



Manual wave dual

Manual

Wave Dual

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Introduction

About this document

This manual covers the installation instructions for the PanelClaw Wave mounting system for solar panels on flat roofs with roofing materials made of concrete, bitumen, EPDM, PVC and TPO. For other roof materials, please contact your supplier.

The mounting system is suitable for mounting solar panels in a dual landscape orientation.

These instructions are addressed at qualified technical personnel.

You can download the latest version of this manual from www.panelclaw.eu.

Other relevant documents

When installing the PanelClaw Wave mounting system, you will need the following documents in addition to this manual:

- The project plan, which you can create in the calculator at <https://calculator.panelclaw.eu>.
- The installation manuals for the solar panels, inverters and any other components.

During the installation of the mounting system, it is important to adhere to the installation manual, the installation manual of the components, and the accompanying standards to prevent accidents. Pay special attention to (local) standards, regulations and legislation (among others):

- Local Building Regulations (latest version)
- Health and Safety at Work etc Act 1974
- Health and Safety in Roof work - HSE
- Eurocodes 0 (EN 1990 - Structural Design)
- Eurocodes 1 (EN 1991 - (Influences on structures)
- HD-IEC 60364 series - Electrical installations for low voltage
- EN-IEC 62305-2 - Protection lightning - Risk Management
- MIS 3002 - The solar PV standard
- MCS012 - Product Certification Scheme Requirements: Pitched Roof Installation Kits

Symbols used in this manual

	Warning!	Failure to follow this instruction could result in serious injury or major damage to the product.
	Caution!	Failure to follow this instruction could result in personal injury or damage to the product.
	Note	Emphasises an instruction.

Warranty and liability

Warranty

The warranty is subject to the warranty terms and general terms & conditions of PanelClaw. These can be found on the website www.panelclaw.eu.

Maintenance

Please refer to the maintenance checklist at <https://eu.enstall.com/>.

Liability

PanelClaw accepts no liability for damage or injury caused by the failure to comply (strictly) with the safety guidelines and instructions in this manual, or by negligence during installation of the product and the accessories listed in this document.

PanelClaw reserves the right to change this document without notice.

Product information

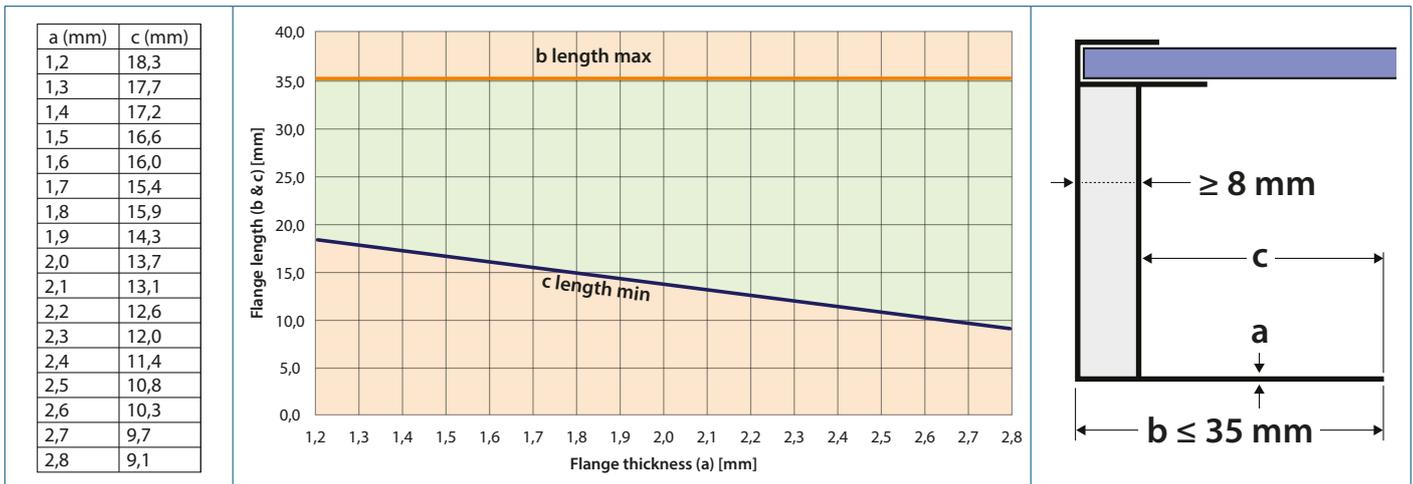
Intended use

The PanelClaw Wave Dual mounting system is intended for mounting solar panels on flat roofs. With this mounting system you can install solar panels with the long side at the bottom (landscape). The mounting system is intended to be installed in a dual arrangement.

Specifications

Orientation of solar panels	Landscape
Frame height of solar panel	29 - 50mm
Maximum dimensions of solar panels	Length: 1550 mm - 2500 mm Wave Dual 2P 990-1070: Width: 990 mm - 1070 mm Wave Dual 2P 1070-1150: Width: 1070 mm - 1150 mm
Maximum field size	40 × 40 m per segment
Roof material	Concrete Bitumen EPDM PVC TPO
Roof pitch	0 - 5°  If your roof slope is > 5°, please contact your supplier.
Maximum roof height	 Subject to Eurocode guidelines and national additions. Use the calculator to calculate the possibilities of your project.
Edge zone	The edge zone is not a fixed distance and is indicated in the Enstall calculator. Within this zone, installation is permitted in certain cases, depending on the calculation.
No-go zone	30cm distance to the ridge, 30cm to the side of the roof and 30 cm to the gutter.

Solar panel flange dimensions



! Enter the data in the calculator, so you are sure of choosing the right system for the terrain category, snow loads and wind zone that applies to your project.

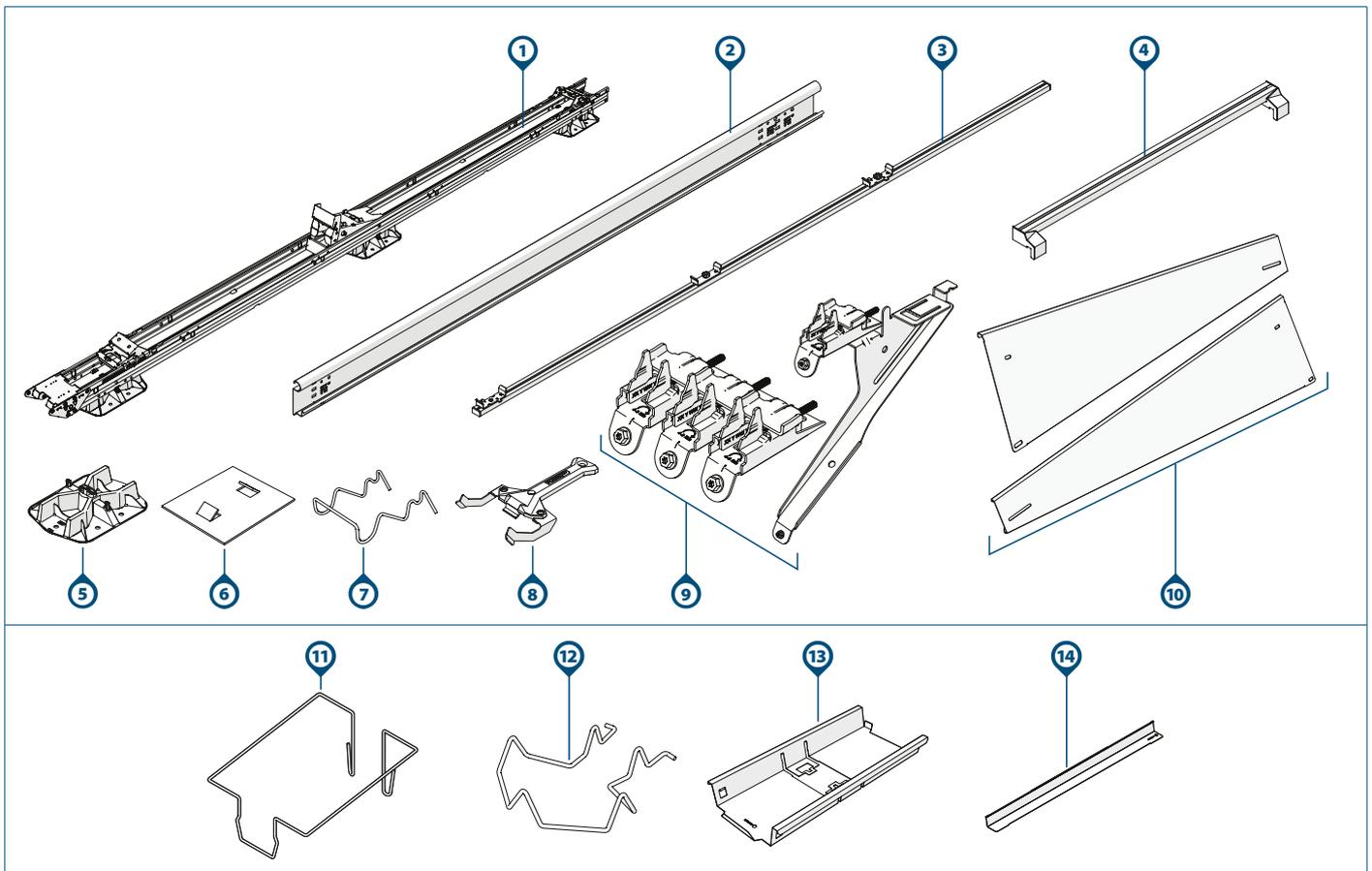
i If your project has different specifications than these, please contact PanelClaw.

Requirements for the work environment

<input type="checkbox"/>	The roof is in good condition.
<input type="checkbox"/>	The roof construction has sufficient bearing capacity to support the installation, taking into account wind and snow loads.

System and application

1. Components



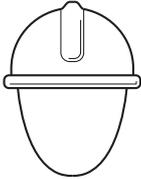
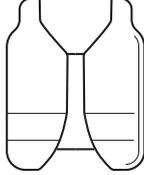
Component	Article number	Component	Article number
1 a. Wave Dual 2P 990-1070	1009147	6 a. Wave Support Mat	1009131
b. Wave Dual 2P 1070-1150	1009157	b. Wave Support Mat Alu	1009132
c. Wave Dual Unit High Load 2P 990-1070	1009166	7 Wave Cable Bracket - Stabilizer	1009124
d. Wave Dual Unit High Load 2P 1070-1150	1009167	8 Wave Module Unlock Tool	1009142
2 a. Wave Stabilizer 3030	1009113	9 Wave Wind Deflector Clamp Set	1009163
b. Wave Stabilizer 3530	1009111	10 a. Wave Wind Deflector Set 990-1070	1009148
c. Wave Stabilizer 4000	1009114	b. Wave Wind Deflector Set 1070-1150	1009162
d. Wave Stabilizer 4350	1009115	11 Wave Ballast Bracket	1009123
3 Wave Measuring Bar 2500mm	1009143	12 Wave Ballast Bracket Perimeter	1009126
4 Wave Spacer Tool	1009144	13 Wave Ballast Tray	1009129
5 Wave Base Plate	1009120	14 Wave Ballast Tray Extender	1009130

i Check that the correct components are present in the required numbers according to the project plan generated by the calculator.

For situations where a PV system needs to be connected to the lightning collection system, see Appendix Lightning protection for more information.

Safety

1. Personal protective equipment

						
Hearing protection	Safety helmet	Safety glasses	Face masks	Safety gloves	Safety clothing	Safety shoes

2. Safety warnings and regulations

Warning!

-  Installation work should always be carried out by at least two skilled people.
-  Do not use components from other mounting systems.
-  Do not leave out parts.
-  Always work according to the current regulations for working on roofs.
-  Do not perform the installation in strong winds, or when the roof is slippery or wet.
-  Always work on the roof with fall protection and, if necessary, with safety nets and edge protection.
-  Never stand on or in the gutter.
-  Always use a lifting aid or hoisting device when moving heavy equipment.
-  Always place ladders on a strong, stable surface.

Caution!

-  Never walk on the system or on the solar panels.
-  PanelClaw is in no way responsible for the installation and/or connection of lightning protection on the roof. Get expert advice from your specialist and ensure that a safe installation can be guaranteed according to EN-IEC 62305 and HD-IEC 60364.

Installation

1. Preparation

1 Inspect the roof.



The roof is in good condition.



The roof construction has sufficient bearing capacity to support the installation, taking into account wind and snow loads.



If required, determine the roof surface friction coefficient using the PanelClaw Friction Test Kit. Refer to the Friction Test Kit Manual for detailed instructions.

2 Check the project plan and components.

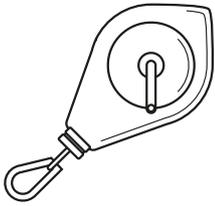


Check the project plan. Is there no project plan? Then create one in the online calculator before starting installation.

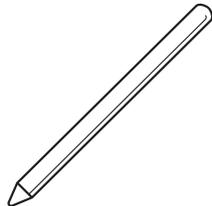


Check that all components are present (page 5).

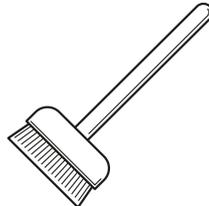
3 Make sure all the required tools are at hand.



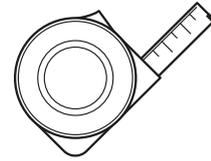
Chalkline tool



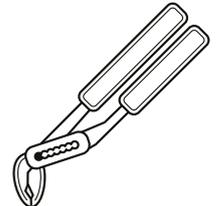
Marker or chalk



Broom

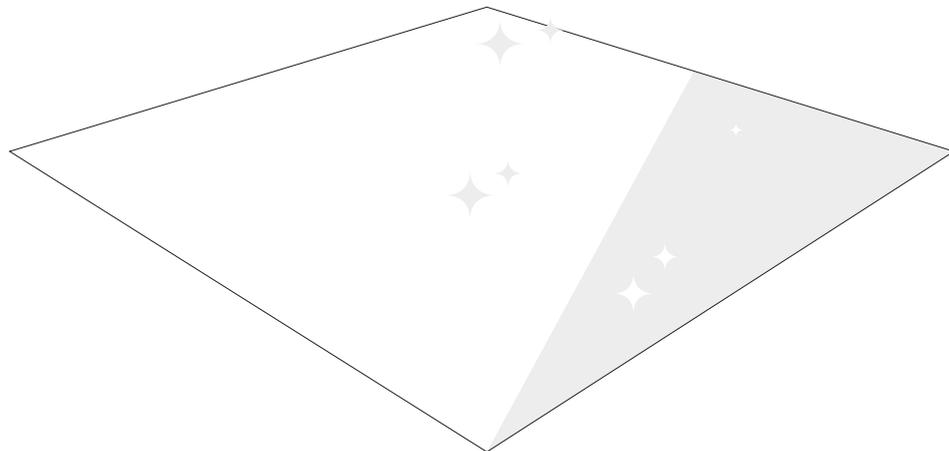


Tape measure



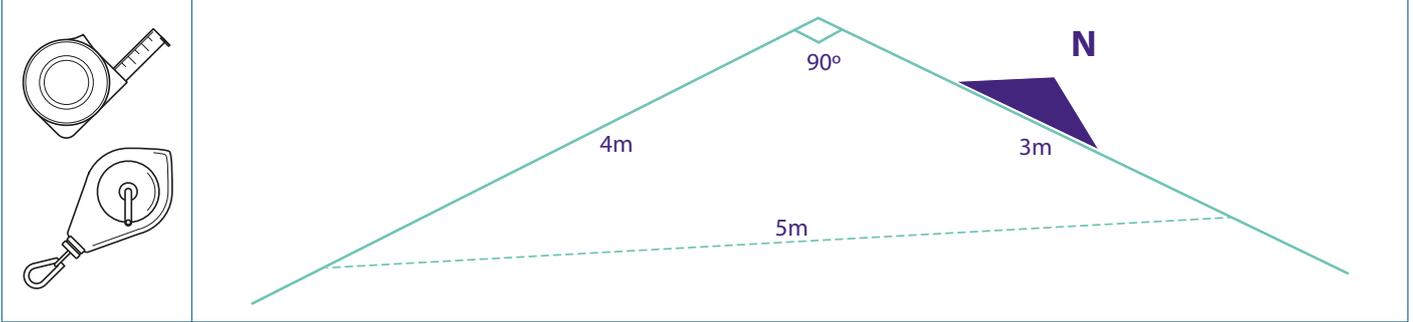
Water pump pliers

4 Clean and tidy the roof.



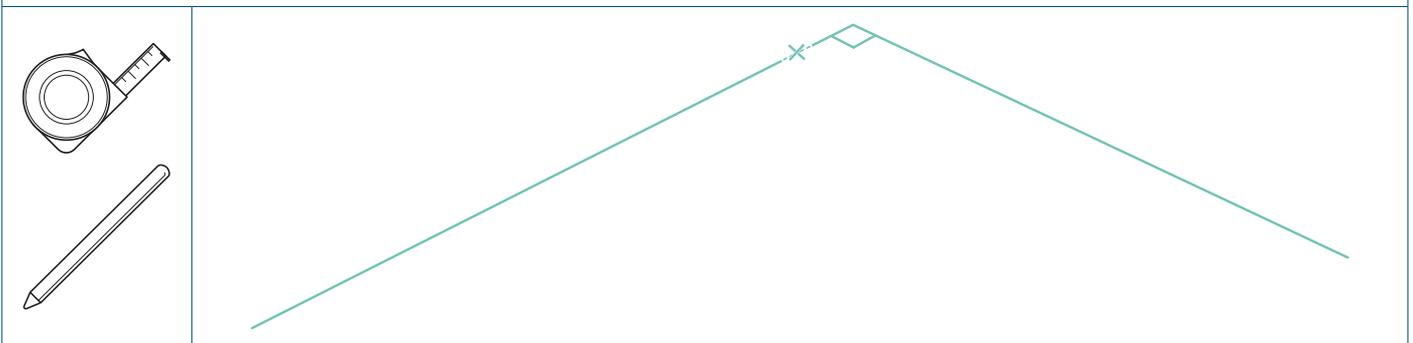
5 Draw the lines of the field and make note of the orientation of the north arrow.

- i** Use the 3-4-5 rule to make sure the angle between your perpendicular lines is 90 degrees.
- i** Consult the project plan to determine the position of the units for your project.
- i** Take the starting point of the installation from the project plan.



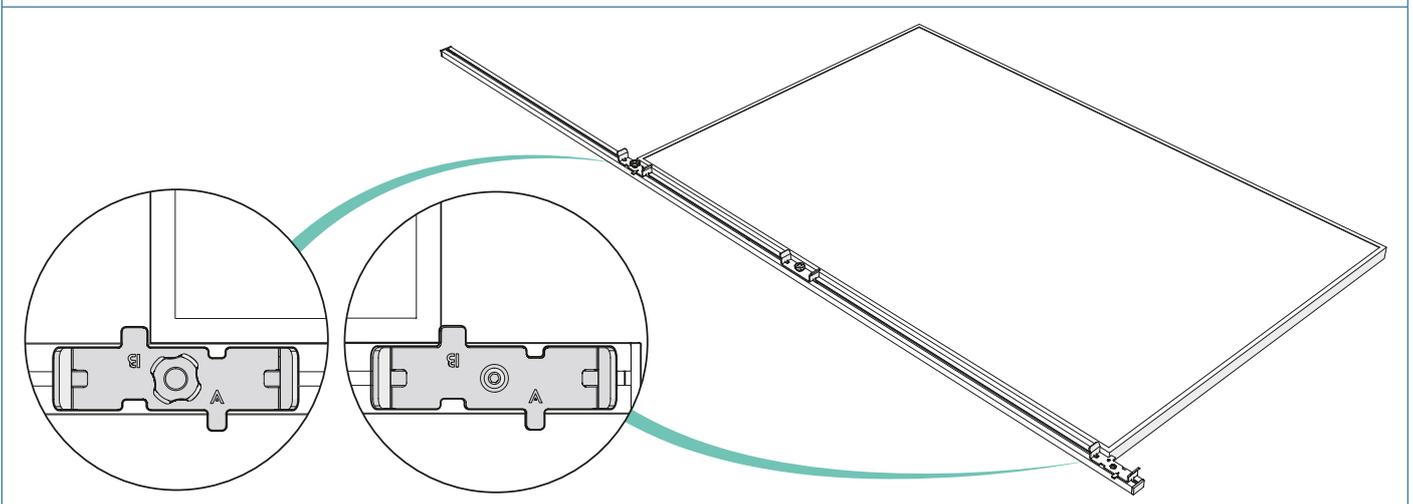
6 Mark the position of the first Wave unit.

- i** Be mindful of the no-go zone. Consult the project plan to determine the position of the first unit.

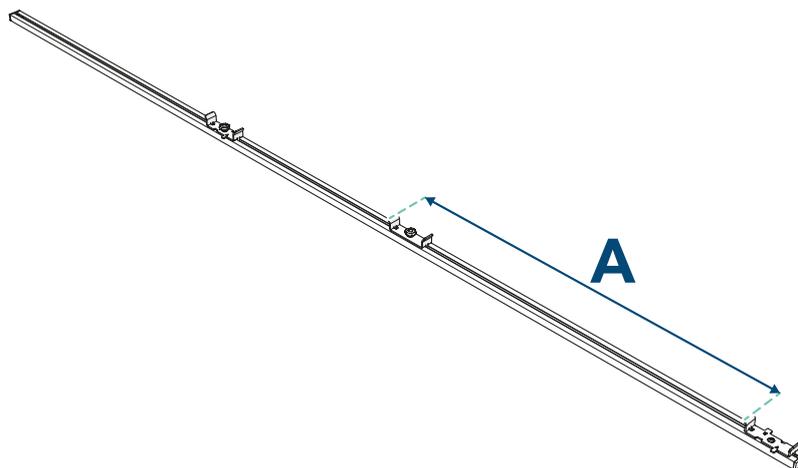


7 Align the "B"-marked side of the first and third bracket of the measuring bar to the corners of a solar panel.

- i** Alternatively, use a tape measure and check the project plan for the specified distance "B".

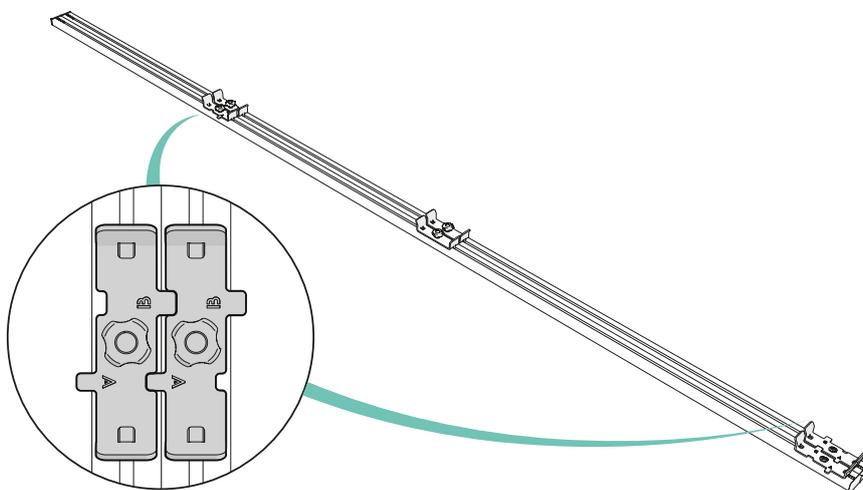


8 Adjust the centre bracket to the distance "A" as specified in the project plan.



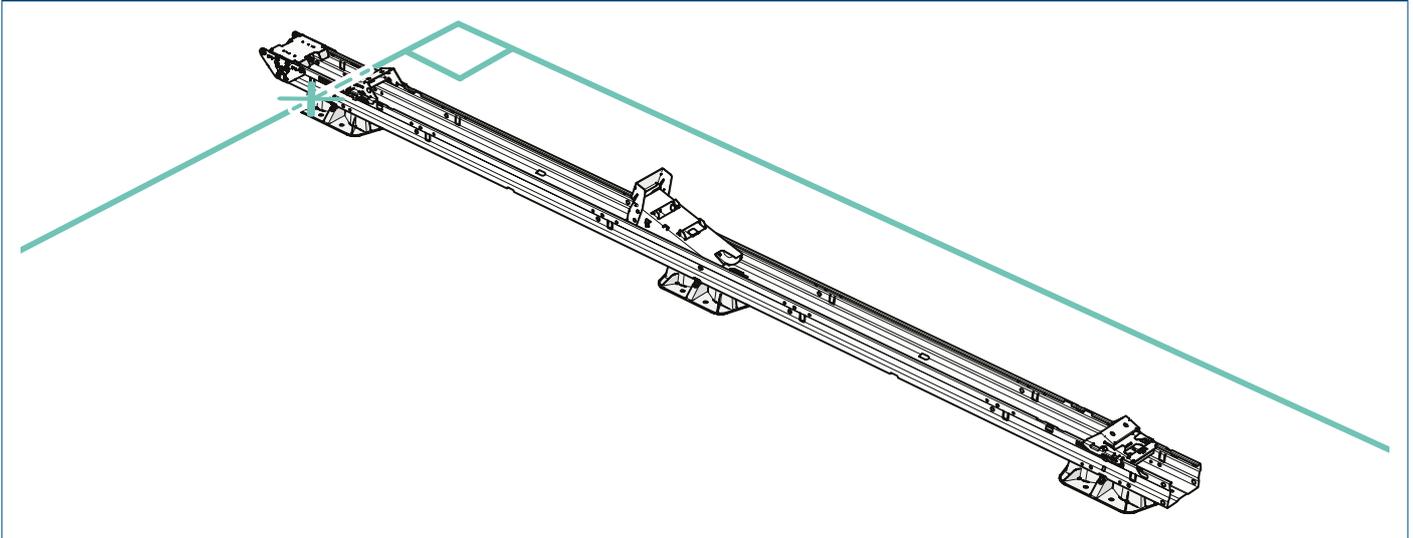
9 Duplicate the distances "A" and "B" for all measuring bars.

i Tip: often, six measuring bars are used to easily align and install the units and the solar panels.

