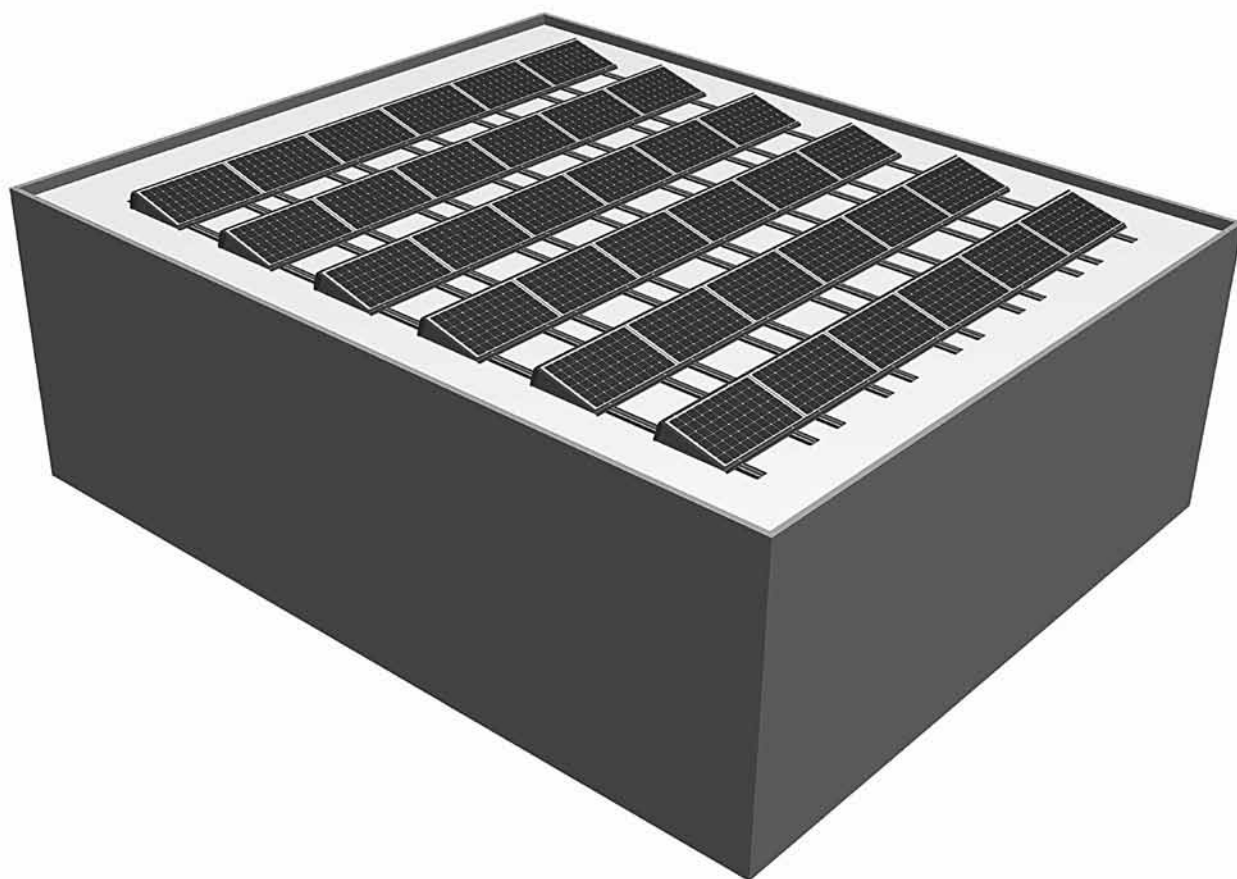


Sunfix[®] aero 15° from SolarWorld[®]

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

Translation of the original instruction manual for installers



08/2011

Proven quality – simply clever

The **Sunfix/aero** for solar power systems is a high quality product from the SolarWorld AG product line. Only the highest quality components are used in the mounting system in order to ensure trouble-free operation of your solar power system. The following information explains the proper arrangement of the **Sunfix/aero** based on a sample roof to help you install the mounting system without any problems. Any unique structural features must be documented so that the unique features of the roof can be taken into account when planning the layout.

Date: 08/2011

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A Safety information

A1 Safety notices



Read the entire instruction sheet and observe the safety information!

Warning level



DANGER!

Warning level

Warns of immediate risk of death.



WARNING!

Warns of possible risk of death and/or severe injury.



CAUTION!

Warns of possible personal injury.

CAUTION

Warns of possible property damage without possibility of injury.

Additional notice symbols



Indicates additional important information.



Observe applicable accident prevention regulations during mounting.



Do not stand or walk on modules.

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

A2 Safety information

DANGER!

Risk of fatal electric shock

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

DANGER!

Risk of fatal arcing

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

WARNING!

Risk of falling

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

WARNING!

Flammable materials

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

CAUTION!

Risk of hand injury

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

CAUTION!

Beware of falling objects

- ▶ During installation, there is a risk of tools, mounting materials or modules falling from the roof and injuring persons below.
- ▶ Block off the area at risk on the ground before starting installation work and warn persons in the vicinity.

A3 Comments regarding system planning

- ▶ Ensure adequate load capacity (based on dimensions, condition and material properties) of the substructure, support structure and other affected layers (such as an insulation layer).
- ▶ Make sure that the runoff of rainwater is not impeded.
- ▶ Consider any physical structural issues.
- ▶ It is to be ensured that the roof structure is even. if this is not the case, it is to be professionally corrected.
- ▶ In case of doubt, consult an expert (e.g. a structural engineer, surveyor).
- ▶ Protect cables installed outdoors from weather, UV light and mechanical damage using suitable precautions (such as by using UV-resistant plastic tubes or cable conduits).

CAUTION!

- ▶ The horizontal force on the PV system caused by wind loads are transferred to the roof structure via anti-slip mats and the resulting static friction. For a correct construction, it is therefore necessary to determine the static friction between frame, anti-slip mat and roof covering during the planning stage.

CAUTION!

- ▶ When choosing the anti-slip mat, chemical compatibility with the roof covering must be taken into consideration!

Fire protection

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

Information about compartment walls and cut-offs

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

In general, the following applies:

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

A4 Comments regarding installation

- ▶ Observe applicable accident prevention regulations during mounting.
- ▶ 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.
- ▶ To prevent damage to the roof covering, do not carry out sawing work (base frames) on the roof.

Required tools	
①	Torque wrench (20Nm) with Torx T40-bit
②	Riveting machine
③	Chop saw (cut aluminum profiles to bottom layer)

Additionally required materials	
①	Anti-slip mat (required static friction value and chemical compatibility with the roof covering must be taken into consideration)
②	Pot. ballast elements (e.g. concrete slabs)

B

System description

B1 Proper and improper use

Proper use

The Sunfix®aero mounting system is intended to install solar power modules onto roofs of standard construction and height.

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

Improper use

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

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

B2 Technical overview

The Sunfix[®]aero mounting system is a support structure for installing solar power modules on flat roofs. It is custom-built in advance as a complete mounting kit. Information on the existing roof construction and on the static requirements (snow and wind loads, etc.) at the installation site serve as the basis for the

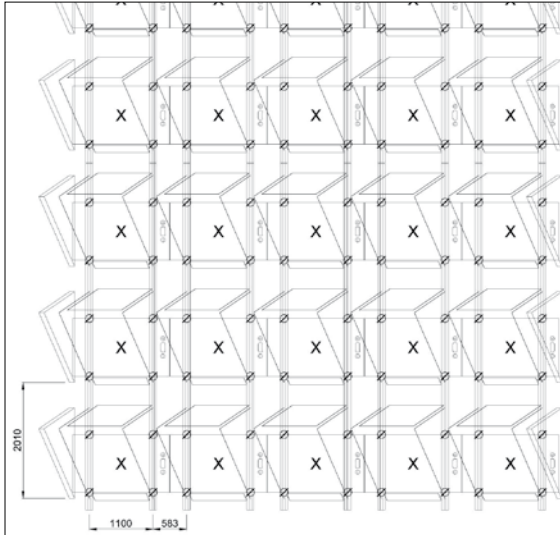


Fig. B 2-1 Sample frame diagram

customized planning. With each system, you receive a "frame diagram" and a "DC wiring diagram" custom made for your system. These show the arrangement of the Sunfix[®]aero elements as well as the wiring of the modules to the inverters, customized to your roof structure and module arrangement.

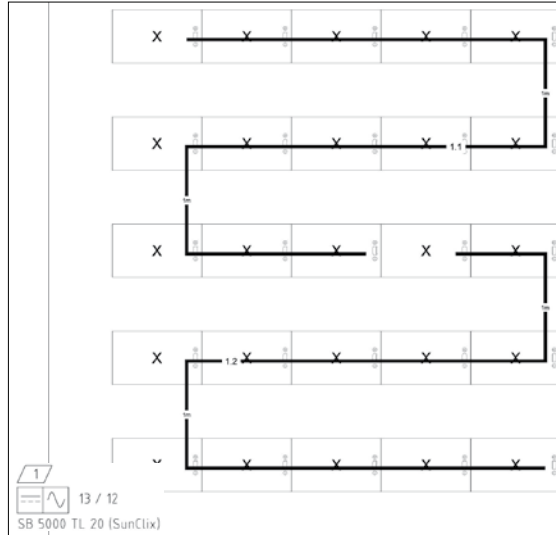


Fig. B 2-2 Sample DC wiring diagram

Sunfix[®]aero mounting system features

► Permissible Wind Load	$w = 0.90 \text{ KN/m}^2$
► Permissible building height	$H \leq 20 \text{ m}$
► Permissible Snow Load	$s_k = 4.76 \text{ KN/m}^2$
► Edge distance to roof edge all the way around	$a \geq 1.00 \text{ m}$
► Permissible roof pitch	$\leq 5^\circ$ (flat roof)
► Frame available for module inclinations	15° and 25°
► Minimum system size	3 x 3 modules
► The customer is to install a protective mat/anti-slip mat below the base profiles between the frame and the roof covering to prevent a horizontal shift caused by wind loads.	
► Standard static friction value:	$\mu \geq 0.60 [-]$
Lower values are possible after consultation with us and may require an increase in ballast!	
► Minimum width anti-slip mat	$b \geq 15 \text{ cm}$
► When choosing the protective mat and the anti-slip mat, chemical compatibility with the roof covering must be taken into consideration!	
► System measured according to the latest snow and wind load standards (DIN 1055, EC)	
► The required ballast is determined within the scope of system planning and depends on system size, wind load (location, building height), static friction between system and roof, as well as the presence of an attic.	

NOTE

The system is not connected to the roof structure. Stability is only ensured by its own weight and ballast. The measurement is carried out in accordance with current wind load standards.

Nonetheless, the system should be checked after extreme wind events as a shift by a few centimeters can never be completely ruled out.

