ASSEMBLY SYSTEM FOR SOLAR ARRAYS. PLANING AND DESIGN.

Original Instruction sheet for Installers
Proven quality – simply clever

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

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

Date: 01/2014
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<tr>
<td></td>
<td>Liability</td>
</tr>
</tbody>
</table>
General information

A1  Types of safety notices

Read the entire installation manual and observe all safety information!

<table>
<thead>
<tr>
<th>Warning symbol, word</th>
<th>Warning level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER!</td>
<td>Warns of immediate risk of death.</td>
</tr>
<tr>
<td>WARNING!</td>
<td>Warns of possible risk of death and/or severe injury.</td>
</tr>
<tr>
<td>CAUTION!</td>
<td>Warns of possible personal injury.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Warns of possible property damage with no possibility of injury.</td>
</tr>
</tbody>
</table>

Additional notice symbols

- Indicates additional important information.
- Obey applicable accident prevention regulations during mounting.
- Do not stand or walk on the modules.

- Ensure that the Sunfix plus is used only as intended. Observe local ordinances, building codes and accident prevention regulations during installation. The safety information for other system components must also be followed.
- Not obeying the following instructions may result in electric shock, fire and/or severe injury.
- Keep this instruction manual for future reference
### DANGER!
**Risk of fatal arcing**
- Solar modules generate direct current (DC) when any amount of light shines on them. When breaking a connected string of modules (e.g., when disconnecting the DC line from the inverter under load), a dangerous arc can occur. Observe the following:
  - Never remove the solar generator from the inverter while it is still connected to the main grid.
  - Ensure that the cable connections are in perfect condition (no cracking, soiling or other contamination).

### WARNING!
**Risk of falling**
- There is a risk of falling when working on the roof and when climbing up and down. Observe accident prevention regulations and use suitable fall protection equipment.

### WARNING!
**Flammable materials**
- Modules must not be operated in the vicinity of equipment or spaces in which flammable gases or dust occur or can collect.

### CAUTION!
**Risk of hand injury**
- Hands may be crushed during frame and module installation.
- Work must be carried out by trained personnel only.
- Wear protective gloves!

### CAUTION!
**Beware of falling objects**
- Tools, mounting materials or modules may fall from the roof during mounting and injure persons below.
- Block off the area at risk on the ground before starting installation work and warn persons in the vicinity.
Information about perimeter areas on pitched roofs
EN 1991-1-4 (Eurocode 1)

According to EN 1991-1-4 (Eurocode 1), the edge areas are subject to increased wind loads. These loads, in addition to snow loads and loads due to the system’s own weight, are taken into consideration during system planning. The edge areas have the following dimensions:

- \( e_1 = \frac{t}{10} \) or \( \frac{h}{5} \), the smaller value governs
- \( e_2 = \frac{b}{10} \) or \( \frac{h}{5} \), the smaller value governs

- According to EN 1991-1-4 (Eurocode 1), increased wind loads must be anticipated at the roof edges due to peaks in wind suction, which can raise the mounting parts in these areas.

- When using ballast for position stability, make sure the substructure has sufficient reserve load capacity.

- Check whether the use of protective mats is needed when securing the site of installation with ballast loads.
  - If so, be sure that they are made of suitable materials.
  - If you are certain as to the compatibility of the protective mat and roof flashing materials, we recommend putting in a separating mat layer.

- The friction coefficient between the roof covering and ballast element for the flat roof frame (e.g., concrete element) must amount to \( \mu > 0.6 \).

- The distance between the module rows is calculated individually from the angle of inclination of the modules and the minimum angle of insolation at your location.
Information about perimeter areas on flat roofs

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

![Edge distances to be maintained](image)

Fig. A 3-1

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

Information about compartment walls and cut-offs
Depending on the respective building, various building laws apply to the design of the PV system (corresponding to the locally applicable building regulations).

<table>
<thead>
<tr>
<th>In general, the following applies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The functionality of compartment walls and cut-offs may not be impaired.</td>
</tr>
<tr>
<td>2. PV modules may not be built over compartment walls and cut-offs.</td>
</tr>
<tr>
<td>3. A sufficient gap is to be maintained between PV systems and compartment walls / cut-offs (corresponding to the locally applicable building regulations).</td>
</tr>
</tbody>
</table>
A4 Installation

- Observe applicable accident prevention regulations during installation.
- For installation in the roof area, observe all applicable rules, standards and regulations.
- Obey applicable directives, standards and regulations during installation and commissioning.
- All persons who are on the roof of a building of over 3 m tall must use fall protection.

