Installation Instructions
TopFix 100

Dear customer,

Congratulations! You have chosen an product! Experience for yourself the quality and reliabilit y of the TopFix 100 module mounting system.

To mak e it easy for you to install and commission your TopFix 100 mounting sys tem, we have included these detailed installation instructions. They are intended to help you quickly become familiar with how to fit the frame and the modules.

Please carefully read through these instruc tions before starting installation. If you have questions that you can't find the answers to here, please get in touch with your contact who will be pleas ed to help.

Wishing you a sunny day,

Your team

Contents

What you need:

1 Tool list

Cordless screwdriver with a range of bits (Torx, Philips ...)

Drill 5.5mm diameter (to pre-drill 8x100 wood screws)

Drill 6.0mm, 8.5mm and 15mm diameter (for M12 hanger bolts)

Drill 7.0mm diameter (for transverse securing bolts)

Drill 11.0mm, 13.0mm diameter (for aluminum L-section roof-hook connector)

Pencil

Tape measure

Folding rule

Open-ended spanners; jaw openings SW 13, SW 15, SW 17

Ratchet or drill with socket set and torque limiter

Angle grinder with diamond cutting disc

Allen key with T-grip, size 6

The additional tools needed specifically for installing our trapezoidal sheet mounting system are dealt with in separately in Section 4.5.3, because this type of mounting system differs in some points from other the fastening systems.

2 General information, standards and regulations

The TopFix 100 mounting system is used for installing your solar modules.

The modules are fastened by means of clamps and carrier rails.

The number of components varies according to the size of the system.

Important information:

Your TopFix 100 mounting system is supplied complete with all accessories.

Before beginning work, check that all parts are there using the packing list and the parts list in the Appendix.

Electrical work may only be carried out by qualified electricians!

According to the guidelines of the solar module manufacturer, transformerless grid feeding devices must be grounded individually and integrated in the equipotential bonding.

The processing guidelines and the respective roof covering manufacturer's specifications must be observed!

General important information and standards relating to dimensioning

The entire photovoltaic (PV) system must be installed in accordance with the generally recognized engineering standards. Please be sure to follow the accident prevention regulations of the Institutions for Statutory Accident Insurance and Prevention, in particular:

BGV A1 General regulations
BGV A2 Electrical systems and equipment
BGV C22 Construction work
BGV D36 Ladders and steps

Please ensure that installation work takes account of the actual conditions at the installation site and is in accordance with the generally recognized engineering standards. Local regulations must be complied with.
Please follow all public law regulations and directives, DIN standards, electrical connection regulations (TAB), accident prevention regulations, fire protection regulations of the German Association of Property Insurers (VdS), regulations of the German Roofing Industry (e.g. wooden structures, roof covering and roof sealing works) in the planning, installation, operation and maintenance of grid-connected solar power systems (PV systems).

Of particular importance are (no claim is made as to completeness):

DIN / VDE 0100 particularly Part 712 (Installation of high voltage systems with nominal voltages up to 1000V)
DIN / VDE 0298 (Electrical wiring)
VDI 6012 (Decentralized energy systems in buildings – Photovoltaics)
DIN / VDE 0126 (Solar power systems for domestic use)
DIN / VDE 0185 Part 1 to 4 (Lightning protection)
DIN 1055 Part 4 (Wind loads)
DIN 1055 Part 5 (Snow loads)
DIN 18338 Roof covering and roof sealing works
DIN 18451 Scaffolding works
DIN 1052 Part 1 and Part 2 Substructure dimensioning (wooden structures)
TAB (Utility companies' technical connection conditions)
VDEW standard (Standards for the connection and parallel operation of independent generation systems on the low voltage grid)
DIN 4108 Heat insulation
Energy saving regulation (ENEV)

Unauthorized changes and/or improper use of our components in the installation and construction of the system invalidates all liability claims.

Solar modules:

Only solar modules that have the following valid certificates may be used:
IEC 61215 / IEC 61646 and protection class II / IEC 61730

Framed solar modules:

Please note that performing any modifications (e.g. by drilling additional holes) to the module frame can immediately make the solar module warranty null and void. In order to comply with warranty conditions, the installation instructions of the respective solar module manufacturer must be strictly observed.

Laminates:

Where laminates are installed, we recommend having the clamps and mounting system approved by the laminate manufacturer and strict adherence to the installation instructions.

Lightning and overvoltage protection:

The lightning and surge voltage protection of the PV system must comply with the current specifications of
DIN / VDE 0185 Part 1 to 4,
DIN / VDE 0100 Part 712 and
VdS 2010.

Please refer to the specified directives and standards for detailed information.

We generally recommend integrating the mounting system and the module frame into the on-site equipotential bonding and using overvoltage protective equipment.
Equipotential bonding is always required if the solar modules used do not comply with protection class II and/or transformerless inverters are used.

The cross-section of the equipotential bonding conductor must correspond to the cross-section of the DC main cable, however, it must be at least 6mm2 (copper).

If the building is equipped with a lightning protection system and the PV generator is not located within the protective area of the interception device, the module frame and the mounting system must be integrated into the external lightning protection system and additional overvoltage protective equipment must be installed.
The cross-section of the electrically conducting connection must be at least 16mm2 (copper).

Laying the cables:

Starting with the frame installation, several points concerning the direction of power lines and laying of cables should be observed.

To avoid overvoltage feedback due to lightning strikes, the conductor circuit should be kept as small as possible.
The cables must be laid so as to ensure that snow and ice can easily slide off.
No water may build up where the cables are laid. It must be ensured that any accumulated water is continuously drained off (e.g. cable ducts on the carrier rail type 39-m).
The cables should be protected against UV radiation and the effects of weather as far as possible.

Layout design/Dimensioning:

The layout design and dimensioning of our TopFix 100 mounting system is done with the PV Manager software produced by our company, which enables you to determine the load factor and thus the suitability of the installation components for your roof. If you do not have the PV Manager for layout design of the PV system, please contact your sales representative for calculation and design of the mounting system.

3 Mounting systems

There are various possibilities for the arrangement of the mounting system and the modules on the roof. The most commonly used arrangement is to fit type 39-o carrier rails horizontally and fit the solar modules vertically. For this reason, the remainder of the mounting procedure is described for an arrangement of this type.

Alternatively, carrier rail type 39-m (with integrated cable duct) can always be used instead of carrier rail type 39-o. The exception is with installation on trapezoidal sheets, where only 39-o carrier rails can be used.

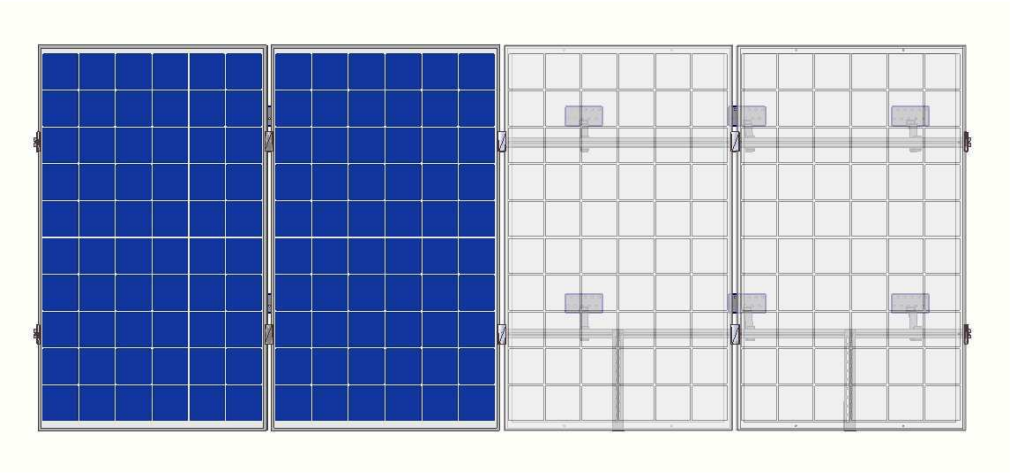


Fig.1: View of the TopFix 100 pitched roof mounting system

IMPORTANT!

Remember that all the relevant accident prevention regulations must be followed when working on the roof (including VBG 37 Bauarbeiten (construction work), § 12 Absturzsicherungen (anti-fall protection).

For greater comprehensibility, the assembly of the TopFix 100 mounting system is shown in schematic form in the following diagrams.

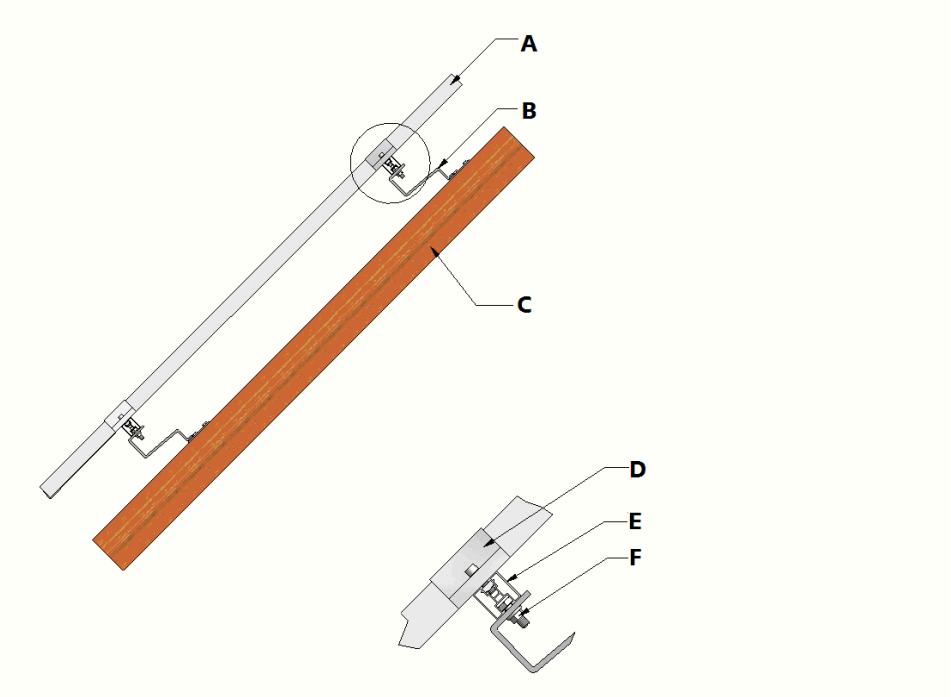


Fig. 2: Fastenings of the TopFix 100 pitched roof mounting system

A	Solar module
B	Roof hook
C	Rafters
D	Outside clamp
E	Carrier rail type 39-o
F	Hexagonal bolt M10x30 A2 and locking nut M10 A2