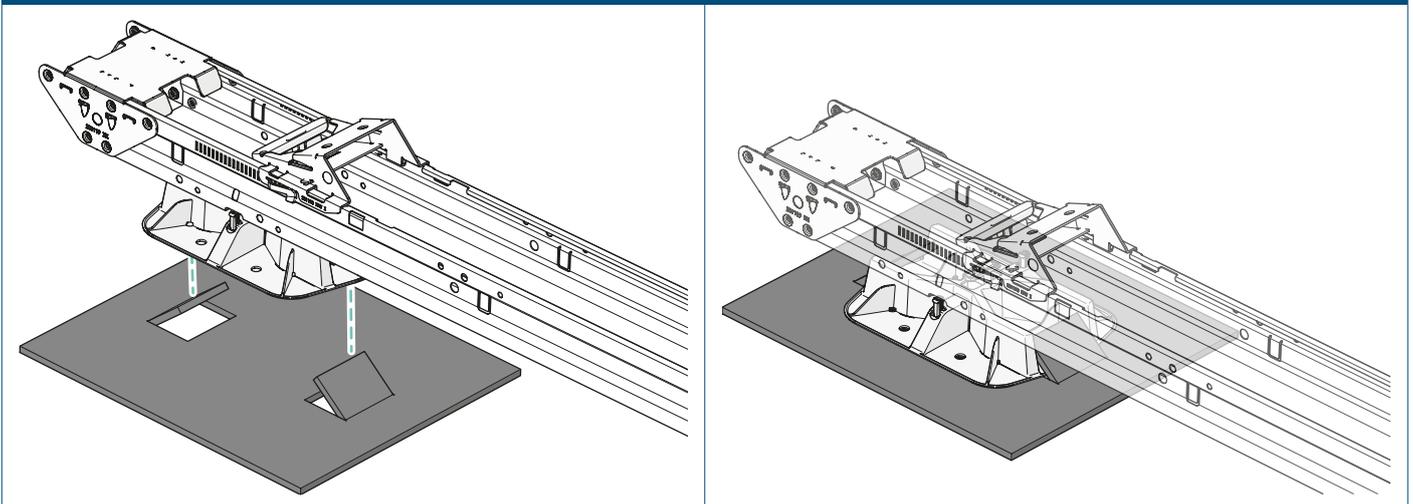


2. Place the units

- 1 Place the first unit on the roof and align the unit with the marked lines.

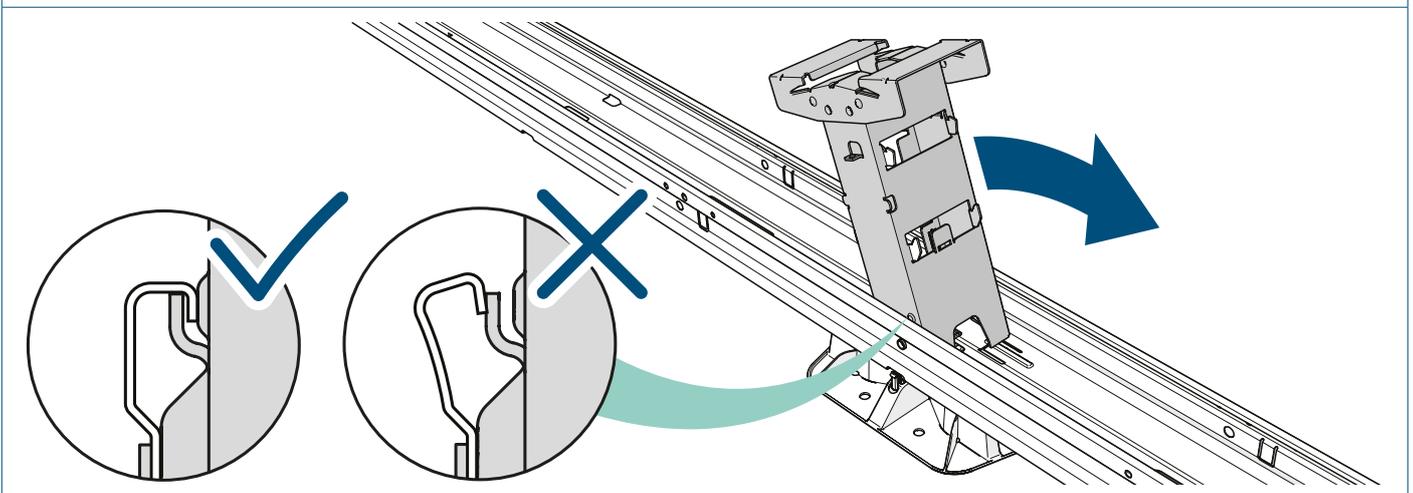


- 2 Optional: Add support mats underneath the base plates of each base element.

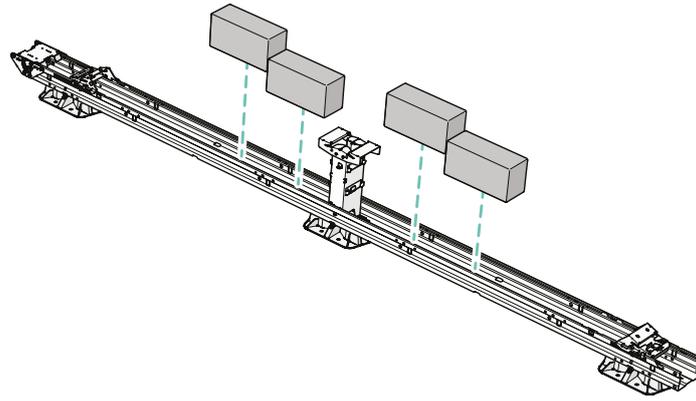


- 3 Tilt up the high base until it clicks into upright position.

- ⚠ While doing this, squeeze the unit to ensure that the hooks of the high base hook into the groove of the unit.
- ⚠ Check that the unit is still aligned with the perpendicular lines.

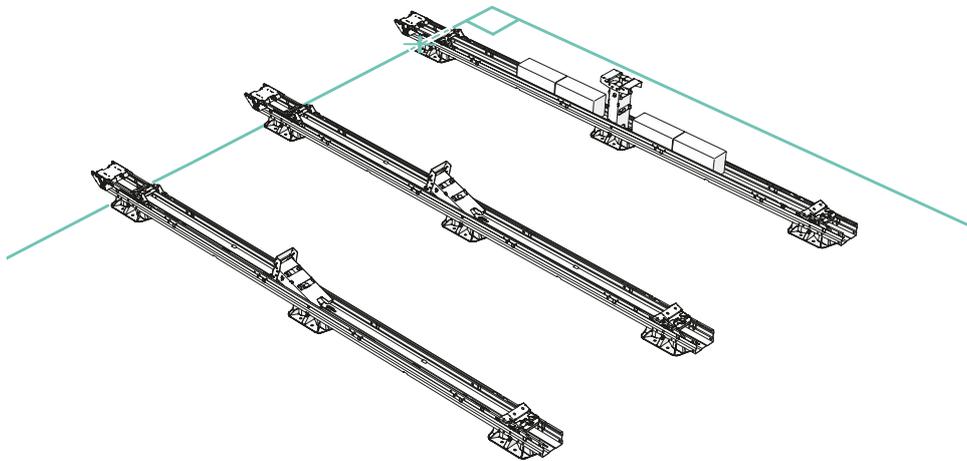


4 Place (temporary) ballast to prevent the unit from accidentally moving.



5 Place the next two units on the roof.

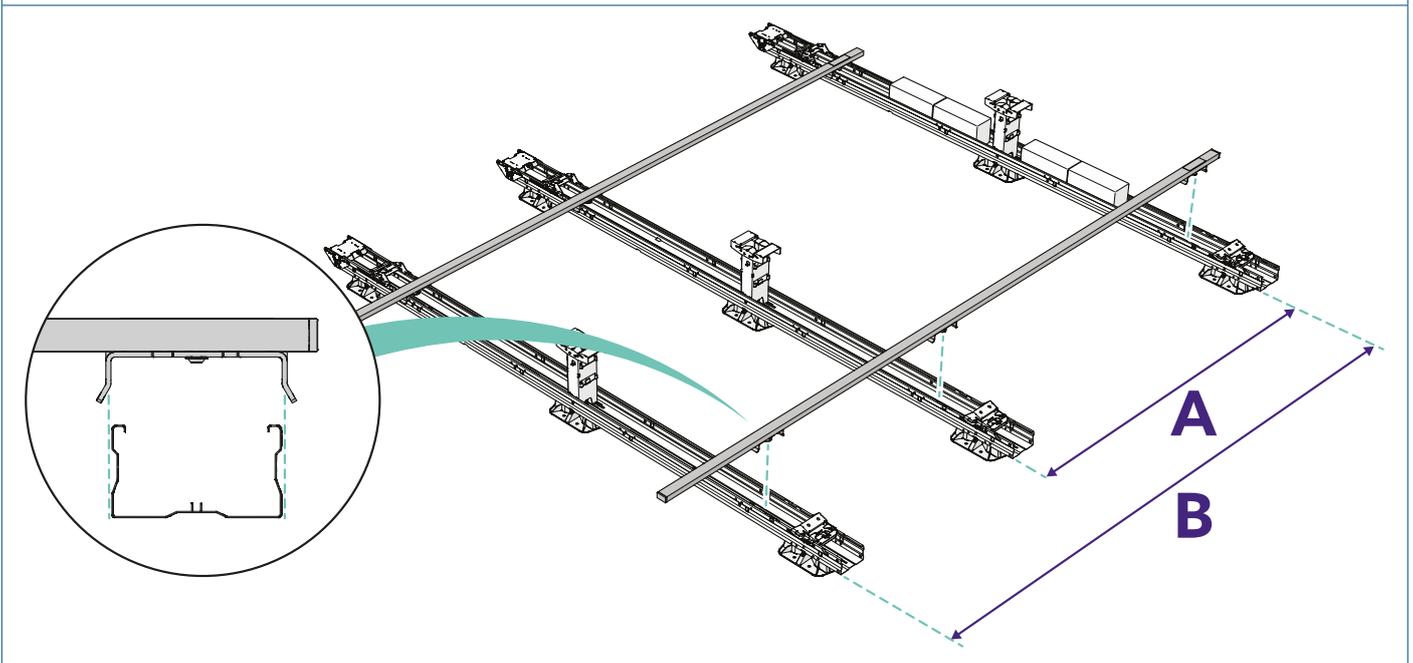
! For installation on a location with high snow loads: Consult the project plan to determine if an additional third unit needs to be placed in the center of each solar panel. This helps prevent damage caused by excessive snow load.



Repeat step 2.3. Tilt up the high base until it clicks into upright position.

6 Use measuring bars to determine the distance between the units

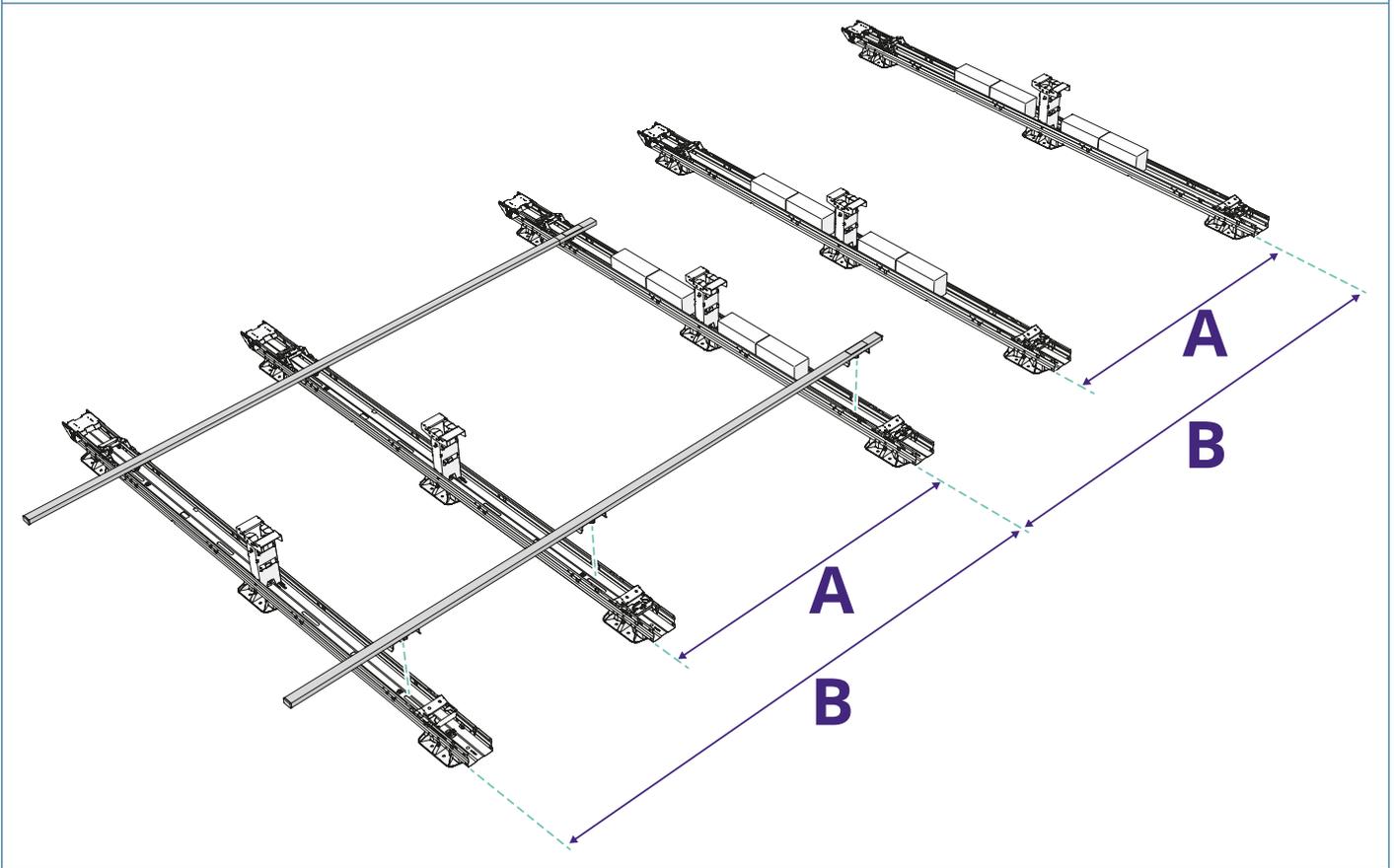
 Ensure correct orientation of the measuring bars.



	Repeat step 2.4. Place (temporary) ballast to prevent the unit from accidentally moving.
	Repeat step 2.5. Place the next two units on the roof.
	Repeat step 2.3. Tilt up the high base until it clicks into upright position.

7 Use measuring bars to determine the distance between the units

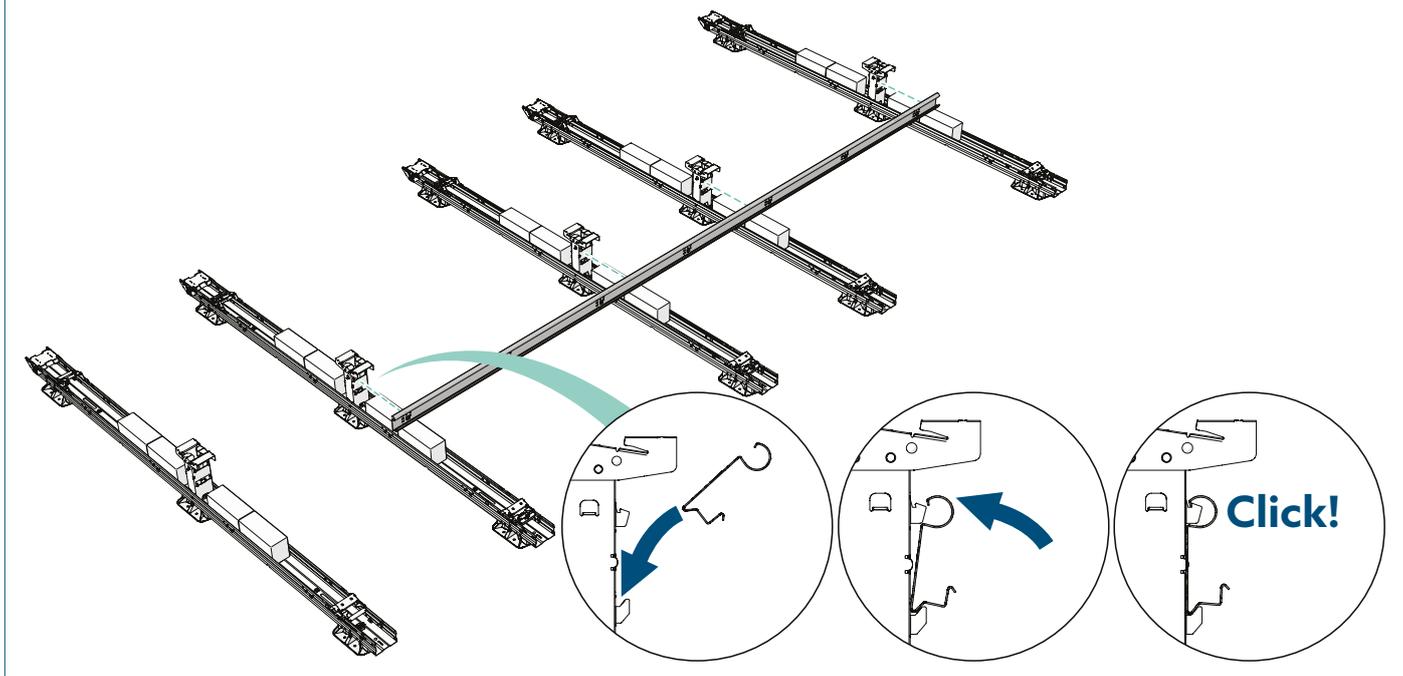
 Ensure correct orientation of the measuring bars.



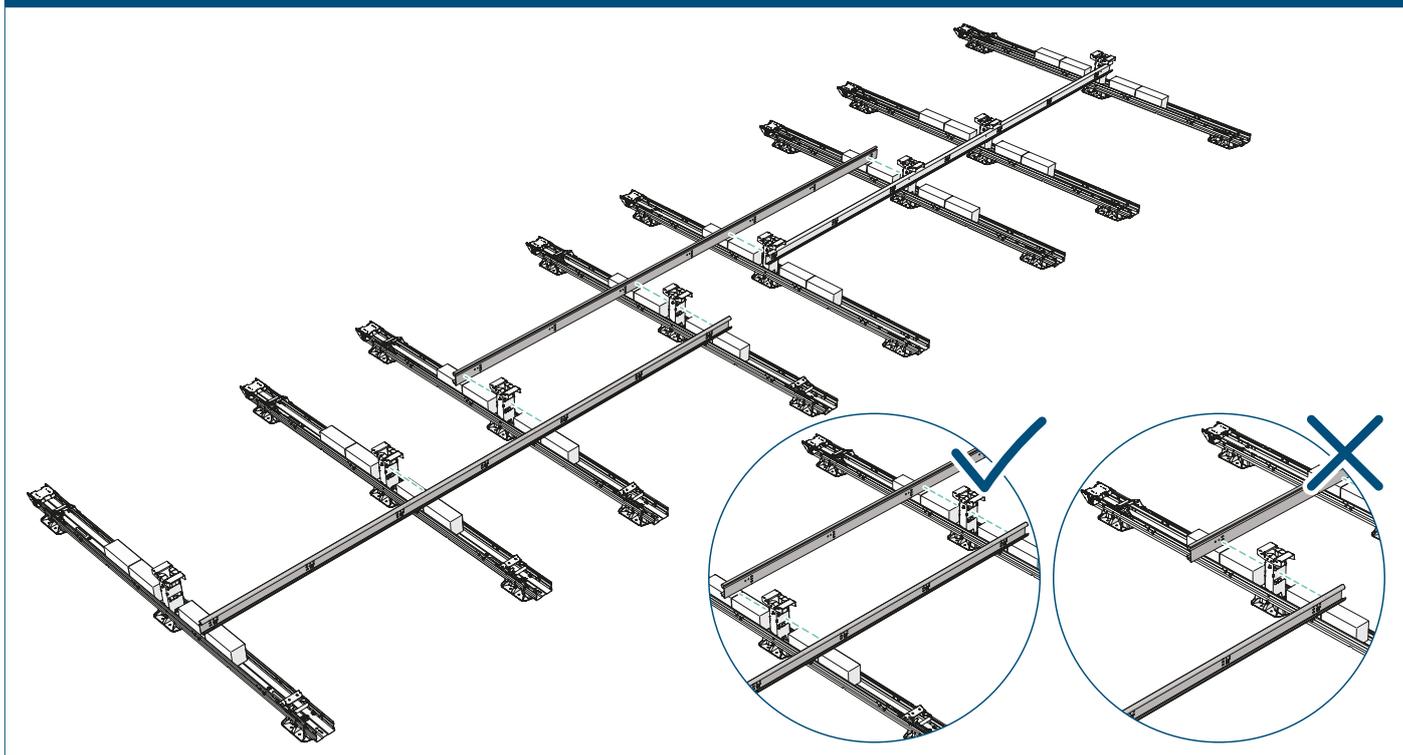
Repeat step 2.4. Place (temporary) ballast to prevent the unit from accidentally moving.

3. Connect units with stabilizers

1 Fit stabilizers to each high base of the first four units.

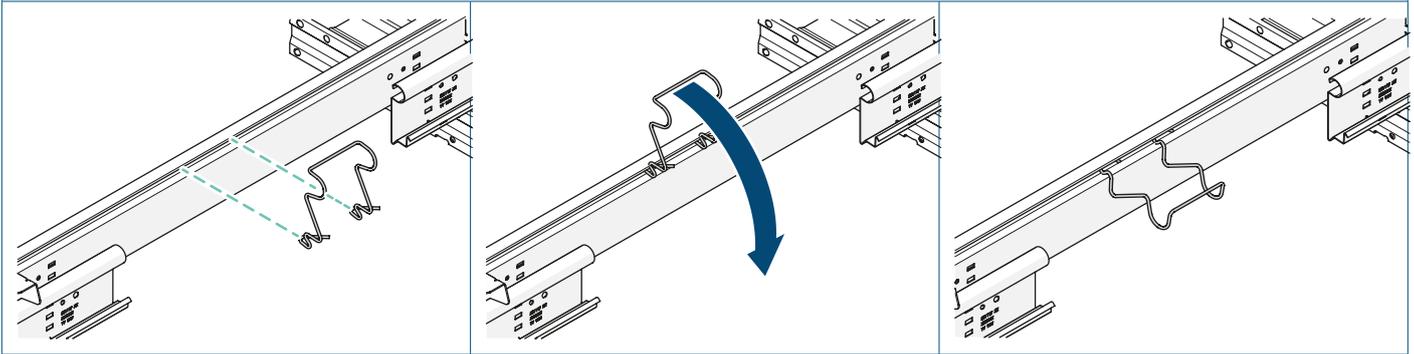


2 Attach the other stabilizers so that each stabilizer overlaps preceding stabilizer over two high bases

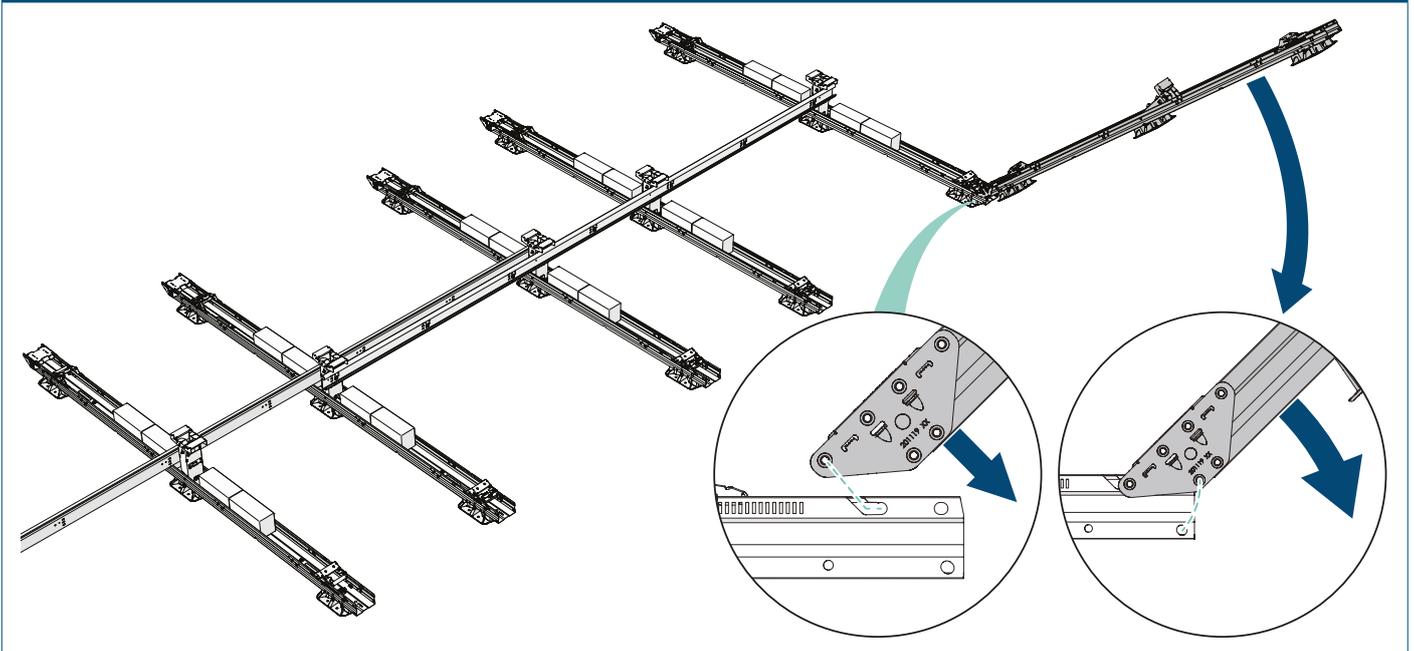


3 Install cable brackets to the rear of the rear stabilizer to bridge the gap between two stabilizers

i See Annex B: Cable management for more information on cable management.