B3 System arrangement

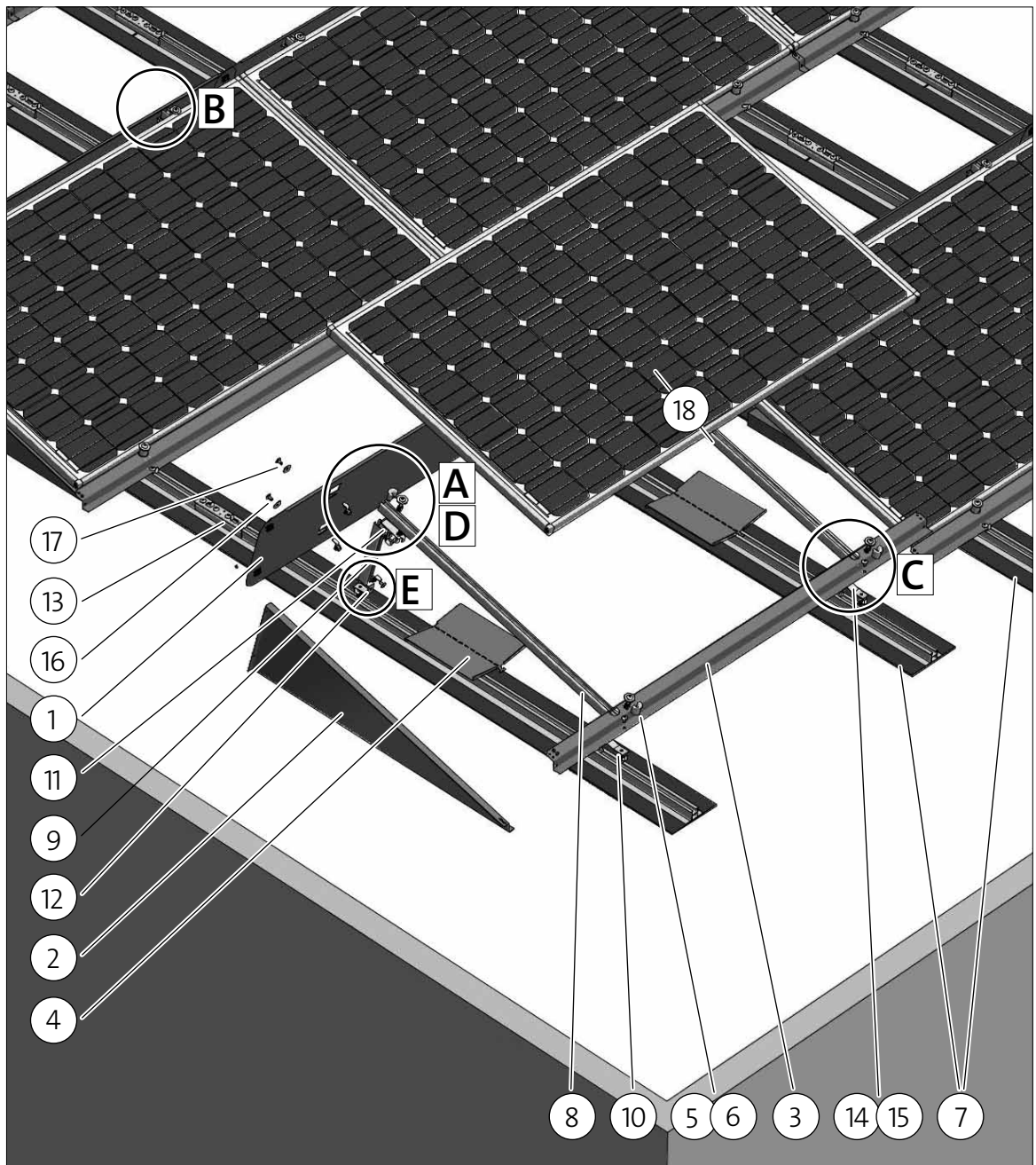


Fig. B 3-1 System arrangement

Sunfix Aero 15° component list	
①	Rear panel 15°
②	Side panel 15°
③	Front panel 15°
④	Supporting plate ballast
⑤	Module clamps
⑥	End piece
⑦	Base frame
⑧	Supporting profile frame 1089 mm
⑨	Supporting profile frame 279 mm
⑩	Connection angle 15°
⑪	Connection angle 90°
⑫	Connection angle 75°
⑬	Base frame connector
⑬ _a	Base frame ridge connector (alternative)
⑭	Fastener set yellow (slot nut)
⑮	Screw M8x16
⑯	Blind rivet sleeve 5.0
⑰	Spacer 8.4x30x1.5 mm (for rear panel)
⑱	Module

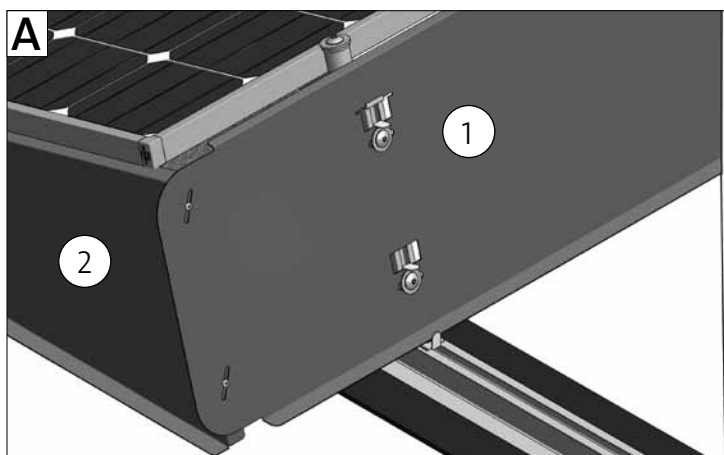


Fig. B 3-1 Detail A

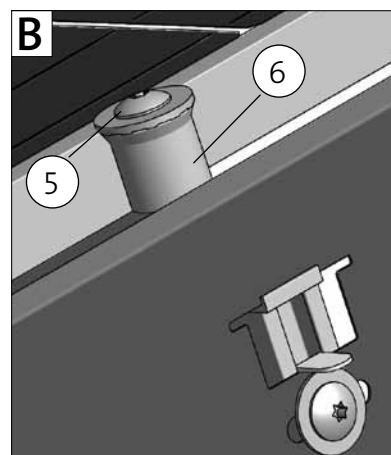


Fig. B 3-1 Detail B

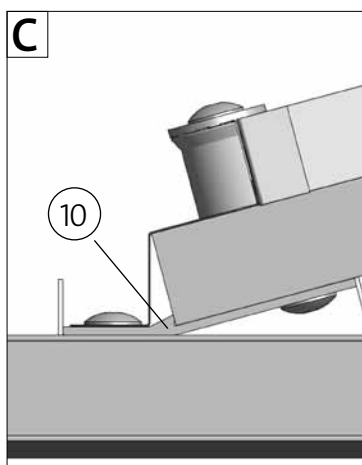


Fig. B 3-1 Detail C

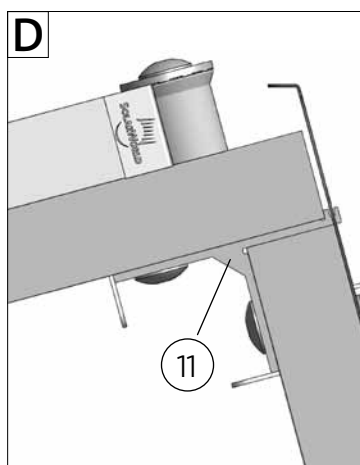


Fig. B 3-1 Detail D

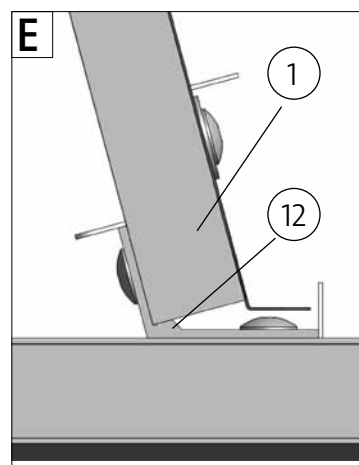


Fig. B 3-1 Detail E

System arrangement dimensions (example)