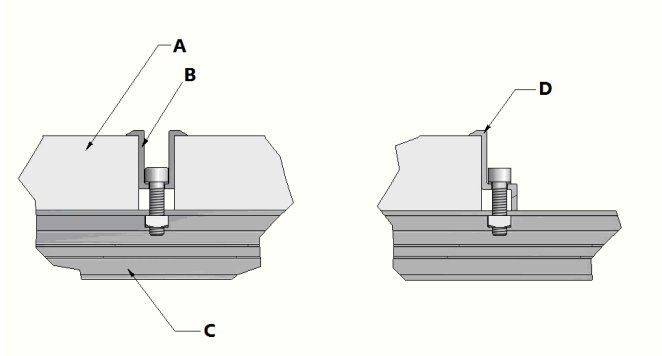


Fig. 3: Module fastening of the TopFix 100 pitched roof mounting system

A	Solar module
B	Middle clamp
C	Carrier rail 39-o
D	Outside clamp

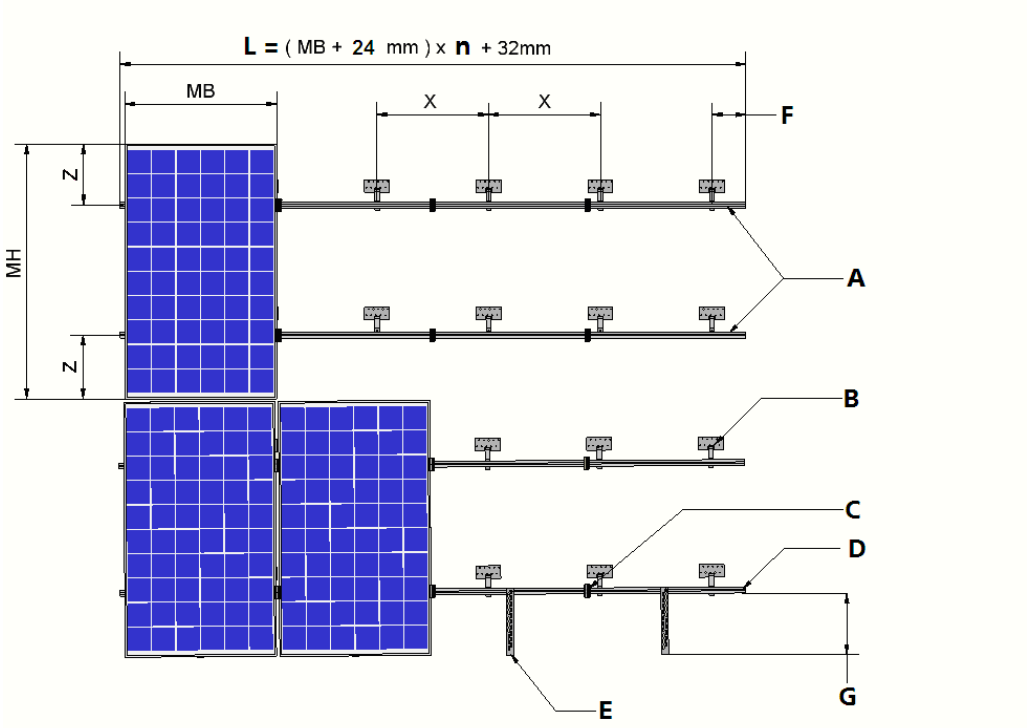


Fig. 4: Structure of the TopFix 100 pitched roof mounting system

L= (MW + 24 mm) x	**n** + 32 mm	Carrier rail length = (MW 24mm) x number of modules per row +32mm
MW		Module width
MH		Module height
A		Carrier rail 39-o
B		Roof hook
C		Middle clamp
D		Outside clamp
E		Module retaining angle
F		max. 400mm
G		max. 290mm
X		X – selected fixing interval (layout design with PV Manager software)
Z		max. 1 of module height (follow module manufacturer's specifications)

IMPORTANT!

Please note that to comply with warranty conditions the installation instructions and specifications of the respective solar module manufacturer must be followed.

Please use the PV Manager two work out the load factor and thus the suitability of the installation components for your roof, taking the actual conditions at the installation site into account as well as the applicable standards and regulations!

If you do not have the PV Manager for layout design of your system, please contact your sales representative for calculation and design of the mounting system.

4 Fitting the various mounting systems

4.1 General notes on dimensioning

The PV system on your roof is exposed to heavy loads through snow, but above all through wind. Improper fastening of the PV system, particularly the modules, can lead to serious damage to property and personal injury. The following points should therefore be strictly observed.

The number of fixing points on the roof is always dependent on the particular design of the roof, building height, roof pitch, the wind and snow load zone and a large number of other factors. The number and selection of the required installation components are determined with the help of our calculation and dimensioning software, "PV-Manager".

The edge and corner regions must be considered separately in accordance with DIN 1055-4 because increased loads can occur as the result of wind uplift. You will find more details on dimensioning in the graphical display of the fixing points in our PV Manager software. A more exact specification must be calculated and verified with reference to the applicable standards.
For this it is advisable to seek the advice of a stress analyst.

Before starting installation, the existing wooden substructure must be checked for sufficient stability. The wooden substructure should have a service life of more than 20 years. In case of doubt, consult a roofer or carpenter.
Please refer to Table 2.2 in the Appendix for the required rafter and purlin dimensions.

4.2 Fitting the roof hooks

In order to comply with warranty conditions (rain-proofing etc.) we recommend having the roof hooks fitted by a roofing firm. Please also observe the guidelines and specifications of the manufacturer of the respective roof covering, particularly where the use of that manufacturer's accessories is concerned, as well as the data on rafter dimensions according to DIN 1052 given in Table 2.2, on page 46.

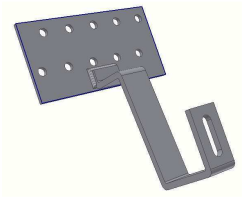


Fig. 5: Roof hook

Fitting steps:

Remove the roof tile above the rafter
Place the roof hook in the depression in the pantile and align it
Mark two mounting holes on the rafter
Using a 5.5mm drill, pre-drill approx. 2/3 of the total screw length into the rafter (if using 8x100 wood screws) If optionally available 8x100 flat head screws are used, pre-drilling is not require.
Screw the roof hook to the rafter using two 8x100 wood screws
Replace the tile

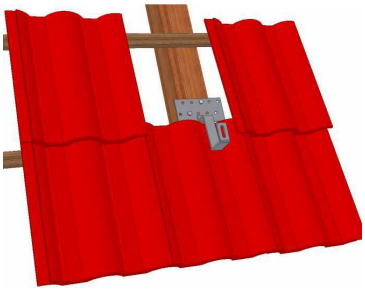


Fig. 6: Roof hook on the rafter

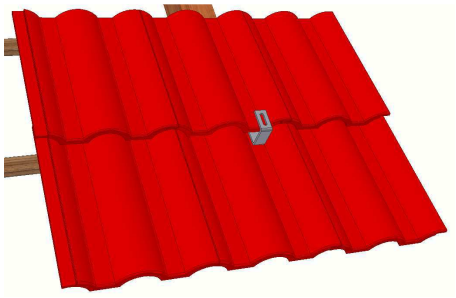


Fig. 7: Mounted roof hook

If the roof hook cannot be fitted as shown above due to the form of the tile or the position of the depression, it is imperative that a roofer is engaged.
Changes to roof covering materials (roof tiles, clay tiles, roof panels, cast stone, etc.) may only be made in accordance with the applicable roofing trade regulations and the manufacturer's guidelines.

IMPORTANT!

The leg of the roof hook lies in the depression in the pantile and should have a clearance of 5mm from the surface of the tile. If necessary an underlay of suitable material should be installed in the space between the rafter and the roof hook's base plate.
The roof covering must not be damaged by loads arising from the fitted roof hooks! If this danger exists, suitable supports should additionally be installed below the tile to spread the load. Especially with older tiles, plain tiles and slate roofs, and where the installation site is in a high snow load zone, the use of sheet metal supports or tin tiles is recommended. The guidelines of the roof covering manufacturer must be observed.

The securing screws in the rafters and the rafters themselves are extremely important for the overall system stress. Chipboard screws are not suitable owing to their smaller head cross-section. We recommend screwing the roof hook to the rafter using two DIN 571 8x100 wood screws, or alternatively using the approved 8x100 flat head screws from our product range, where no pre-drilling is required. Please ensure that at least 75mm of the screw bites into the rafter. Smearing the screw with grease will prevent it shearing off when tightening.

The roof hooks are suitable for most types of tiles. In individual cases, it may be necessary to remove small pieces from the roof tiles using an angle-grinder and suitable cutting disc to ensure that the tile sits flush. It should be noted that this work requires a certain level of skill and precision to avoid removing too much material, which would impair the rain-proofing of the roof. The guidelines of the roof covering manufacturer must also be observed in this case. Particular attention should be paid to the accident prevention regulations when undertaking this work.

Any height differences that occur between the carrier rail and the roof hooks can be offset by the use of special spacers (optionally available in 3mm and 5mm sizes; see parts list).

4.3 Types of roof hook

4.3.1 STANDARD II roof hook

In normal cases, the STANDARD II roof hook is used. This is suitable for the most commonly used types of pantiles.

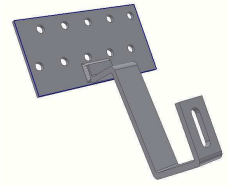


Fig. 8: STANDARD II roof hook

4.3.2 Height-adjustable II roof hook

To even out height differences in the substructure, the Height-adjustable II roof hook has an adjustment area which enables height differences up to 30 mm to be offset.

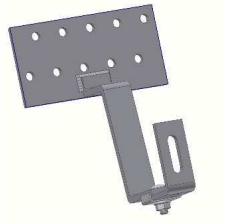


Fig. 9: Height-adjustable II roof hook

4.3.3 Mammut II roof hook

The Mammut II type of roof hook is used to ensure the safety of the structure under high snow loads. This roof hook has higher stress values than the STANDARD II hook. Under certain conditions (e.g. low snow load zone) it is possible to place the Mammut II roof hook on every second rafter only, thus reducing the number of roof hooks required.

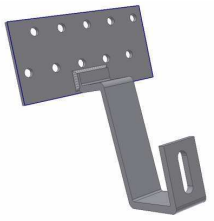


Fig. 9: Mammut II roof hook

4.3.4 Mammut XL roof hook

For regions with very high snow loads. Even more resilient than the Mammut II, high load reserves

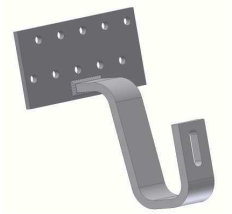


Fig. 10: Mammut XL roof hook

4.3.5 Light roof hook

Similar to the STANDARD II roof hook, but for regions with low wind and snow loads

4.3.6 Slate roof hook

A special roof hook is used on slate roofs. This roof hook has been designed for this special form of roof covering.

Fig. 11: Slate roof hook

4.3.7 Plain tile roof hook

Plain tiles differ in shape from normal tiles. This is why they require a different type of roof hook.

Fig. 12: Roof hook for plain tiles

4.4 Installation using M12x300 hanger bolts

Hanger bolts can be used as a substitute for roof hooks for securing the carrier rails. Hanger bolts are used for eternite roofing sheets, trapezoidal sheet and bitumen-covered roofs. Any height differences that occur in the rafters can be offset using the thread on the hanger bolt.

Fig. 13: Hanger bolt

The roof covering must not be damaged by pressure from the installed hanger bolts. If there is a risk of this, suitable measures should be taken to spread the load. Furthermore, the penetration point of the hanger bolts through the water conducting level should be sealed in accordance with roofing trade regulations. For this reason, we recommend having the hanger bolts installed by a specialist roofing firm. Please also observe the guidelines and regulations of the manufacturer of the respective roof covering.

To fit the hanger bolts:

The holes for the bolts are positioned in the raised parts of the roof, not in the depressions that carry water.

Determine the position of the rafter (if necessary, mark with a string). Drill through the roofing only (e.g. metal sheet, eternite roofing sheets) using a 15mm drill (pre-drill using a 5 to 6mm bit). Now pre-drill the rafter using an 8.5mm bit.

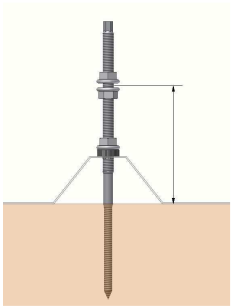
The M12x300 hanger bolt must be screwed min. 100mm into the rafter using a hexagon socket (SW 9) in order to provide load-bearing stability.