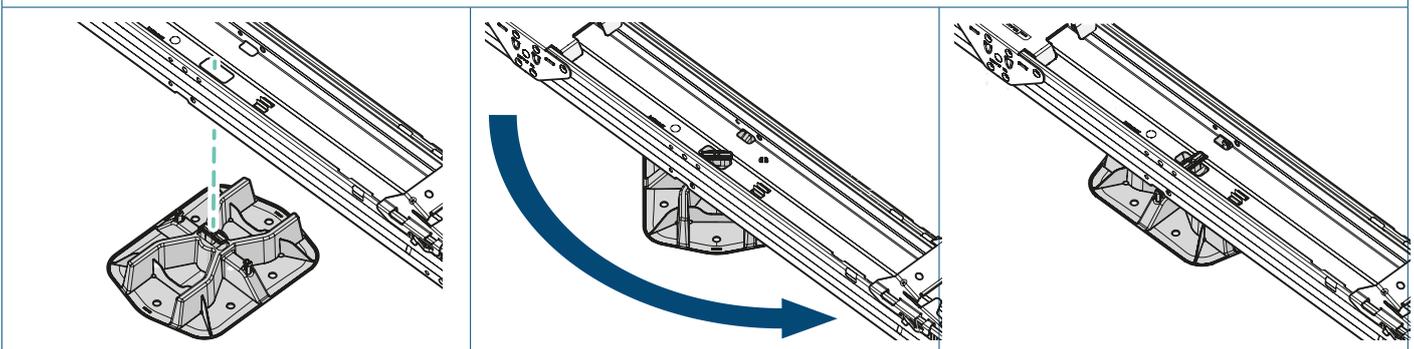


4 Extend the segment by attaching another unit using the pre-installed coupler



5 Optional: Place an extra base plate under the unit where necessary

i Check the project plan to see if additional base plates have been added under the units to reduce the concentrated load on the roof.

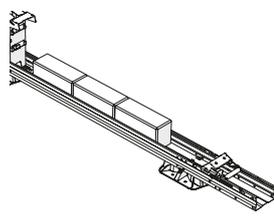
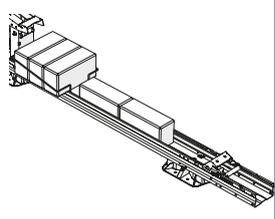
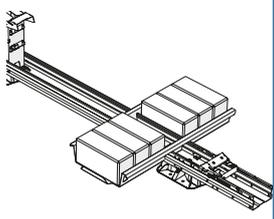
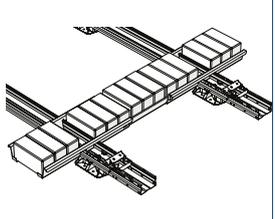
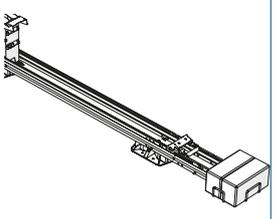


4. Place permanent ballast

The calculator determines the ballast needed for your project. Follow the instructions from the project plan determined by the calculator.

In this chapter we provide a general description of the five possible positions for the ballast.

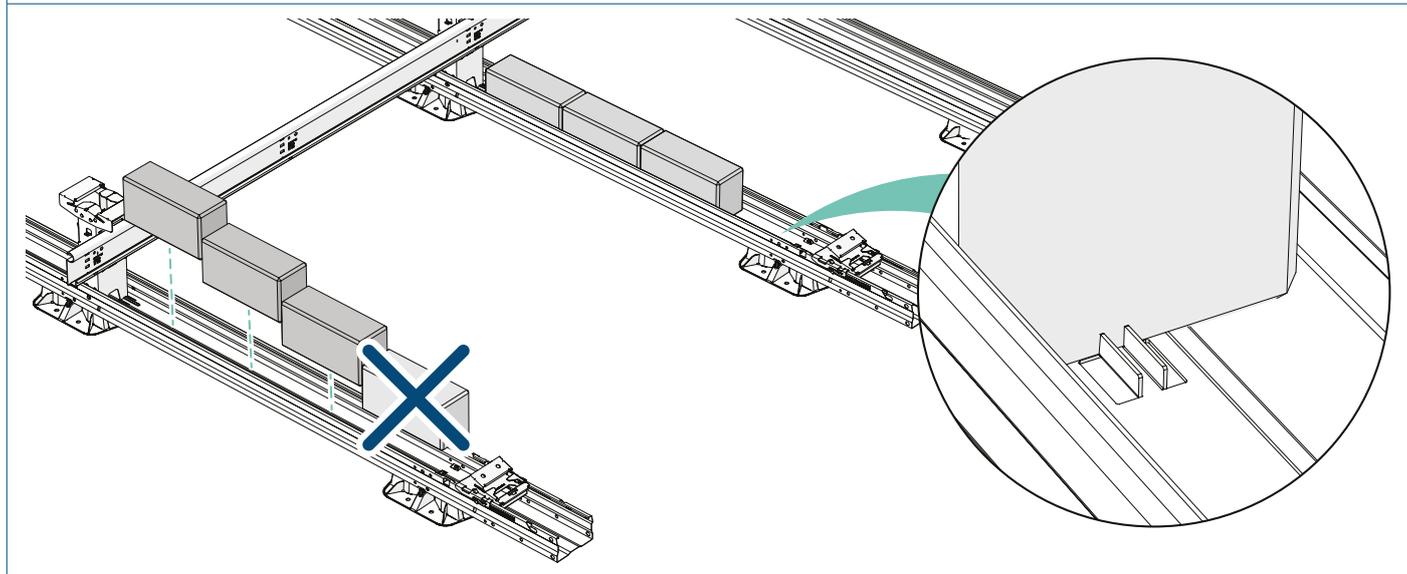
! If anything changes in the layout of the solar panel field, the ballasting has to be recalculated.

Position A	Position B	Position C	Position D	Position E
				
See project plan: "U; XX kg" (Unit)	See project plan: "B; XX kg" (Bracket)	See project plan: "T; XX kg" (Tray)	See project plan: "E; XX kg" (Extender)	See project plan: "P; XX kg" (Perimeter)

Position A In the units

1 Place the ballast in the unit.

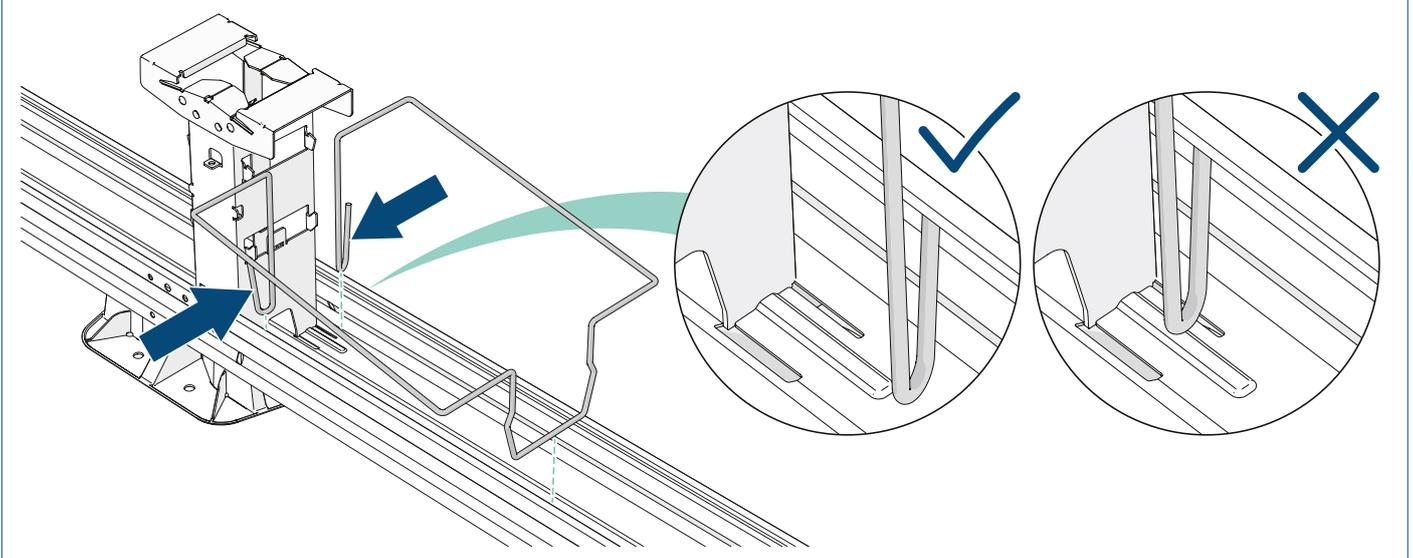
! Place a maximum of three bricks in the unit. A fourth brick will not fit under the solar panel.



Position B In ballast brackets

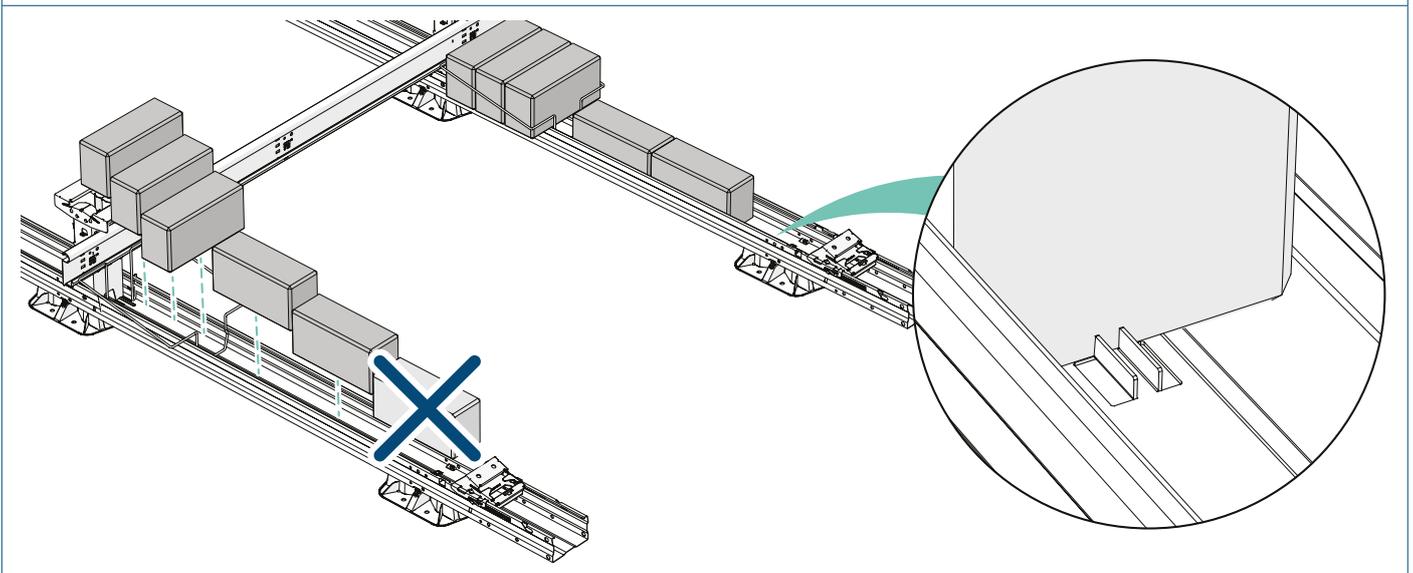
- 1 Squeeze the hooks of the ballast bracket together and place the bracket next to the high base in the unit.

! Do not position the ballast bracket on the locking tab of the high base. This can unlock the high base compromising the structural strength.



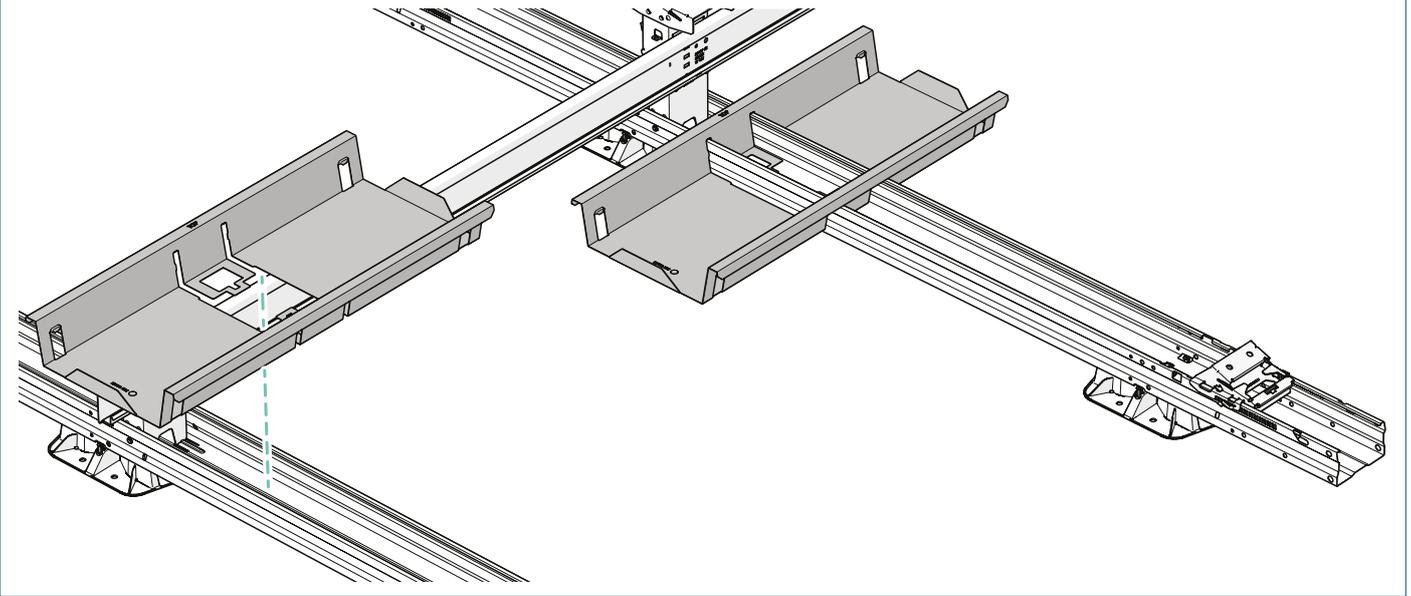
- 2 Fill the ballast bracket and, if necessary, the unit with bricks.

! Place a maximum of two bricks in the unit in combination with the ballast bracket. A third brick will not fit under the solar panel.

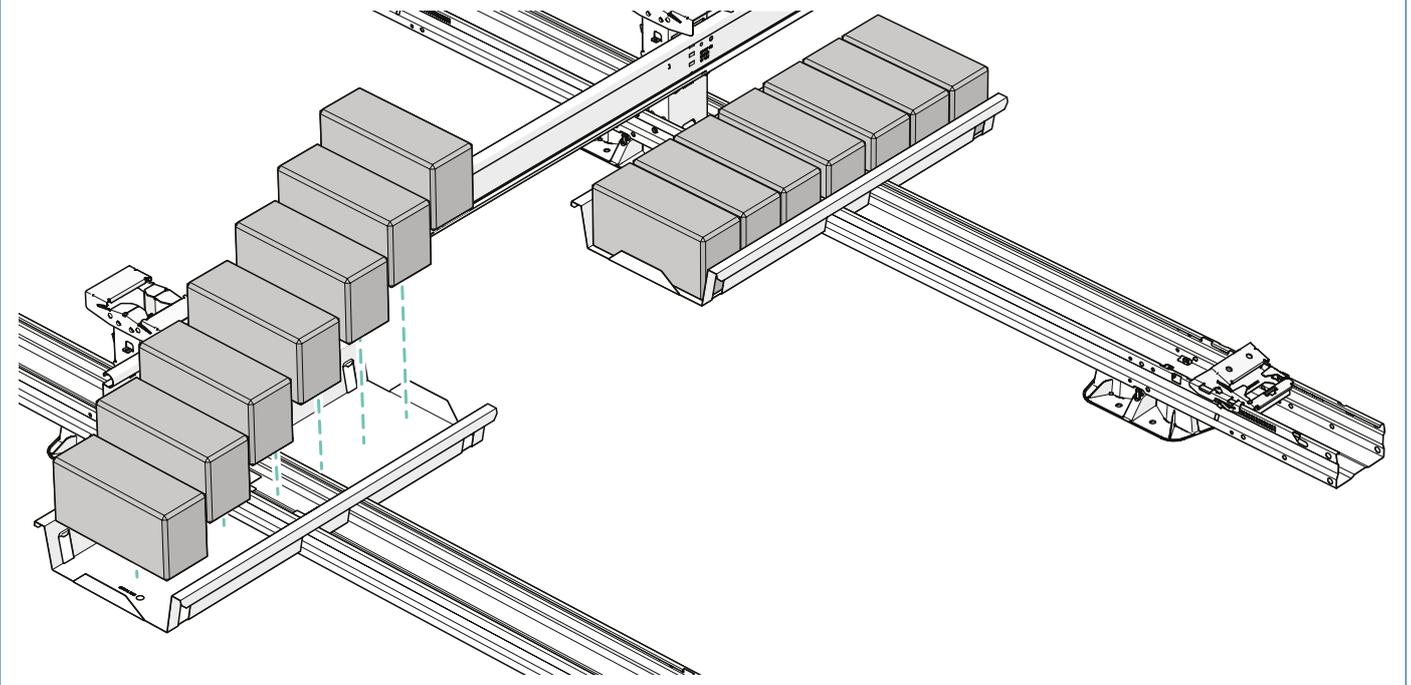


Position C In ballast trays

- 1 Push the ballast tray over the unit in the position specified in the project plan.



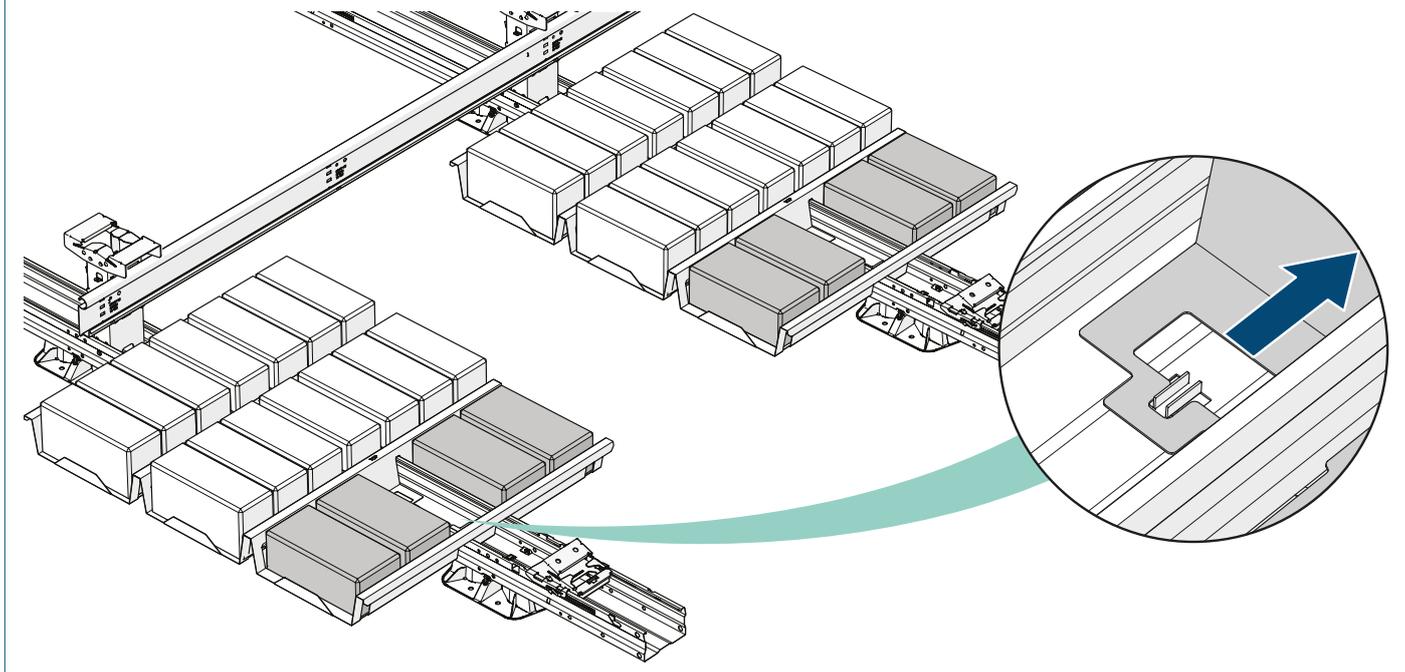
- 2 Fill the ballast tray with bricks.



3 If the project plan specifies more than one ballast tray, slide the outer ballast tray against the tabs in the unit. In this array you can place a maximum of three ballast trays in a row.

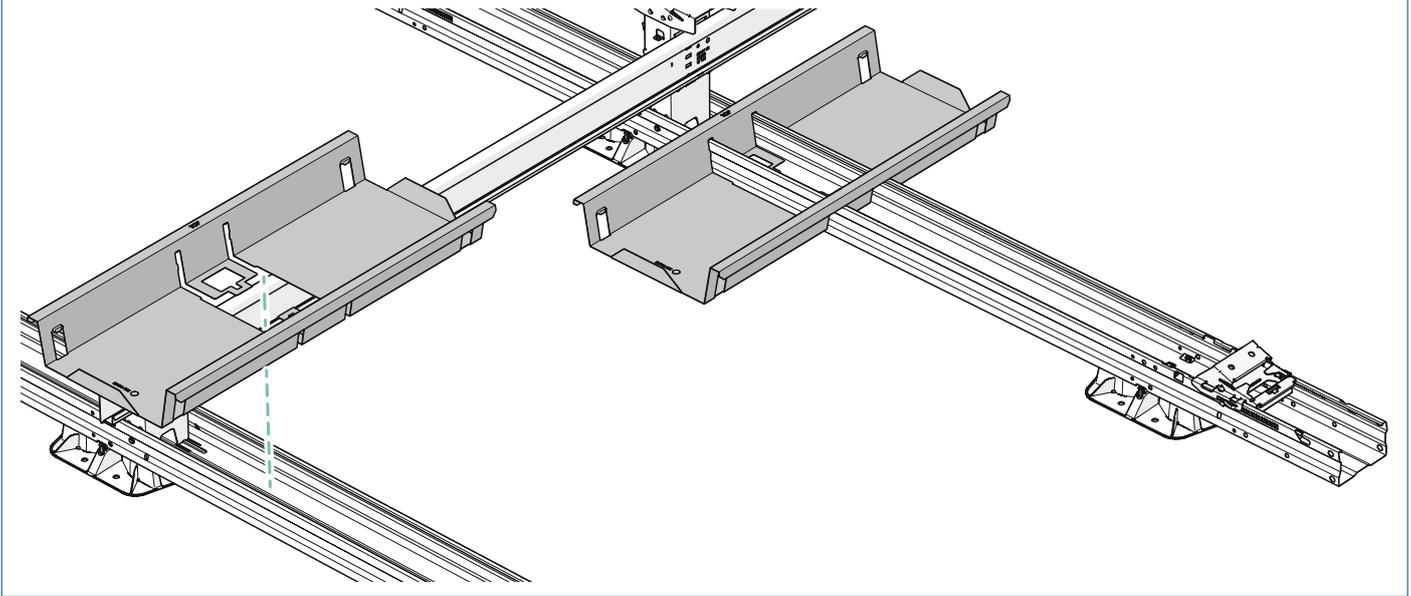
! Place the bricks in the outer ballast tray on the flat side, otherwise they will not fit under the solar panel.

i Follow the project plan for the required positions and quantities of ballast.