- Use safety equipment to protect persons on the ground below from falling debris.
- Also obey the safety instructions for all other system components (e.g., inverters and modules).
- The system must be connected to the mains power grid by a professional electrician only. The electrician must be certified by the local electric supplier or public utility authority.
- Observe the mounting instructions for modules and inverters included with the product as well as the mounting and wiring diagram.
- Ensure that all threaded connections are fully secured.
Improper use
This list does not contain all conceivable types of improper use and thus makes no claim of completeness. It is intended merely to provide an idea of improper use.

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

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

Proper use includes observing the installation manual and following the maintenance and cleaning instructions. The manufacturer accepts no liability for damages resulting from not following the installation manual.
The technical instructions enclosed with the unit shall be strictly adhered to for the installation, electrical connection and operation of the grid-connected inverter.

**DANGER!**

**Lethal voltage**

- Connecting modules in series can cause lethal voltages!
- Never connect the inverter for testing.
- The solar system may be connected to the public grid and isolated only by a certified electrician.

1. Wire the modules according to the wiring diagram.
   - Adhere strictly to the specifications of the wiring plan (distribution of the strings, any separating filters, cable groups). Improper wiring can destroy the inverter and/or modules.
   - In order to minimize inductive coupling in case of lightning strike current, the outgoing and return lines (+/-) of the string must be laid as near to one another as possible (while avoiding looping).
   - Do not under any circumstances allow less than the minimum bending radius (5x the cable diameter).
   - Do not mount or install modules at temperatures below -5°C.
   - Keep sockets and plugs dry during installation.

2. Lay the cable group.
3. Fasten the cables to the supporting profile with UV-resistant cable ties.
4. Mount and wire the next module rows, making sure to observe correct polarity.

**Testing**

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

Deviations are a sign of a wiring error.

- Never connect the inverter for testing.
- The solar system may be connected to the public grid and isolated only by a certified electrician.
- The technical instructions enclosed with the unit shall be strictly adhered to for the installation, electrical connection and operation of the grid-connected inverter.
The Sunfix plus mounting system is a support structure for installing solar power modules on pitched roofs parallel to the roofline. It is custom-built in advance as a complete mounting kit. Information on the existing roof construction and on the static requirements (orientation, snow and wind loads, etc.) at the installation site serve as the basis for the customized planning.

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

### Sunfix plus mounting system features
- Optional solar module mounting parallel to roof or elevated
- Aluminum supporting profile
- Stainless steel or aluminum mounting parts and connectors
- Mounting parts for practically all standard roof structures and coverings (e.g., clay tile, pan tile, slate and plain tile roofs, fiber cement corrugated panel, sandwich, Kalzip and trapezoidal corrugated roofs)
- System measured according to the latest snow and wind load standards
- Flat roof frames (FRF) with tilt angles of 15°, 20° and 30° available.
- Landscape or portrait orientation of the modules possible.
- Arrangement perpendicular to the roof pitch (RP) with FRF type A (horizontal) without stiffening brace up to 5° RP, with stiffening brace < 20° RP possible. With FRF type B (vertical) up to 5° RP possible.
- Arrangement to/against the RP with FRF type A and B < 20° RP possible.
- Installing the modules of type A (horizontal) possible with only one person.

### MCS 012 - wind uplift resistance
- Sunfix plus, hanger bolts, trapezoidal metal sheets: 3509 Pa (tested at 5° RP)
- Sunfix plus, roof hook medium, high profile and curved tiles: 3900 Pa (tested at 20° RP)
- Sunfix plus, roof hook flat tile, plain tiles and slates: 860 Pa (tested at 20° RP)
- Sunfix plus, rivets, trapezoidal metal sheets: 1888 Pa (tested at 5° RP)
- Sundeck, high profile and curved tiles: 5200 Pa (tested at 15° RP)
System description of arrangement parallel to roof

B1  System assembly

Details of profile and module clamps

Profiles

铝型材支持型材

B1 System assembly

Fig. B1-1 Frame layout

Details of profile and module clamps

1. Edge module clamp
2. Inside module clamp

Profiles

Aluminum Fix Plus supporting profiles
Fastening to roof structure (examples):

- **5a**: Hanger bolts + double flange (e.g. for mounting on trapezoidal corrugated roofs)
- **5b**: Roof hook (for mounting on clay tile roofs)
- **5c**: Hanger bolt + angle flange (e.g. for mounting on trapezoidal corrugated roofs)
- **5d**: Seam clips (for mounting on Kalzip roofs)
- **5e**: Fastening with rivets (alternate installation of rivets)
- **5f**: Solar fastener + angle flange (e.g. for mounting on sandwich roofs)
B2 Supporting profiles

Required supporting profile layers
The supporting profiles can be installed in single or dual layers, depending on the roof structure and the module arrangement (vertical or horizontal).