Tighten the lower nut on the machine thread to press the rubber seal against the roofing, thus sealing the hole.

Tighten the sealing nut carefully risk deformation and breakage!

For stress reasons, the distance to the roof covering should be kept as small as possible.

If the hanger bolt protrudes too far, it must be shortened using an angle grinder. (observe the accident prevention regulations)
For stress reasons, the connector plate should always be mounted in the direction of the roof ridge.



L = 100 mm

IMPORTANT!

The stress values for the M12x300 hanger bolt relate to a fixing interval l = 100mm. If this fixing distance is exceeded, the load-bearing values are reduced. The calculation with the PV-Manager software is done on the basis of a fixing interval l = 100mm.

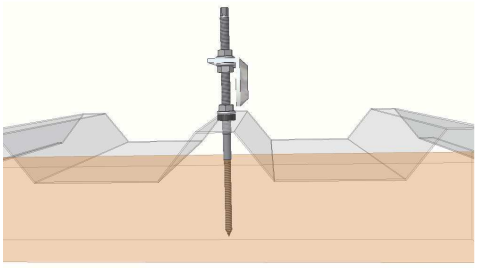


Fig 13.1: Correctly fitted hanger bolt with aluminum L-section roof hook connector

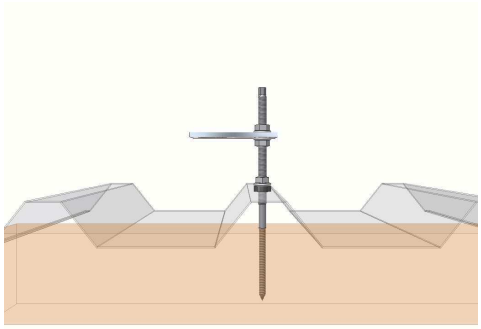


Fig. 13.2: Correctly fitted hanger bolt with connector plate

Fig. 14.1: Correctly fitted hanger bolts with Duo mounting plate and aluminum L-section (side view)

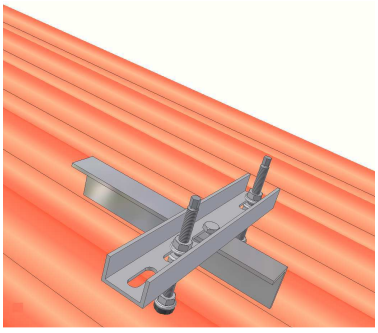
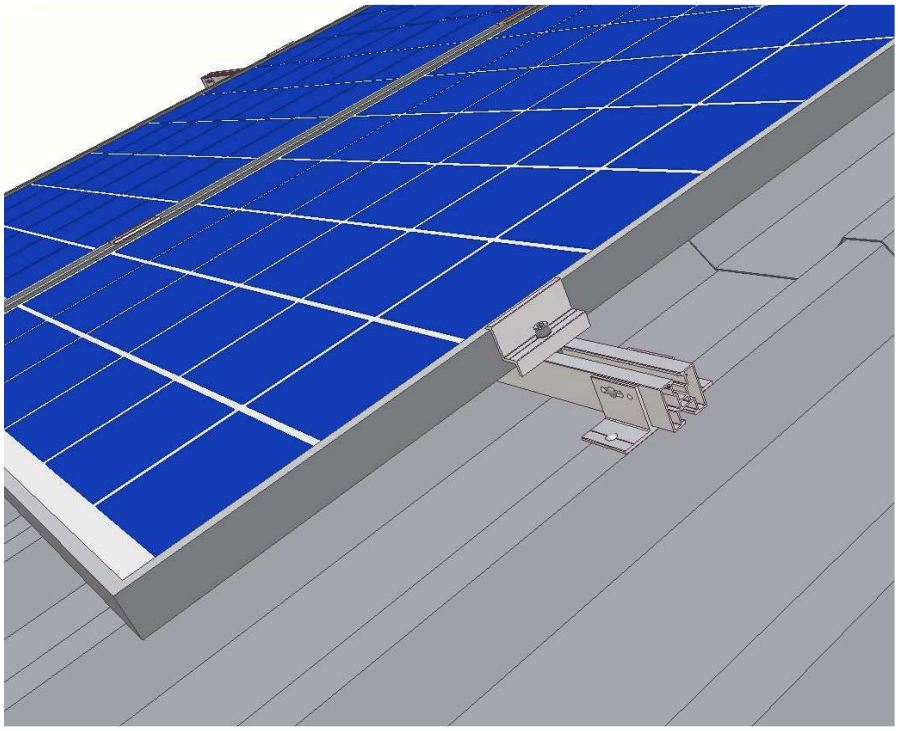


Fig. 14.2: Correctly fitted hanger bolts with Duo mounting plate and aluminum L-section

4.5 trapezoidal sheet mountings for TopFix 100



4.5.1 Introduction

The trapezoidal sheet mountings, in combination with the TopFix 100 mounting system, are a quick, universal, and structurally tested solution for attaching solar modules to trapezoidal sheet roofs.

Please note the following:

The minimum thickness of the trapezoidal sheets is 0.63mm for steel sheets.
The supplied 4.8x11m closed end blind rivets are approved for sheet thicknesses from 0.63mm to 1.9mm.
A maximal vertical crease width of 30mm may not be exceeded.
Since additional loads as well as wind uplift result from the PV system in conjunction with the mounting system and the fixing points, the load-bearing capacity of the roof covering and substructure must be verified by the builder-owner; a task which would normally be performed by a stress analyst.
Special installations on narrower vertical creases, aluminum trapezoidal sheets, sandwich elements and mounting frames must undergo individual structural inspection at the installation site.

4.5.2 Important general information and standards relating to dimensioning

The number of fixing points on the roof is always dependent on the particular design of the roof, building height, roof pitch, snow load zone and size of the solar module. Please refer to our PV Manager software for details on the layout design of the installation components.

The edge and corner regions must be considered separately in accordance with DIN 1055-4 because, depending on the type of building and location, wind uplift can cause increased loads. Further details concerning the location and the building must be assessed and checked in accordance with the relevant standards. For this it is usually advisable to seek the advice of a stress analyst. In general it must be clarified on site whether the roof surface and the supporting structure (steel girders / purlins) are able to withstand the extra pressure and uplift loads of the PV system. In order to comply with warranty conditions (roof sealing etc.) we recommend having the trapezoidal sheets fitted by a roofing firm. The system warranty cannot be applied to the roof sealing, since this is largely dependent on the quality of the installation process and the subsequent roof sealing. The roofing trade regulations as well as the guidelines and specifications of the roof covering manufacturer must be observed. Under normal atmospheric conditions (mainland atmosphere), no extra corrosion protection for the fittings is needed. In unusual regions (e.g. those with acidic or alkaline environments, contact with de-icing salt, or direct proximity to the sea) supplementary measures should to be taken to achieve the appropriate protection against corrosion.

Unauthorized changes and/or improper utilization in the mounting and construction of the system shall invalidate all warranties and liability claims.

Further important information is given in Section 2 of these installation instructions.

4.5.3 Required tools / materials*

Riveter with appropriate depth gauge

Illustration 1: Riveter with rivet depth gauges

o4.9mm drill
Cleaning agents (isopropyl alcohol, acetone)
Lint-free paper towels
Abrasive cleaning fabric for severely soiled roofs

*The tools and materials listed here are only required for the installation of trapezoidal sheets. Details of the tools required for module and carrier rail installation may be found in the Section 1 of these installation instructions.

4.5.4 Dimensioning:

The design of the mounting system is done with our PV Manager software, taking account of the on-site conditions.

Important!

Due to thermal expansion, the carrier rail length may not exceed three rods (approx. 18.18m).

4.5.5 Instillation

Step 1: Distributing the TRAPEZOIDAL CLAMPS on the roof

Step 2: Cleaning the roof covering

Figure 2: Cleaning the adherent surface

The roof covering should only be cleaned at the places where the TRAPEZOIDAL CLAMPS are to be stuck on. In order to ensure optimal protection against leaks, the top surface should be dry and free of fat, oil, and silicone coatings, as well as dirt particles. In case of severe soiling, we recommend sanding lightly with a suitable material (e.g. abrasive cleaning fabric) followed up by cleaning. Suitable cleaning materials are isopropyl alcohol or acetone combined with lint-free paper towels.

Important! When using solvents and chemicals, observe the safety regulations!

Step 3: Sticking on the TRAPEZOIDAL CLAMPS

Note:

High-performance adhesive tape may be used at an object and process temperature of **0°C or higher** . It reaches its full fixity at an ambient temperature of 20°C after approx. 72 hours. Higher temperatures accelerate this process.
Sticking onto surfaces below this temperature is not recommended, as the adhesive becomes too hard to stick properly. Once the adhesion has been achieved, low temperatures should not cause any problems.
To ensure good instant bonding a build-up of condensation should be avoided, e.g. if the materials to be stuck together are of widely different temperatures.

The TRAPEZOIDAL CLAMPS should be aligned and stuck on so as to enable stress-free mounting of the type 39-o carrier rails. The carrier rail has to touch the TRAPEZOIDAL CLAMP with the button. (see Fig. 11) Be sure to completely remove the protective film.

Illustration 3: Removing the protective film

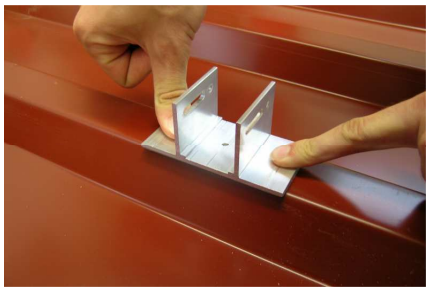


Illustration 4: Sticking on the TRAPEZOIDAL CLAMPS

Step 4: Riveting the TRAPEZOIDAL CLAMP to the roof surface
l

Drill **o4.9mm** **two** holes per TRAPEZOIDAL CLAMP. Be sure to make clean drill holes at this stage, in order to comply with the stress values.

Illustration 5: Drilling through the roof surface

Important:

To comply with the stress values, a drill bit of o4.9mm is essential!
Drill bits of o5.0mm are not permitted.

Now the 4.8x11mm closed end blind rivets are inserted into the drill holes and riveted.

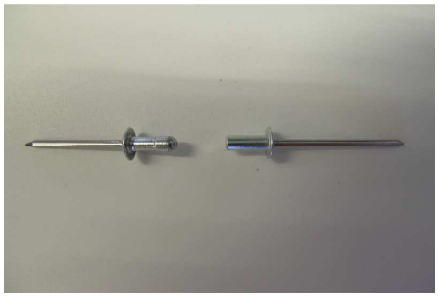


Illustration 6: correct / incorrect

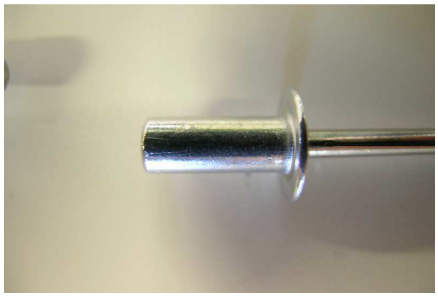


Illustration7: 4.8x11mm closed end blind rivet

The supplied 4.8x11m closed end blind rivets are approved for sheet thicknesses from 0.63mm to 1.9mm.

Note: The standard rivet head is used to rivet the closed end blind rivets **, not** the rivet depth gauge! In this way, a fixed-point connection to the roof surface is created.