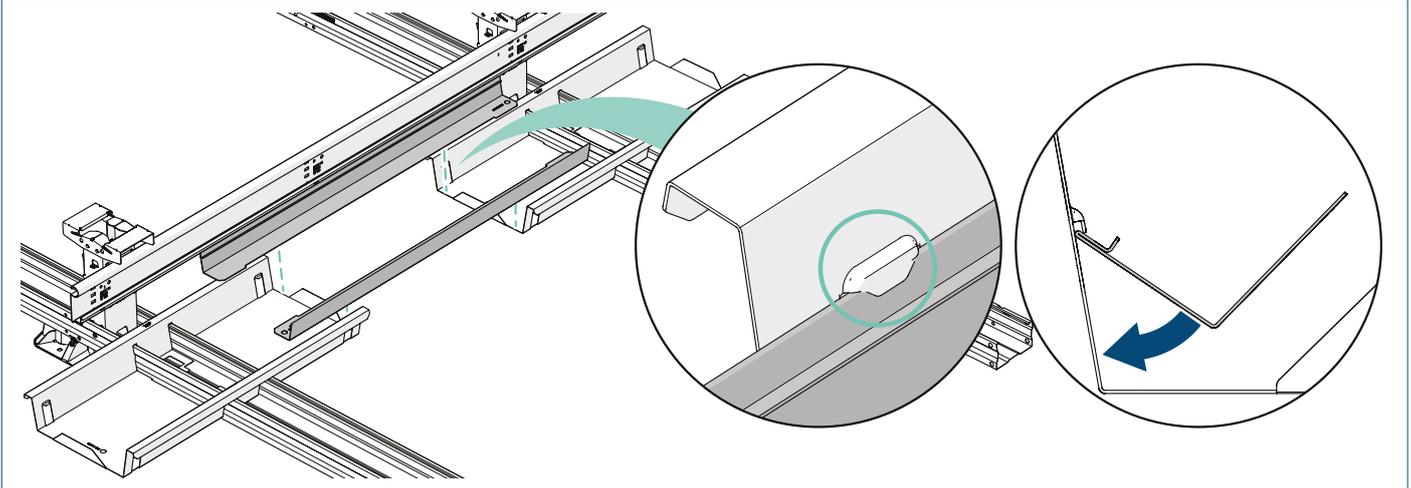


Position D In ballast trays with ballast tray extenders

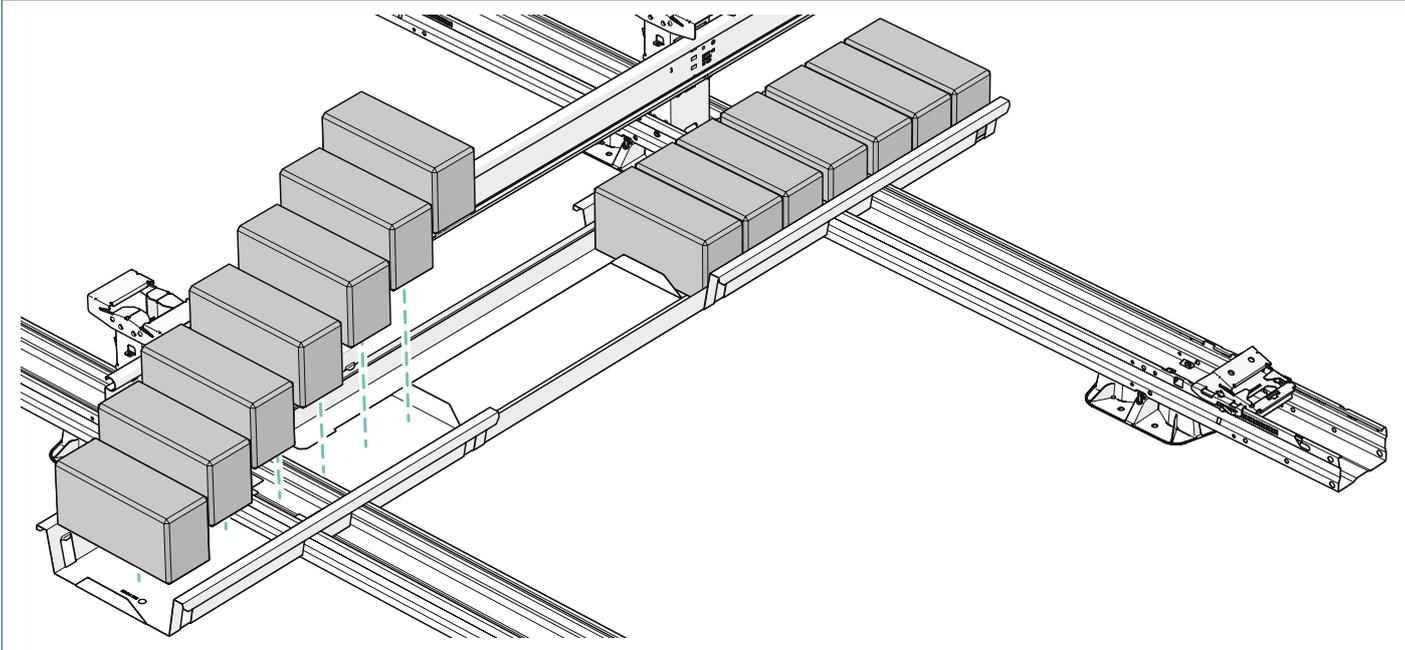
- 1 Push the ballast tray over the unit in the position specified in the project plan.



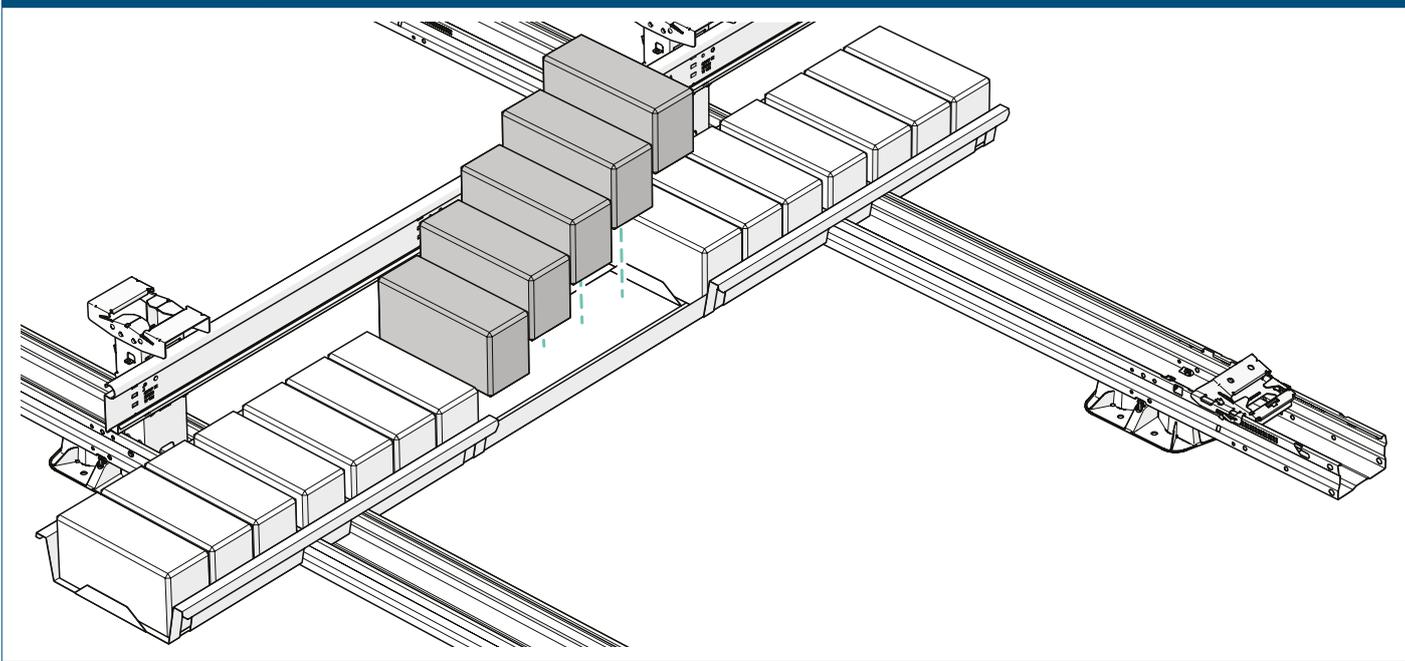
- 2 Connect two ballast trays together with the ballast tray extender.



3 Fill the ballast trays with bricks.



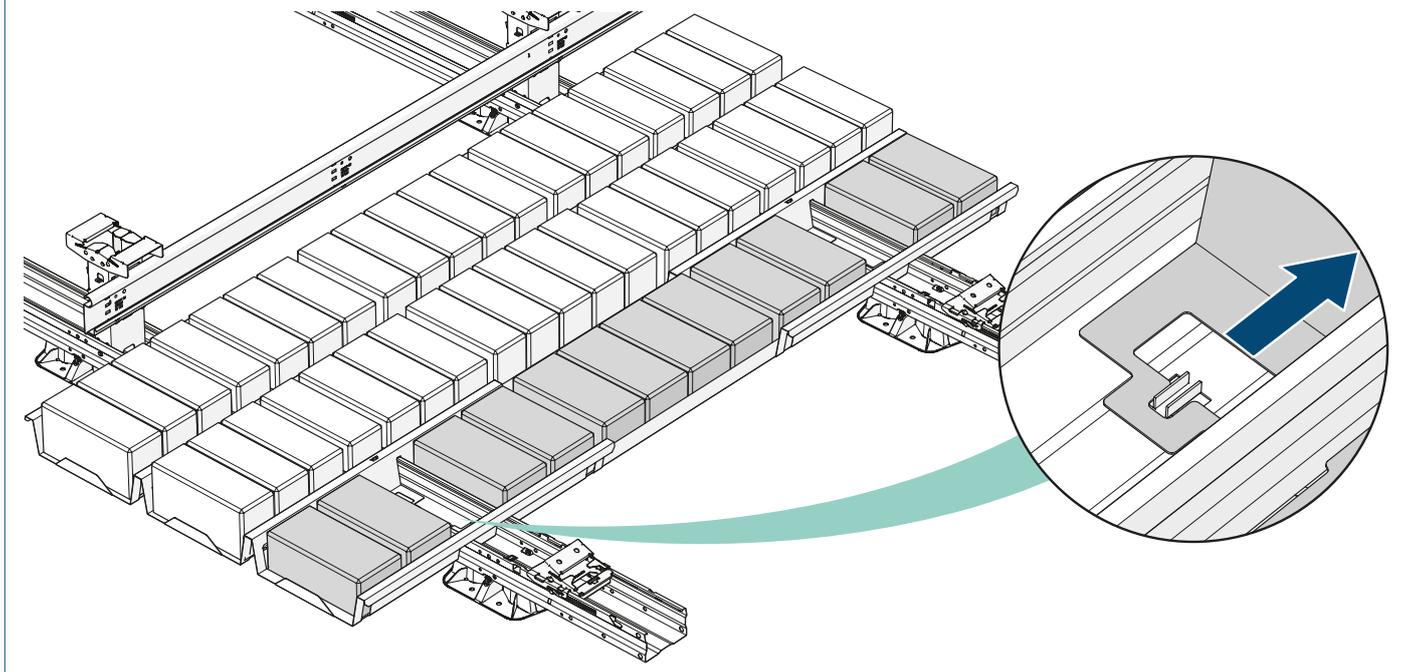
4 Fill the ballast tray extender with bricks.



5 If the project plan specifies more than one ballast tray, slide the outer ballast tray against the tabs in the unit. In this array you can place a maximum of three ballast trays in a row.

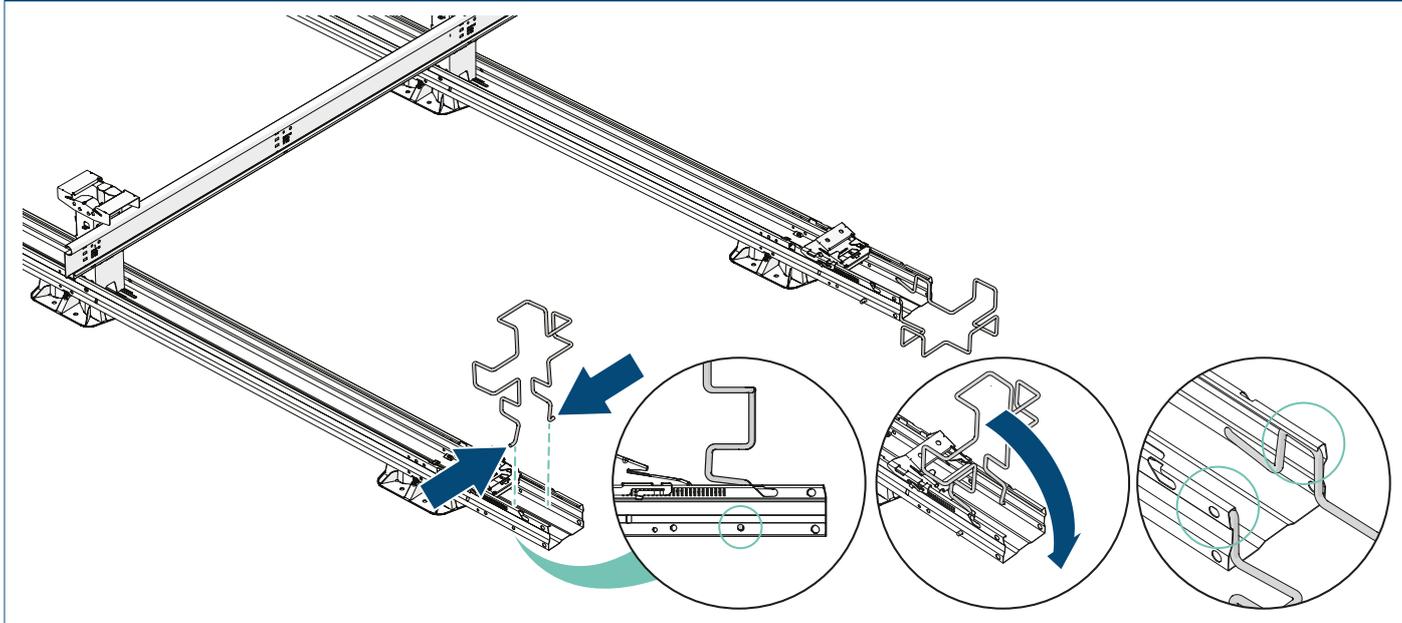
! Place the bricks in the outer ballast tray on the flat side, otherwise they will not fit under the solar panel.

i Follow the project plan for the required positions and quantities of ballast.

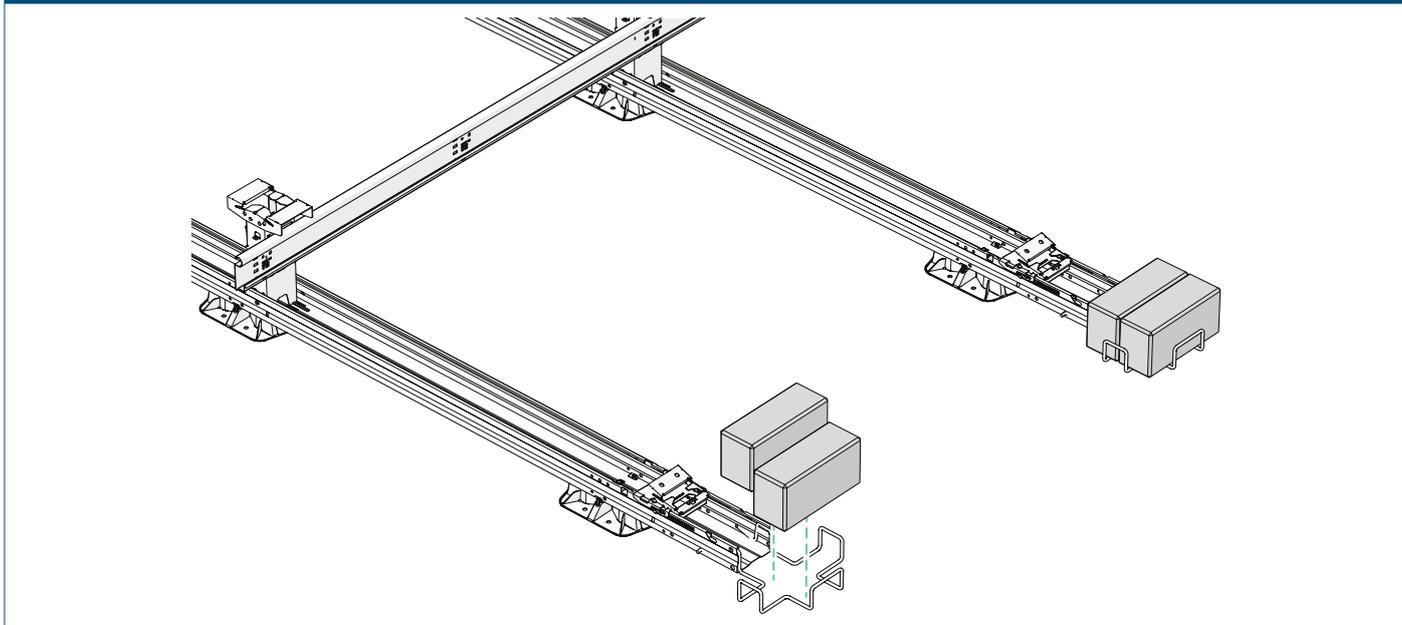


Position E In perimeter ballast brackets

- 1 Squeeze the hooks of the perimeter ballast bracket and insert the bracket into the end of the unit.



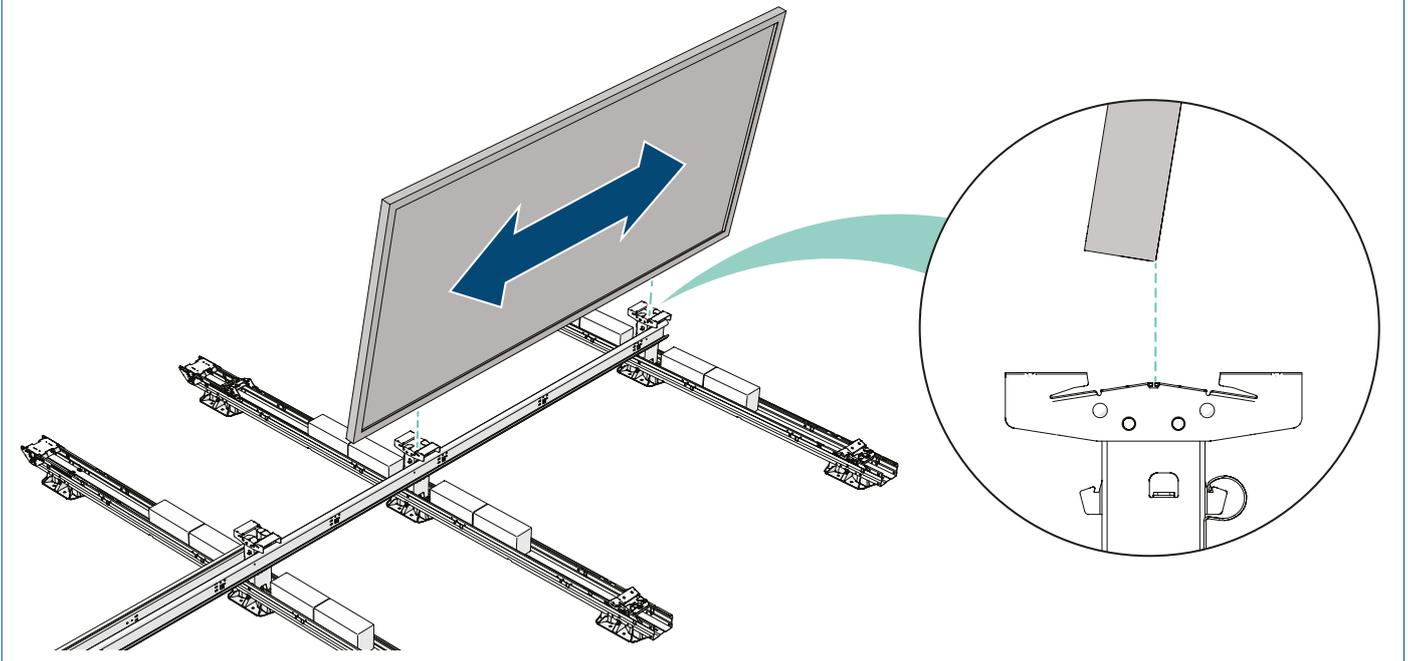
- 2 Always fill the perimeter ballast bracket with two bricks.



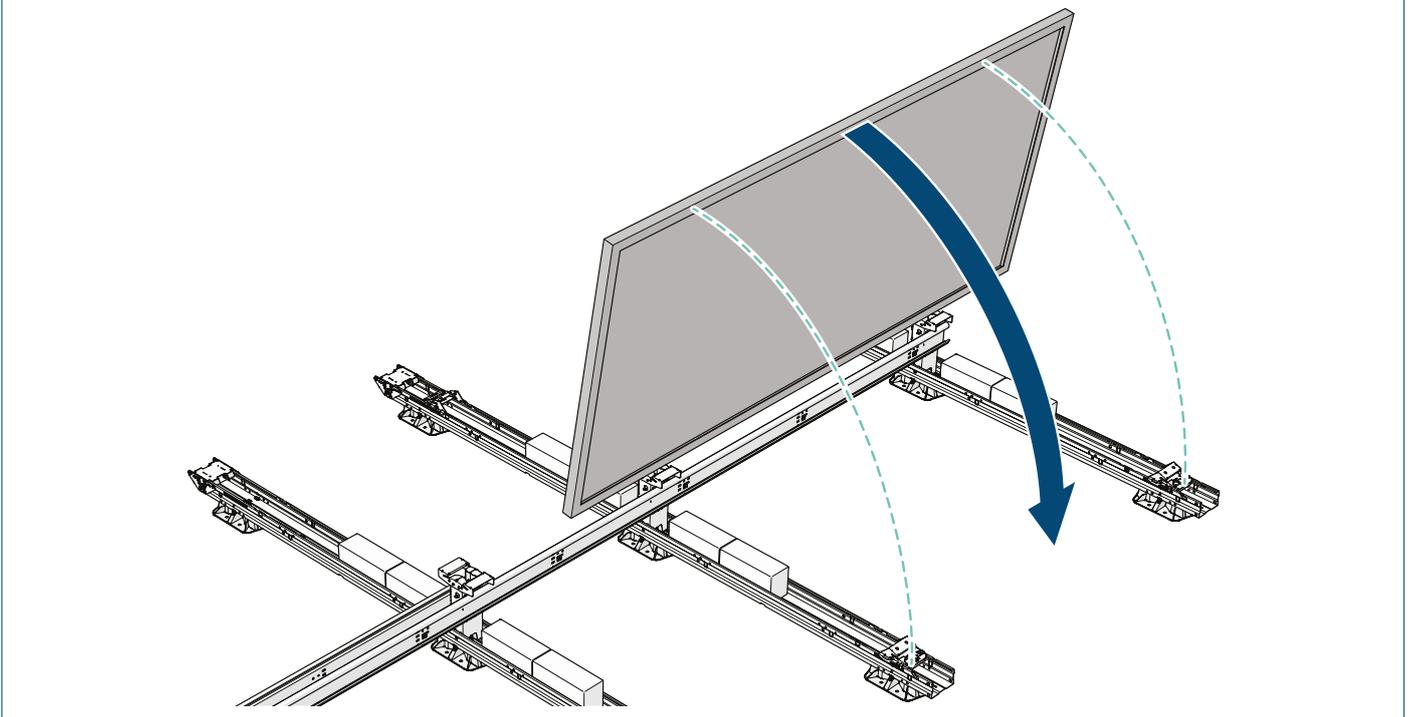
5. Mounting the first solar panel

! Do not mount any solar panels if there may be strong winds in the time between mounting the solar panel and wind deflectors. Immediately mount the wind deflectors after mounting a field of solar panels.

1 Place the solar panel upright on two high bases and align the solar panel in the middle.

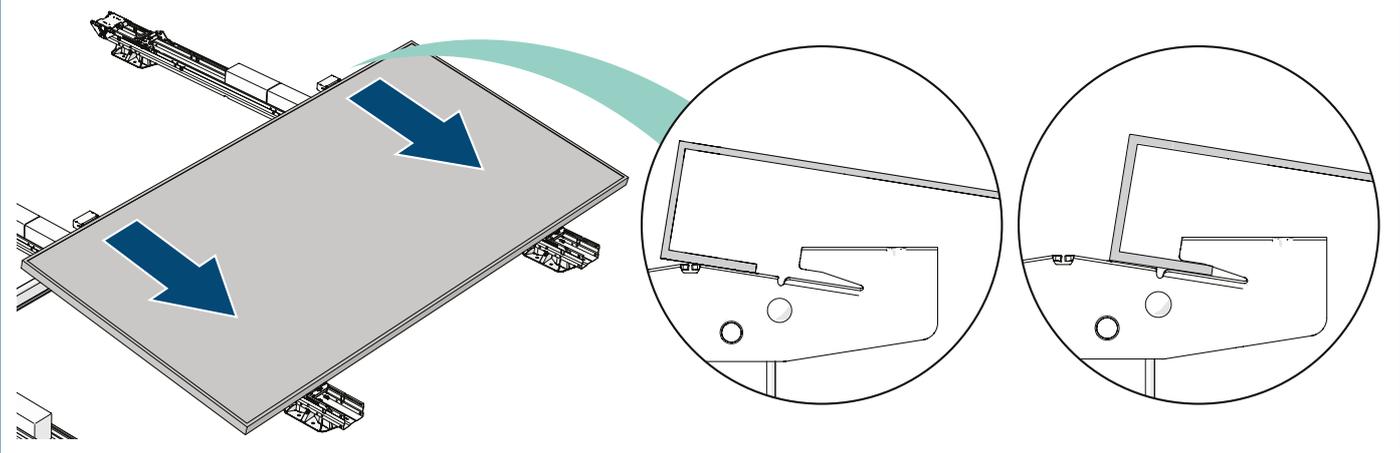


2 Carefully tilt the solar panel on the panel clamps.



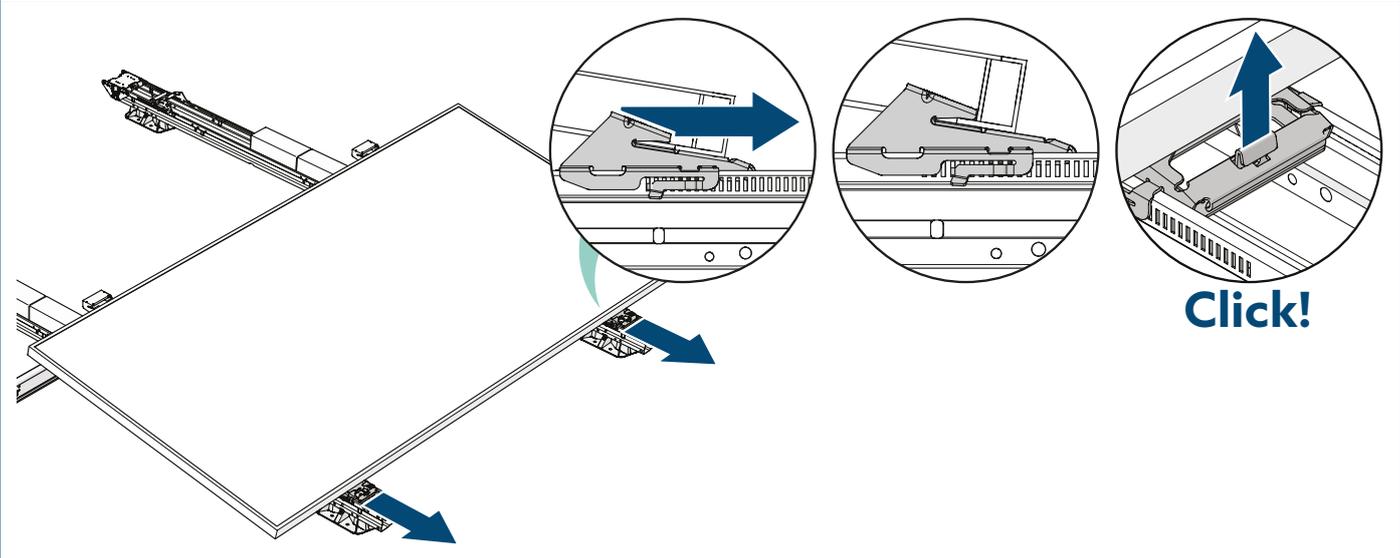
3 Pull the solar panel towards you so that the solar panel frame hooks into the high bases.

i The solar panel should now rest on the lower section of the panel clamp. If the solar panel frame rests on the top part of the panel clamp, push the panel clamp backwards using the unlock tool. See Appendix for more information.