Dual-layer installation
The standard mounting profile installation is dual-layer. This arrangement allows for the maximum flexibility regardless of the substructure.

The distance between the modules is 9mm.

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

Boundary conditions for single-layer substructures:
- Suitable only with flat substructures
- Because the number of possible fastening points is limited, this type of installation is not always possible due to the mechanical loads.

The distance between supporting profiles under a row of modules is 1100 mm. This can vary according to the module instructions.
For single-layer mounting, we recommend a technical feasibility check.

With gently pitched roofs, it is possible to mount the modules at an angle to the roof covering. The modules can then be mounted horizontally as well as vertically. For more information, see the installation manual for the Sunfix flat roof mounting system from SolarWorld.
There are various supporting profiles available depending on the spacing of the substructure, the loads (snow, wind) and the type of mounting. All of these profiles can be individually combined with one another. The profiles are already cut to length at the factory and so only in exceptional cases need to be modified at the installation site.

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

The small Fix Plus 1 and Fix Plus 2 profiles installed using two rail splice connectors/fasteners. The additional rail splice connector is inserted in the side groove as usual.

In special cases (e.g., if a roof hook is fastened in this area) the additional rail splice connector can also be inserted in the top groove.
According to the framing plan, each profile requires at least 2 fasteners to the roof construction.

Two frame layers are joined using the aluminum clamps.

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

Condition for the use of aluminum cross clamp L (additional clamp)
- 1. Layer (clamp layer) Fix Plus 5
B3 Threaded connections

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

1. M8x16mm or 18.5mm screw with T40 driver
2. Fastener set yellow (slot nut with yellow plastic tab)

Assembly:

1. Use of fastener set yellow.

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

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

4. Screw in and tighten the M8 screw.

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

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

- Spot-check the screws annually for required tightness!

- Torque \( M_a = 15 \text{ Nm} \)
  Driver for module clamp: T40

**Edge mounting**

1. Place module clamp
2. Place end piece
3. Insert module clamp
4. Tighten screw

**Inter module**

1. Place second module, tighten screw
B4.1 Additional comments regarding the installation of modules of the Sunmodule Plus Vario W x H 1001 x 1357 mm type

Clamping ranges for modules W x H 1001 x 1357 mm

1. Permitted clamping ranges exclusively for the installation of Sunmodule Plus Vario W x H 1001 x 1357 mm modules (symmetric support, standard assembly).

2. Permitted clamping ranges for the installation of Sunmodule Plus Vario W x H 1001 x 1357 mm and Sunmodule Plus W x H 1001 x 1675 mm modules (mixed).

If the support is not symmetric, a spacing of $e > 20$ mm has to be maintained between the clamping area and the module edge. The area of the module corner must not be clamped.
During the installation of Sunmodule Plus Vario W x H 1001 x 1357 mm modules and Sunmodule Plus W x H 1001 x 1675 mm modules (mixed), make sure that the junction box module is not located above the clamping profile in order to prevent damage during loading! If necessary, the module has to be installed rotated by 180°.

Fig. B 4.1-4 – position of the junction box - OK!

Fig. B 4.1-5 – position of the junction box - WRONG!
B5  Mounting components

B5.1  Roof hook fastener set

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

① Supporting profile
② Screw similar to DIN 603 M8x16
③ Fastener set yellow
④ Screw similar to DIN 603 M8x24
⑤ Roof hook
⑥ Flange nut M8 A2
⑦ Wafer-head screw
⑧ Flange plate with extended
⑨ Adapter plate medium roof hook

Roof hook technical data

<table>
<thead>
<tr>
<th></th>
<th>Not adjustable roof hook</th>
<th>Adjustable roof hook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastening to wood substructure</td>
<td>Wafer-head screw 8x100mm Up to 8x280mm by request for rooftop insulation</td>
<td>Wafer-head screw 6x80mm</td>
</tr>
<tr>
<td>Req. embedment depth of wafer-head screws in the wood substructure</td>
<td>60 mm</td>
<td></td>
</tr>
<tr>
<td>Minimum wood rafter dimensions w x h</td>
<td>60x100 mm (wafer-head screws 8x100mm)</td>
<td>51x100 mm (wafer-head screws 6x80mm)</td>
</tr>
<tr>
<td>Driver for wafer-head screw</td>
<td>T40</td>
<td>T25</td>
</tr>
</tbody>
</table>
At maximum load, the roof hook lies directly on the roof covering. The distance between the roof hook and tiles must be ≥ 5 mm in the unloaded state.