Illustration 8: Standard **rivet head for riveter**

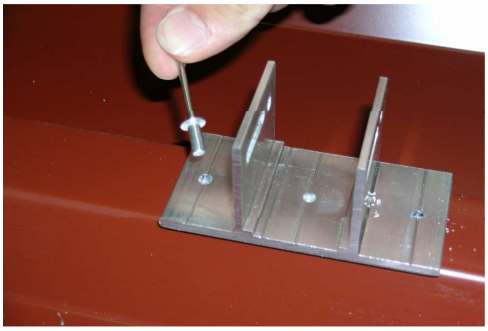


Illustration 9: Inserting the **closed end blind rivets**

Illustration 10: Riveting with **standard rivet head**

Step 5: Riveting the carrier rails

Illustration 11: Inserting the 39-o **carrier rail**

Illustration 12: Drilling the **carrier rail**

The o4.9mm drill holes are drilled on both sides, through the center of the oval hole in the TRAPEZOIDAL CLAMP.

The carrier rail has to touch the TRAPEZOIDAL CLAMP with the button.

Now the 4.8x10mm dome head blind rivets are inserted into the drill holes and riveted.

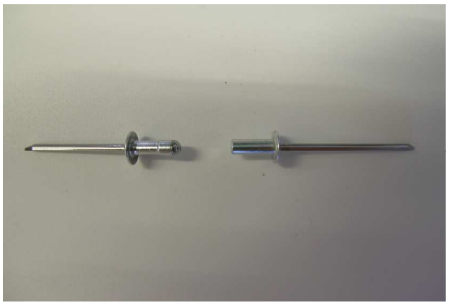
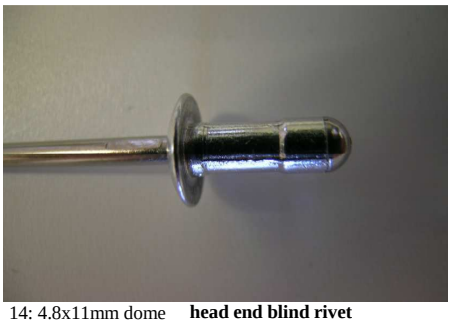


Illustration 13: correct / incorrect



14: 4.8x11mm dome **head end blind rivet**

Note: The rivet depth gauge is used to rivet the dome head blind rivets, not the standard rivet head! In this way, a non-rigid support is created to balance out the different thermal expansion coefficients of the aluminum support and the sheet steel.

Illustration 15: Rivet depth gauge for riveter

Illustration 16: Inserting the first dome head rivet

Illustration 17: Inserting the second dome head rivet

Illustration 18.1: Attaching the rivet depth gauge

Illustration 18.2: Riveting with the rivet depth gauge

Illustration 19: Fully mounted TRAPEZOIDAL CLAMP

Step 6 If necessary, attach butt connector

Note: The butt connector enables optimum alignment of the carrier rails, but it does not perform any load-bearing function .

The butt connector is slid into the rail opening which faces the lower edge of the roof, and is fixed with two 4.8x10mm dome head rivets. (see illustrations)

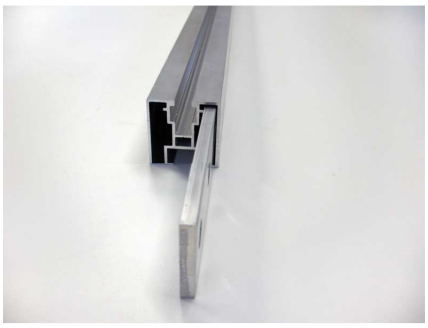


Illustration 20: Sliding the butt connector into the rail

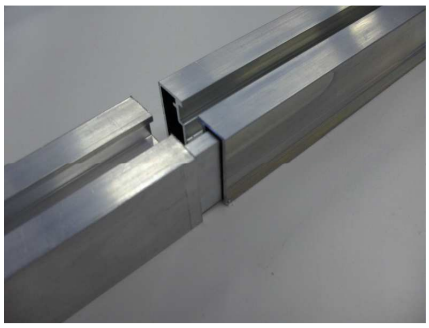


Illustration 21: Fastening the rails together

Illustration 22: Fastening the rails together

Illustration 23: Drilling the rails with o4.9mm drill bit for 2 dome head blind rivets 4.8x10mm

Illustration 24: Riveting the rails with butt connectors

Illustration 25: Riveted rails

4.5.6 Fitting the solar modules

The solar modules are fitted as described in Section 6 of these installation instructions.
To comply with warranty conditions, the installation instructions of the respective solar module manufacturer must be followed.

4.6 Fitting roof seam clamps

On standing seam roofs, the system is mounted using special fastening elements, to which the carrier rails are secured to in turn.

The roof covering must not be damaged by loads arising from the fitted clamps. For this reason, we recommend having the seam clamps installed by a specialist roofing firm.

The clamps are distributed vertically according to the number of carrier rails. Generally, one clamp should be placed on each standing seam. The carrier rail should not protrude more than 0.4m to the left or right.

Fig. 15: Roof seam clamps

IMPORTANT!

The builder-owner must establish whether the roof and substructure can support the additional loads that occur with the installation of the PV system. If PV systems are mounted on standing seam roofs, the roof must not only be able to bear the additional loads but also the additional wind uplift forces. The number of fixing points (seam clamps) must be determined by a stress analyst based on the actual conditions at the installation site. Observe the respective guidelines of the manufacturer of the roof covering.

4.7 Fitting Kalzip® clamps

To mount the system on so-called Kalzip® roofs, Kalzip® clamps are used.

The clamps are spread out vertically according to the number of transverse rails. Generally, one clamp should be placed on each standing seam. The carrier rail should not protrude more than 0.4m to the left or right.

Fig. 16: KalZip® clamps

IMPORTANT!

The builder-owner must establish whether the roof and substructure can support the additional loads that occur with the installation of the PV system. If PV systems are mounted on KalZip®roofs, the roof must not only be able to bear the additional loads but also the additional wind uplift forces. The number of fixing points (KalZip® clamps) must be determined by a stress analyst based on the actual conditions at the installation site. Here too the specifications and guidelines of the roof covering manufacturer must be observed.

5 Fitting the carrier rails

The heads of the M10x30 hexagonal bolts are slotted into the groove in the carrier rails and spread out approximately at the spacing of the fixing points (e.g. roof hooks).

Start with the topmost or the lowest carrier rail. Align the bolts to the fixing points (roof hooks, roof seam clamps etc.) and secure them. See Fig. 17.

If required, extend the carrier rails using butt connectors. The butt connector enables optimum alignment of the carrier rails, but it does not perform any load-bearing function.

Due to thermal expansion, the carrier rail length may not exceed three rods (approx. 18.18m).

To prevent frost damage, it must be ensured that water cannot accumulate in the carrier rails.

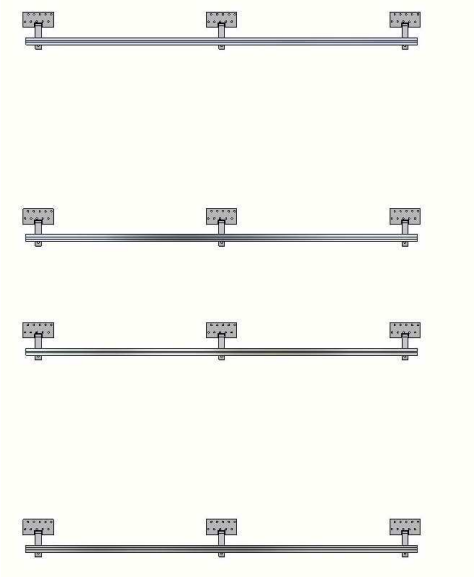


Fig. 17: Carrier rail, fitted

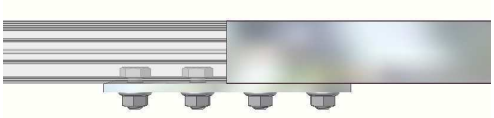


Fig. 18: Butt connector for carrier rail type 39-o

NOTES:

Special spacers (see parts list) are available in various types and sizes to even out height differences on uneven roofs.
The carrier rails must run parallel to each other. To achieve this, the first step is to ensure the lowest carrier rail is in horizontal alignment.
The ends of the rows must be aligned at an exact right angle (90°) to the bottom rail, as otherwise it will not be possible to align the joints between the modules.
Once the carrier rails are aligned, tighten all bolts to the correct torque and check the installation again.

6 Fitting the PV modules

Assemble the clamps first before sliding them into the carrier rails.
For the required bolt lengths for the individual clamp types, please consult Table 1 in the Appendix.

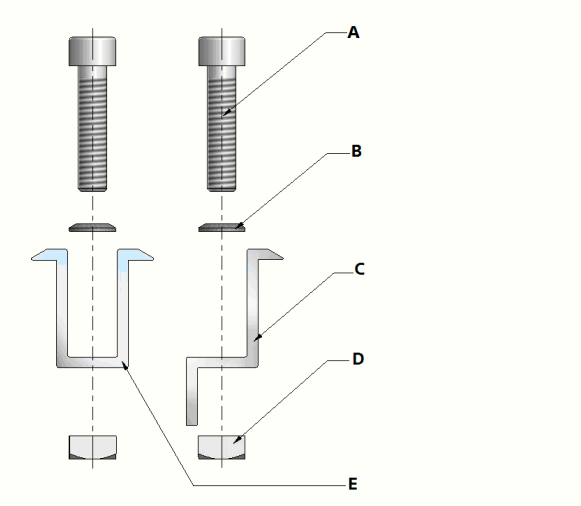


Fig. 19: Clamp assembly

A	Cylinder screw M8 A2
B	Retaining washer (rustproof)
C	Outside clamp
D	Square bolt M8 A4
E	Middle clamp

IMPORTANT!

Different outside clamps are used depending on the module frame height. The middle clamp is the same for all module heights, only a different length bolt is used.

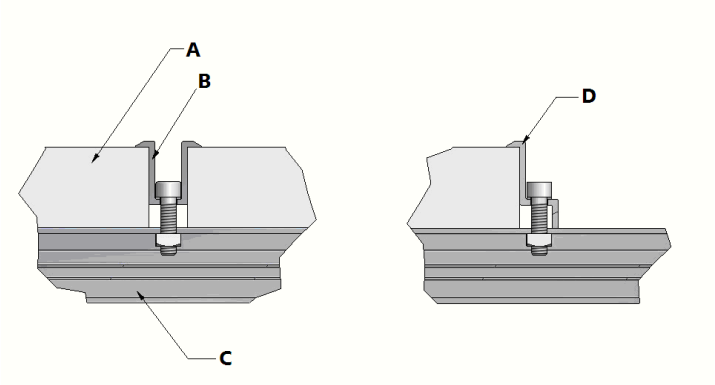


Fig. 20: Clamps correctly fitted (sectional view)

A Solar module
B Middle clamp
C Carrier rail type 39-o
D Outside clamp

Slide the middle clamps into the upper groove of the carrier rail and distributed them along its length. Do not fit clamps to the bottom rail of the array just yet.

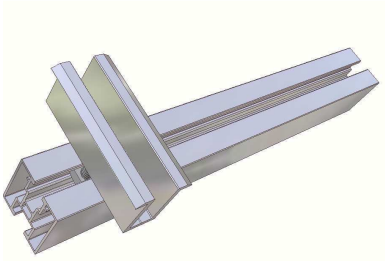


Fig. 21: Sliding in the middle clamps

Slide in the outside clamps at the end of the carrier rail and loosely secure them.

In the bottom carrier rail in the module array, middle clamps and module retaining angles are slid alternately into the groove. The module retaining angle is fitted using an M8x20 hexagonal bolt and matching locking nut. To do this, slide the head of the hexagonal bolt into the upper groove.
The module retaining angle should be regarded as an additional transverse bolt for the modules and also makes the insertion of the modules easier.