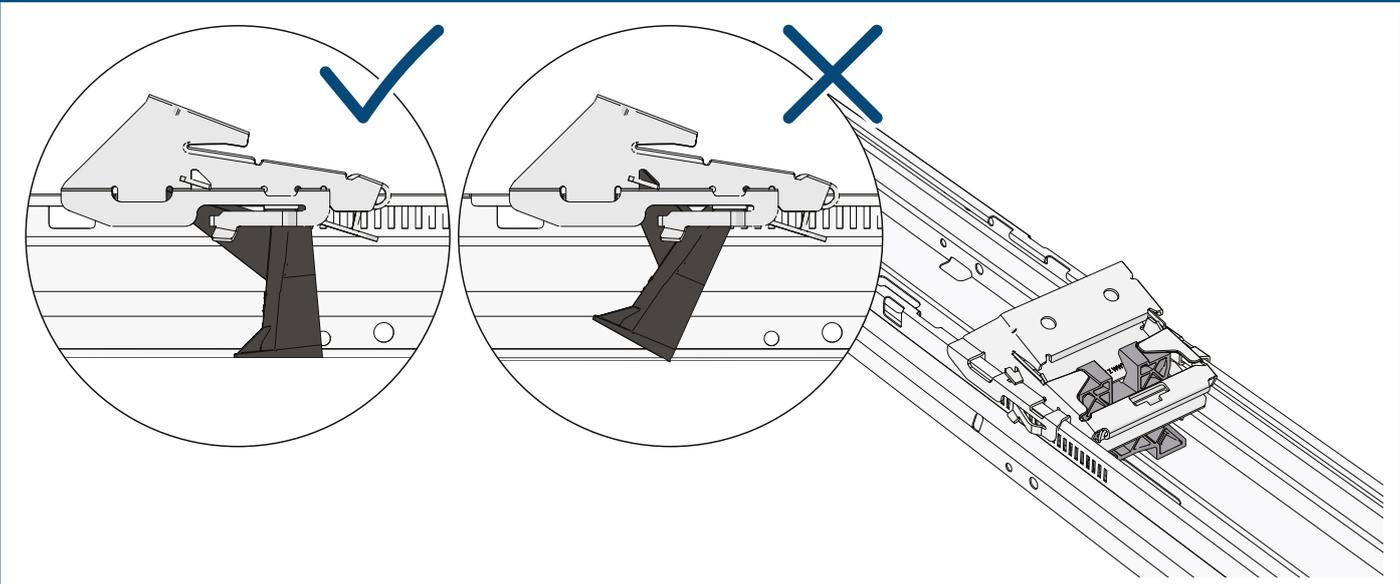


4 Pull the panel clamp towards you until they can go no further, so the panel clamps hook into the frame of the solar panel.

5 Pull the locking mechanism up through the clamp handle until it clicks into place to lock the solar panel in place.

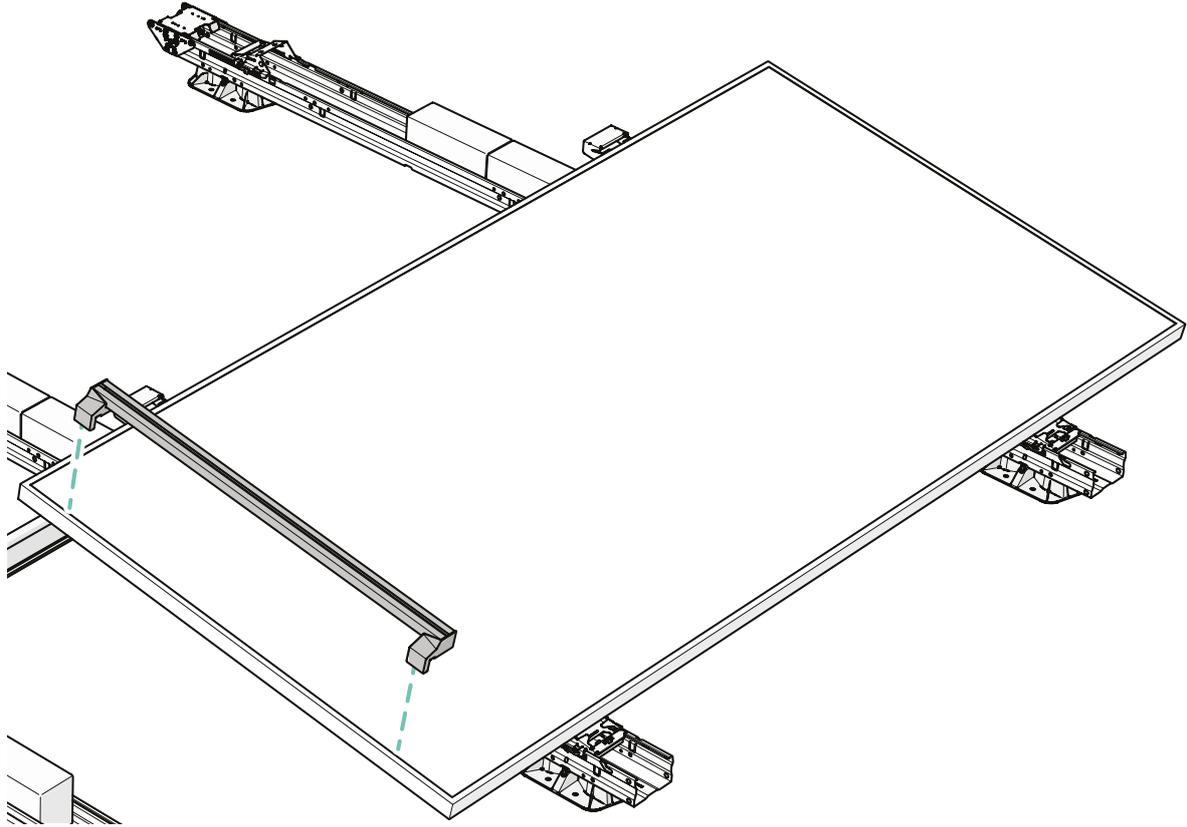


6 For projects with the Wave Dual High Load system, check if the Snow Load addons are properly positioned upright underneath the panel clamps, also after performing maintenance.

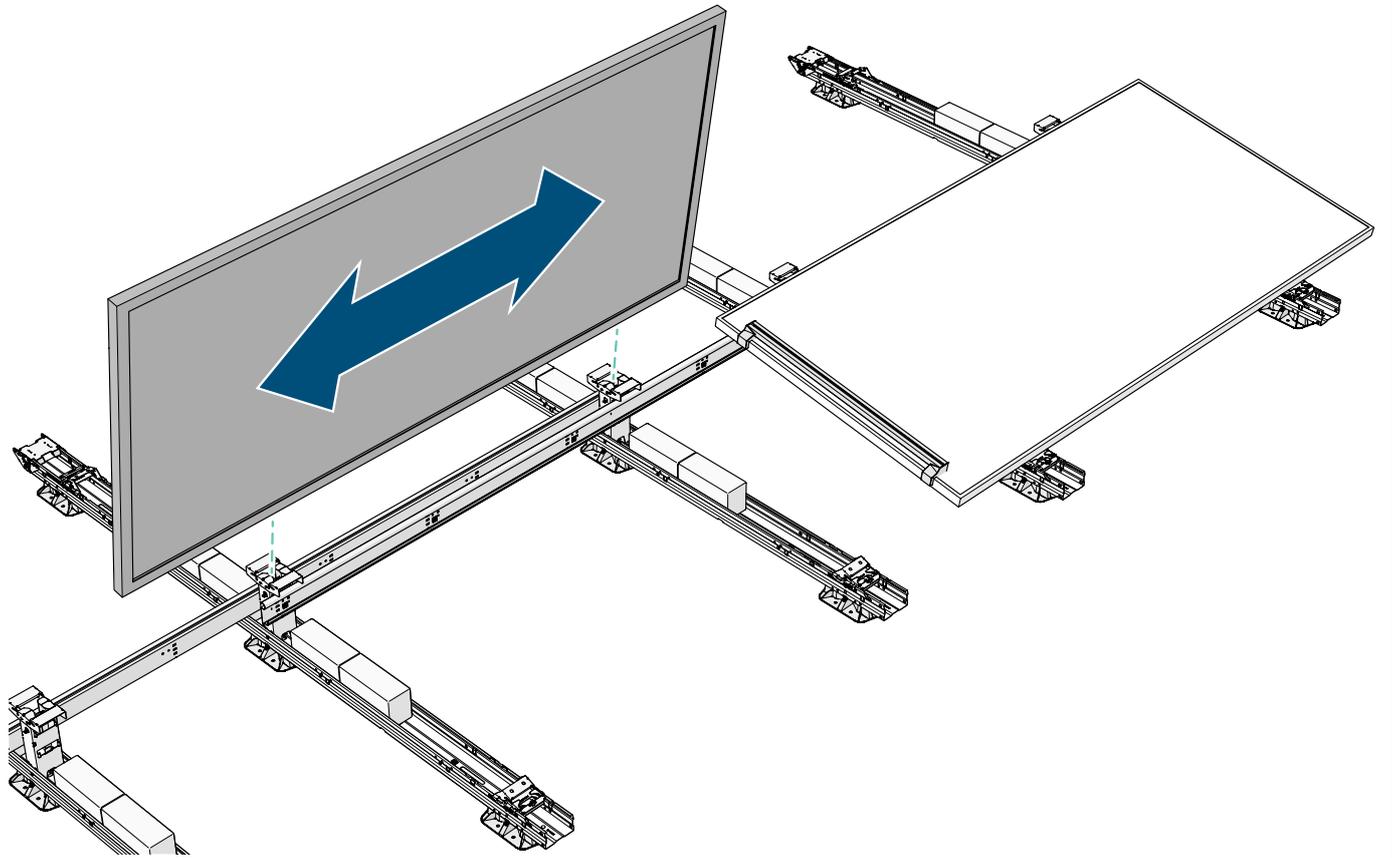


6. Mounting the following solar panels

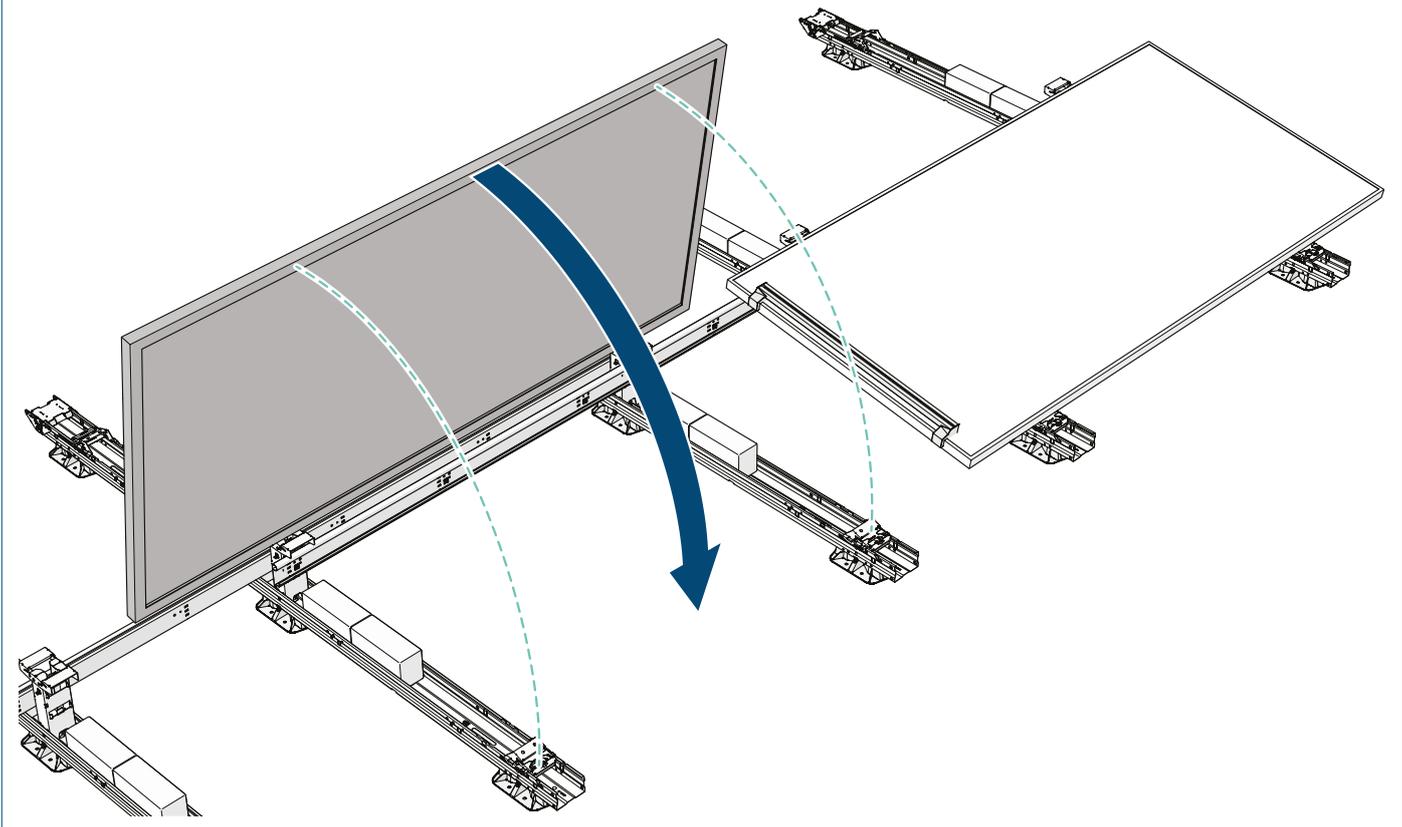
- 1 Place the spacer tool on the installed solar panel.



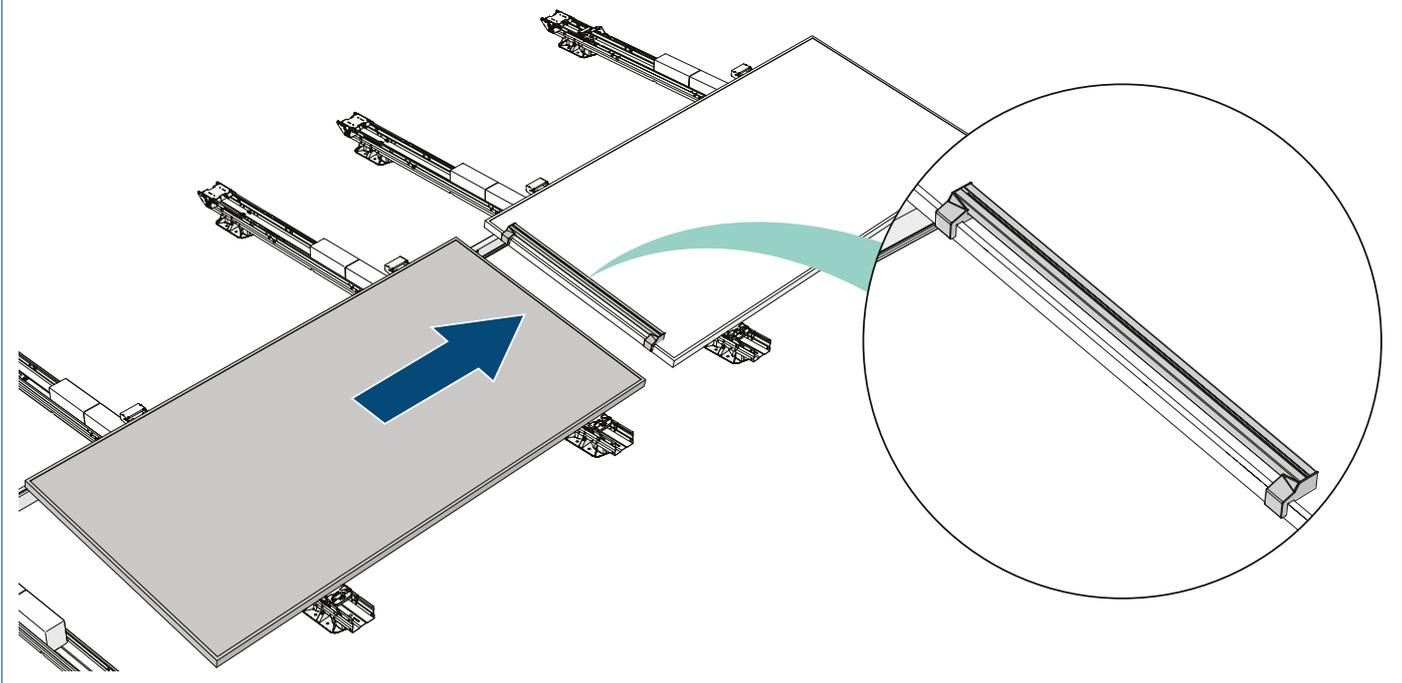
- 2 Place the solar panel upright on two high bases and align the solar panel in the middle.



3 Carefully tilt the solar panel on the panel clamps.



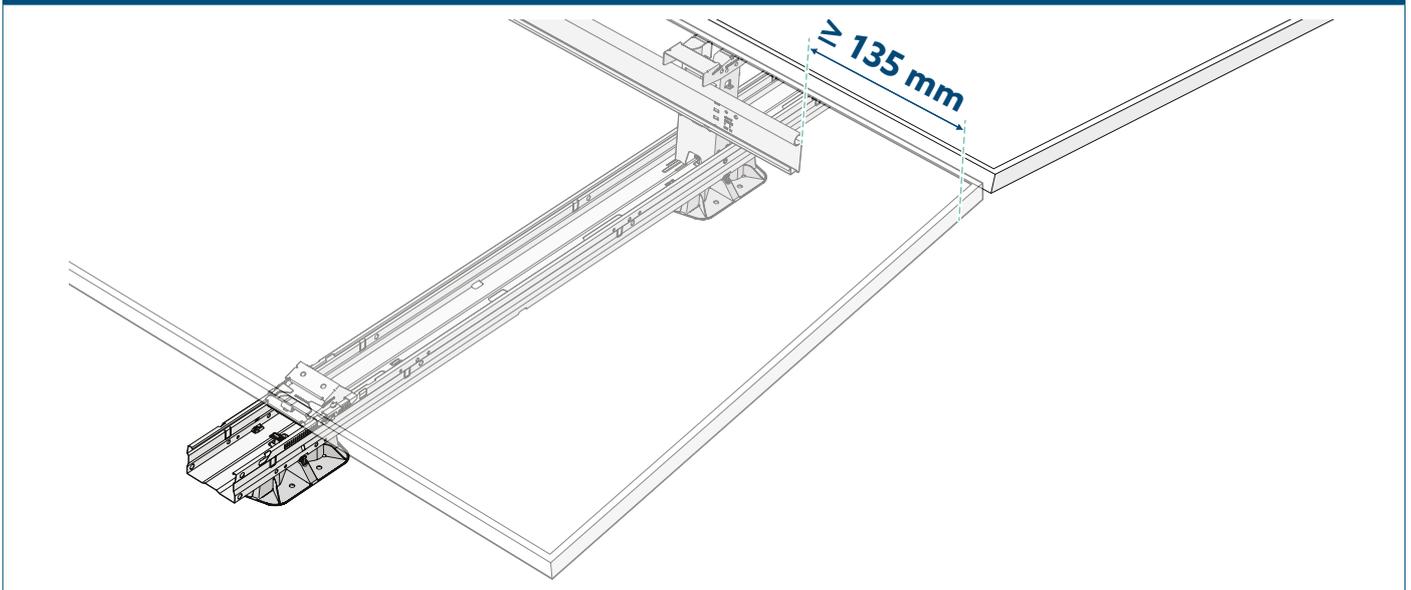
4 Slide the panel against the spacer tool



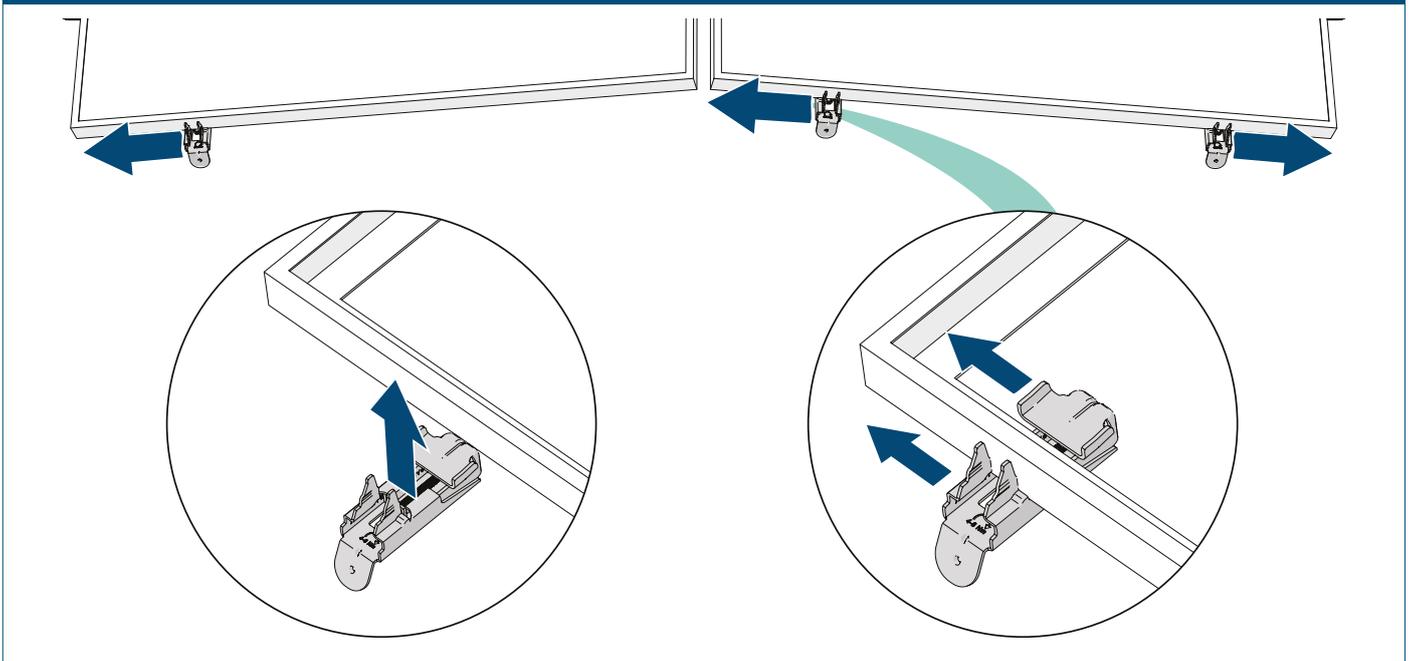
	Repeat step 5.3. Pull the solar panel towards you so that the solar panel frame hooks into the high bases.
	Repeat step 5.4. Pull the panel clamp towards you until they can go no further, so the panel clamps hook into the frame of the solar panel.
	Repeat step 5.5. Pull the locking mechanism up through the clamp handle until it clicks into place to lock the solar panel in place.
	Repeat the steps in this chapter for all panels.

7. Installing wind deflectors

- 1 If the last stabilizer is positioned on the left side of the high base, make sure that the solar panel extends at least 135 mm from the stabilizer. This spacing is necessary for the installation of the mid bracket of the wind deflector.