1. Remove the tile above the hook location

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

3. Grind out back of tile and replace on roof. With interlocking tiles, the tile below must also be recessed.
B5.1.1 Information about the installation of SolarWorld roof hooks on pitched roofs with rooftop insulation

Fastening to roof structure

Fig. B 5.1.1 Example of roof structure with over

General information

Please observe the following information during the installation of SolarWorld roof hooks on pitched roofs with over rafter insulation:

1. The counter battens must be fastened properly and able to support additional loads, which can occur with over rafter insulation (please note manufacturer's data).

2. In the installation area of the roof hook, the counter batten must be void-free (knot hole, crack, etc.) in order to safely support the loads resulting from roof hooks and screws.
B5.1.2 Information about installation of SolarWorld flange plates for additional adjustability

**Fastening to roof structure**

Please observe the following during flange plate installation:

1. Flange plates are an expansion of the Sunfix plus roof hook fastener set and can be used with all types of SolarWorld roof hooks.

2. Additional height adjustment from 38 to 54 mm is possible.

3. Roof hooks without flange plate require an offset of 6 mm! (90°: horizontal, 0°: vertical)
B5.2 Roof hook fastening set for slate roofs

B5.2.1 Slate roofs on a wooden frame

The slate/shingle roof hook fastener set is suitable for both slate/shingle roofs with wooden frames and bitumen roofs (e.g., bitumen shingles).

- M8 screw
- Fastener set yellow
- Slate roof hooks

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

When mounting on bitumen roofs, the hook must be sealed again afterwards.

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

**Slate/shingle roof hook technical data**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastening to wood substructure</td>
<td>Countersunk screw 6x100mm</td>
</tr>
<tr>
<td>Req. embedment depth of countersunk screws in the wood substructure</td>
<td>60 mm</td>
</tr>
<tr>
<td>Minimum wood rafter dimensions w x h</td>
<td>50x100mm</td>
</tr>
<tr>
<td>Fastening angle to frame</td>
<td>0° and 90° (see fig.)</td>
</tr>
<tr>
<td>Driver for countersunk screw</td>
<td>T25</td>
</tr>
</tbody>
</table>
B5.2.2 Slate on battening

The flat tile roof hook fastener set is suitable for slate roofs without wooden boarding.

1 M8 screw  
2 Fastener set yellow  
3 Flat tile roof hook  
4 Wafer-head screw  
5 Weather-resistant flashing (not part of the kit).  
6 Wooden frame

Installation notes:
The covering slate must be notched in the area of the roof hook. The notched area must be sealed using a cover plate made of plastic or sheet metal. (the sheet metal or cover plate must be provided at the installation site and are not part of the kit). If necessary, spacer may be placed under the roof hook to compensate for variations in batten thickness.

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

Flat tile roof hook technical data

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastening to wood substructure</td>
<td>8x80mm wafer-head screw (standard)</td>
</tr>
<tr>
<td></td>
<td>Up to 8x280mm by request for rooftop insulation</td>
</tr>
<tr>
<td>Minimum wood rafter dimensions w x h</td>
<td>60x100mm</td>
</tr>
<tr>
<td>Fastening angle to frame</td>
<td>0° and 90° (see fig.)</td>
</tr>
<tr>
<td>Driver for wafer-head screw</td>
<td>T40</td>
</tr>
</tbody>
</table>
B5.3 Plain tile roof hook fastener set

The plain tile roof hook fastener set is suitable for mounting on plain tile roofs.

1. Supporting profile
2. M8 screw
3. Fastener set yellow
4. Plain tile roof hook
5. Wafer-head screw M8
6. Rafters
7. Counter battens
8. Tile battens

The hook is positioned on the tile below. Load-distributing plates should therefore be placed.

Plain tile roof hook technical data

<table>
<thead>
<tr>
<th>Fastening to wood substructure</th>
<th>Wafer-head screws 8x100mm up to 8x280mm by request for rooftop insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req. embedment depth of countersunk screws in the wood substructure</td>
<td>60 mm</td>
</tr>
<tr>
<td>Minimum wood rafter dimensions w x h</td>
<td>60x100mm</td>
</tr>
<tr>
<td>Fastening angle to frame</td>
<td>0° and 90° (see fig.)</td>
</tr>
<tr>
<td>Driver for wafer-head screw</td>
<td>T40</td>
</tr>
</tbody>
</table>

Installation note:
The cover tile around the hook must be recessed, or half or third tiles must be used. A plate that has been cut to fit is laid in the recessed area, overlapping on all sides, to ensure water-proofing (to be provided on site, sheets not included in the kit). A spacer (e.g., a piece of wood) may be placed under the roof hook to compensate for variations in batten thickness.
B5.4  Hanger bolt fastener set

