check the change times and the temperatures and interval operation. Check settings.
The pump does not switch off.	Defective sensor or incorrect location of sensor.	The sensor's position, composition, properties and values.
	Fault in the control unit.	NOTE! Pumps with variable speed are not shut off immediately, but first after minimum speed has been achieved.

7 Start up protocol

Cut out, copy/scan and send in (return) via e-mail or via fax with receipt.

Customer name/Project name	Date _____
Address	
Executing company	Technician _____
The solar panel's serial number	_____/_____/_____ _____/_____/_____
Installation type	<input type="checkbox"/> Installed <input type="checkbox"/> on roof <input type="checkbox"/> in roof <input type="checkbox"/> on low pitch roof (Stand)
Version	<input type="checkbox"/> Vertically <input type="checkbox"/> Horizontally
The solar panel's orientation	Direction <input type="checkbox"/> South <input type="checkbox"/> South west <input type="checkbox"/> South east <input type="checkbox"/> East <input type="checkbox"/> West <hr style="width: 50%; margin-left: 0;"/> Roof pitch _____ degrees
The solar panels are overshadowed	<input type="checkbox"/> yes <input type="checkbox"/> no
Type/brand accumulator	Contents _____ litre
Pipe length from solar panel to accumulator, single	_____ metres
Pipe type	DN _____
Solar control	Brand _____ Type _____
Adjust the control unit's settings according to instructions	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> DT on _____ <input type="checkbox"/> DT off _____ <input type="checkbox"/> Tank _{max} _____ °C <input type="checkbox"/> Collector _{max} _____ °C
Control unit operated according to the instruction manual	Date _____
Tank filled and vented	<input type="checkbox"/> yes <input type="checkbox"/> no
The solar circuit's safety valve routed to the container/collection vessel	<input type="checkbox"/> yes <input type="checkbox"/> no
The solar circuit pressure tested when the system is cold	<input type="checkbox"/> yes <input type="checkbox"/> no
Check for leaks at connections and connectors	<input type="checkbox"/> yes <input type="checkbox"/> no

Operating pressure (cold)	_____ (bar)
---------------------------	-------------

The system is free of air and filled with heating medium	<input type="radio"/> yes <input type="radio"/> no
--	--

Pump set level	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4
----------------	---

Insulated pipes (according to national norms and practice)	<input type="radio"/> yes <input type="radio"/> no
--	--

Insulation material	Type _____ Thickness of the insulation _____ mm
---------------------	---

Adjusting the flow	Litres/minute _____
--------------------	---------------------

Frost resistance	_____ °C	Checked <input type="radio"/> yes <input type="radio"/> no
------------------	----------	--

Electrical connections according to national norms and practice

Executing company	Date _____
	Stamp/signature _____ Technician _____

 NOTE! The system (control unit) must not be switched off!

Country		Stamp/signature	
City			
Date			

8 Maintenance log

	Date	Signature
Inspection/Service 1		
Inspection/Service 2		
Inspection/Service 3		
Inspection/Service 4		
Inspection/Service 5		
Plant address		

Inspection/Service										
Solar panel and mountings ok?	yes	no								
Insulation and roof lead-in ok?	yes	no								
Operating pressure ok?	yes	no								
Does the pump start manually?	yes	no								
Venting performed?	yes	no								
Freeze protection performed?	yes	no								
Is the PH value of the glycol at least 7?	yes	no								
Pump speed/flow ok?	yes	no								
Pump speed?										
Dt on?										
Dt off?										
Tank max?										
Collector max?										
Does the solar automatic device show reasonable temperature values?	yes						no			
Miscellaneous										

9 Technical specifications

Solar panel dimensions

Installation on roof with or without stand 25°(P)

Number of solar panels	Length mounting rail	Solar panel's total length	Minimum number of brackets	Minimum number of joint kits
1	1 068 mm	1 030 mm	4	0
2	2 125 mm	2 084 mm	4	0
3	3 193 mm	3 138 mm	6	1
4	4 250 mm	4 192 mm	8	1
5	5 318 mm	5 246 mm	10	2
6	6 375 mm	6 300 mm	12	2
7	7 443 mm	7 354 mm	14	3
8	8 500 mm	8 408 mm	16	3
9	9 568 mm	9 462 mm	18	4
10	10 625 mm	10 516 mm	20	4
11	11 693 mm	11 570 mm	22	5
12	12 750 mm	12 624 mm	24	5
13	13 818 mm	13 678 mm	26	6
14	14 875 mm	14 732 mm	28	6
15	15 943 mm	15 786 mm	30	7

Installation on flat roof with adjustable stand (P)

Number of solar panels	Length mounting rail	Solar panel's total length	Minimum number of brackets	Minimum number of joint kits
1		1127 mm		
2		2181 mm		
3		3235 mm		
4		4289 mm		
5		5343 mm		
6		6397 mm		
7		7451 mm		
8		8505 mm		
9		9559 mm		
10		10613 mm		
11		11667 mm		
12		12721 mm		
13		13775 mm		
14		14829 mm		
15		15883 mm		

Type	FP 215P	FP 215PL
Dimensions	2088 × 1030 × 81 mm	
Gross area	2,15 m ²	
Aperture area	1.91 m ²	
Glass thickness	3,2 mm	
Glass type	Hardened low ferric glass	

Type	FP 215P	FP 215PL
Absorber pipe's diameter	22 mm	
Serpentine pipe's diameter	10 mm	
Weight	32.5 kg	33 kg
Collector frame	Black anodised aluminium	
Absorber type	Meander/serpentine pipe, blue high selective absorber coating	
Optical efficiency	80,6%	82,3%
Insulation overview	20 mm mineral wool	
Insulation underlayer	20 mm PIR sandwich insulation	
Filling volume	1.65 litres	2.32 litres
Heating medium	Water mixed propylene glycol	
Max operating pressure	10 bar	
Max stagnation temperature	191.2 °C ¹⁾	
Part no.	057001	057002

1) With solar radiation of 1000 W/m² and 30°C ambient temperature

10 Item register

Item register

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