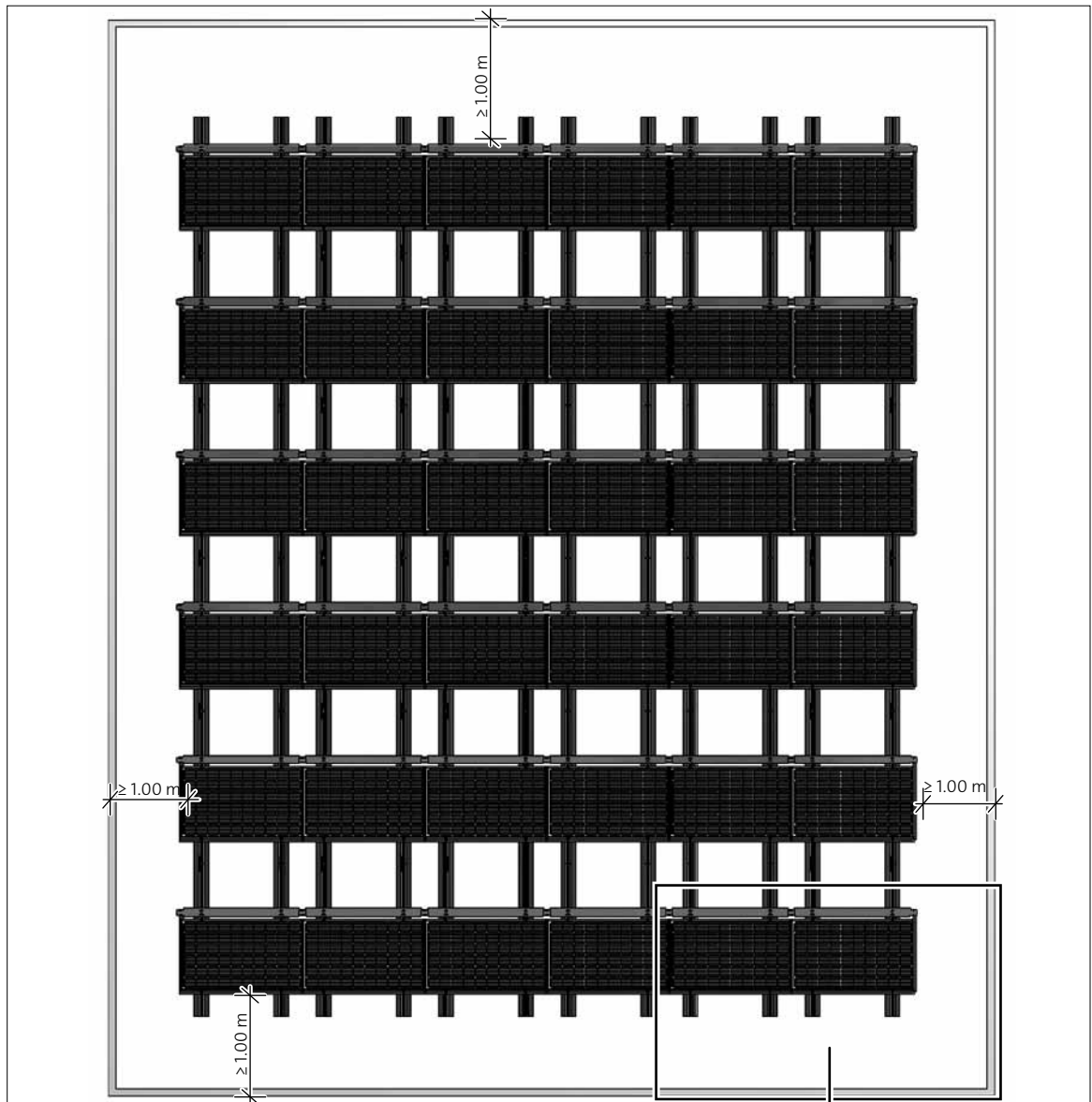


Fig. B 3-2 System arrangement dimensions

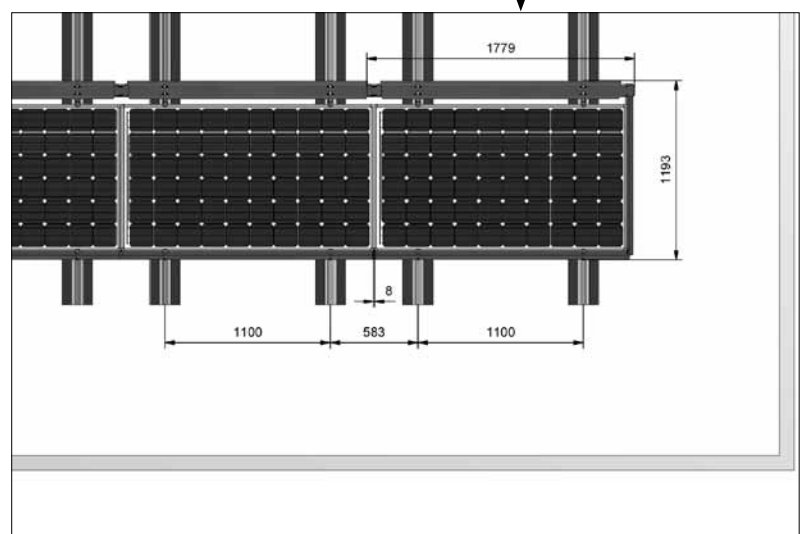


Fig. B 3-3 Detail system arrangement

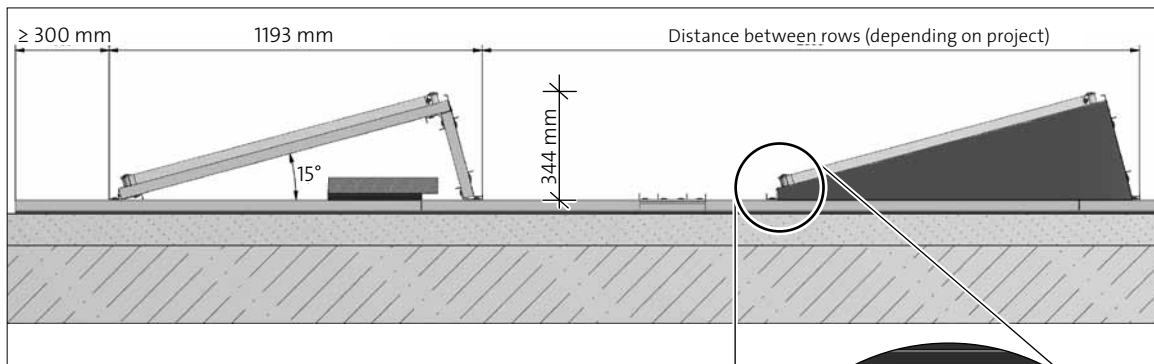


Fig. B 3-4 System arrangement side view

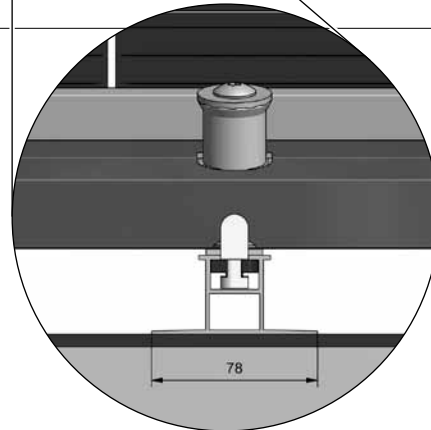


Fig. B 3-4 Detail

C Mounting example

The following describes an example installation of a system with 3 x 3 modules.

C1 Determining the system position

CAUTION!

Warning of wind loads in the structural condition

- ▶ The Sunfix Aero mounting system can only withstand all wind loads in its fully installed state.
- ▶ The wind resistance is lower in the structural condition (e.g. without rear panels, without side panels, etc.).
- ▶ The customer is to secure frames in the structural condition sufficiently according to weather conditions!

1. Determine the position of the system on the roof.
- ▶ Maintain minimum edge distance ≥ 1.00 m

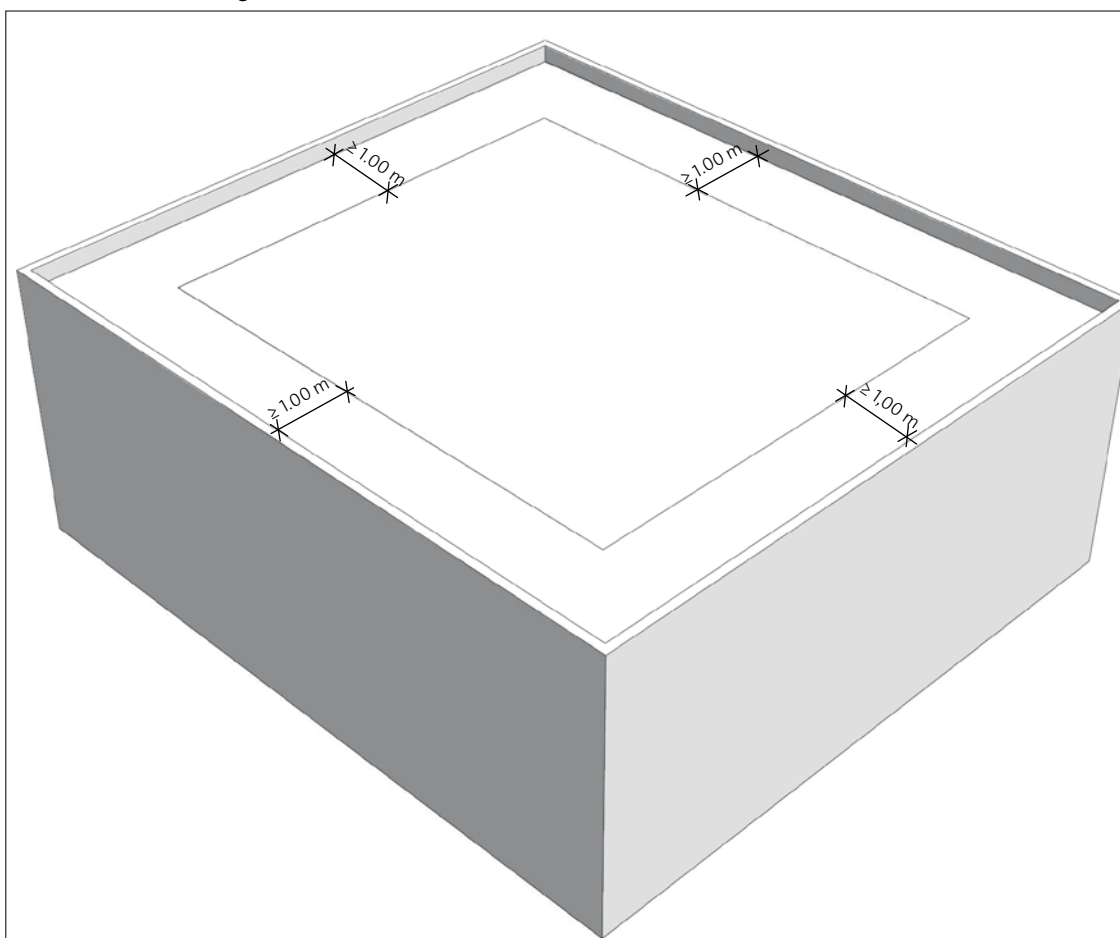


Fig. C 1-1

C2 Laying the anti-slip mats

1. Determine the position of the anti-slip mats and lay the mats with the required distances.

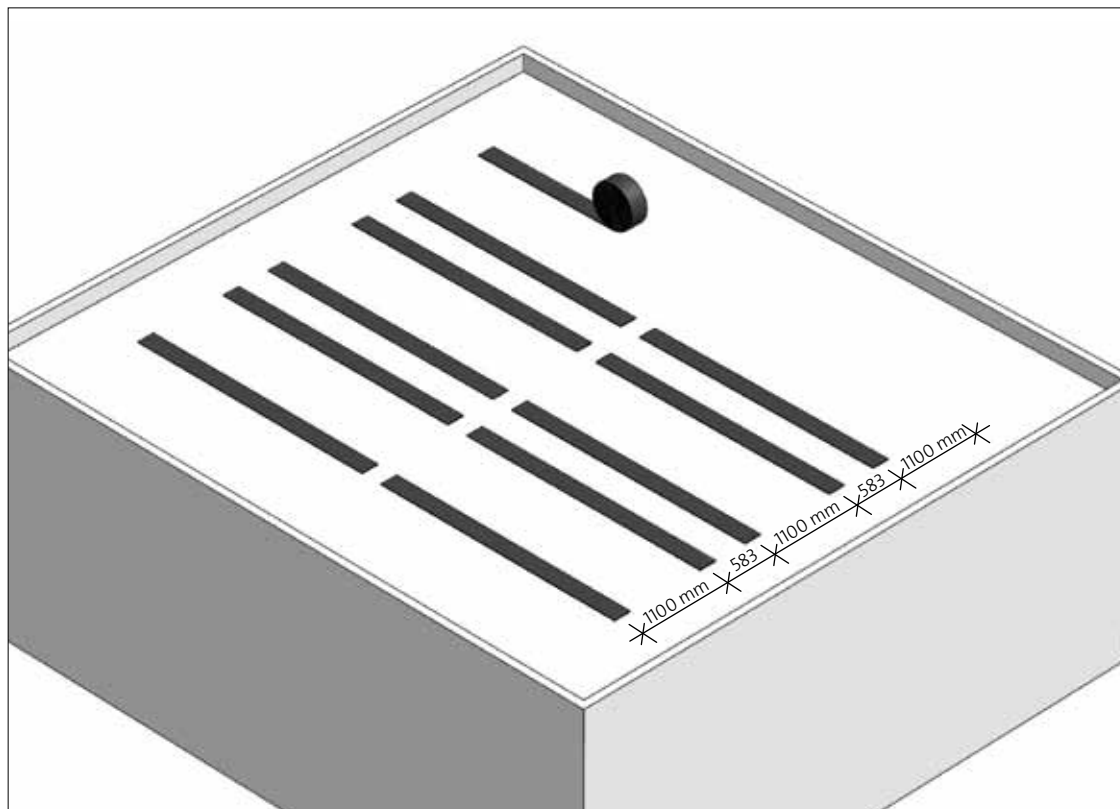


Fig. C 2-1

NOTE

The customer is to install a protective mat/anti-slip mat between the frame and the roof covering to prevent a horizontal shift caused by wind loads.

Standard static friction value: $\mu \geq 0.60 [-]$

Lower values are possible after consultation with us and may require an increase in ballast! When choosing the protective mat and the anti-slip mat, chemical compatibility with the roof covering must be taken into consideration!

NOTE

Ensure adequate drainage. If necessary, the anti-slip mat can be separated in 3.00 m intervals at a length of approx. 0.20 m in order to improve drainage.

C3 Laying the base frames

1. Cut base frames with a saw according to sawing list. Do not carry out sawing work on the roof in order to prevent damage to the roof covering due to chipping!
2. Screw together the base frames and the connectors in longitudinal direction and position them on the anti-slip mats with the specified spacing.