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

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

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

1. M10/12 hanger bolt
2. M10/12 flange nut
3. Angle flange
4. Double flange
5. L-angle
6. Schraube M8
7. Dichtung EPDM
8. M8 screw
9. M8 flange nut
10. Wood substructure
11. Fix Sun
**Hanger bolt fastener set technical data**

<table>
<thead>
<tr>
<th>Fastening to supporting profile</th>
<th>Angle flange (with 1 hanger bolt)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Double flange (with 2 hanger bolts)</td>
</tr>
<tr>
<td>Hanger bolt diameter</td>
<td>M10 (L = 190-240 mm)</td>
</tr>
<tr>
<td></td>
<td>M10 (L = 190-240 mm)</td>
</tr>
<tr>
<td>Req. embedment depth of hanger bolt in the wood substructure</td>
<td>70 mm</td>
</tr>
<tr>
<td>Minimum wooden beam dimensions w x h</td>
<td>70x70mm for M10</td>
</tr>
<tr>
<td></td>
<td>84x70mm for M12</td>
</tr>
<tr>
<td>Pilot hole diameter in roof covering</td>
<td>ds + 2 mm (ds = screw shank diameter)</td>
</tr>
<tr>
<td>Pilot hole diameter in wood substructure</td>
<td>0.7 x ds</td>
</tr>
<tr>
<td>Driver for hanger bolt</td>
<td>Hex</td>
</tr>
</tbody>
</table>

**Assembly:**

1. Pilot drill wood substructure and roof covering.

   ![Fig. B 5.4-5](image)

2. Screw in hanger bolt.

   ![Fig. B 5.4-6](image)

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

   ![Fig. B 5.4-7](image)

4. Mount flange.

   ![Fig. B 5.4-8](image)
B5.5 Solar fastener set

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

**Important points regarding solar fastener mounting:**
- The solar fastener is always anchored in the substructure.
- Both steel and wood purlins are suitable for the substructure.
- The manufacturer's approval EJOT R Z.14.4-532 must be observed.
**Recommended procedure for installing the solar fasteners:**

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

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

The hole must be drilled perpendicular to the surface.

4. Remove bore chips from the surface.
5. Place cap.
6. Screw in the solar fastener with a screwdriver and suitable bit (see table) at \( n \leq 100 \, 1/min \).

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

### Table of solar fasteners

<table>
<thead>
<tr>
<th>Screw Designation</th>
<th>Substructure [mm]</th>
<th>Pilot hole diam. [mm]</th>
<th>Driver for Thread rod</th>
<th>Screw length/ Screw-in depth [mm] / Borehole depth [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>JZ3-SB-8.0xL-E16/8 + Cap</td>
<td>steel 1.5 &lt; 5.0; 5.0 &lt; 7.5; 7.5 &lt; 10 ≥ 10 mm</td>
<td>6.8; 7.0; 7.2; 7.4</td>
<td>SW 5</td>
<td>Screw length: Sandwich element thickness or trapezoidal profile height +20 mm</td>
</tr>
<tr>
<td>JZ3-SB-8.0xL-FZD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JA3-SB-8.0xL-E16/8 + Cap</td>
<td>Wood</td>
<td>5.5</td>
<td>SW 5</td>
<td>32–96</td>
</tr>
<tr>
<td>JA3-SB-8.0xL-FZD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDF-SB-7xL/50-E16+ Cap + Dowel</td>
<td>Concrete (Strength class C12/15)</td>
<td>10</td>
<td>SW 5</td>
<td>Screw length: 87–227 Screw-in depth: 50 mm Borehole depth: 70-80 mm</td>
</tr>
<tr>
<td>SDF-SB-7xL/50-FZD + Dowel</td>
<td></td>
<td>10</td>
<td></td>
<td>Screw length: 87–227 Screw-in depth: 50 mm Borehole depth: 70-80 mm</td>
</tr>
</tbody>
</table>
Additional measures in case of transverse load on solar fasteners

If the solar fasteners are loaded crosswise to the profiled sheets (this is only the case with standoffs perpendicular to the roof pitch), the profiled sheets must be fastened to the substructure at the same height in the neighbouring troughs (see B 7.5-2). These fastening elements must be designed so that the shear forces are transferred from the solar fasteners to the substructure. In the case of shear forces from the solar fasteners in the longitudinal direction of the profiled sheets, more remote connections of the corresponding profiled sheet with the substructure are also permitted to be included for the load transfer.