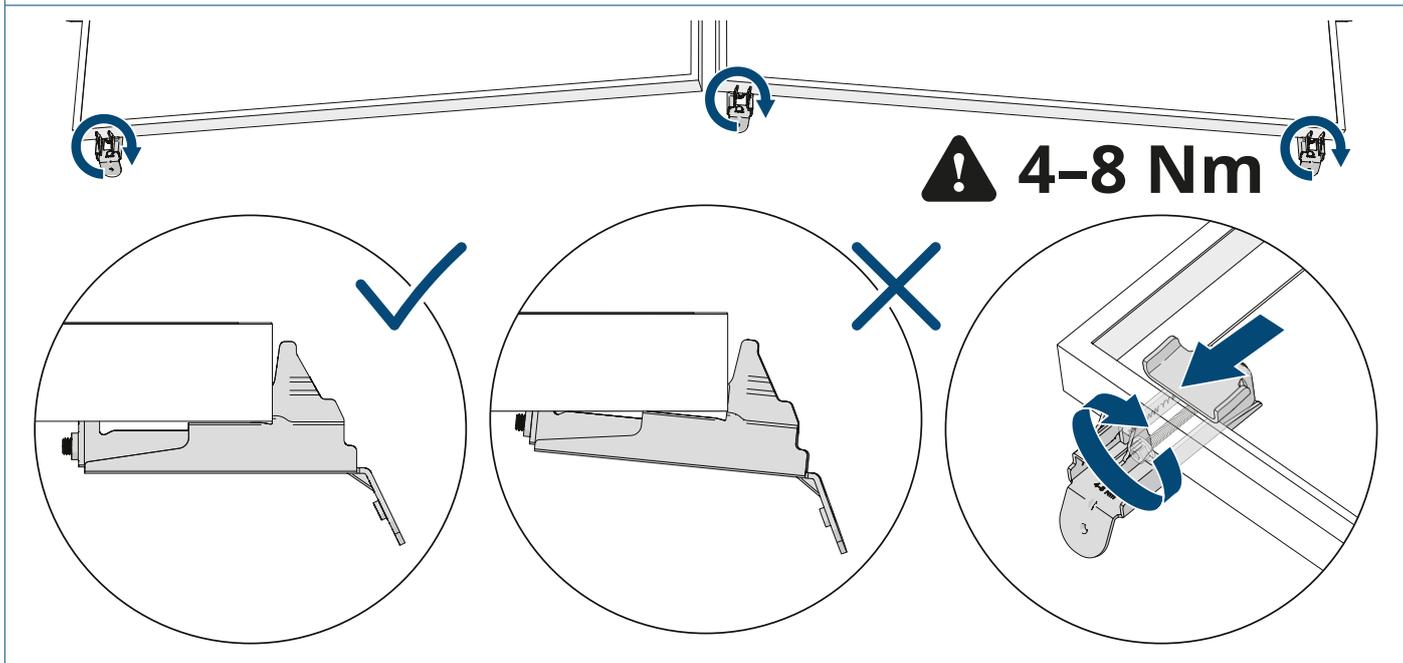


- 2 Place a side clamp on both sides of the right solar panel.
- 3 Place a side clamp on the left side of the left solar panel.
- 4 Align the side clamps to the corners of the solar panel frames.



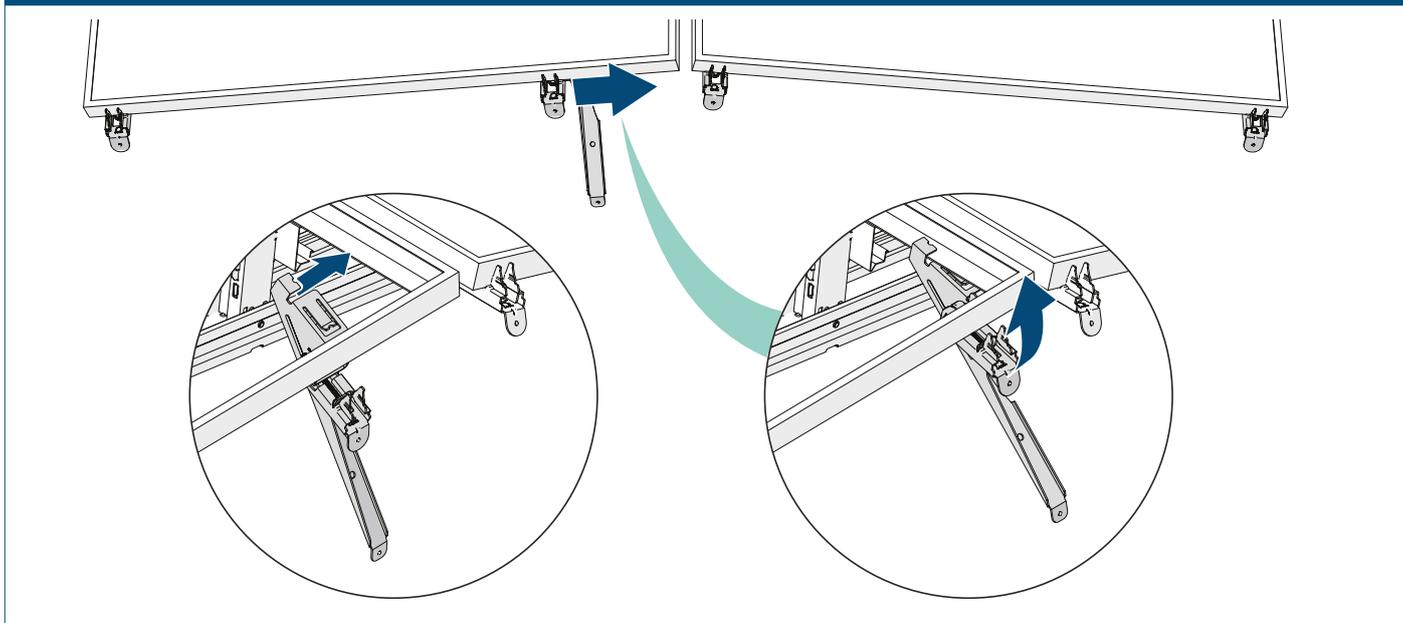
5 Fasten the screws to secure the side clamps in place. Apply a torque of 4-8 Nm.

i Make sure the edge of the panel clamps align against the side of the solar panel frame.



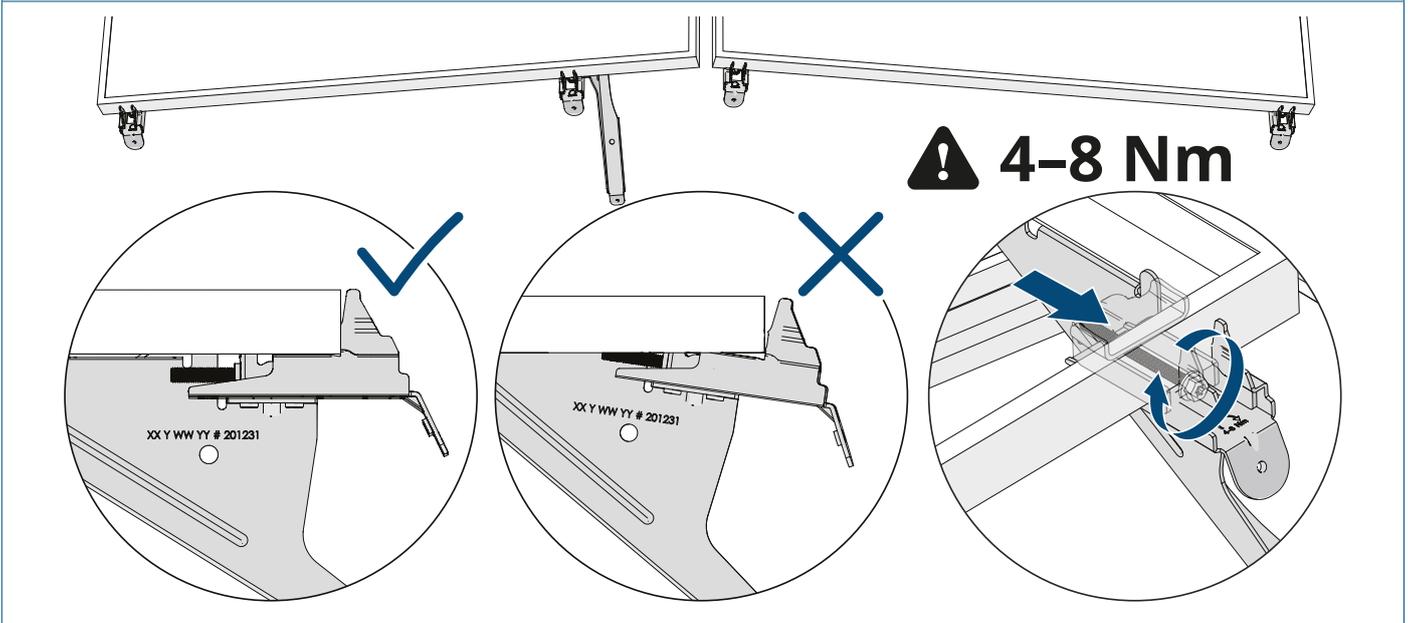
6 Hook the back of the mid clamp onto the right side frame of the left solar panel.

7 Lift the front of the mid clamp against the solar panel frame.

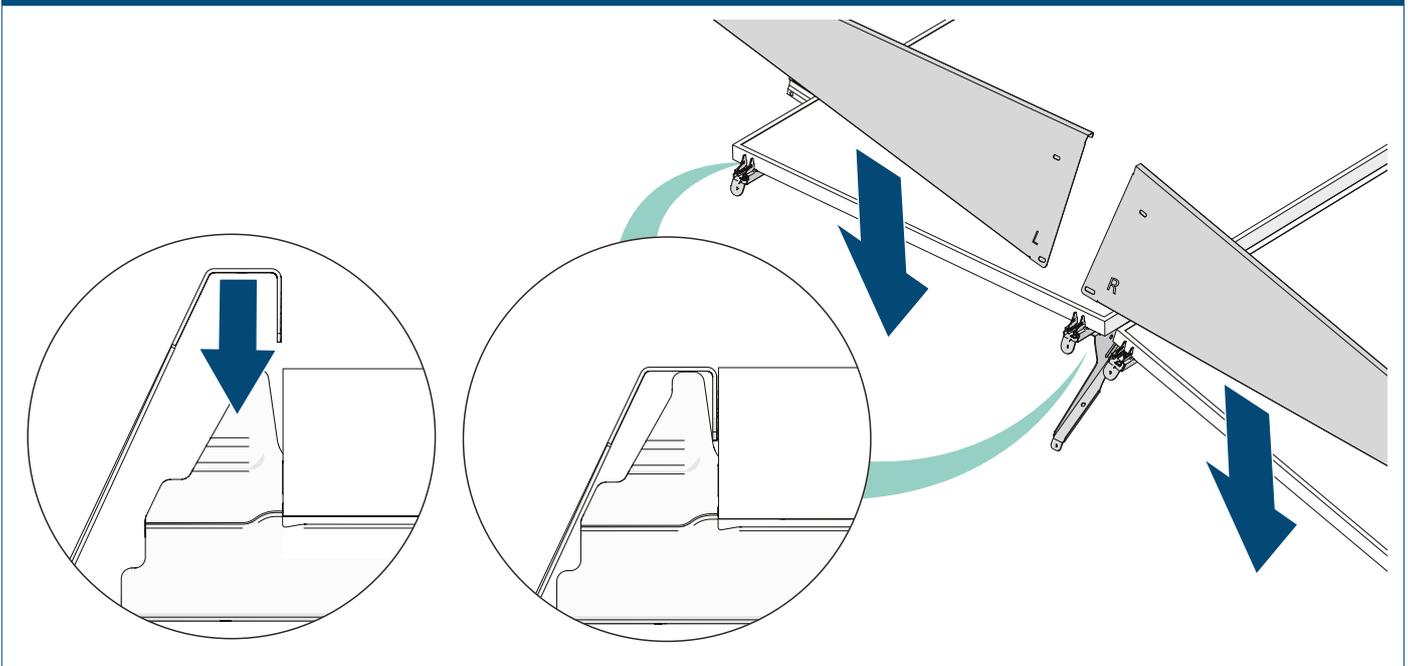


8 Fasten the screws to secure the mid clamp in place. Apply a torque of 4-8 Nm.

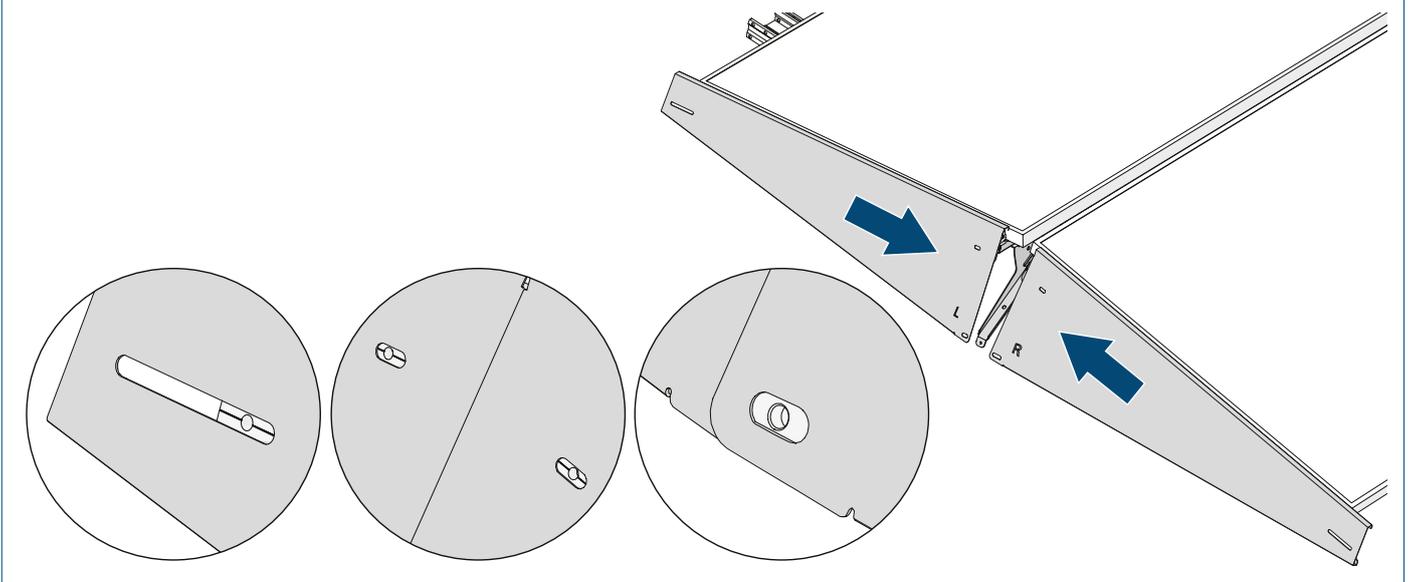
i Make sure the edge of the panel clamps align against the side of the solar panel frame.



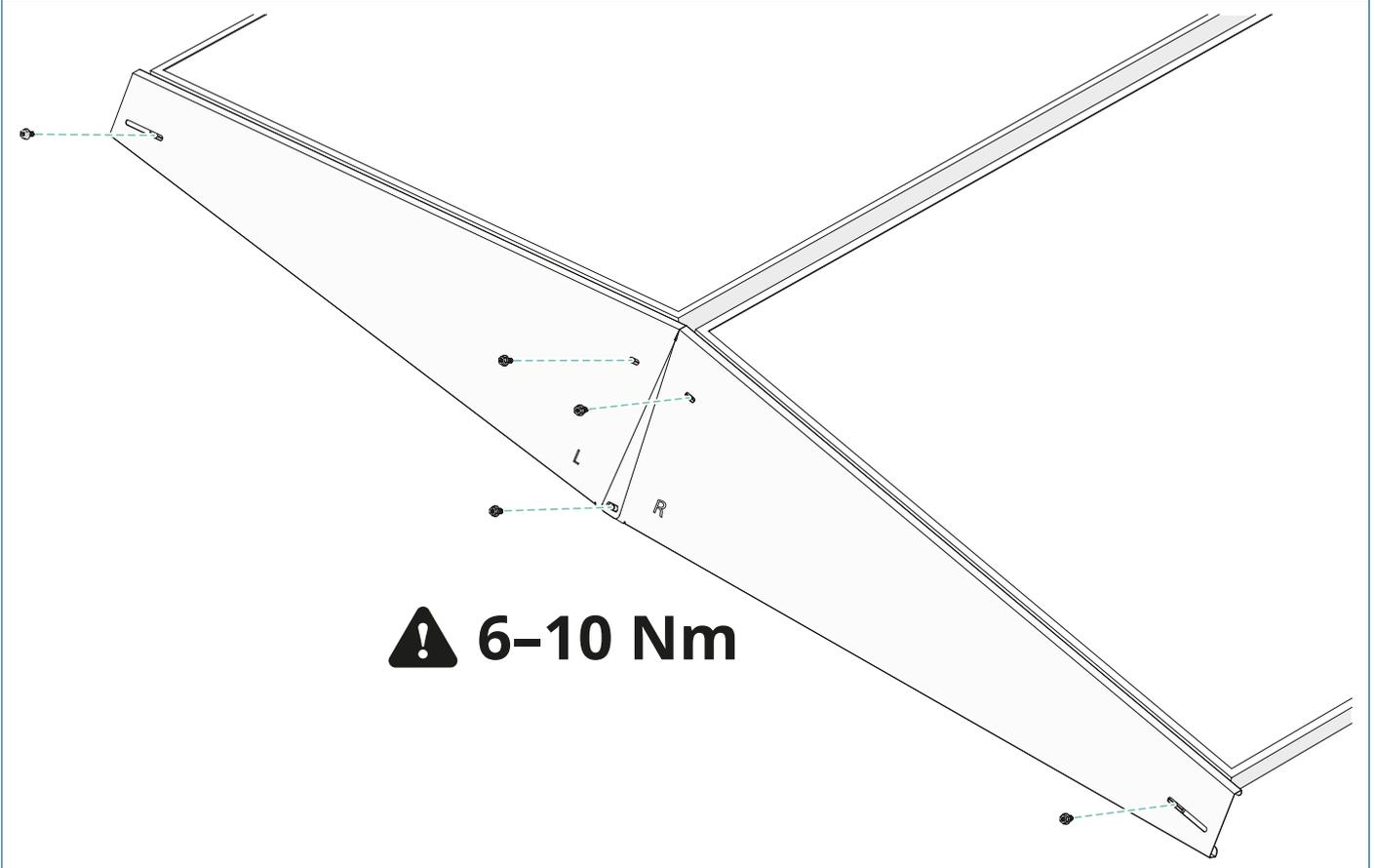
9 Hook the top flange of the wind deflectors between the deflector brackets and the solar panel frames.



10 Slide the wind deflector panels to the centre. Make sure the panels overlap at the bottom and align with the screw holes in the deflector clamps.

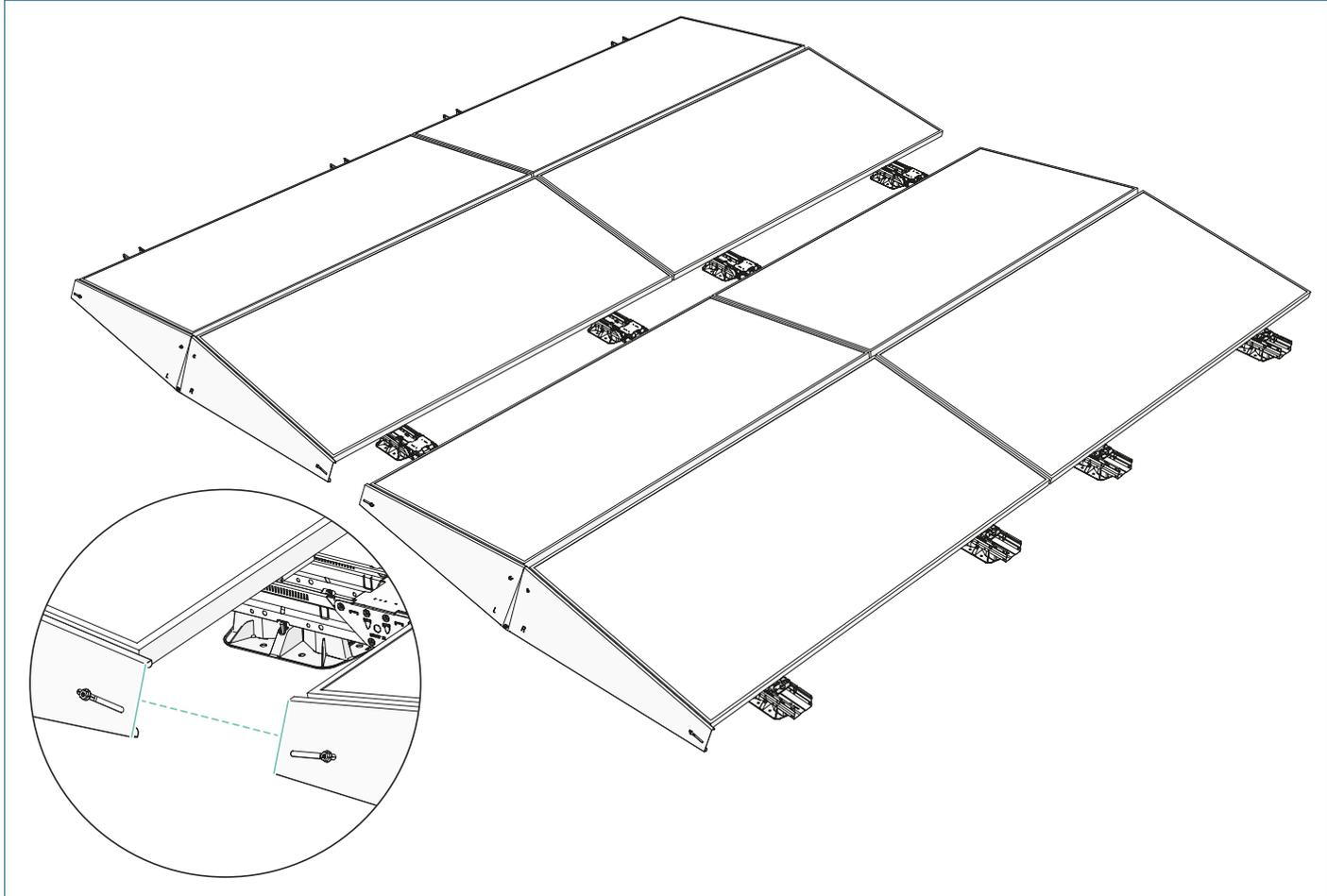


11 Screw the wind deflector panels to the deflector clamps using the 5 provided Torx screws. Apply a torque of 6-10 Nm.



Repeat the steps in this chapter for all wind deflectors.

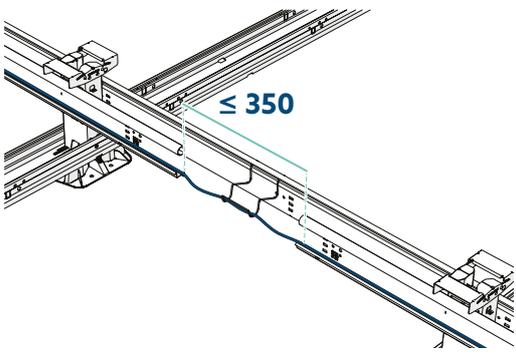
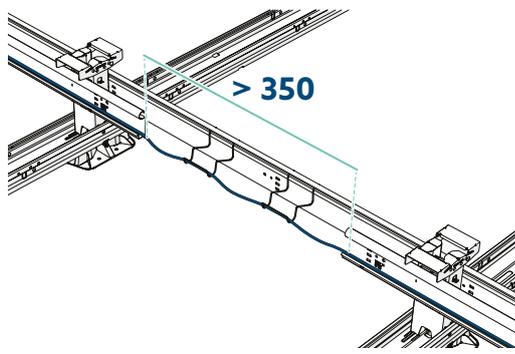
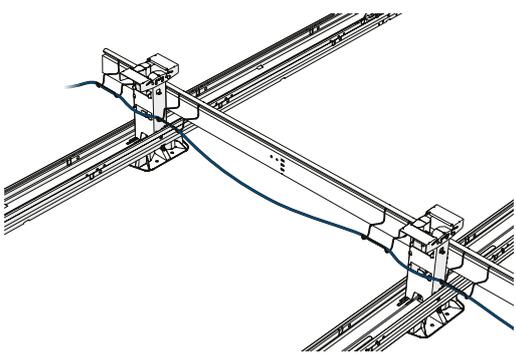
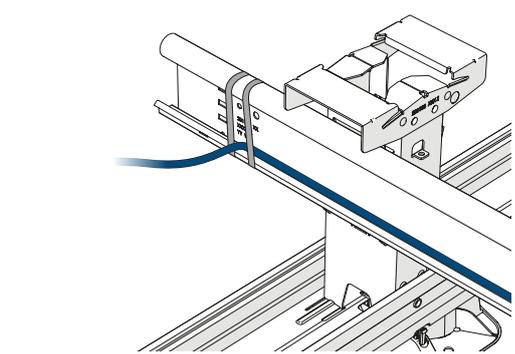
If the wind deflectors are properly inserted and aligned, there will be space between two wind deflectors. The wind deflectors are then correctly mounted.