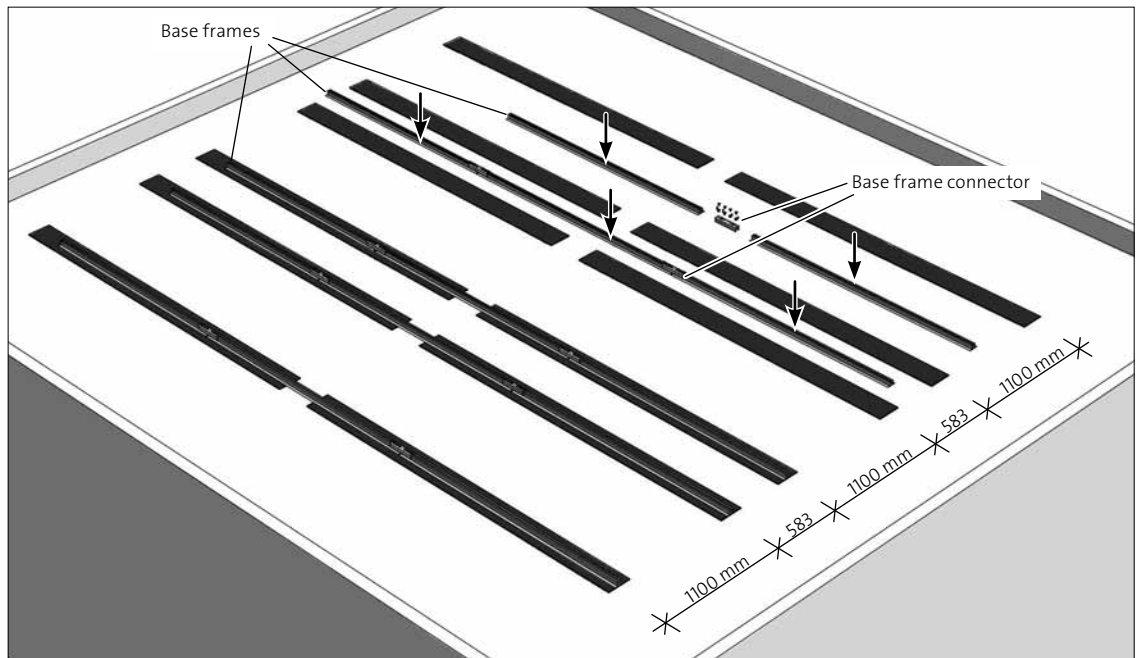


Fig. C 3-1

Base frame butt connector

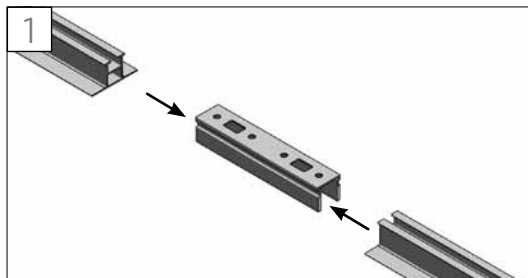


Fig. C 3-2

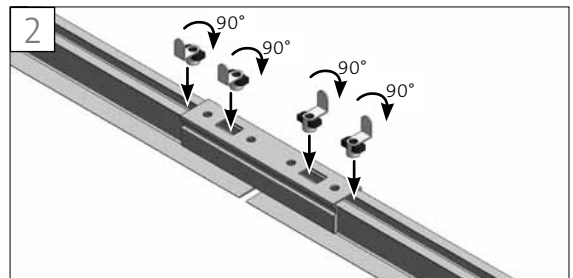


Fig. C 3-3

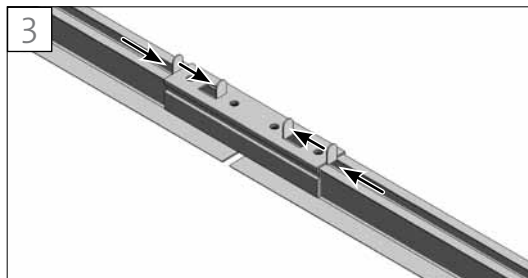


Fig. C 3-4

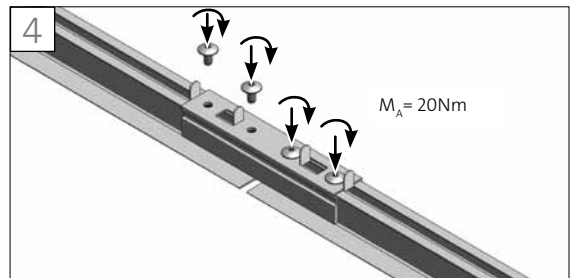


Fig. C 3-5

Use the ridge connector instead of the standard connector in roof covering areas with changes in inclination.

The ridge connector can be used to adjust the base frame to changes in inclination.

Butt connector ridge connector

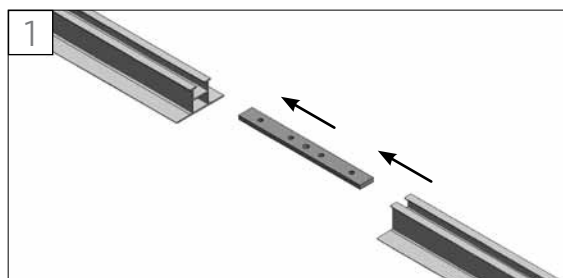


Fig. C 3-6

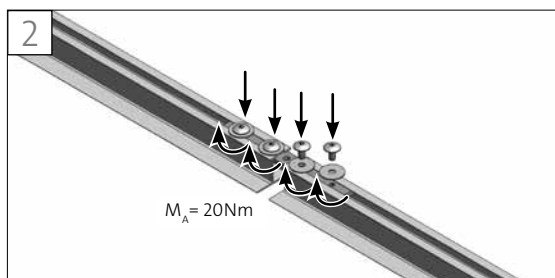


Fig. C 3-7

Ridge connector installation

1. Mounting the ridge connector

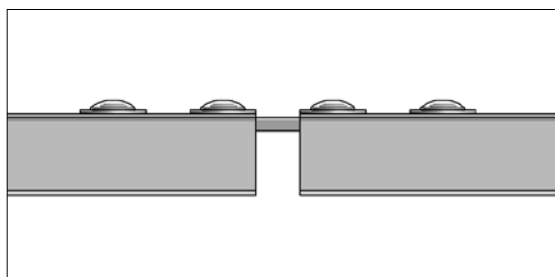


Fig. C 3-8

2. Adjusting the angle of inclination

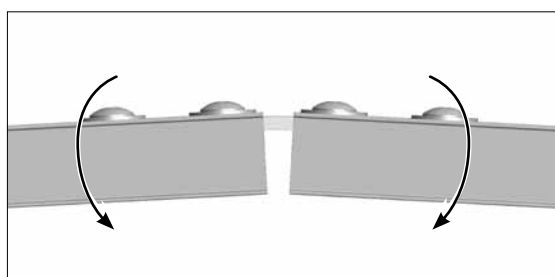


Fig. C 3-9

3. Positioning the base frame

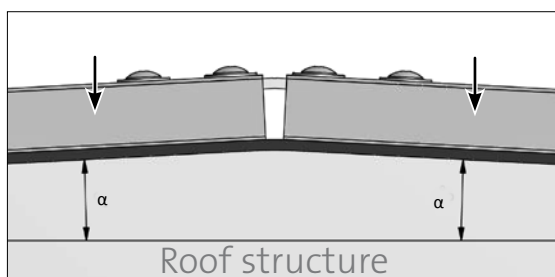


Fig. C 3-10

C4 Pre-assembling the frame

1. Screw short and long supporting profiles with M8 screws, fastener sets (slot nuts) and connection angles 15°, 90° and 75° in accordance with the figure. Torque $M_A = 20\text{Nm}$