Up to a module width of 1060mm, one module retaining angle is required per module. If the modules are fitted horizontally or exceed a width of 1060mm, then two module retaining angles should be used per module.

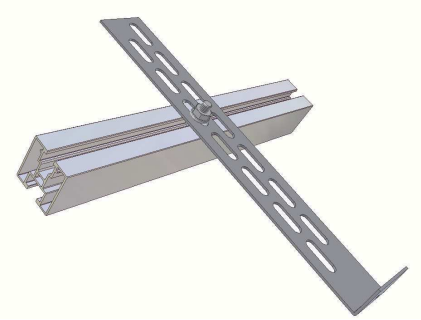


Fig. 22: Mounted module retaining angle

Now place the first module on both carrier rails, loosely secure it using the outside clamps, and align it to the row of tiles. A length of string can also be used as a guide. Now tighten the clamps to the torque given in Table 2.1 in the Appendix. For this job, we recommend using a torque wrench with a size 6 Allen key bit.
The remaining modules are then fitted in a similar way.
We recommend that you start with the bottom module row. Once this is exactly in alignment, the rows above can be fitted.

To ensure better ventilation behind the modules and to counter thermal expansion, there should be a gap of at least 20mm between the module rows.

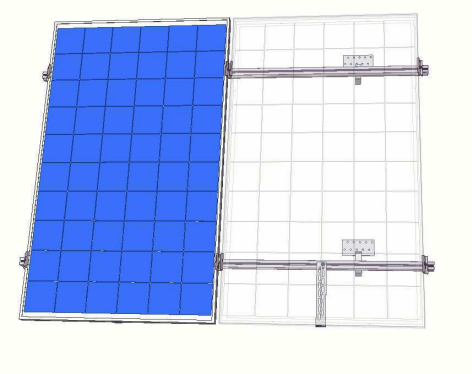


Fig. 23: Mounted module retaining angle in relation to the system as a whole

To give a clean finish to the ends of the carrier rail, end pieces are fitted using 4.2x13 self-tapping screws.

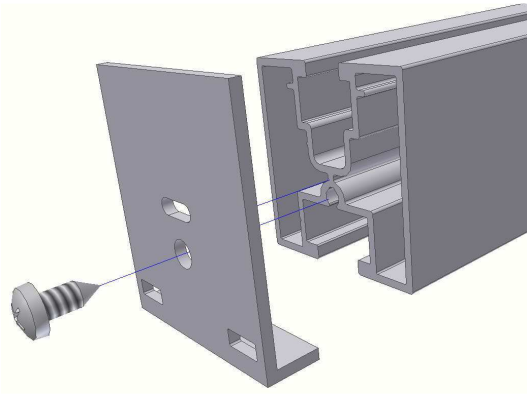


Fig. 24: Aluminum end piece

7 Mounting modules on vertical carrier rails

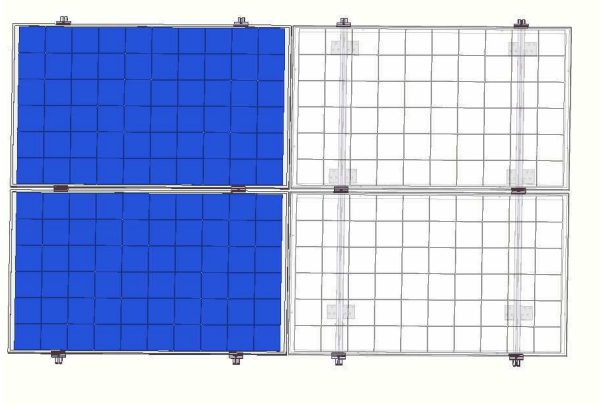


Fig. 25: Modules mounted on vertical carrier rails

With vertically positioned carrier rails, the modules are fitted following the same installation steps, except the complete module array (including the carrier rail) is rotated by 90°.

However, certain special points should be noted:

The module retaining angles are not required.

Additional transverse securing bolts are fitted to prevent the solar modules from slipping.

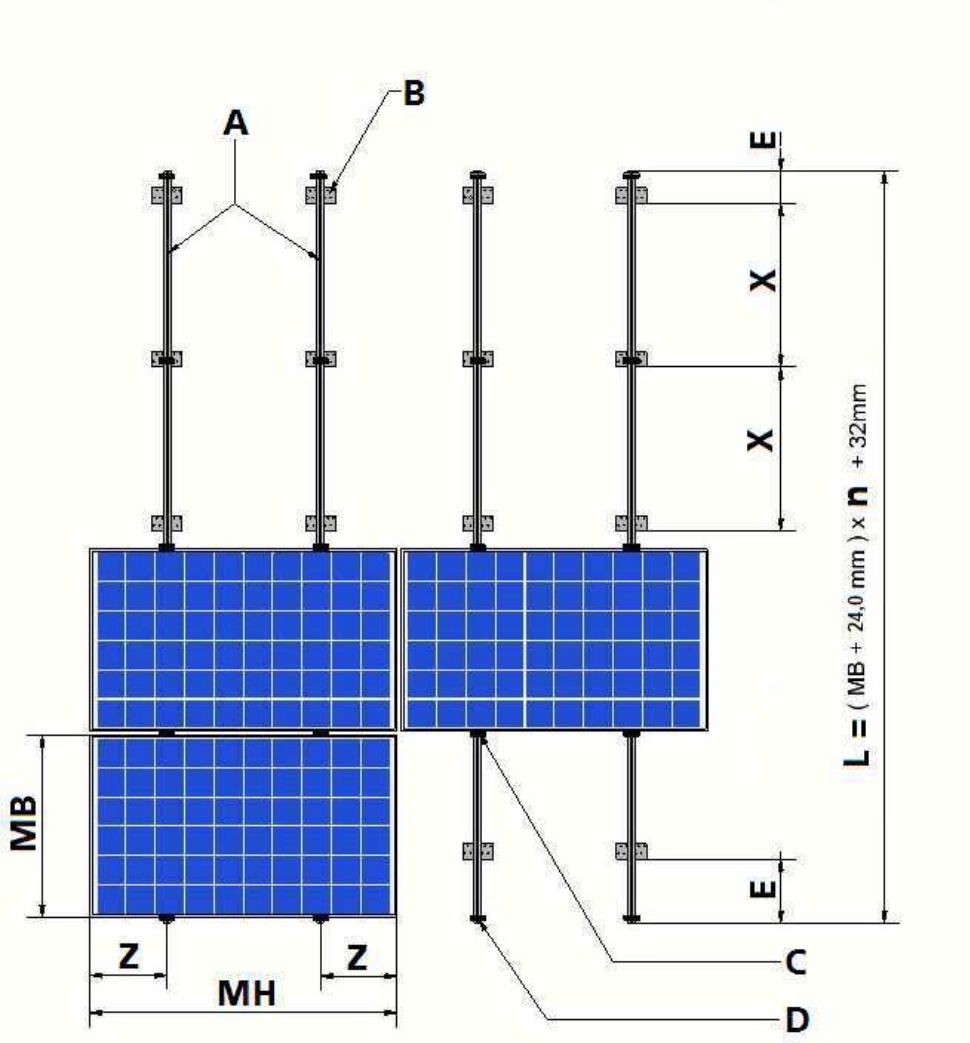


Fig. 26: Dimensions of the module mounting system

L= (MW + 24 mm) x **n** + 32 mm	Carrier rail length = (MW + 24mm) x number of modules per row + 32mm
MH	Module height
MW	Module width
A	Carrier rail type 39-o
B	Roof hook
C	Middle clamp
D	Outside clamp
E	Max. 400mm
X	Max. fixing interval X
Z	Max. 1 of module height (follow module manufacturer's specifications)

Fitt ing the transverse securing bolts

To prevent the carrier rails from slipping on the roof hooks, additional transverse securing bolts must be fitted in each carrier rail. These are fitted above the lowest roof hook of each carrier rail. See Fig. 27.

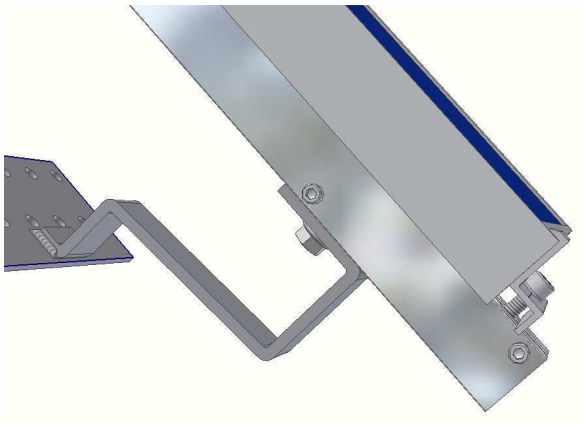
To enable the bolt to be fitted, a 7mm diameter hole should be drilled in the lower bolt guide groove in the carrier rail.

One transverse securing bolt is suitable for a carrier rail length of up to 6.06m. If this length is exceeded, the number of transverse securing bolts must be increased accordingly.

Transverse securing bolt M6x45 with nut

Fig. 27: Carrier rail secured against slippage

In addition, for this installation method, it is necessary to prevent the clamps from slipping in the carrier rail. To do this, an additional transverse securing bolt is positioned in the upper bolt guide groove in each carrier rail. This is fitted as shown in Fig. 28.



Transverse bolt to secure the clamps

Fig. 28: Clamps secured against slippage

Here too, only one transverse securing bolt is required up to a carrier rail length of 6.06m. Beyond this length, the number of transverse bolts must be increased accordingly.

8 Fitting two-la yer mounting systems

8.1 General

Unlike the single-layer carrier rail, in this case additional type 39-o carrier rails are used to connect up the roof hooks before the actual module carrier rails are fitted.
The only exception is where hanger bolts are used. In order to achieve the highest possible load-bearing values, aluminum L-sections 60x40x5 are used.