Annexes

A. Cable management

Cable bracket positioning table

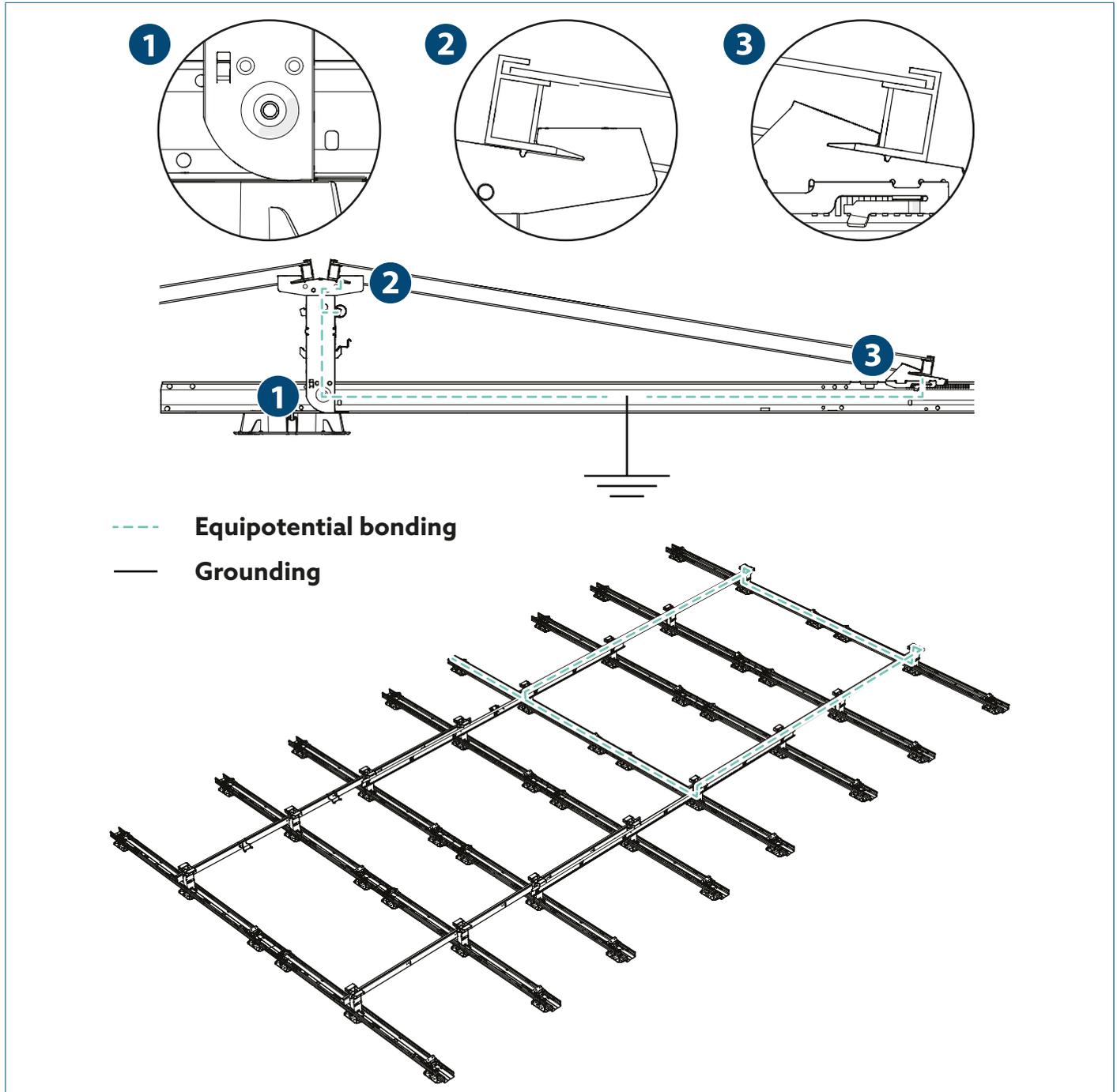
	Spacing ≤ 350 mm	Spacing > 350 mm
		
Number of cable brackets	1	2
Positioning of the cable bracket	in the middle between the two stabilizers	2× 10 cm next to the two stabilizers
Fixing of the cable	Cable ties	Cable ties
	End of a row without stabilizer	End of a row with stabilizer
		
Number of cable brackets	3	0
Positioning of the cable bracket	1× 10 cm next to the end of the stabilizer 2× 5 cm next to the high base	 Do not lay the cable over the end of the stabilizers: sharp edges can damage the cable.
Fixing of the cable	Cable ties	Cable ties

B. Grounding and equipotential bonding

Method for grounding/equipotential bonding

Thanks to the integrated part bonding, no additional equipotential bonding between the metal parts is required:

- 1 Fully tightening the panel clamping ensures the correct contact of the panel frame with the high base
- 2 The cutting edge at the top of the uprights cut into the frame edge of the solar panels.
- 3 The cutting edge at the bottom of the high base elements cuts into the module frame of the solar panel.



Installation of equipotential bonding conductor

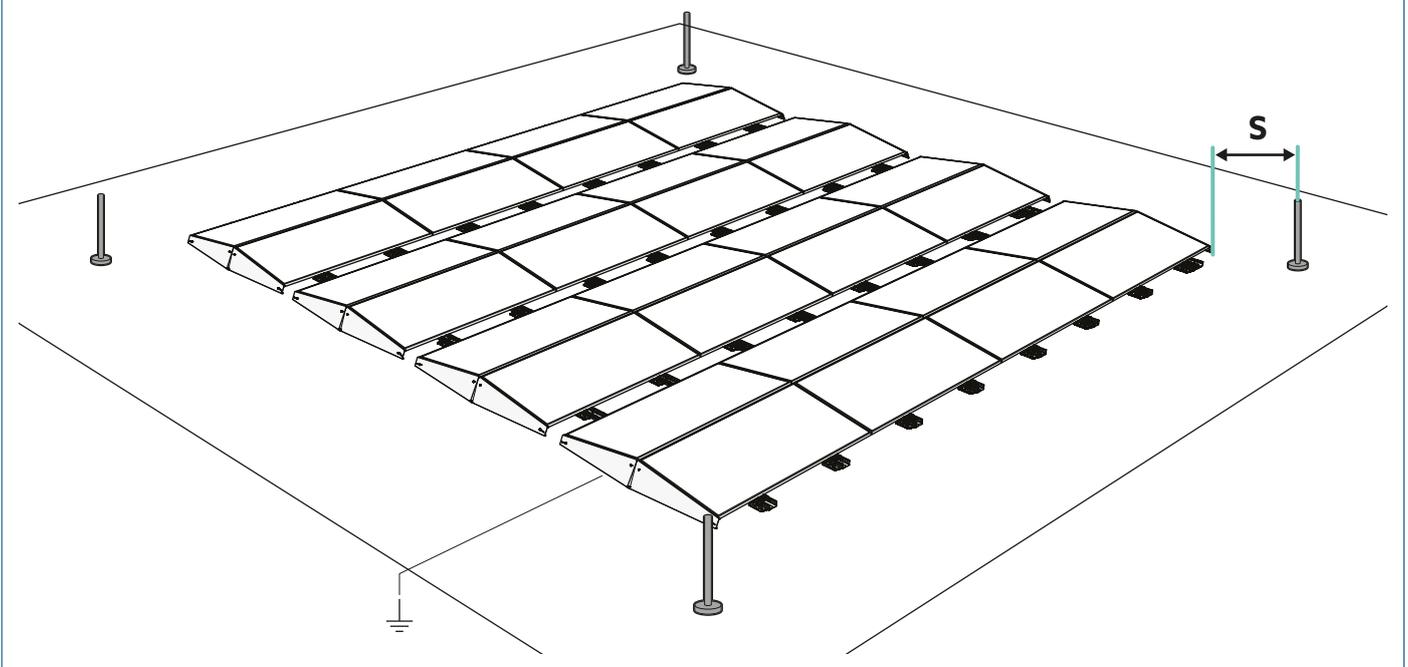
- The earthing conductor ($\geq \varnothing 4\text{mm}^2$) runs parallel to the plus and min. conductors and is connected to a separate earthing point of the inverter.
- Each individual PV field will have its own bonding conductor.
- At least one unit in a field must be connected to an earth rail.
- The earthing cable can be fitted with a cable eye and screwed to the rail together with serrated spring washers.
- Correct installation: protected against corrosion and firmly assembled.

C. Lightning protection

Preferred method: Installation of lightning protection system (LPS) with air-termination rods

Determine the safe separation distance (S in graphic below) according to NEN-EN-IEC 62305 (minimum 0.5 metres). Maintain this separation distance as a minimum between the solar panels field and lightning protection system (LPS).

- i** In this way you keep the solar panel field separate from the existing LPS and prevent lightning current from being conducted into the field.
- i** The correct distance for ' S ' can be calculated using the formulas in the EN-IEC 62305-3 series.



Alternative method: connecting the PV system to the LPS

Is it impossible to maintain the required separation distance or is it specified that the PV system must be integrated into the lightning system? Then combine the PV system with the lightning protection system in accordance with EN-IEC 62305. Please refer to the table below.

Mesh size	LPL level	Connect the PV system every
5 x 5 metre	I	5 metre
10 x 10 metre	II	10 metre
15 x 15 metre	III	15 metre
20 x 20 metre	IV	20 metre

A few points to note:

- To ensure the integrity of your installation, the complexity of lightning conduction requires an expert assessment by a qualified lightning protection expert, regardless of the preliminary recommendations provided by our planning tool.
- Calculate with our calculator tool to get an accurate estimate for your installation plan.
- Make sure that cable supports, ducts, etc. are grounded and connected to the lightning protection system.

! Metal cable brackets also form part of the PV system.

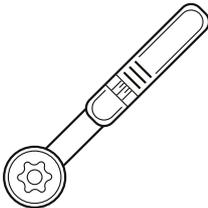
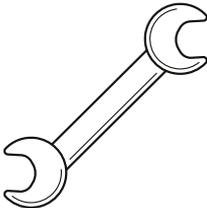
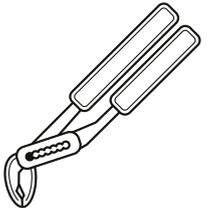
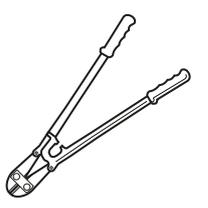
- Check whether an additional type 1 or type 2 surge protector is required for the cable lines (according to standard EN-IEC 62304).
- Preferably lay the cabling of the PV system in separate metal earthed conduits over the entire route, from roof entry, via inverter to the main distributor. The conduit should preferably be grounded to the roof safety net of the lightning protection system, to the grounding point at the inverter and to the earth rail at the main distribution system.

- An earth wire must run along the cabling of the PV system, coupled to the roof protection grid of the lightning protection installation, coupled to the ground point at the inverter and coupled to the main earth rail of the main distribution system.
- Each individual PV installation must have an inlet and outlet to the lightning protection system at each corner of the field.
- To connect to the external lightning protection system, use a round aluminium or copper conductor (solid wire) with a minimum cross section of $\varnothing 8$ mm (= 50 mm²).
- To reduce the contact resistance, each rail connector must be bridged. Use aluminum wire as described below (tested and approved solution).

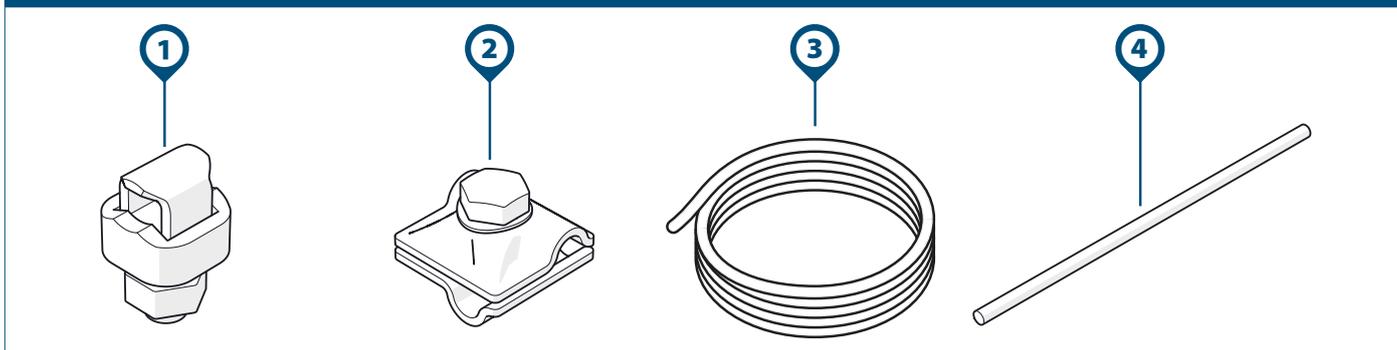
! PanelClaw is in no way responsible for the installation and/or connection of lightning protection on the roof. Get expert advice from your specialist and ensure that a safe installation can be guaranteed according to EN-IEC 62305 and HD-IEC 60364.

Preparation

1 Make sure all the required tools are at hand.

			
Torque wrench up to 25 Nm with hexagon bit size 13	Open-end wrench size 13	Water pump pliers	Bolt cutter

2 Requirements for the integration of PanelClaw Wave in the LPS

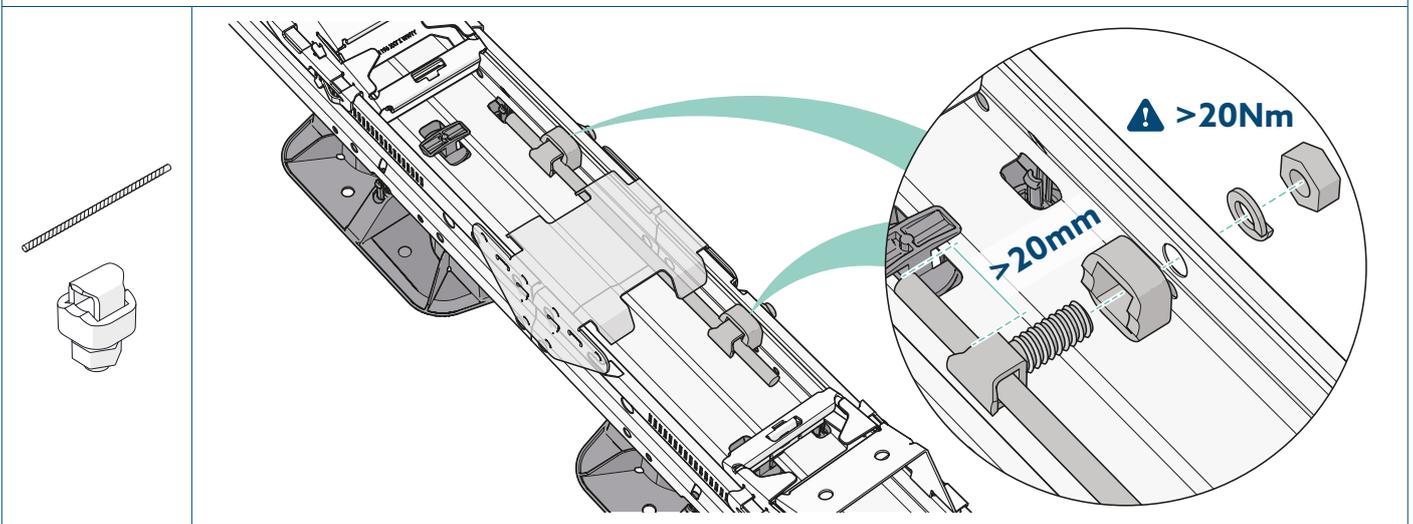
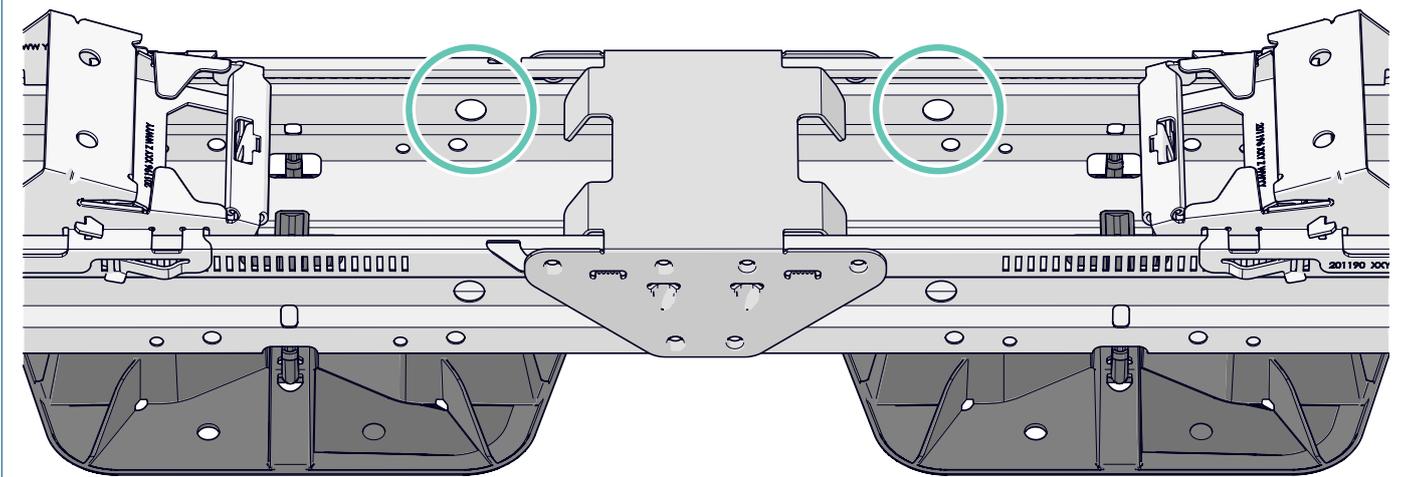


Component	Article number
4 Wave Lightning connector	1009133
5 Wave Lightning connector Cross	1009134
6 Wave Lightning Alu wire long	1009135
7 Wave Lightning Alu wire short	1009136

i Get expert advice from your lightning protection expert.

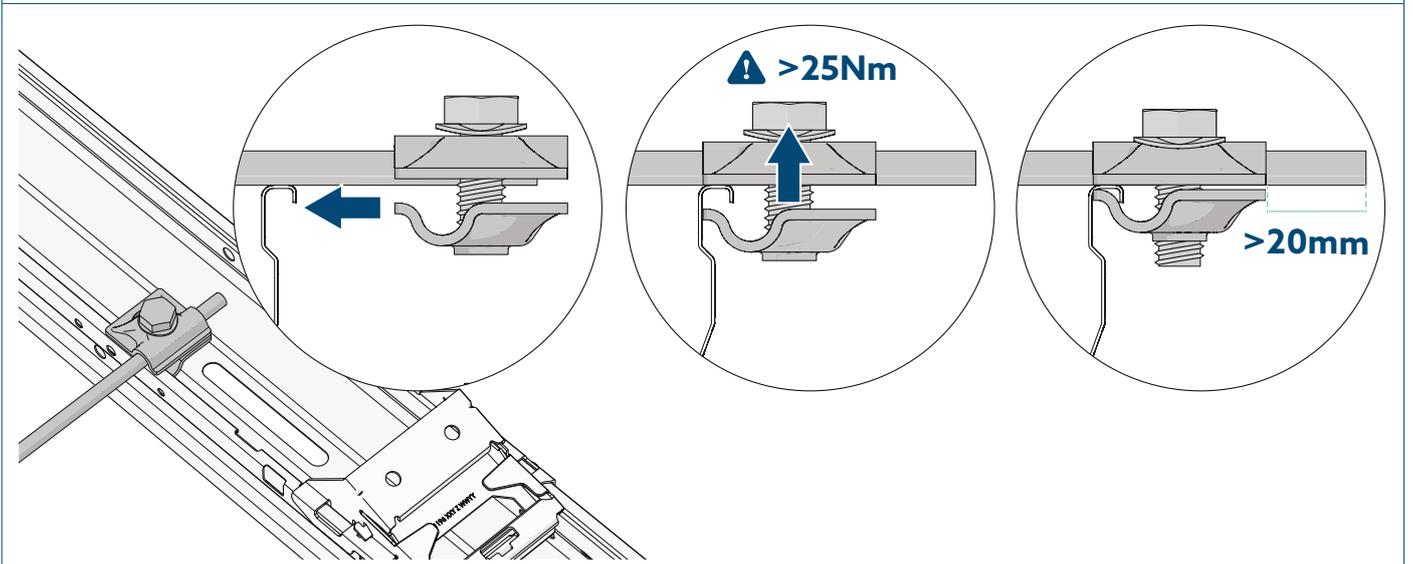
Installation

- 1 Attach a short Alu wire with two Wave lightning connectors, washers and nuts in the circled holes at each coupler between two modules.



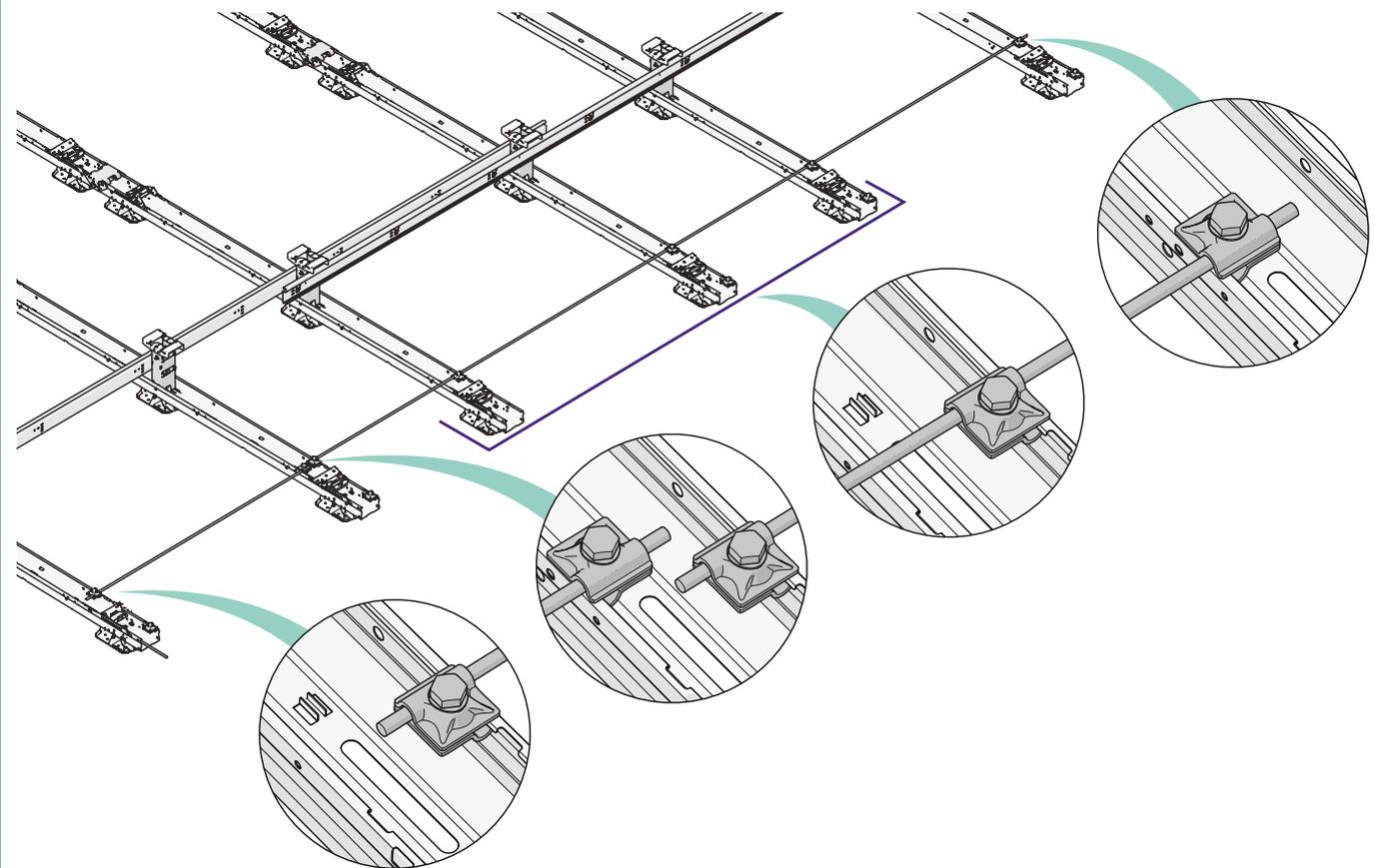
- 2 Attach a cross connector on each module behind the first panel clamp and insert a long Alu wire.

- i** Ensure that the cross connector clamps the module on a solid section of the rail, without gaps.
- i** Attach the cross connector behind the panel clamp so the solar panels cover the alu wire and keep it out of sight.
- i** You can also attach the cross connectors in front of the solar panel clamps if the solar panels are already installed.