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

**Wood substructures**

<table>
<thead>
<tr>
<th>Screws</th>
<th>JT3-2-6.5 x L with 22 mm diam. sealing disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length L</td>
<td>Thickness of sandwich profile in wave valley + 50 mm</td>
</tr>
<tr>
<td>Pilot hole diameter</td>
<td>No pilot hole</td>
</tr>
</tbody>
</table>

**Steel substructures**

<table>
<thead>
<tr>
<th>Screws</th>
<th>JZ3-6.3 x L with 22 mm diam. sealing disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length L</td>
<td>Thickness of sandwich profile in wave valley + 20 mm</td>
</tr>
<tr>
<td>Pilot hole diameter</td>
<td>Depends on the thickness of the steel element</td>
</tr>
<tr>
<td>Thickness of steel element [mm]</td>
<td>Pilot hole diameter [mm]</td>
</tr>
<tr>
<td>2.0 ≤ d &lt; 5.0</td>
<td>5.3</td>
</tr>
<tr>
<td>5.0 ≤ d &lt; 7.0</td>
<td>5.5</td>
</tr>
<tr>
<td>d ≥ 7.0</td>
<td>5.7</td>
</tr>
</tbody>
</table>
B5.6 Trapezoidal roof fastener set

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

The trapezoid frames must be mounted perpendicular to the standing ribs of the trapezoidal sheet! Profile connectors are not necessary.

Trapezoidal sheet fastener set technical data

<table>
<thead>
<tr>
<th>Minimum sheet thickness, trapezoidal sheet</th>
<th>Steel</th>
<th>t ≥ 0.50 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aluminum</td>
<td>t ≥ 0.50 mm; Rm ≥ 215 N/mm²</td>
</tr>
</tbody>
</table>

Fastening: Bulb-tite blind rivet

Pilot hole diameter: 5,4 mm

Profile spacing (profile joint): 5-7 mm

Assembly:
1. Affix EPDM rubber to the rivet points of the trapezoidal sheet.
2. Place frame.
3. Drill rivet pilot holes
4. Install rivets.
B5.7 Standing seam roof fastener set

B5.7.1 Clamp for Kalzip roofs

The seam clamp is suitable for Kalzip profiled sheet roof coverings.

![Fig. B 5.7-1](image1)

![Fig. B 5.7-2](image2)

1. Seam clamp  
2. M8 screw with square neck  
3. M8 screw  
4. Fastener set yellow

Kalzip roof fastener set (seam clips) technical data

<table>
<thead>
<tr>
<th>Minimum sheet thickness, Kalzip Sheet</th>
<th>Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req. Clip distance, Kalzip Sheet</td>
<td>t ≥ 0.80 mm</td>
</tr>
<tr>
<td></td>
<td>e ≤ 2.00 m</td>
</tr>
</tbody>
</table>

B5.7.2 Standing seam clamp

The standing seam clamp is suitable for standing seam profiled sheet roof coverings.

![Fig. B 5.7-2-1](image3)

![Fig. B 5.7-2-2](image4)

1. Standing seam clamp  
2. M8 screw  
3. Hex. screw nut DIN 934-M12  
4. Fastener set yellow  
5. Hex. screw DIN 933-M12x30

Installation notes:
- The seam clamp and standing seam clips should be arranged so that as many profiled sheets as possible are uniformly stressed.
- The customer must ensure the load transmission from the covering to the substructure.
B6 Bonding/grounding

Professional grounding is the responsibility of the installation company.

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

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

The connecting terminal for equipotential bonding enables internal equipotential bonding within the frame system. The terminals are connected with an 8 mm aluminum wire, for example. With this terminal, the system can be connected to a ground bus or a lightning protection system. Note the connection to the equipotential bonding in the system documentation and check functionality prior to system commissioning.

The equipotential bonding must be executed according to local regulations and standards.

The equipotential bonding between anodized module frame and frame system is ensured by the use of the "MODULE FIX" module clamp. Check and document functionality prior to commissioning.
Mounting example of arrangement parallel to roof

The installation of a dual-layer Sunfix plus mounting system on a clay tile roof with modules arranged vertically and 90° roof hooks is described as an example.

C1 Determining the system position and the mounting points

Determine the position of the system on the roof and mark it. Observe the edge distances indicated in the plan.
Position the supports (here: roof hooks) according to the enclosed mounting plan, adapted to the local conditions.
C2 Installing the mounting components

Remove the roof tiles at the designated points and fasten the roof hooks. Ensure that the mounting points are in a uniform line. Recess removed roof tiles as needed with the angle grinder and replace on roof. See also Chapter B 5 — Fastening options.
C3 Installing the supporting profiles

Mounting the bottom profile layer (dual-layer)

Align the vertical supporting profiles on the top and bottom in a row and fasten to the roof hooks using one M8 Torx screw each with slot nut. If necessary, install PLUS CONNECT connector between frames.
Mounting the top frame layer (first layer, clamp layer)

Mark the position of the horizontal supporting profiles according to the mounting plan (2 supporting profiles are required per module, spaced 1100 mm apart) and mount horizontal supporting profile using X-CONNECT profile connector.