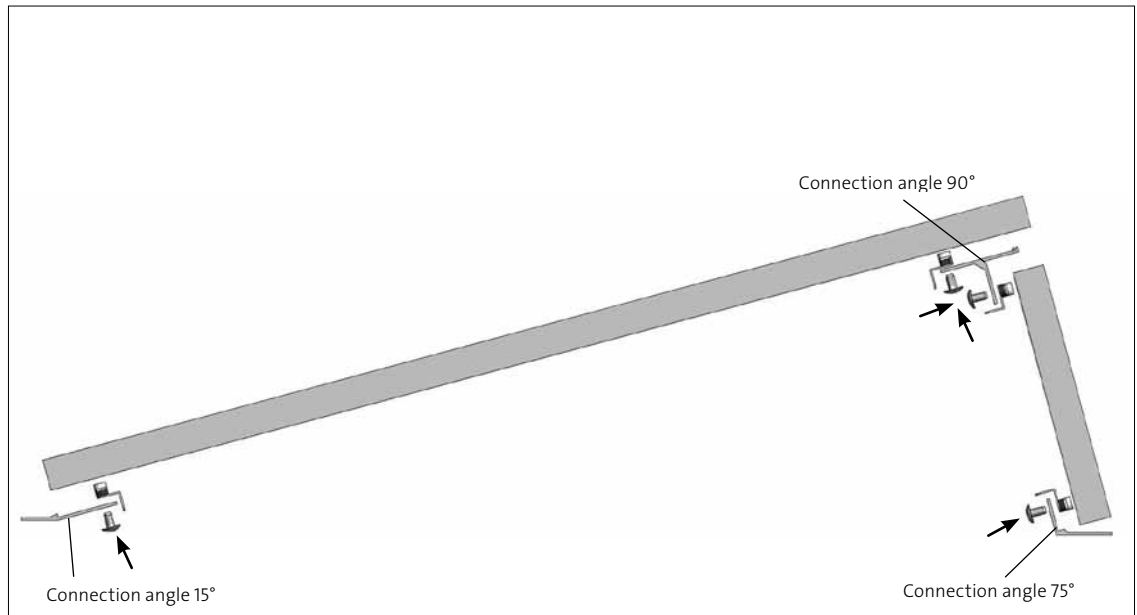


Fig. C 4-1

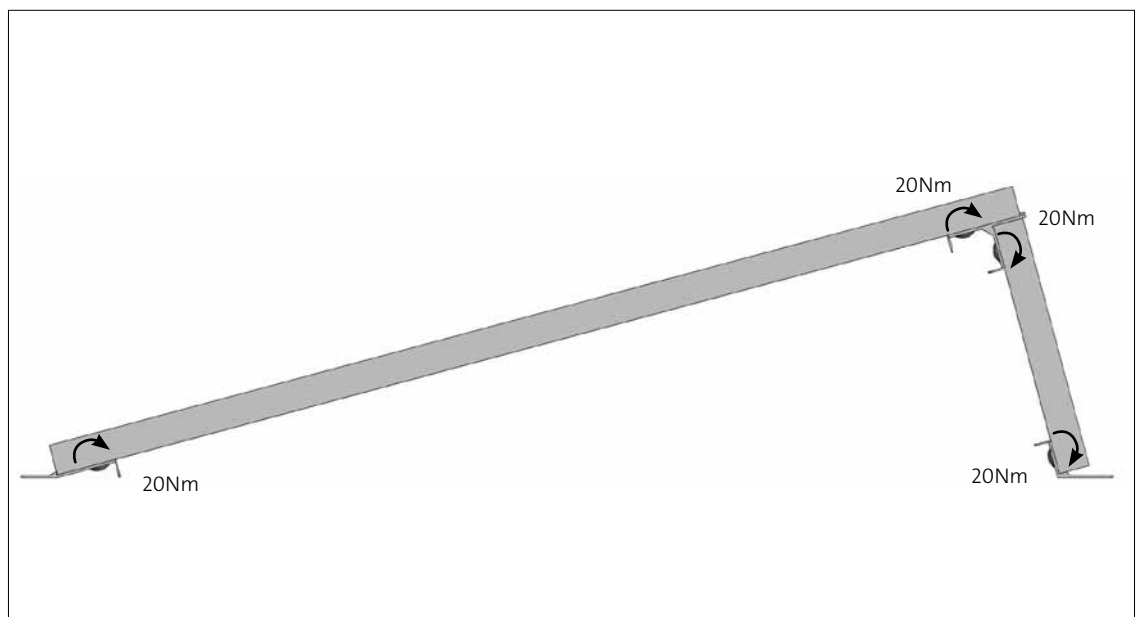


Fig. C 4-2

C5 Screw on frame and front panel

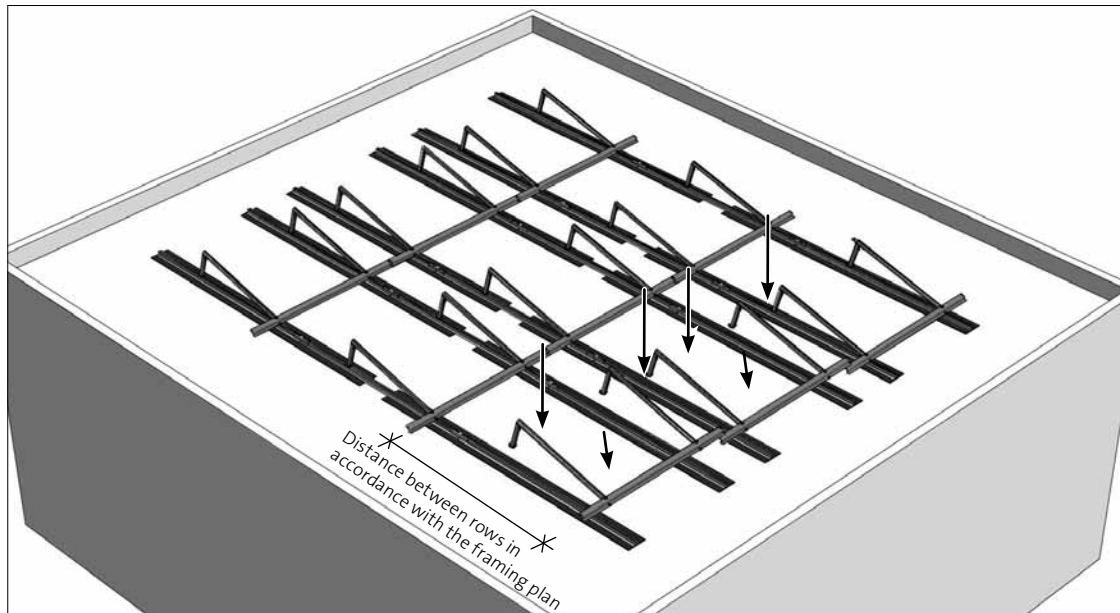


Fig. C 5-1 Overview frame and front panel installation

1. With the specified spacing, screw the pre-assembled frames with the front panels onto the base frames.

Torque $M_A = 20\text{Nm}$

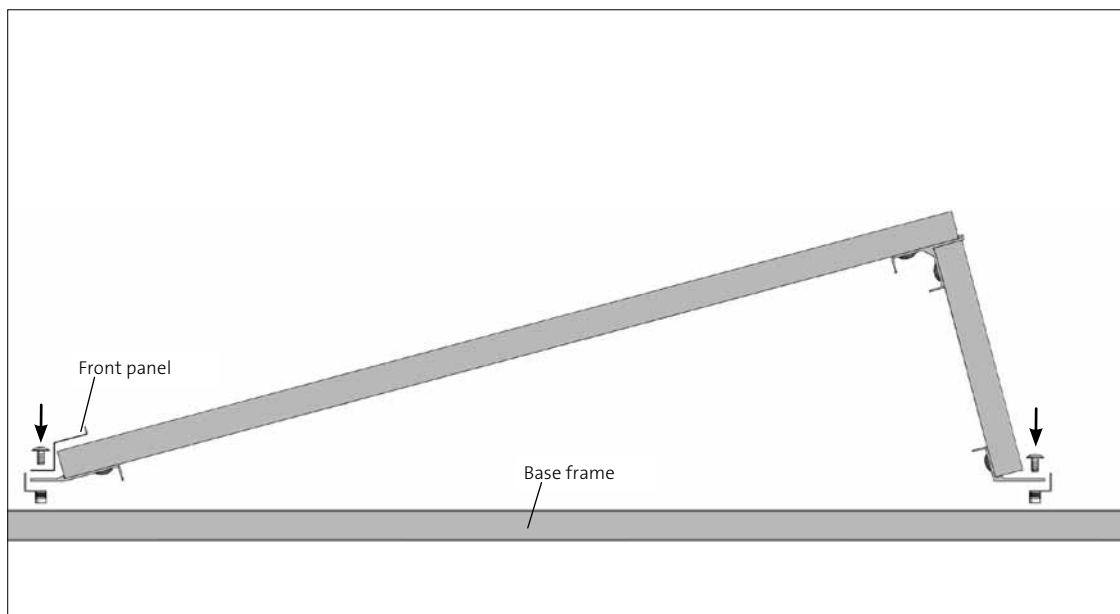


Fig. C 5-2 Side view frame installation

Threaded assemblies frame-front panel-base frame

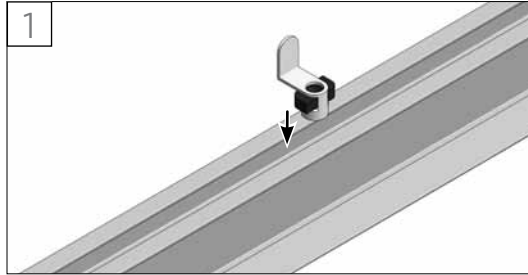


Abb. C 5-3

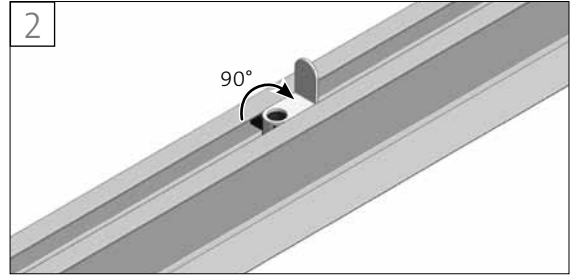


Abb. C 5-4

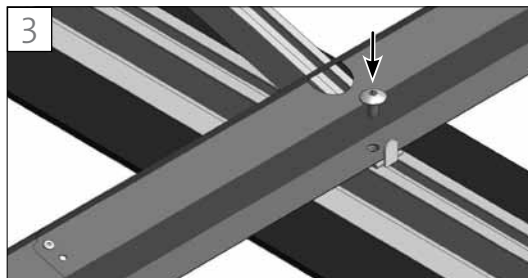


Fig. C 5-5

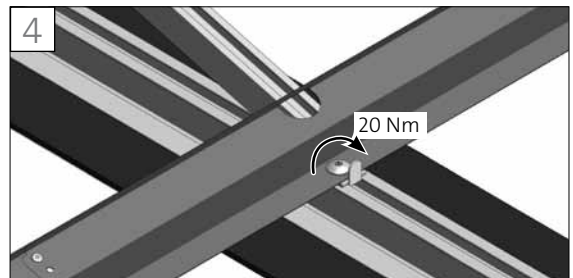


Fig. C 5-6

2. Connect the front panels with 2 rivets to the joints. 1 rivet shall be mounted to the upper and front side

respectively. The third bore hole is only needed in the edge area for riveting the side panels.

Riveting front panel

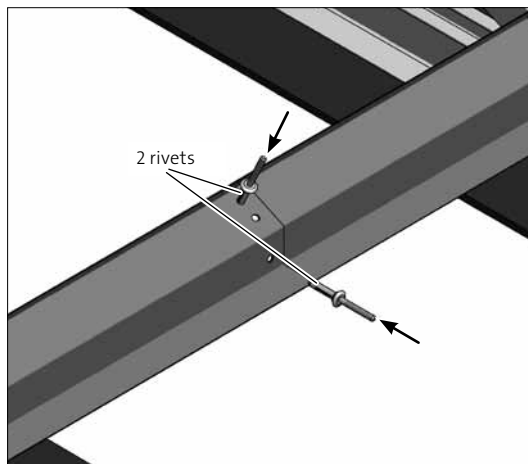


Fig. C 5-7

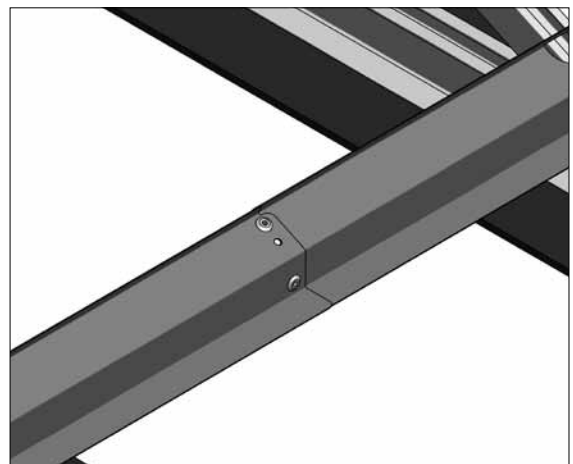


Fig. C 5-8

Fastening on the connector

Fastening the frames is also possible on the connector. The frame shall be screwed to the connector and the base frame.

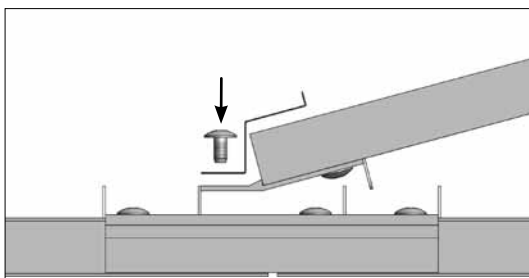


Fig. C 5-9

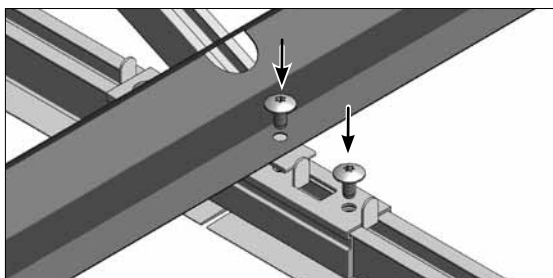


Fig. C 5-10

C6 Add ballast

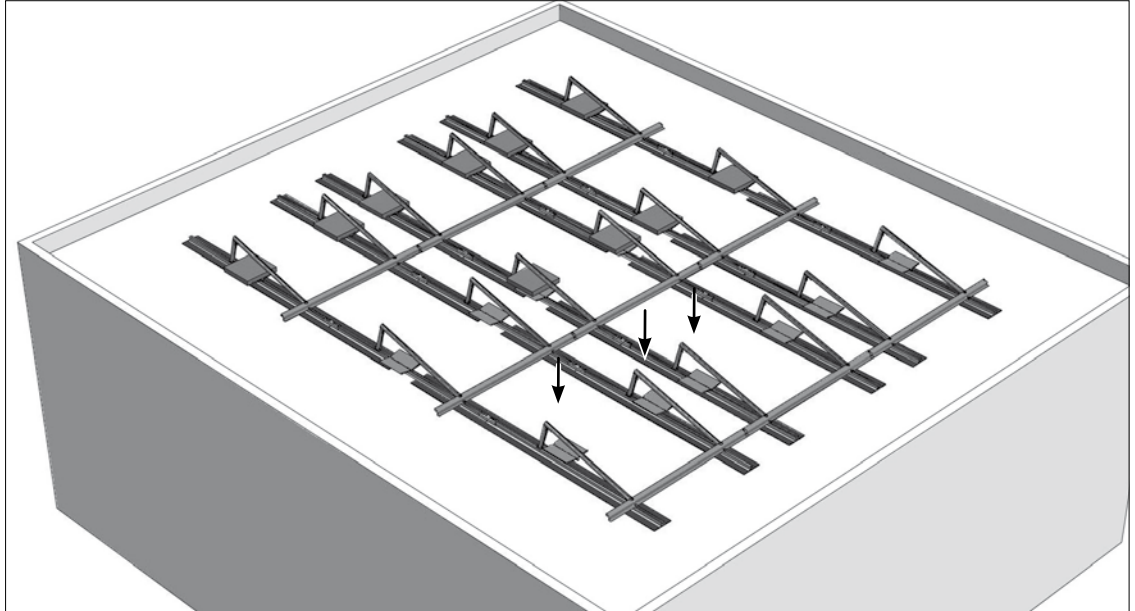


Fig. C 6-1

1. If ballast is required: screw in the supporting plate ballast in the center of the flat roof frame into the bottom layer frame.