8.2 Roof hook connecting rail type 39-o

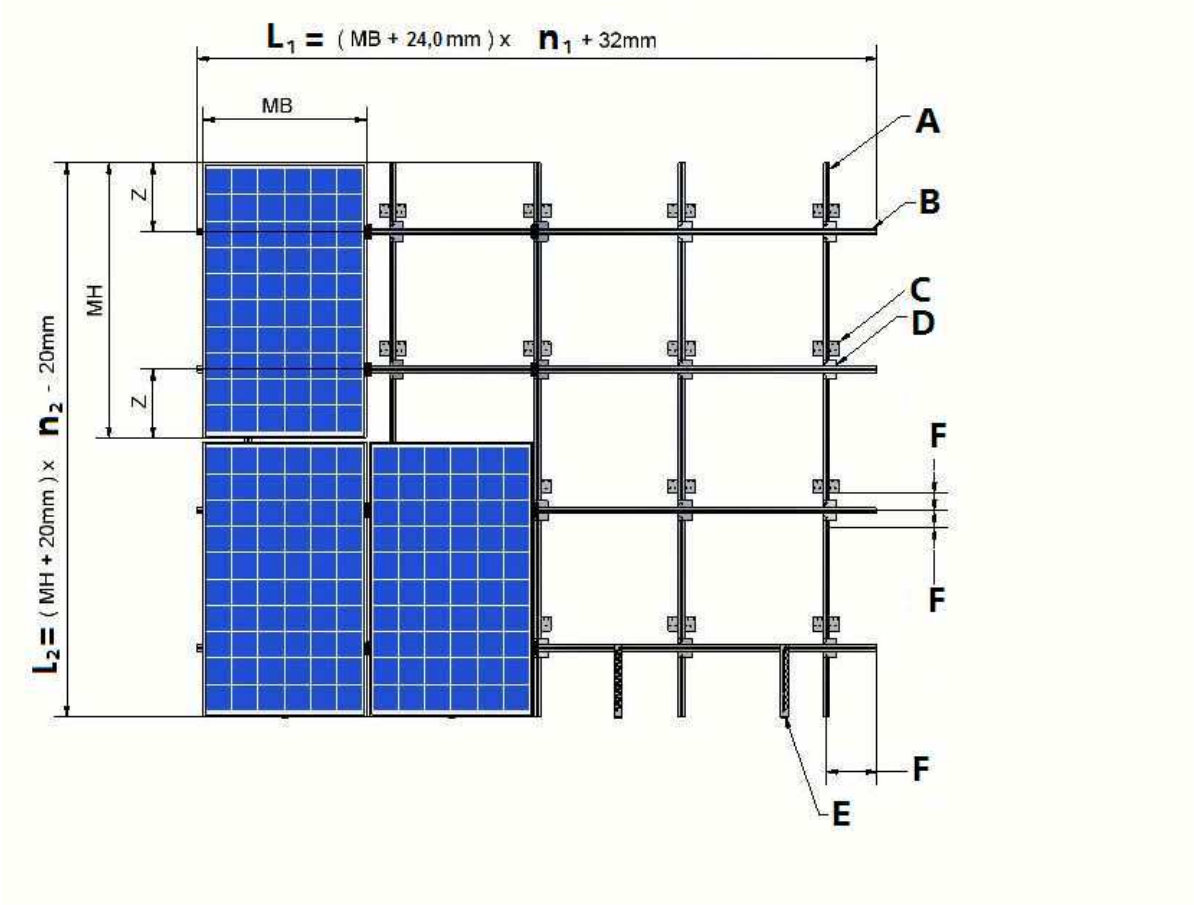


Fig. 29: Roof hook connecting rails and carrier rails shown in a two-layer arrangement

L_1 = (MW + 24 mm) x + 32 mm	Carrier rail length = (MW + 24mm) x number of modules per row + 32mm
L_2 = (MH +20 mm) x n_2 – 20 mm	Roof hook connecting rail length = (MH + 20mm) x number of modules – 20mm
MW	Module width
MH	Module height
A	Roof hook connecting rail type 39-o
B	Carrier rail type 39-o
C	Roof hook
D	STANDARD connector plate
E	Module retaining angle
F	Max. 200mm
Z	Max. 1 of module height (follow module manufacturer's specifications)

Dimensioning:

The dimensions of the two-layer system are calculated in the same way as for the single-layer system, but taking the following special points into account:

One roof hook needs to be provided for each carrier rail / roof hook connecting rail intersection point.

The permitted tolerance range (see drawing) for each intersection point is a maximum of ± 200mm.

In addition to the roof hook and the carrier rail, the stress values for the roof hook connecting rail must also be considered. Load bearing dimensioning is determined with the use of the PV Manager software.

Due to thermal expansion, the carrier rail length may not exceed three rods (approx. 18.18m).

1st installation step: Cut the roof hook connecting rails type 39-o to length.

The length of the roof hook connecting rails (see Fig. 29) is calculated according to the following formula:

Roof hook connecting rail length = (module height + 20mm) x number of modules – 20mm

2nd installation step: Fitting the STANDARD connector plates.

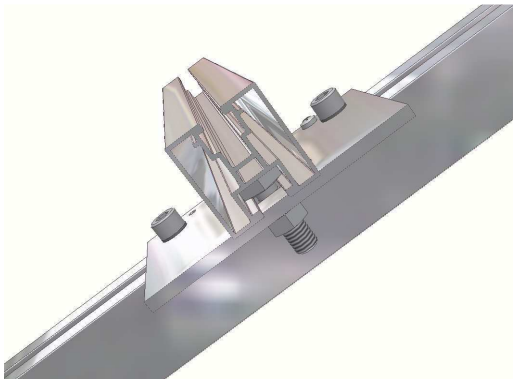
The fixing intervals of the connector plates are as shown in fig. 29 or according to the solar module manufacturer's fixing point specifications.

To fit the plates, the two square nuts are slotted into the upper guide groove of the roof hook connecting rail and secured at the correct position. In addition, a self-tapping securing screw is fitted through the connector plates in order to ensure the connector plate cannot slip out of position.

3rd installation step: Fitting the roof hook connecting rails to the roof hooks.

To secure the vertically orientated roof hook connecting rails to the roof hooks, first of all slide the heads of the M10 hexagonal bolts into the lower groove of the carrier rail and secure them tightly to the roof hooks (see Fig. 30).

Carrier rail type 39-o



Roof hook connecting rail type 39-o

STANDARD connector plate

Fig. 30: Roof hook connecting rail and carrier rail

4th installation step: Fitting the transverse securing bolts

To prevent the roof hook connecting rail from slipping on the roof hooks, an additional transverse securing bolt must be fitted. This is fitted above the lowest roof hook of each rail – see Fig 31.

To enable the bolt to be fitted, a 7mm diameter hole should be drilled in the lower bolt guide groove in the roof hook connecting rail.

One transverse securing bolt is suitable for a roof hook connecting rail length of up to 6.06m. If this length is exceeded, the number of transverse securing bolts must be increased accordingly.

If roof hook connecting rails are fitted horizontally, the transverse securing bolts are not required.

Transverse securing bolt M6x45 with nut

Fig. 31: Roof hook connecting rail secured against slippage

If the roof hook connecting rail consists of more than one length connected together, these must be joined using butt connectors for type 39-o carrier rails – see Fig. 32.

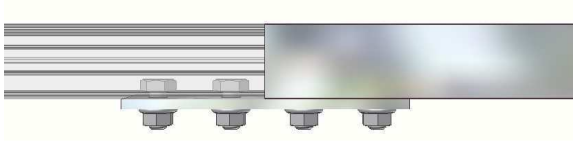


Fig. 32: Butt connector for carrier rail and roof hook connecting rail type 39-o

IMPORTANT!

Butt connectors do not perform any load-bearing function.

8.3 Roof hook connecting rail for laminate installation

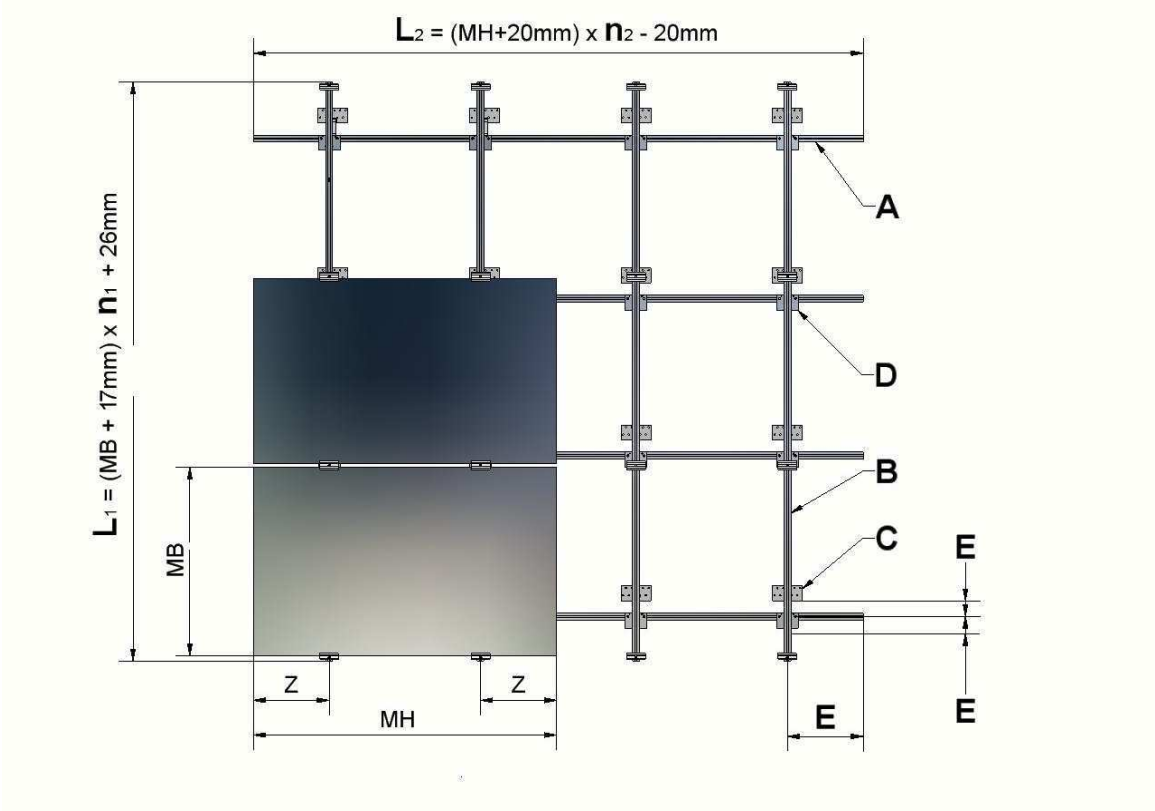


Fig. 33: Roof hook connecting rails for laminate installation in relation to the system as a whole

L_1 = (MW + 17mm) x n_1 + 26 mm	Carrier rail length = (MW + 17mm) x number of modules per row + 26mm
L_2 = (MH +20mm) x n_2 – 20 mm	Roof hook connecting rail length = (MH + 20mm) x number of modules – 20mm
MW	Module width
MH	Module height
A	Roof hook connecting rail type 39-o
B	Carrier rail type 39-o
C	Roof hook
D	STANDARD connector plate
E	Max. 200mm
Z	Max. 1 of module height (follow module manufacturer's specifications)

Laminate installation is always done with two-layer systems, because many laminate manufacturers only allow this type of installation so as to avoid any mechanical stress on the laminate and thus prevent breakage. The modules must be mounted with a horizontal orientation. Otherwise, the installation of laminates is the same as with two-layer mounting systems.

Please note that the installation of laminates requires special middle and outside clams (see parts list).

8.4 Aluminum L-section 60x40x5 roof hook connector

This roof hook connector is used only in combination with hanger bolts. The holes for fitting the carrier rails are factory drilled. Only the holes for fitting to the hanger bolts need to be drilled at the installation site.

If unmachined aluminum L-sections are used instead of factory-prepared roof hook connectors, then the holes for fitting the carrier rails must be drilled on site. If this is the case, instead of fitting the connector plates as described at Section 8.2 (steps 1 and 2), the 11mm diameter mounting holes should be drilled at exactly the place where the connector plates are normally fitted (see Fig. 29).

Fig. 34 Aluminum L-section 60x40x5 roof hook connector

1st step: Drilling the roof hook connectors

The first step is to drill the roof hook connectors according to the exact dimensions of the fitted hanger bolts. A 13mm drill is required for this. The hole is positioned exactly in the middle of the 40mm side of the roof hook connector. The 60mm side is pointing towards the roof covering. See Fig. 34.