If necessary: Install PLUS CONNECT for connections in lengthwise direction connector between frames.
C4 Installing the modules

Fasten modules to the supporting profiles on the long sides using module clamps. General dimensional tolerances must be observed when arranging the modules; a maximum gap of 1 mm from the clamping screw can even these out. Indent ≥ 30 mm at the edge of each module and insert a spacer. Use a torque wrench during installation. Supply a torque of 15 Nm.

- Read the module instructions provided with the modules.

\[ \text{Torque } M_s = 15 \text{ Nm} \]

Driver for module clamp: T40
D System description of elevated arrangement

D1 Flat roof frame (FRF) types

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

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

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

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

Fig. D 1-1 side view flat roof frames type A

Fig. D 1-2 example system with flat roof frames type A

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

Fig. D 1-4 example system with flat roof frames type B
Dimensions of flat roof frames

<table>
<thead>
<tr>
<th>Angle</th>
<th>Height h [mm]</th>
<th>l [mm]</th>
<th>Drilled hole spacing b [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15°</td>
<td>≈320</td>
<td>≈1070</td>
<td>1035</td>
</tr>
<tr>
<td>20°</td>
<td>≈405</td>
<td>≈1070</td>
<td>1035</td>
</tr>
<tr>
<td>30°</td>
<td>≈560</td>
<td>≈1070</td>
<td>1035</td>
</tr>
<tr>
<td>Type B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15°</td>
<td>≈405</td>
<td>≈1244</td>
<td>1210</td>
</tr>
<tr>
<td>20°</td>
<td>≈500</td>
<td>≈1244</td>
<td>1210</td>
</tr>
<tr>
<td>30°</td>
<td>≈680</td>
<td>≈1244</td>
<td>1210</td>
</tr>
</tbody>
</table>

The maximum distance between the flat roof frames and the maximum projection of the profiles depends on the building height, the expected regional snow and wind loads, the terrain conditions and the installed height above sea level. For this reason, it is not possible to make general recommendations as to these dimensions. Please refer to the system planning information for precise values relating to your system.
D2 External boundary conditions

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

### Boundary conditions flat roof frames type A
(Modules landscape)

<table>
<thead>
<tr>
<th>Direction of elevation</th>
<th>Wind load [kN/m²]</th>
<th>Snow load [kN/m²]</th>
<th>Height above sea level [m]</th>
<th>Building height [m]</th>
<th>Allowable roof pitch [°]</th>
<th>Reinforcement strut</th>
<th>Frame spacing [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>to/against the roof pitch</td>
<td>≤ 1,20</td>
<td>≤ 4,00</td>
<td>≤ 1000</td>
<td>≤ 25</td>
<td>≤ 20</td>
<td>not necessary</td>
<td>1.10 m (2 frames per module)</td>
</tr>
<tr>
<td>perpendicular to the roof pitch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>necessary</td>
<td></td>
</tr>
</tbody>
</table>

Custom solutions are available on request in order to accommodate individual system plans!

### Boundary conditions flat roof frames type B
(Modules portrait)

<table>
<thead>
<tr>
<th>Direction of elevation</th>
<th>Wind load [kN/m²]</th>
<th>Snow load [kN/m²]</th>
<th>Height above sea level [m]</th>
<th>Building height [m]</th>
<th>Allowable roof pitch [°]</th>
<th>Reinforcement strut</th>
<th>Frame spacing [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>to/against the roof pitch</td>
<td>≤ 1,20</td>
<td>≤ 4,00</td>
<td>≤ 1000</td>
<td>≤ 25</td>
<td>≤ 20</td>
<td>not necessary</td>
<td>freely selectable, depending on the system plan</td>
</tr>
<tr>
<td>perpendicular to the roof pitch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[!] Ballasted systems are only permissible for roof pitches up to 5°!
D3 System arrangement

Type A
D4  Supporting profiles

D4.1  Frame layer

Type A

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

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

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

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

![Fig. D 4.1-1a](image)

![Fig. D 4.1-3a](image)

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

Type B

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

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

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

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

![Fig. D 4.1-2b](image)

![Fig. D 4.1-4b](image)

*We recommend a technical feasibility check for double-layer mounting.*
D4.2 Clamp layer modules

**Type A**
Clamp layer not necessary.

**Type B**

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

- Align profile vertically!
- Clamp layer

<Torque $M_A = 15 \text{ Nm}$>

Fig. D 4.2-1
Abb. D 4.2-2
Fig. D 4.2-3
Fig. D 4.2-4
Fig. D 4.2-5
Fig. D 4.2-6

max. 10 mm
The module is fastened by clamping. A torque wrench is recommended to ensure the required force.