NOTE

Determining the required ballast as part of the framing plan.

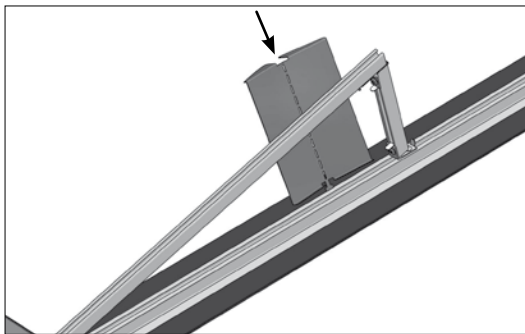


Fig. C 6-2

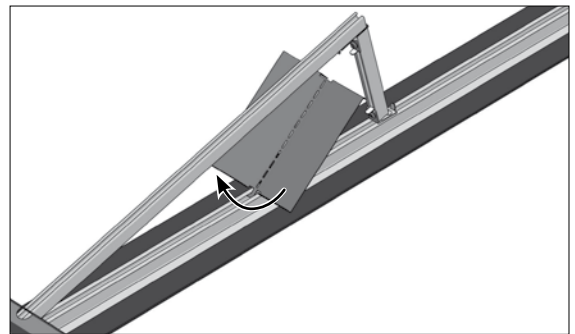


Fig. C 6-3

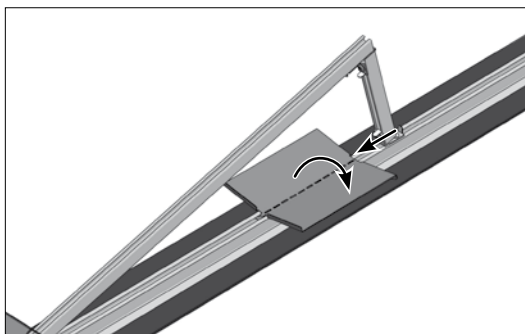


Fig. C 6-4

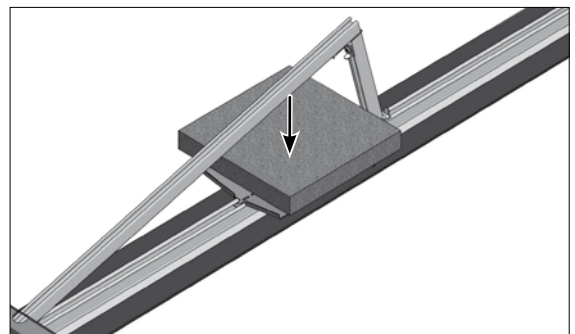


Fig. C 6-5

If only one supporting plate/ballast per module is used, these must be installed alternately to ensure an even roof load.