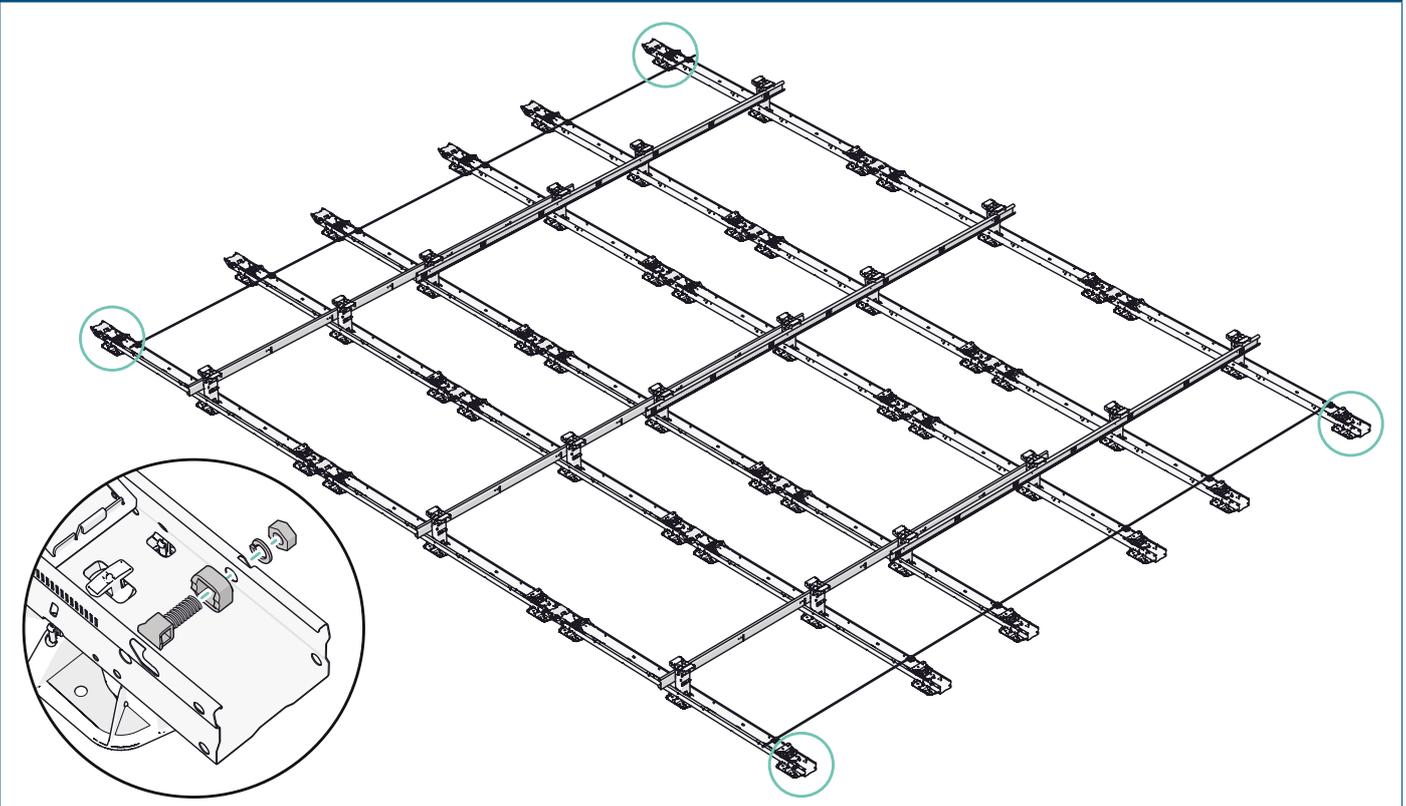


3 Connect all modules in the width direction of the (individual) field with each other with Alu wire and cross connectors.

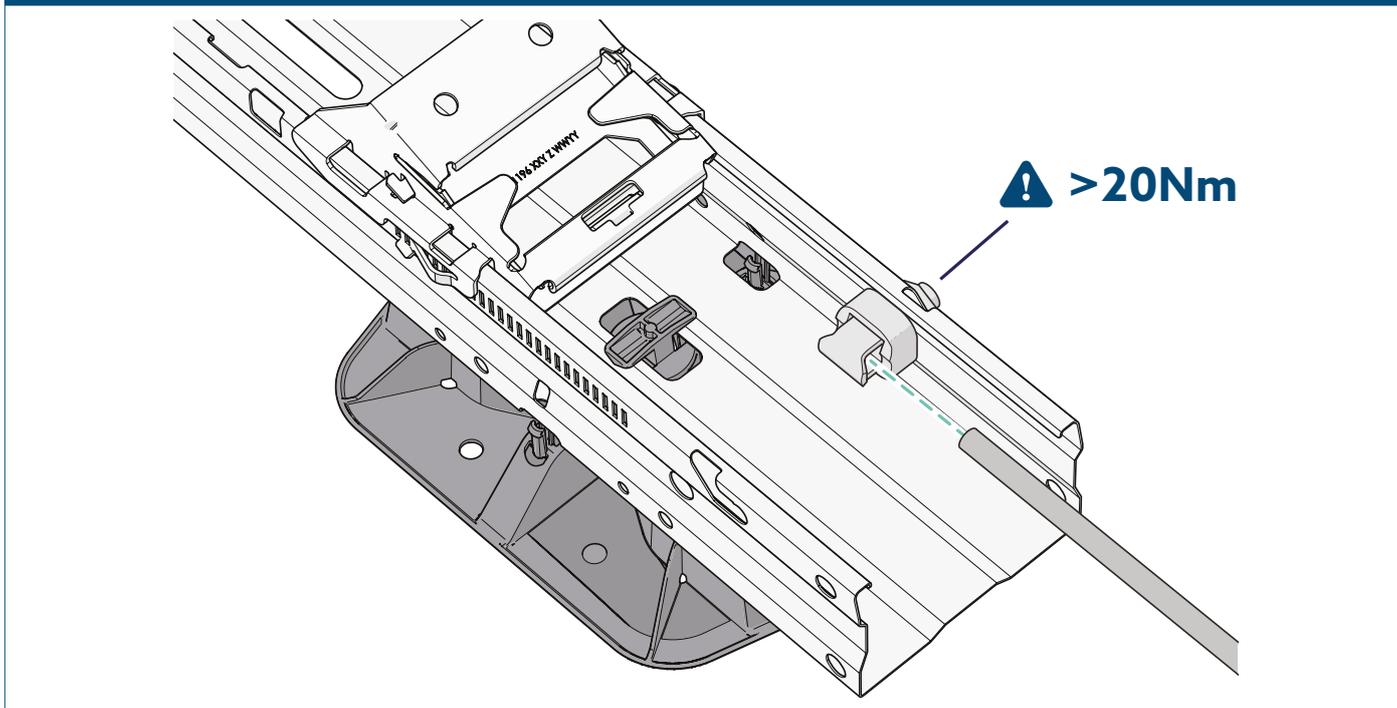
i If a single Alu wire is insufficient to connect all modules, add a second cross connector next to the last connector of the Alu wire and insert a new alu wire to continue linking the modules together.



4 Mount the four Wave Lightning connectors in the holes in the modules at all corners of the field for the connection to the roof trap.



- 5 Attach an aluminium or copper conductor with a diameter of at least $\varnothing 8\text{mm}$ to the four Wave Lightning connectors. Attach the four conductor wires to the LPS on the roof.



- i** The connection of the PV system to the external lightning protection system can now be established. To do this, attach a round aluminium or copper conductor (solid wire) with a minimum cross section of $\varnothing 8\text{mm}$ (= 50mm^2) for the incoming and outgoing line on the one side to the four KSV 7.10 connectors and on the other side to the external lightning protection system.
- i** The PanelClaw Wave mounting system has been tested and approved for use in accordance with EN-IEC 62305. The lightning current carrying capacity has been tested according to EN 62561-1 and complies with test class N (50kA).

D. Removal, replacement, and recycling

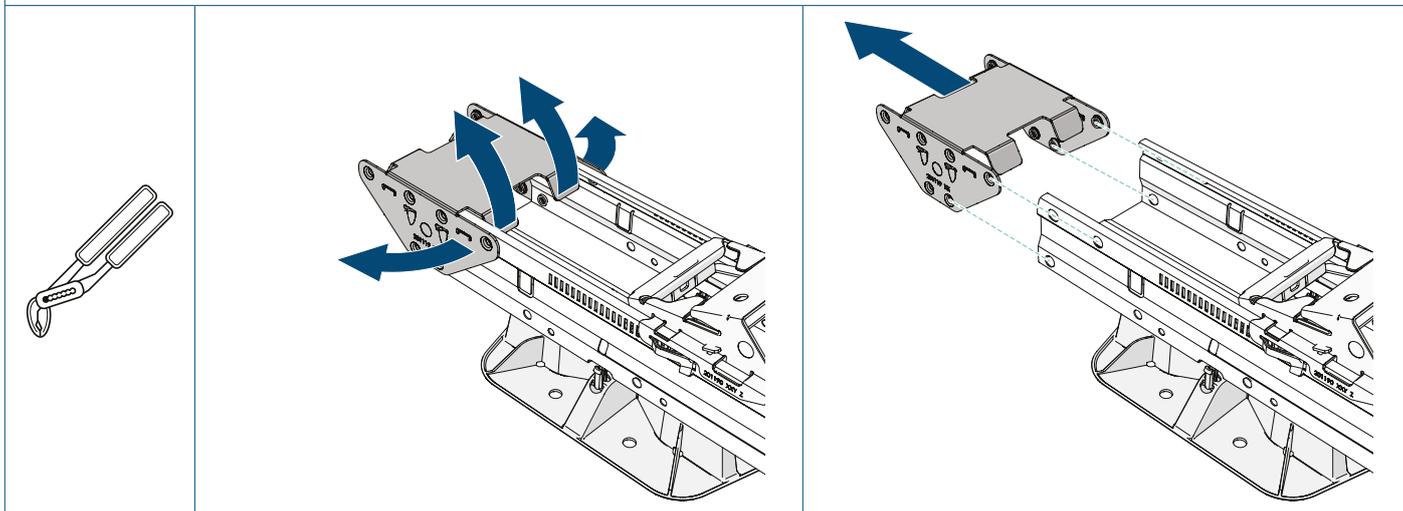
General

Always follow local laws and regulations when dismantling the mounting system and disposing of it.

Removing coupler

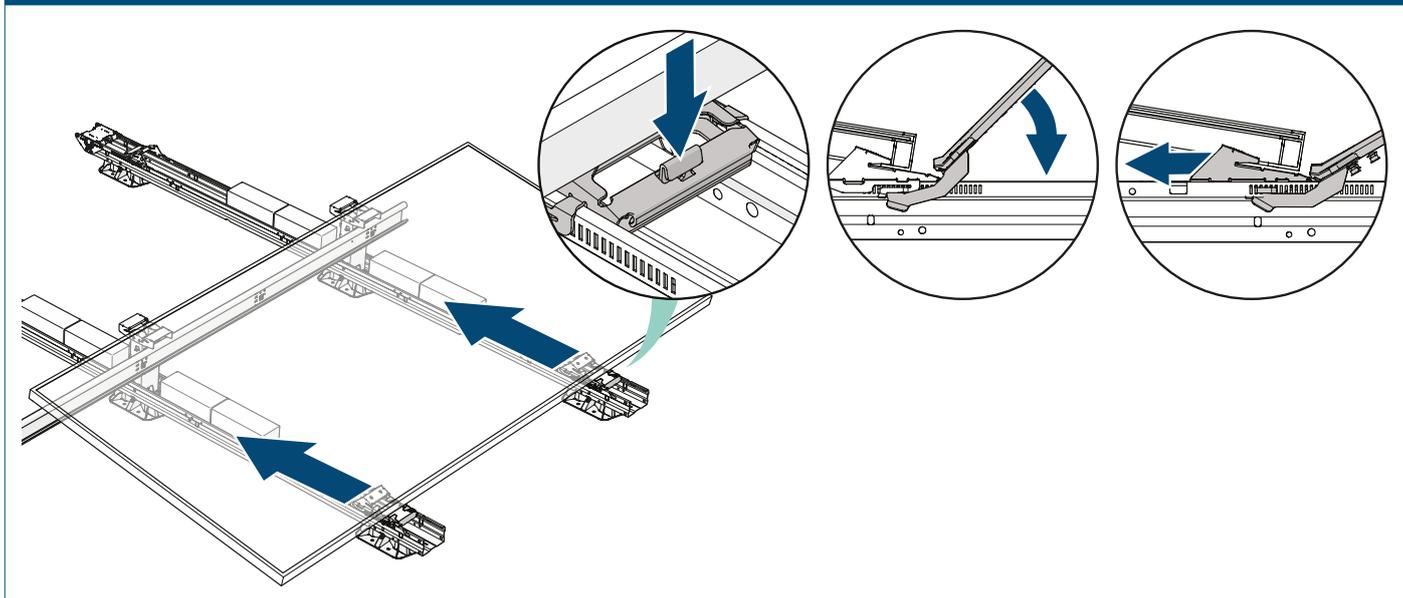
Remove the coupler from the first row of units if it is in the way

i Couplers can not be re-used after removal.



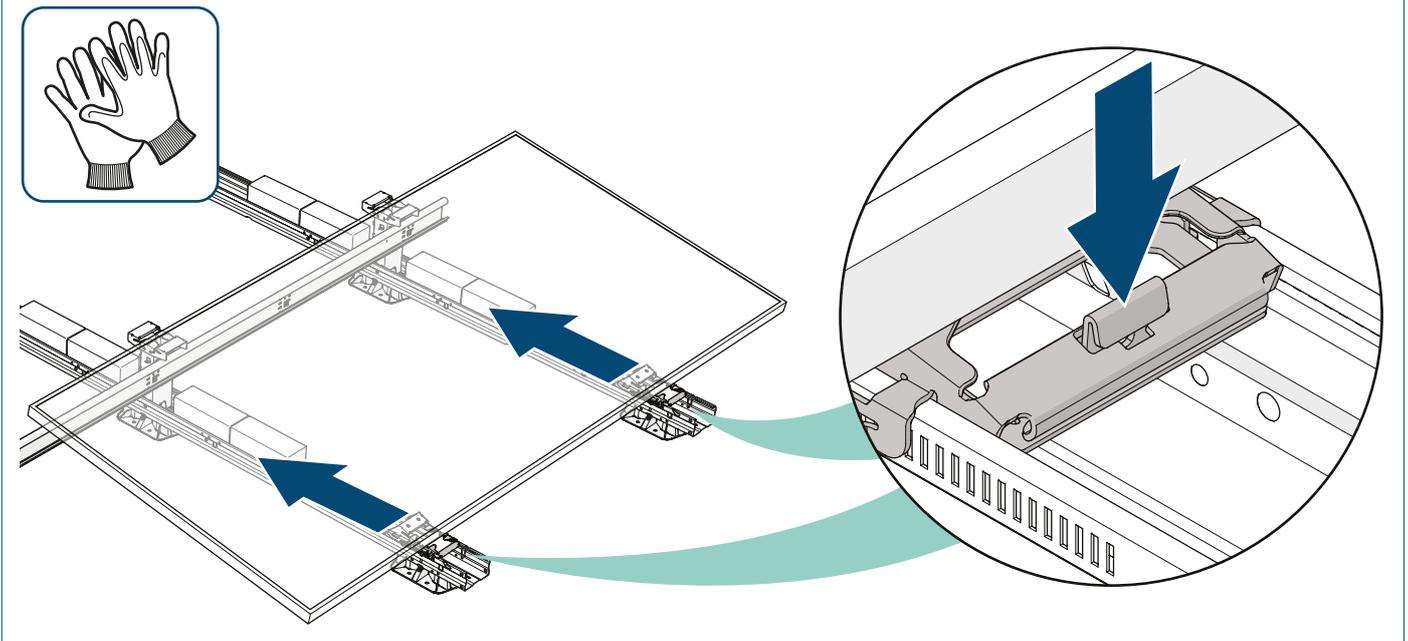
Removing a solar panel

- 1 Unlock the panel clamp using a small flathead screwdriver.
- 2 Slide the panel clamp back using the module unlock tool.
- 3 Lift the front of the solar panel 2 to 3 cm and push it back to slide the solar panel out of the high bases.

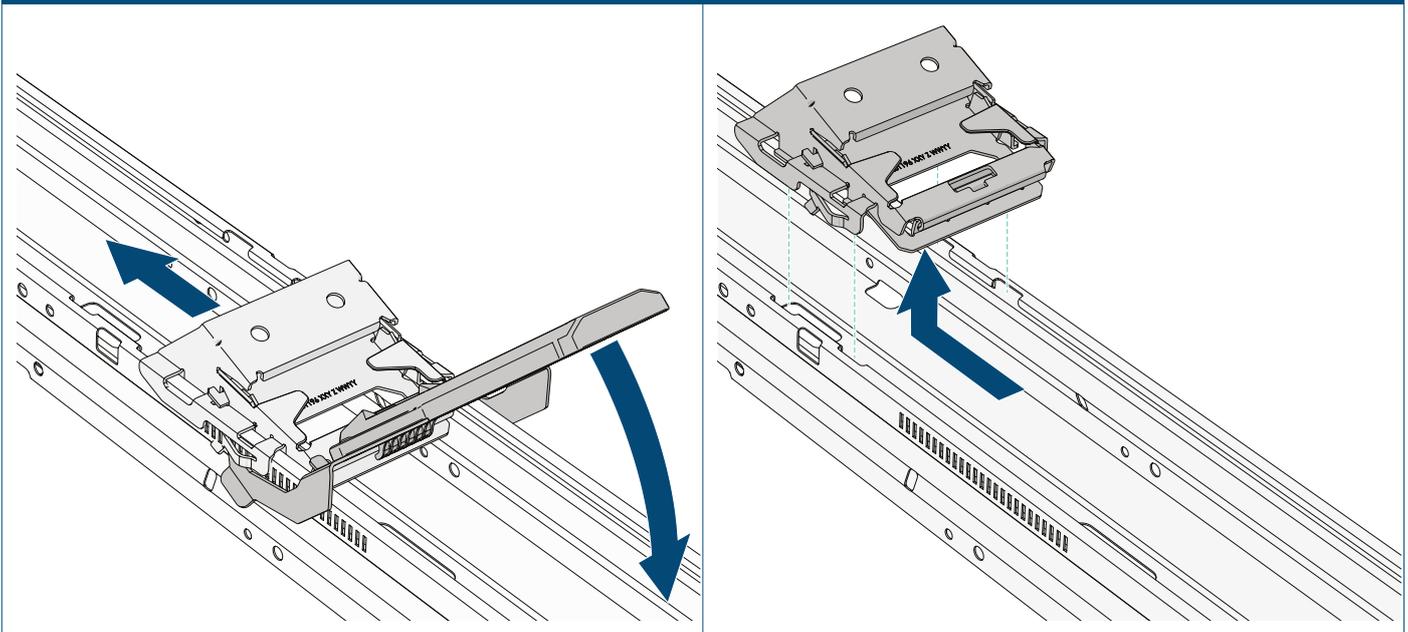


Removing a panel clamp

- 1 Unlock the panel clamp using a small flathead screwdriver.

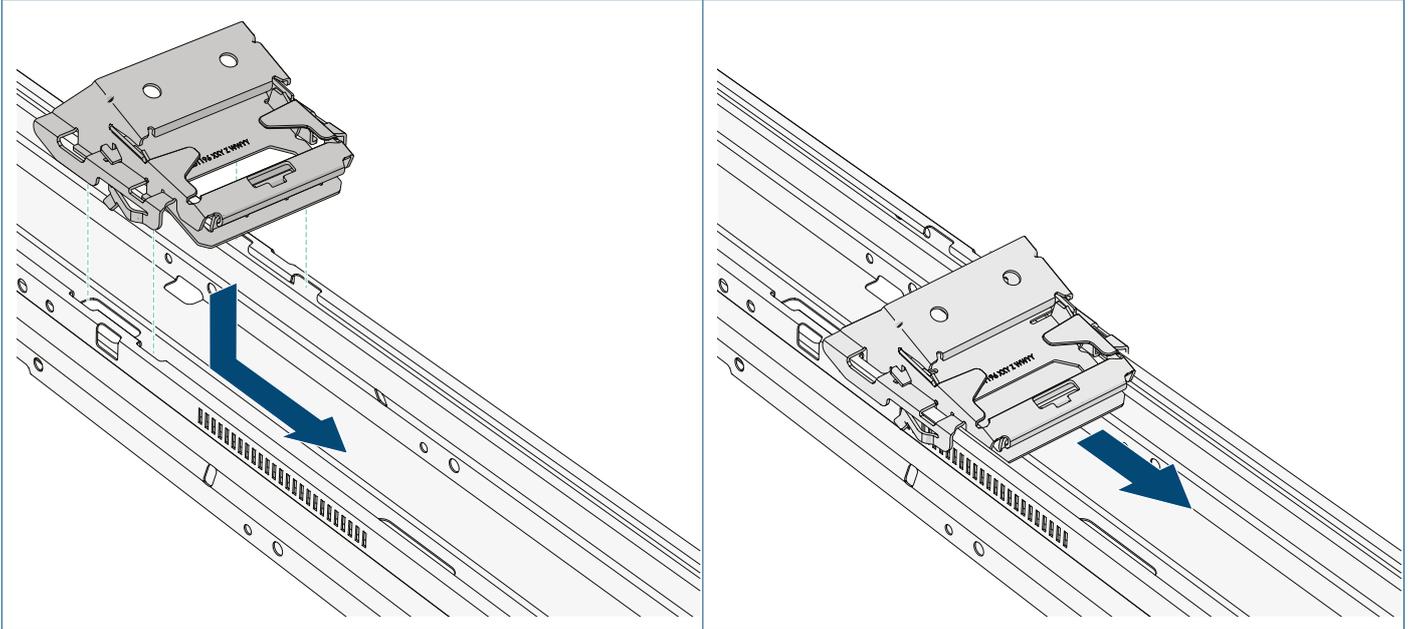


- 2 Slide the panel clamp back using the module unlock tool.
- 3 Remove the panel clamp from the module.

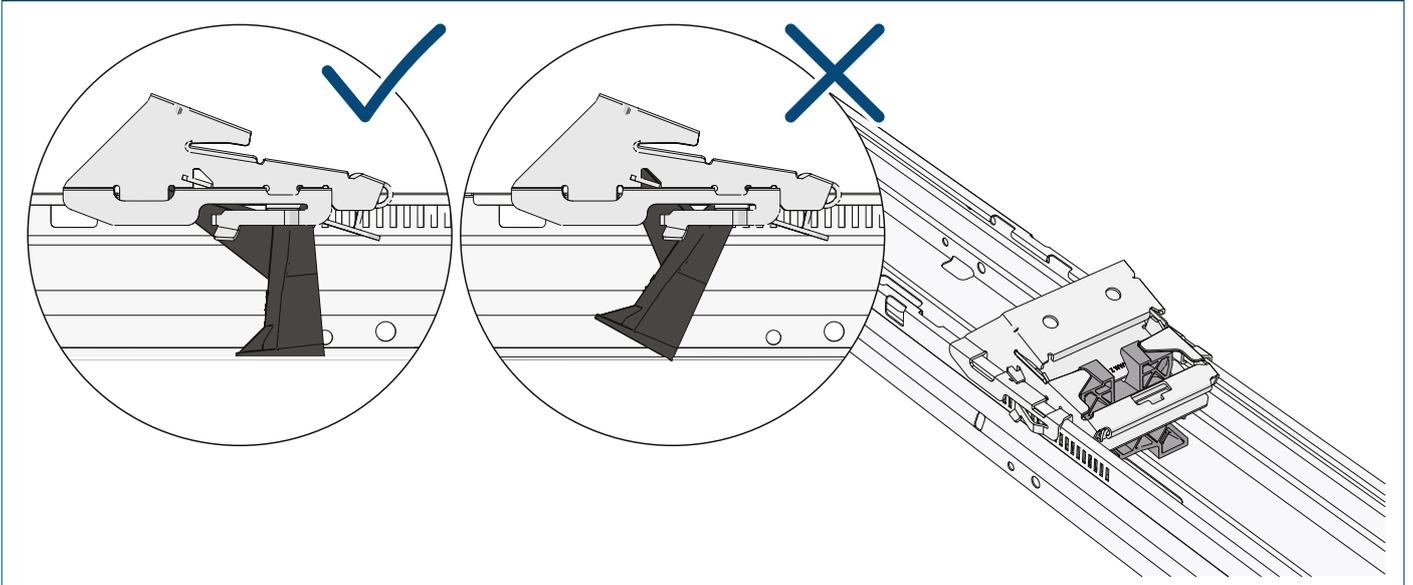


Replacing a panel clamp

- 1 Place the replacement panel clamp into the module.
- 2 Pull the panel clamp forward until it locks into the first slot of the locking mechanism in the module

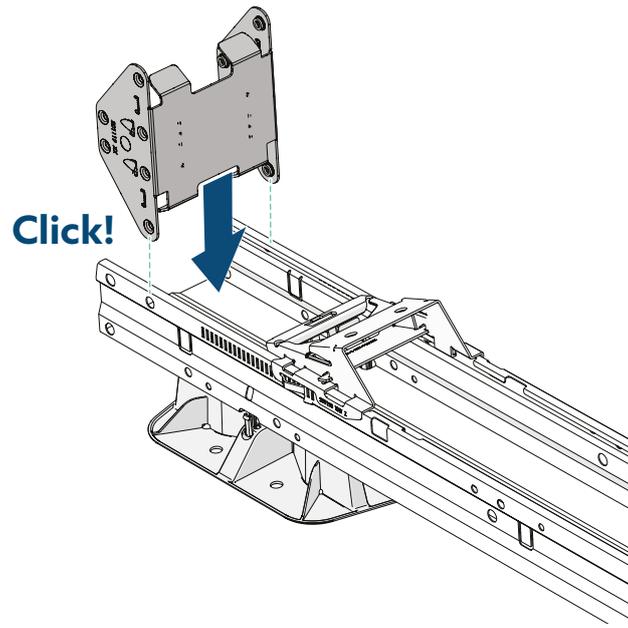


- 3 For projects with the Wave Dual High Load system, check if the Snow Load addons are properly positioned upright underneath the panel clamps, also after performing maintenance.



Replacing a coupler

- 1 Position the replacement coupler at a 90 degree angle on the edge of the module.



- 2 Push the coupler down over the module until the coupler clicks into the holes in the module.
- 3 Tilt the coupler down until it clicks into the bottom holes in the module.