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

- Spot-check the screws annually for required torque!

- Torque $M_\alpha = 15 \text{ Nm}$
  - Driver for module clamp: T40

---

**Type A**

1. End piece
2. Module clamps

---

**Bottom mounting**

1. Insert module clamp
2. Twist in module clamp and push on to embossing
3. Place module, slide on end piece and tighten screw

---

**Top mounting**

1. Push on module clamp
2. Slide on end piece
3. Tighten screw
Type B

See section B4.

D6 Mounting components

See section B5.1 - B5.6

D7 Bonding/grounding

See section B6.
If the frames are not directly connected to the roof, then they must be equipped with ballast, in relation to the external conditions. This serves to avoid lifting, toppling or shifting of the system as a result of wind loads. These are to be determined individually for each system in relation to the building and location.

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

<table>
<thead>
<tr>
<th>Building height [m]</th>
<th>Wind load q [kN/m²]</th>
<th>Minimum required ballast for module inclination 30° [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>per m² module area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perimeter area</td>
</tr>
<tr>
<td>0/-10</td>
<td>0.50</td>
<td>121</td>
</tr>
<tr>
<td>10/-18</td>
<td>0.65</td>
<td>161</td>
</tr>
<tr>
<td>18/-25</td>
<td>0.75</td>
<td>187</td>
</tr>
</tbody>
</table>

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

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

E1 Determining the system position and attachment points

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

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

Please refer to chapter B9 – Fastening Options.

Fig. E 2-1
E3 Installing the supporting profiles

Mounting the bottom profile layer

Align the vertical supporting profiles on the top and bottom in a row and fasten to the angle flange using one M8 Torx screw each with slot nut. If necessary: Insert profile connector between the profiles.

Fig. E 3-1
Mounting the upper profile layer

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

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

---

Fig. E 3-2

Cross connection of frames

Lengthwise connection of frames (here: Profile connector 3)

Fig. E 3-2 Detail 1

Fig. E 3-2 Detail 2
E4  Installation of the flat roof frames

E4.1  Threaded assemblies for flat roof frames

Screw the pre-assembled frames together.

🧰 Torque $M_a = 15$ Nm for M8 screws

![Type A diagram](Fig. E 4.1-1a)

![Type A diagram](Fig. E 4.1-2a)

![Type B diagram](Fig. E 4.1-1b)

![Type B diagram](Fig. E 4.1-2b)

E4.2  Fastening of flat roof frames

Mount flat roof frames with the specified spacing.

![Type A diagram](Fig. E 4.2-1)

![Type B diagram](Fig. E 4.2-2)
E5  Installing the clamp layer

Type A
Clamp layer not necessary.

Type B
Screw the supporting profile clamp layer to the flat roof frames. If necessary, mount profiles with connectors. Install profiles on end! Install clamp positioned underneath (see detail)!
E6 Installing the modules

Type A
Install the modules in accordance with chapter B8

- Read the module instructions provided with the modules.

Torque $M_A = 15$ Nm
The distance between the modules is $a = 9$ mm
Type B
Install the modules in accordance with chapter B8.
- Read the module instructions provided with the modules.

\[ \text{Torque } M_A = 15 \text{ Nm} \]
The distance between the modules is \( a = 9 \text{ mm} \)
Maintenance and cleaning

CAUTION!

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

- With a roof pitch of 15°, it is generally not necessary to clean the modules, as rainfall will have a self-cleaning effect.
- In case of heavy soiling (reduced performance) we recommend cleaning with large amounts of water (using a hose) and a gentle cleaning tool (sponge). Under no circumstances may the dirt be scraped or rubbed off dry, as this may cause microscratches that would impair module performance.

PV system maintenance

The system should be inspected annually for the following:

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

CAUTION!

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

- Do not stand or walk on modules.

- The generator array should be inspected at regular intervals for flawless condition (visual inspection, connection check).

Liability

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

- The preceding limitations of liability notwithstanding, liability on the part of SolarWorld for patent law violations or violations of the rights of third parties arising due to the use of the modules and the mounting system is excluded unless required by law.

- The text and images in this installation manual correspond to the current state at the time of printing. Subject to change.
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