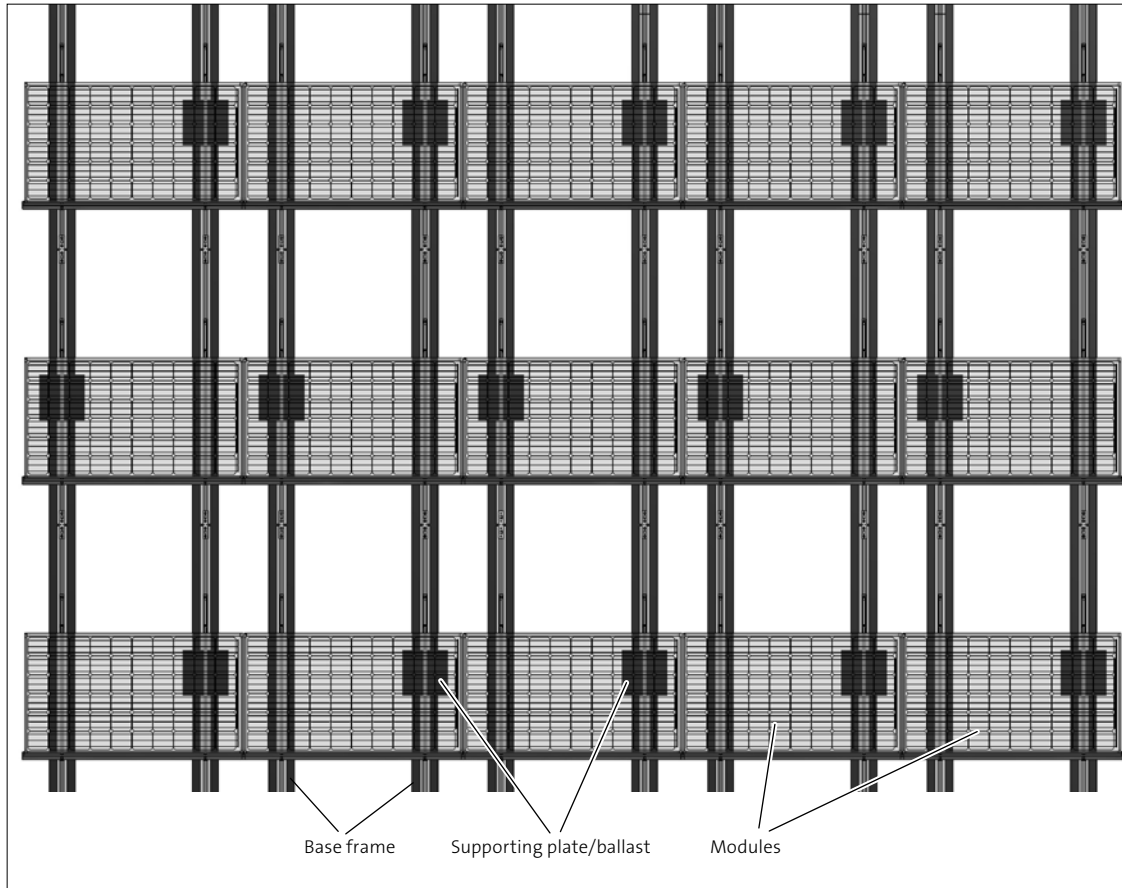


Fig. C 6-6 Alternate ballast alignment

C7 Installing the modules

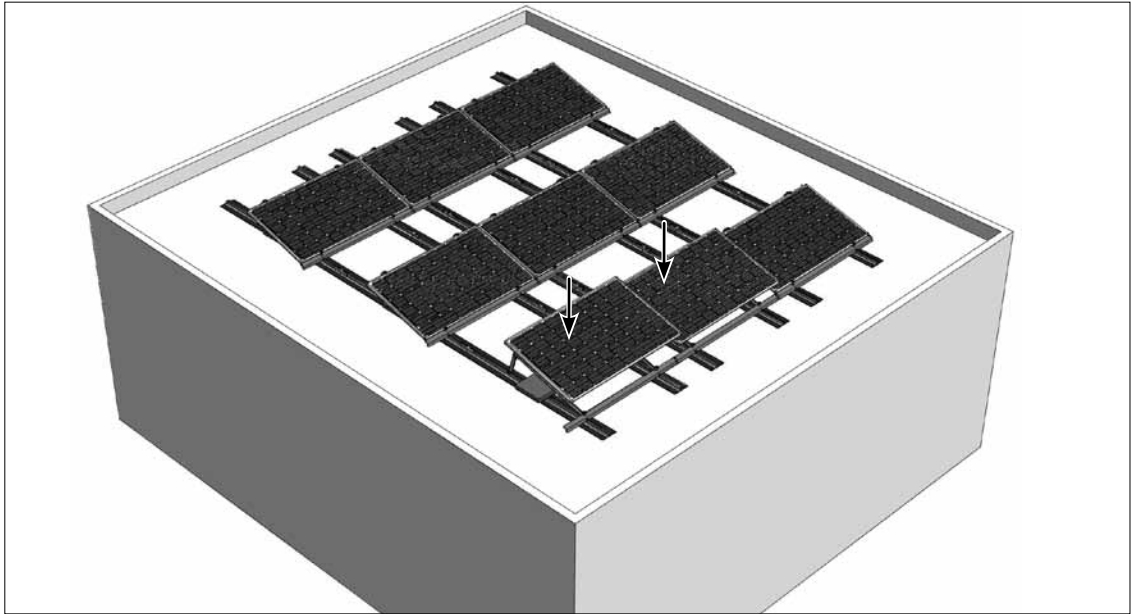


Fig. C 7-1

1. Slide modules on 2 flat roof frames

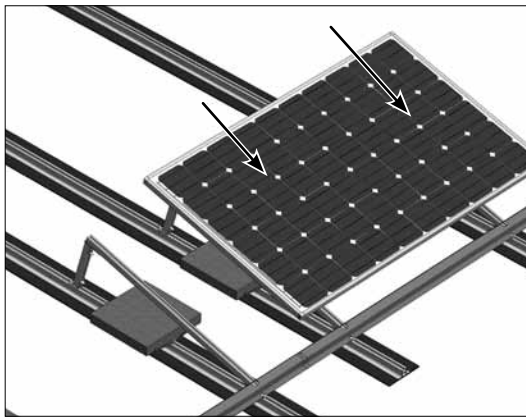


Fig. C 7-2

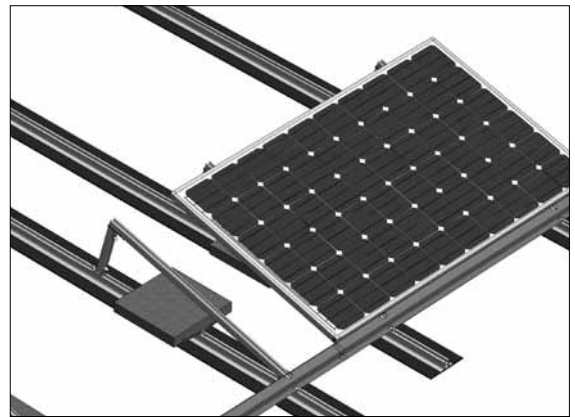


Fig. C 7-3

2. Aligning the module to the front panel.



Fig. C 7-4

2. Fasten the module with 4 screws.

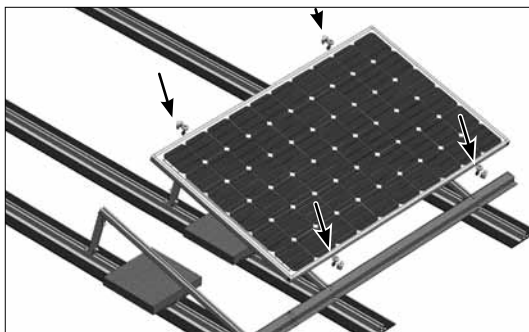


Fig. C 7-5

Installing the lower clamp connection

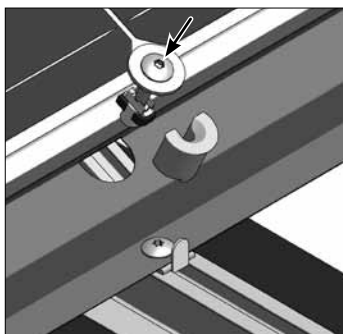


Fig. C 7-6

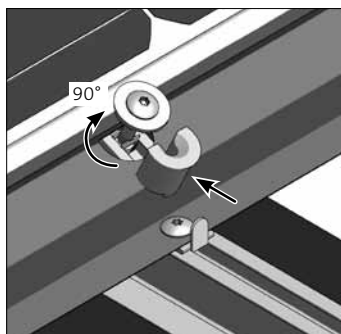


Fig. C 7-7

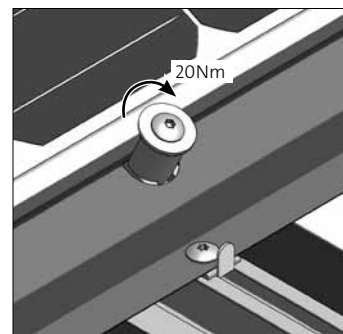


Fig. C 7-8

Installing the upper clamp connection

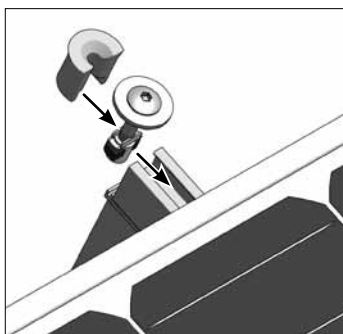


Fig. C 7-9

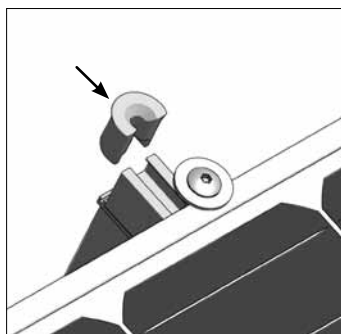


Fig. C 7-10

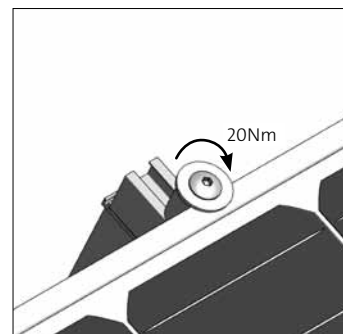


Fig. C 7-11

C8 Connecting the modules

DANGER!

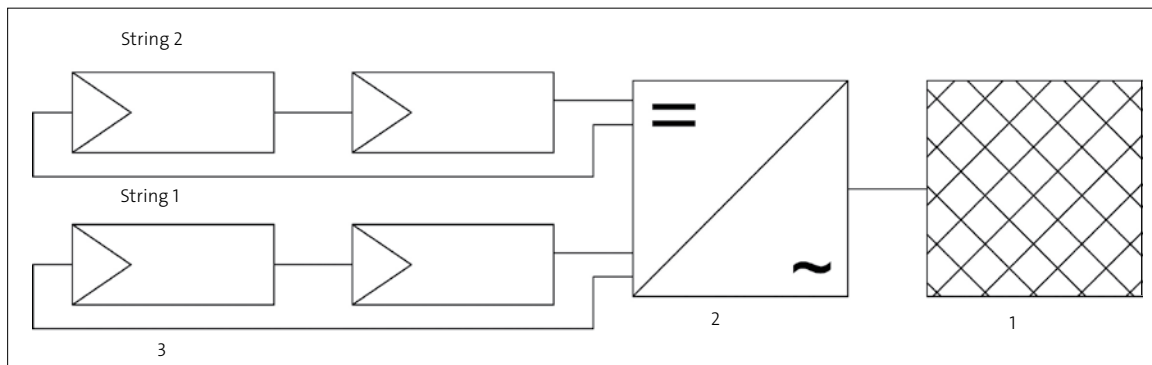
Lethal voltage

- ▶ 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.

DANGER!

Lethal voltage

- ▶ The technical instructions enclosed with the unit shall be strictly adhered to for the installation, electrical connection and operation of the grid-connected inverter.



- 1 Power supply
2 Inverters
3 Solar power generator

- ▶ 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 strike lightning current, the outgoing and return lines (+/-) of the string must be laid as close to one another as possible (while avoiding looping).
- ▶ Do not under any circumstances allow less than the minimum bending radius (5x the cable diameter).

- ▶ Do not mount or install modules at temperatures below -5°C.
- ▶ Keep sockets and plugs dry during installation.
- ▶ Ensure correct polarity.