2nd step: Fitting the roof hook connectors

The roof hook connectors are now fitted as shown in Fig. 35. For stress reasons, the distance between the roof hook connectors and the roof covering should be kept as small as possible. But water drainage from the roof must not be impeded. In some circumstances it may be necessary to shorten the hanger bolts using an angle grinder in order to prevent damage to the solar modules.
(Observe the accident prevention regulations)

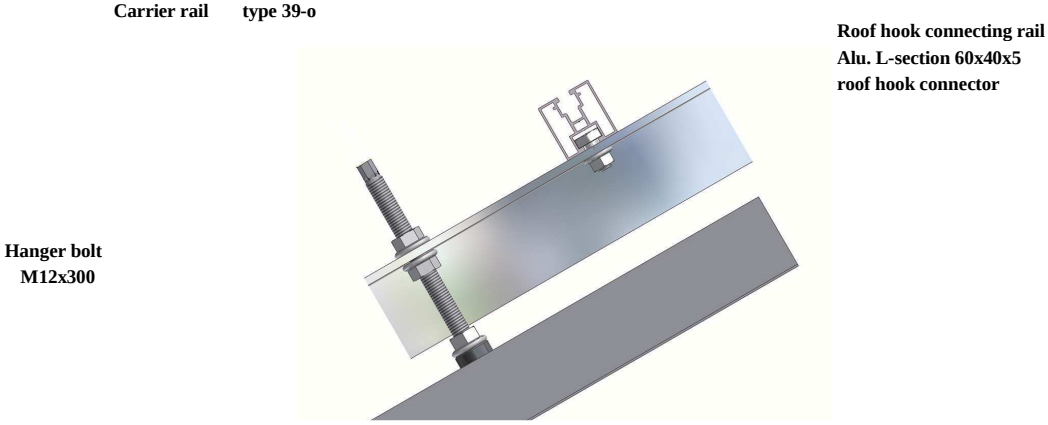


Fig. 35: Carrier rail on aluminum L-section roof hook connector

If the roof hook connecting rail consists of more than one length connected together, these must be joined using butt connectors for aluminum L-sections – see Fig. 36.

The butt connector is fitted to the 60mm side of the aluminum L-section.

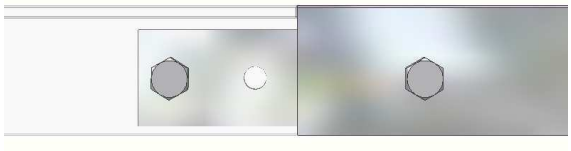


Fig. 36: Butt connector for aluminum L-section 60x40x5 roof hook connector

IMPORTANT!

Butt connectors do not perform any load-bearing function.

3rd step: Fitting the carrier rails

After fitting the roof hook connectors, the carrier rails are fitted as shown in Fig. 35.

9 STANDARDsupport

9.1 General

Using the STANDARDsupport, the TopFix 100 mounting system can be used as an elevated mounting system so as always to achieve the optimum module tilt.

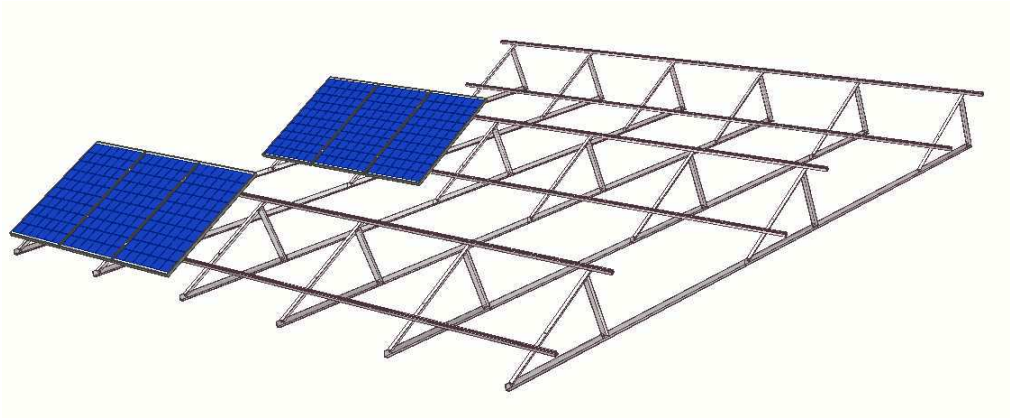


Fig. 37: STANDARDsupport with continuous base rails

The STANDARDsupport is available in two different sizes and with various tilt angles to enable the optimum module tilt angle to be achieved on flat and also on sloping roof surfaces.

Technical data:

STANDARDsupport 1000:	For module heights up to 1m
STANDARDsupport 1450:	For module heights up to 1.7m
Tilt angle:	10°...45° in 5° steps

STANDARDsupports are available with individual (see Fig. 38) and with continuous base rails (see Fig. 37).

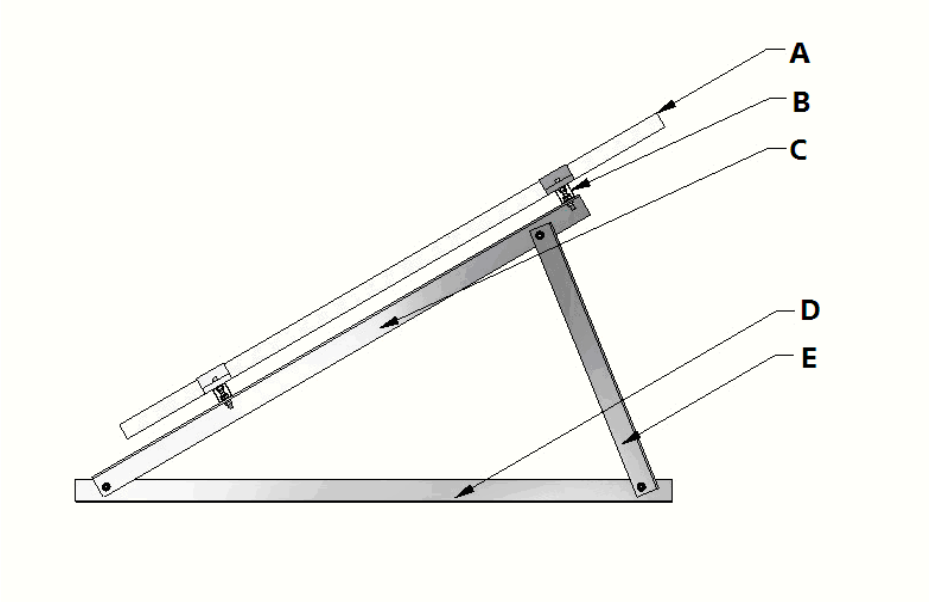


Fig. 38: Side view of STANDARDsupport

A	Solar module
B	Carrier rail type 39-o
C	Carrier rail standard support
D	Base rail
E	Support rail

9.2 Installation

The first step when installing the STANDARDsupport is to assemble the individual support elements comprising the base rail, support rail and carrier rail, as shown in Fig. 37. For this stage, use 3 hexagonal bolts M10x20 with appropriate locking nuts for each support element.

The next step is to loosely fit the type 39-o carrier rails to the support elements and place them in their approximate positions on the roof. For this stage, 2 hexagonal bolts M10x30 with locking nuts are provided for each support element. Please refer to our PV Manager software for the building-specific support spacings.

Continuous base rails make it easier to align the support elements and increase the flexibility of the securing points on the roof surface.

Now fit the individual support elements to the roof surface. There are various installation options for this step:

- Installation using hanger bolts
- Installation by applying additional weights (laying paving slabs, etc.)
- Installation using rivets (for trapezoidal sheet roofs)

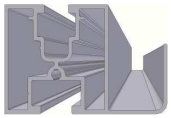
IMPORTANT!

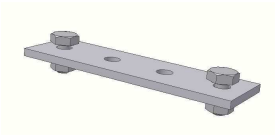
Due to the higher wind uplift loads, the mounting requirement must calculated by a stress analyst at the installation site.

The next step is to tighten all bolted connections to the correct torque.

The solar modules are fitted as described in Section 6, Fitting the PV modules. If the STANDARDsupport is used there is no need to use the module retaining angle.

10 Parts list

Illustration	Article No.	Article
	680010039O	**Aluminum carrier rail type 39-o** (Uncut length = 6060mm)
	680011039O	**Aluminum carrier rail type 39-o** (Cut to size)
	680010039M	**Aluminum carrier rail type 39-m** (Uncut length = 6060mm)
	680011039M	**Aluminum carrier rail type 39-m** (Cut to size)
	670030005M	**Module retaining angle, stainless steel** Includes: 1 hexagonal bolt DIN 933 M 8x20 A2 1 locking nut DIN 6923 M 8 A2
	6700300375	**Aluminum end piece 2, aluminum** Includes: 1 screw 4.2x13
	6700300320	**Butt connector standard** Includes: 4 hexagonal bolts DIN 933 M10x20 A2 4 locking nuts DIN 6923 M10 A2

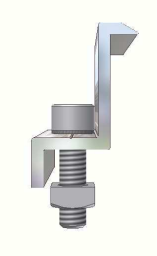


6700300325 **Butt connector L-section**
Includes:
2 hexagonal bolts DIN 933 M10x20 A2
2 locking nuts DIN 6923 M10 A2

Middle clamp TopFix 100

670040135M Middle clamp 30mm including bolts
670040134M Middle clamp 34mm including bolts
670040135M Middle clamp 35mm including bolts
670040136M Middle clamp 36mm including bolts
670040137M Middle clamp 37mm including bolts
670040138M Middle clamp 38mm including bolts
670040140M Middle clamp 40mm including bolts
670040141M Middle clamp 41mm including bolts
670040140M Middle clamp 42mm including bolts
670040143M Middle clamp 43mm including bolts
670040145M Middle clamp 45mm including bolts
670040146M Middle clamp 46mm including bolts
670040150M Middle clamp 50mm including bolts

Outside clamp TopFix 100



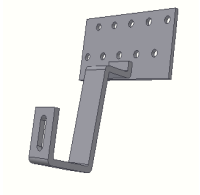
670040230M Outside clamp 30mm including bolts
670040234M Outside clamp 34mm including bolts
670040235M Outside clamp 35mm including bolts
670040236M Outside clamp 36mm including bolts
670040237M Outside clamp 37mm including bolts
670040238M Outside clamp 38mm including bolts
670040240M Outside clamp 40mm including bolts
670040241M Outside clamp 41mm including bolts
670040242M Outside clamp 42mm including bolts
670040243M Outside clamp 43mm including bolts
670040245M Outside clamp 45mm including bolts
670040246M Outside clamp 46mm including bolts
670040250M Outside clamp 50mm including bolts

670050107M Laminate clamp, middle clamp incl. bolts

670050207M Laminate clamp, outside clamp incl. bolts

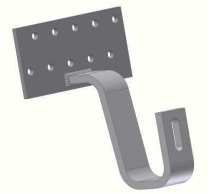
670010102O **STANDARD II roof hook**

670010102M **STANDARD II roof hook including**
2 wood screws DIN 571 8x100 A2
1 hexagonal bolt M10x30 A2
1 locking nut M10 A2



670010103O **Mammut II roof hook**

670010103M **Mammut II roof hook including**
2 wood screws DIN 571 8x100 A2
1 hexagonal bolt M10x30 A2
1 locking nut M10 A2



670010107O **Mammut XL roof hook**

670010107M **Mammut XL roof hook including**
2 wood screws DIN 571 8x100 A2
1 hexagonal bolt M10x30 A2
1 locking nut M10 A2

670010106O **Height-adjustable II roof hook**

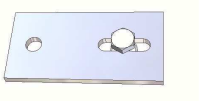
670010106M	**Height-adjustable II roof hook including** 2 wood screws DIN 571 8x100 A2 1 hexagonal bolt M10x30 A2 1 locking nut M10 A2

670010105O	**Light roof hook**
670010105M	**Light roof hook** Includes: 2 wood screws DIN 571 6x100 A2 1 hexagonal bolt M10x30 A2 1 locking nut M10 A2

670010201O	**Roof hook for slate roofs**
670010201M	**Roof hook for slate roofs** Includes: 2 wood screws 8x100 A2 1 hexagonal bolt M10x30 A2 1 locking nut M10 A2

670010202O	**Roof hook for plain tiles**
670010202M	**Roof hook for plain tiles** Includes: 2 wood screws DIN 571 8x100 A2 1 hexagonal bolt M10x30 A2 1 locking nut M10 A2

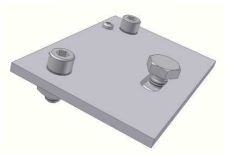
6700200101	**Hanger bolt M12x300 A2** Fully assembled with 1 EPDM seal 3 locking nuts M12 A2



670030010M	**Mounting plate for hanger bolt** Includes: 1 hexagonal bolt M10x30 A2 1 locking nut M10 A2
670030012M	**DUO mounting plate** Includes: 1 hexagonal bolt M10x30 A2 1 locking nut M10 A2

6700200301 **Sheet seam clamp**

6700200401 **Kalzip® clamp**



6700300305 **STANDARD connector plate**
Includes:
2 cylinder screws M8x20 A2
2 square bolts M8 A4
2 locking washers (non-rusting)
1 securing screw
1 hexagonal bolt M10x30 A2
1 locking nut M10 A2

6700300153 **Spacer 3mm**

6700300155 **Spacer 5mm**

6700310330 **Transverse securing bolt M6x45**
Incl. M6 nut with self-locking element

6900308100 **Wood screw DIN 571 8x100 A2**

6900210020 **Hexagonal bolt DIN 933 M10x20 A2**

6900210030 **Hexagonal bolt DIN 933 M10x30 A2**

6903100010 **Locking nut DIN 6923 M10 A2**

69003T08100 **Flat head screw 8x100 A2**

STANDARDsupport 1000
Comprising:
Carrier rail 1000, support rail 1000
3 hexagonal bolts M10x20 A2
2 hexagonal bolts M10x30 A2
5 locking nuts M10 A2

6100310010	**STANDARDsupport 1000 10°**
6100310015	**STANDARDsupport 1000 15°**
6100310020	**STANDARDsupport 1000 20°**
6100310025	**STANDARDsupport 1000 25°**
6100310030	**STANDARDsupport 1000 30°**
6100310035	**STANDARDsupport 1000 35°**
6100310040	**STANDARDsupport 1000 40°**
6100310045	**STANDARDsupport 1000 45°**
6100310099	**STANDARDsupport 1000 10...45° in 1° steps**

6100310101	**Individual base rail for STANDARDsupport 1000**

6100310105	**Continuous base rail for STANDARDsupport 1000**

STANDARDsupport 1450
Comprising:
Carrier rail 1450, support rail 1450
3 hexagonal bolts M10x20 A2
2 hexagonal bolts M10x30 A2
5 locking nuts M10 A2

6100314010	**STANDARDsupport 1450 10°**
6100314015	**STANDARDsupport 1450 15°**
6100314020	**STANDARDsupport 1450 20°**
6100314025	**STANDARDsupport 1450 25°**
6100314030	**STANDARDsupport 1450 30°**
6100314035	**STANDARDsupport 1450 35°**
6100314040	**STANDARDsupport 1450 40°**
6100314045	**STANDARDsupport 1450 45°**
6100314099	**STANDARDsupport 1450 10...45° in 1° steps**

6100314101	**Individual base rail for STANDARDsupport 1450**

6100314105	**Continuous base rail for STANDARDsupport 1450**

6700200505
20 pcs

Trapezoidal sheet mountings (incl. accessories)
20 wrought trapezoidal sheet clamps with high-performance adhesive tape
45 closed end blind rivets 4.8x11mm
45 dome head blind rivets 4.8x10mm

6700200505
100 pcs

Trapezoidal sheet mountings (incl. accessories)
100 wrought trapezoidal sheet clamps with high-performance adhesive tape
225 closed end blind rivets 4.8x11mm
225 dome head blind rivets 4.8x10mm

6700300335

Butt connector for trapezoidal sheets
Includes:
2 dome head blind rivets 4.8x10mm
(20 / 100 pcs)

6908148011

Closed end blind rivet 4.8x11.5
(for sheet thicknesses of max. 1.9mm)

6908348010

Dome head blind rivet 4.8x10

6000301005

Abrasive cleaning fabric
10 pcs Dimensions: 158x224

6000301001

Cleaning agent: isopropyl alcohol
2.5l canister

6000305010

Blind riveting toolkit
(incl. rivet depth gauge and replacement battery)

6000301010

O 4.9mm drill bit
10 pcs

11 Appendix

11.1 Notes on TopFix 100

Bolt lengths for different clamps

Module frame height for middle and outside clamps	Cylinder screw length for middle and outside clamps
	20mm
30mm	
34mm	25mm
35mm	25mm
36mm	25mm
37mm	25mm
38mm	25mm
40mm	30mm
41mm	30mm
42mm	30mm
43mm	30mm
45mm	35mm
46mm	35mm
50mm	40mm

Table 1

Tightening torque for bolted connections

The tightening torques for the bolted connections used in the TopFix 100 mounting system should be determined in accordance with DIN ISO 3506. Owing to the difficulty of assessing the friction coefficients in outdoor situations, it is difficult to determine the tightening torques in accordance with DIN ISO 3506. For this reason, the following tightening torques are recommended:

Bolted connection	Tightening torque
M8	18Nm
M10	35Nm

Table 2.1

IMPORTANT!

With the use of laminate clamps the tightening torque should be clarified with the laminate manufacturer in the respective installation situation.

Required rafter/purlin dimensions

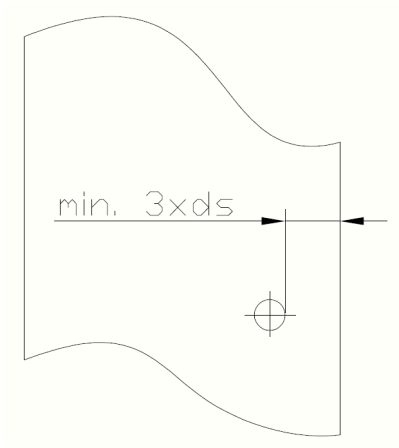
In accordance with DIN 1052, the following minimum rafter and/or purlin dimensions are required.

Nominal diameter of the wood screws used in mm	8 10 12
Minimum width of rafter/purlin in mm	64 80 96

Table 2.2

The height of the rafter/purlin should be at least 100mm.

The distance of the installed wood screw to the outer rafter/purlin edge must be at least three times that of the wood screw diameter. Hanger bolts must be installed in the middle of the rafter or purlin.



11.2 STRESS ANALYSIS for TopFix 100 pitched roof mounting system

Extracts from the load rating certificate for the TopFix 100 mounting system in accordance with DIN 1055 in normal applications using roof hooks, aluminium carrier rails, roof hook connecting rails and solar modules.

The snow and ice loads that act on structures are dealt with in the standard DIN 1055-5 (7.2005).
The wind loads that act on structures are dealt with in the standard DIN 1055-4 (3.2005/2006).

The stress analysis calculation assumes that the substructure is dimensioned in accordance with DIN 1052 Part 1 and Part 2.

In the investigation of wind uplift loads, increased values at the edge and corner region of the roof need to be taken into account for the dimensioning. On this point, see the standard DIN 1055-4 (3.2005) – Action on structures; wind loads. Because these vary according to the specific building and location, no generally applicable assessment can be made.

Among other things, determining the structurally relevant values is based on module dimensions, module weight, the snow and wind load zone, height above sea level as well as data on the site category, roof pitch angle, distance between rafters and/or purlins, the arrangement of the modules or generator array on the roof, taking account of the respective edge and corner regions of the roof.

The standards should be considered authoritative in respect of the proper structural design.

Particular attention should be given to the connection points (e.g. hole spacing, marking dimensions, etc.)
It is the responsibility of the installer to investigate the additional load impact on the existing roof structure, which must be investigated individually at each installation site.

11.3 10-year warranty

issues a warranty for the materials used in the TopFix 100 mounting system (except for sealing and plastic materials) should these materials impair the function of the entire system. The warranty period is 10 years starting from the date of purchase. If the warranty is invoked, shall render subsequent performance of its choice by either remedying the defect or delivering defect-free goods. In accordance with § 444 BGB (German Civil Code), all additional claims are excluded. assumes no liability for any type of consequential damage that results due to the materials used.

Basic warranty conditions:

- Professional dimensioning, installation and maintenance according to the current version of the installation instructions as well as all applicable standards (particularly DIN 1055 and DIN 1052), regulations, directives and recognized engineering standards.
- Usage under normal atmospheric conditions (onshore atmosphere without industrial atmosphere).

Warranty claims resulting from damages and consequential damage of any kind due to the following reasons are excluded:

Dimensioning, installation or maintenance work performed to the mounting system that does not correspond to the basic warranty conditions
Force majeure
Using the mounting system outside of the area of application specified in the installation instructions
Misuse, incorrect installation or act of negligence
Roof leakage
Use in application areas deviating from the basic warranty conditions (e.g. contact with de-icing salt, direct proximity to the ocean, acidic and alkaline environments)
Snow, ice and wind loads that exceed the specifications of the mounting system
Exceeding the values specified according to DIN 1055 at the installation site
Fire and/or lightning strike
Frost damage resulting from weather-related factors that cause water to enter into components of the mounting system and module frame
Modifying and/or using non- components

11.4 Notes on disposal / energy payback time

The TopFix 100 mounting system consists almost entirely of aluminum and stainless steel. After their service life, these materials can be returned into the recycling cycle using the commonly known methods.

The energy requirement for producing aluminum (without recycling portion) is approx. 13… 16 kWh/kg (average 14.5 kWh/kg).
A pitched roof mounting system for 1 kWp of crystalline solar modules contains approx. 16 kg of aluminum.

Energy required for aluminum production x aluminum portion of the mounting system
= aluminum energy requirement for 1kWp

14.5kWh/kg x 16kg/kWp = 232kWh/kWp

Aluminum energy requirement for 1kWp / regional irradiation = energy payback time

232kWh/kWp / 900kWh/kWp*a = 0,2578a (corresponds to approx. 1 year)

Due to the aluminum components used in the mounting system, there is an increase in the energy payback time of the solar module of approx. 1 year.

11.5 Weights / Installation times for pitched roof installation

	Weight per m2 module surface	Weight per kWp
Thin-film solar module	10...17 kg/m2	130...300 kg/kWp
Crystalline solar module	11...21 kg/m2	70...175 kg/kWp
Single-layer mounting system	*2,4...5 kg/m2	*18...35 kg/kWp
Two-layer mounting system	*5...7 kg/m2	*35...50 kg/kWp

*Values are based on the crystalline solar modules; for thin-film solar modules the weight of the mounting system is increased.

Installation time:

Two installers require approx. 1-2 hours of assembly time for a solar power system of 1kWp (under normal conditions).

All specified values have been determined based on theory. Depending on the type of system, installation times and weights can deviate in practice. Weights and installation times for the DC wiring, ground and lightning protection have not been taken into consideration.

11.6 Notes on maintenance

Due to the materials used, the TopFix 100 mounting system is virtually maintenance-free.

In addition to the electrical inspections of the entire PV system, we also recommend an inspection of the PV generator every 2 years that takes the following points into consideration.

Check:

- the solar modules for damage and soiling
- that all mechanical connections are properly attached (tighten the screw connections)
- the mounting system and the module frame for mechanical damage due to snow and ice loads
- the roof covering for leaks
- all electrical lines for damage (e.g. caused by animals)
- that all electrical plug and screw connections are making proper contact and for protection against accidental contact

If the modules require cleaning, they should be cleaned without using chemical cleaning agents and only using clear water.

A module can be easily replaced by removing the module wiring and loosening the relevant module clamps. The relevant safety regulations must be observed when replacing a module.