Testing

1. Verify that the multi-string 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.

C9 Installing the rear panel

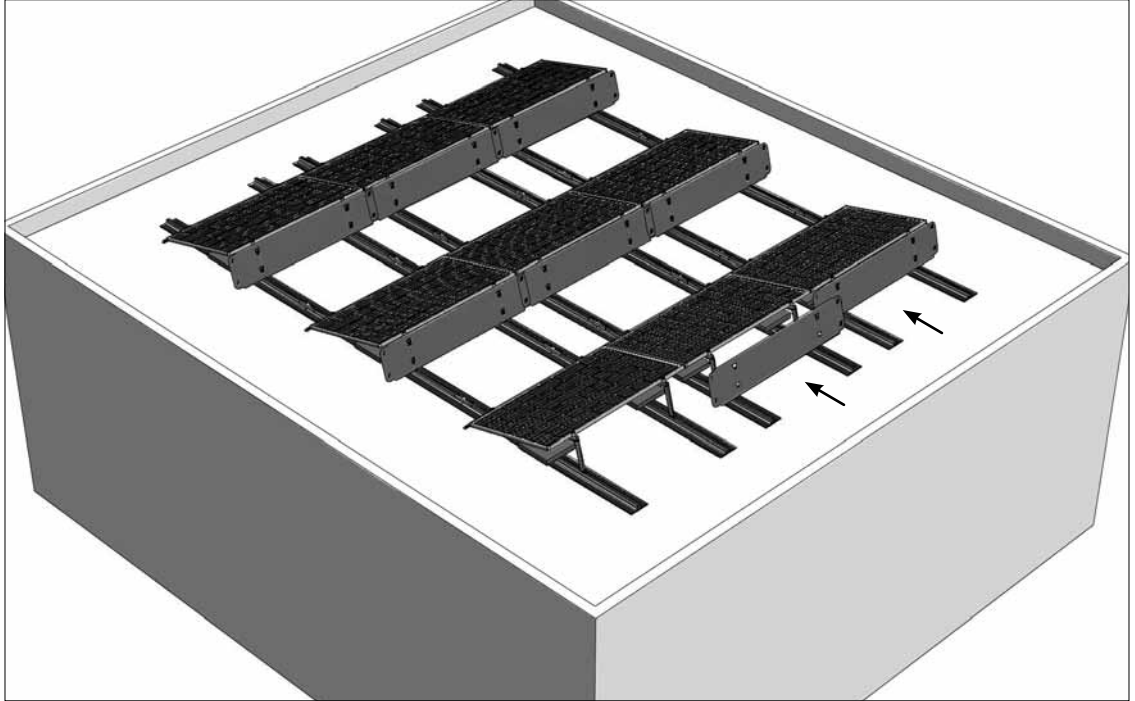


Fig. C 9-1

1. Position the rear panel on the back of the frame and slide down.

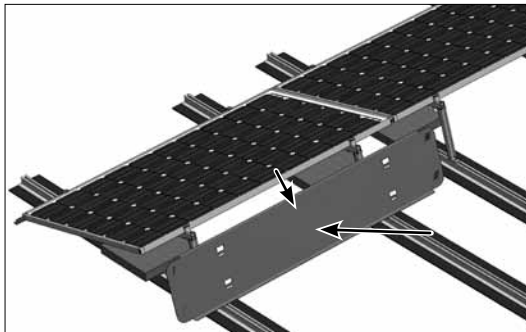


Fig. C 9-2

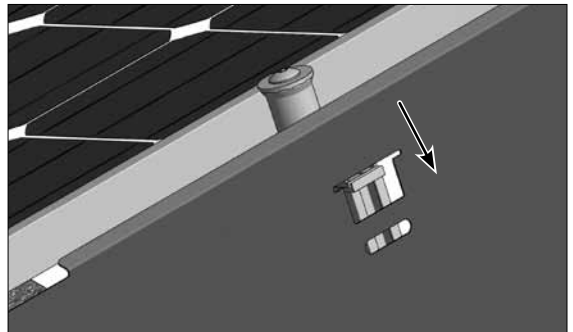


Fig. C 9-3

2. Insert nut slot, turn 90° and slide down.

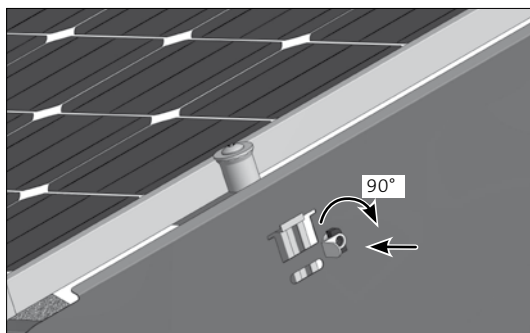


Fig. C 9-4

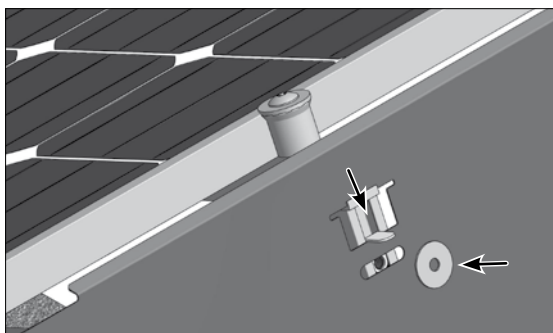


Fig. C 9-5

3. Position the spacer and fasten the M8 screw. Fasten all 4 screws in the same way.

 Torque $M_A = 20 \text{ Nm}$

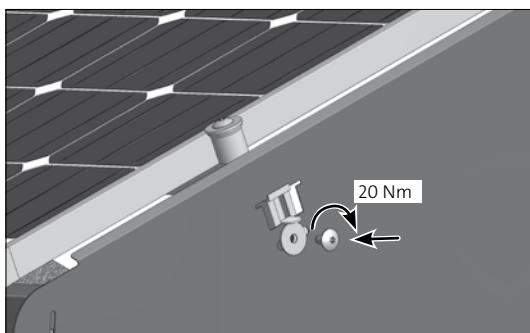


Fig. C 9-6

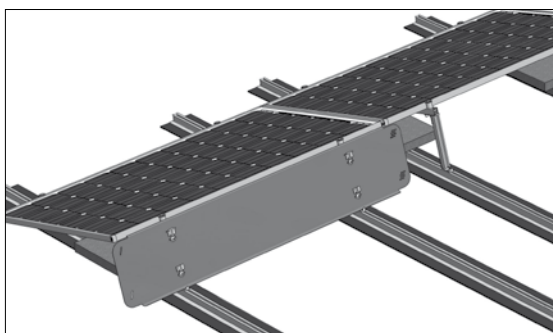


Fig. C 9-7

4. Mount the next plate in the same way. Connect adjacent plates with 2 rivets each.

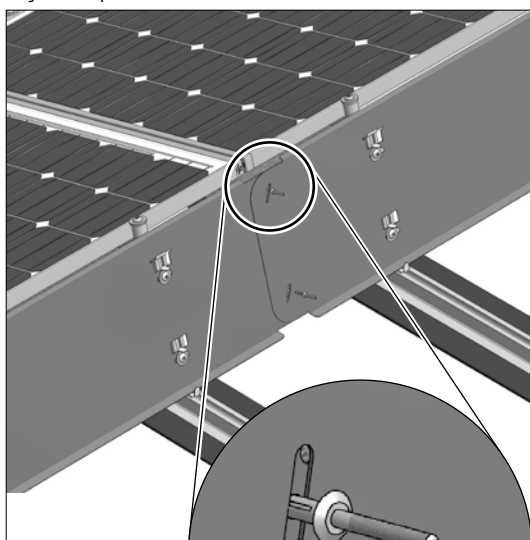


Fig. C 9-8

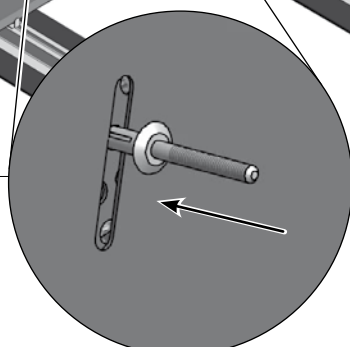


Fig. C 9-8 Detail 1

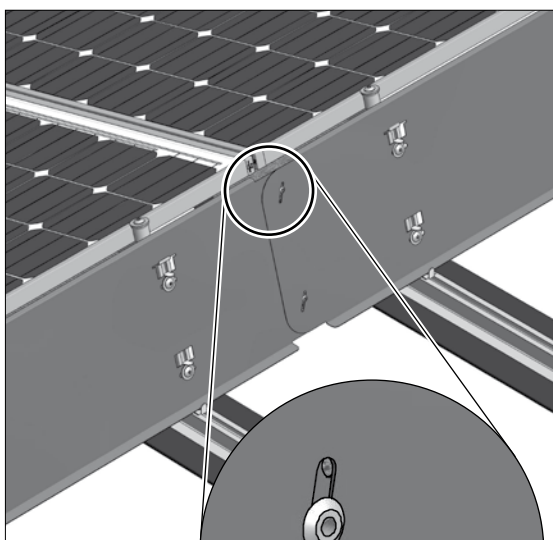


Fig. C 9-9

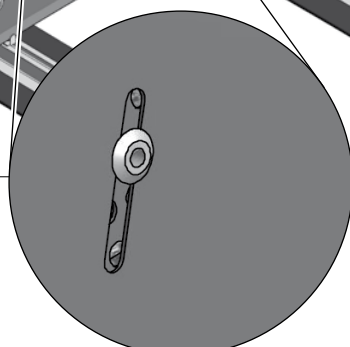


Fig. C 9-9 Detail 1

C10 Installing the side panels

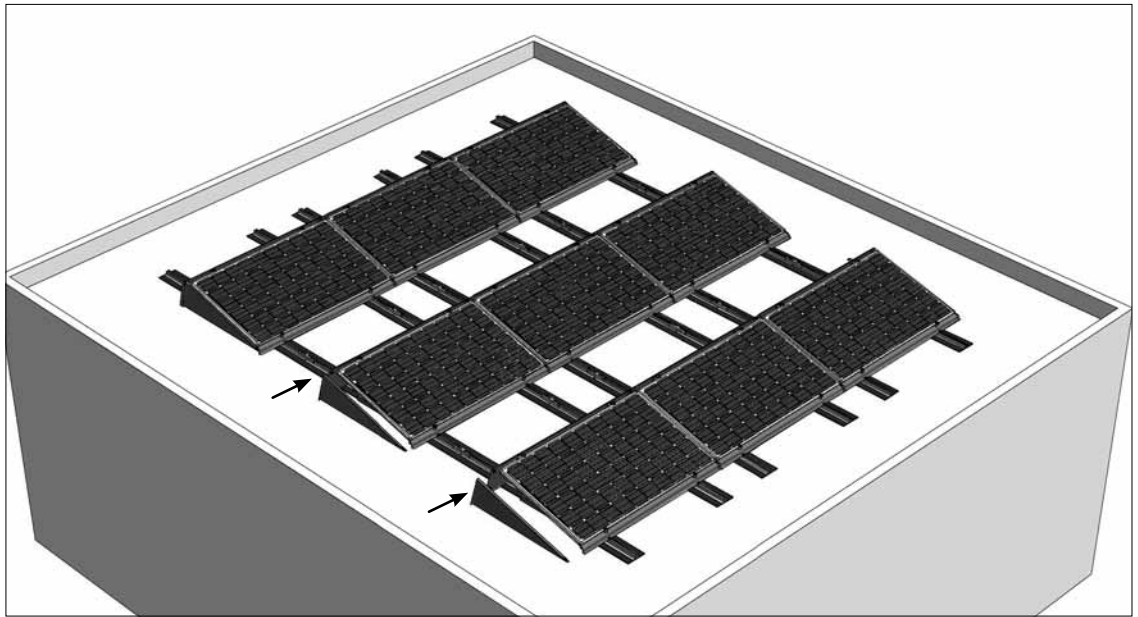


Fig. C 10-1

1. Align the side panel and screw in place. Mount 3 rivets to the rear side and 2 rivets to the front panel.

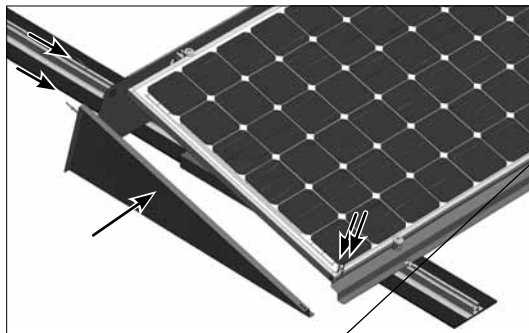


Fig. C 10-2

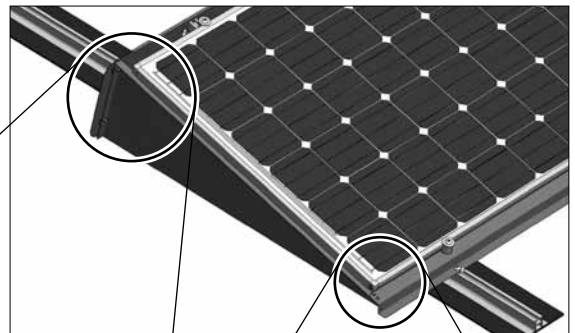


Fig. C 10-3

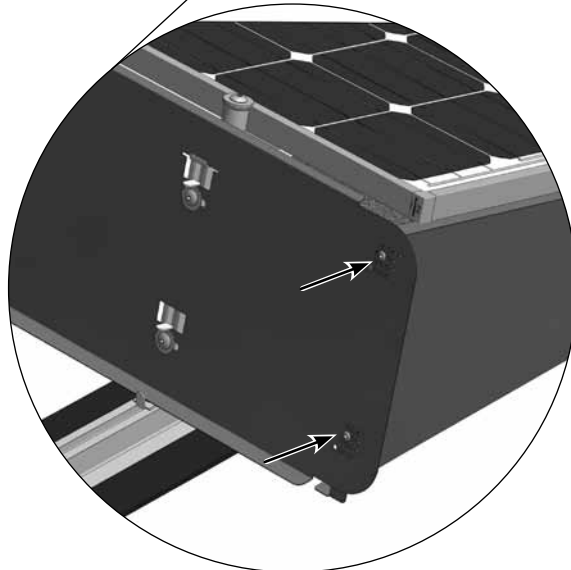


Fig. C 10-5

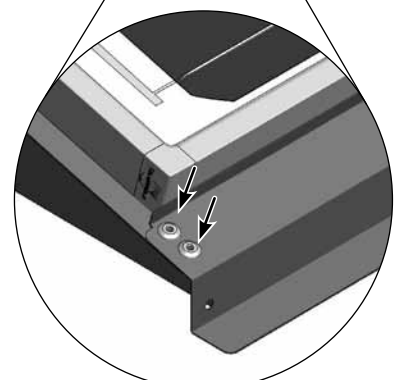


Fig. C 10-4

C11 Grounding/equipotential bonding

Professional grounding is the responsibility of the installation company.

► **No external lightning protection available**

Functional grounding recommended for PV module frames. 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).

► **External lightning protection available** PV module frames must be included in the protection concept for direct strikes.

Consult a lightning protection professional if needed.

Optionally, a mount for a lightning protector rod may be supplied.

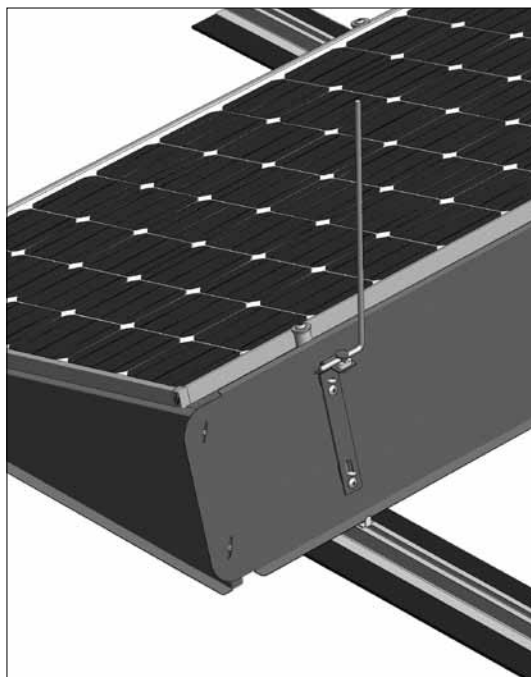


Fig. C 11-1

D 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!



- ▶ Do not stand or walk on modules.

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

PV system maintenance

The system should be inspected annually for the following:

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

Liability

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

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Notes

[illegible]

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18.01.2012 EN/KA 0102

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Deutsche Cell/Freiberg, Germany
Solar Factory/Freiberg, Germany
Sunicon/Freiberg, Germany
SolarWorld Innovations/Freiberg, Germany
- ② SolarWorld Industries America/Hillsboro, OR, USA

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- ④ SolarWorld Ibérica/Madrid, Spain
- ⑤ SolarWorld France/Grenoble, France
- ⑥ SolarWorld Africa/Cape Town, South Africa
- ⑦ SolarWorld Asia Pacific/Singapore, Singapore
- ⑧ SolarWorld Americas/Camarillo, USA



SolarWorld AG

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

SolarWorld Ibérica, S.L.

C/La Granja 15,
Bloque B-1ºB
28108 Alcobendas, Madrid
Spain

SolarWorld Americas LLC.

4650 Adohr Lane
Camarillo, CA 93012
USA

SolarWorld France SAS

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

SolarWorld Africa Pty. Ltd.

20th Floor
1 Thibault Square
Cape Town, 8001
South Africa

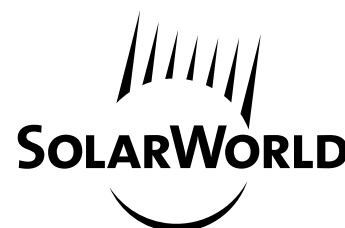
SolarWorld Asia Pacific Pte. Ltd.

72 Bendemeer Road
#07-01, Luzerne
Singapore 339941
Singapore

SolarWorld AG

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

www.solarworld.com



We turn sunlight into power.