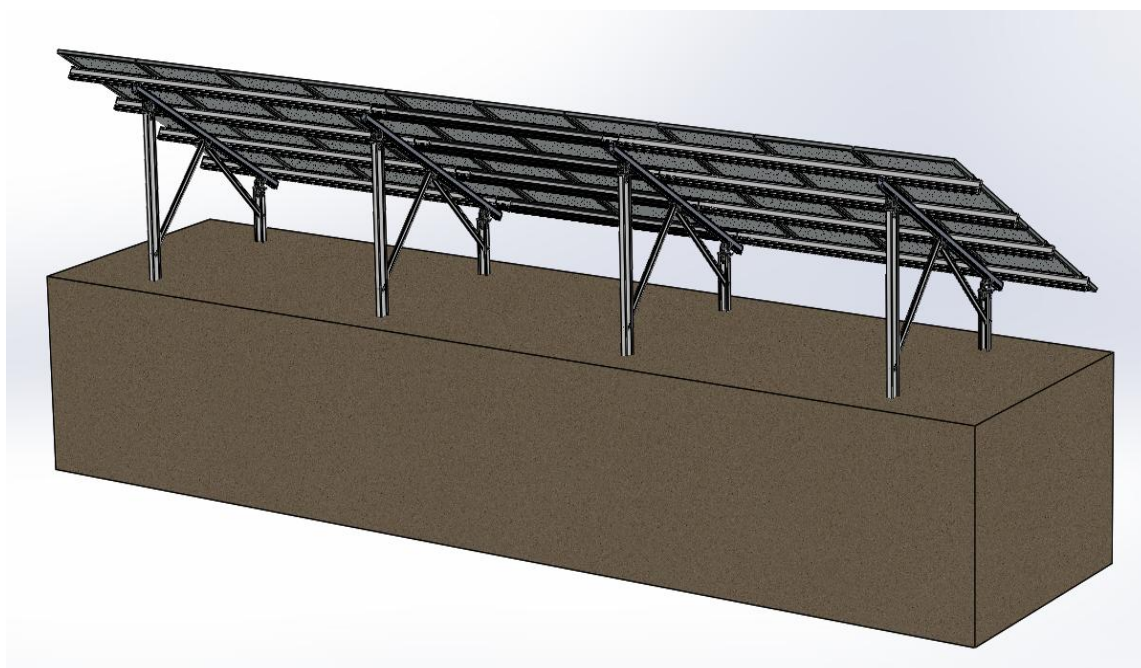


Ground Mounting System Installation Guide



GS Pile Ground Mounting System is applicable for the large commercial and utility scale PV system on a non-sandy ground. It is suitable for the framed or frameless module installation.

In GS Pile Ground Mounting System, Open Column can be pile into the ground 1~2meters by Pile Machine quickly, and the Beam is pre-assembly, the size of the Pile and the MR-Rail is plan and machined on factory to eliminate the weld and cut on installation site to save your install time and cost.

The installations please follow the procedures and precautions in these instructions carefully. And it must be complied with the local construction acts and the safety laws.

1. Introduction

1.1 Intended use

- Are intended to be used by individuals with sufficient technical skills for the task. Knowledge and use of hand tools, measuring devices and values is also required.
- Include various precautions in the forms of Notes, Cautions, and Warnings. These are to assist in the assembly process and/or to draw attention to the fact that certain assembly steps may be dangerous could cause serious personal injury and/or damage to components. Following the step-by-step procedures and these precautions should minimize the risk of any personal injury or damage to components making the installation not only safe but an efficient process.

1.2 Service life warranty

Grace Solar provides a warranty of 10 years for the service life of all materials used.

1.3 Safety

The following basic safety instructions and warning symbols form an essential part of this manual and are of fundamental importance when handling this product.

- Do not remove or disable any safety devices
- Comply with the relevant safety regulations.
- The presence of a second party who can provide help in the event of an accident is obligatory during the entire installation process.
- Keep a copy of this installation manual in the immediate vicinity of the system.

1.4 Responsibilities of the owner/operator

The system operator has the following safety-related responsibilities:

- To ensure that installation of the system is only carried out by individuals with specialist technical knowledge and basic knowledge of mechanical engineering.
- To ensure that those commissioned to perform the work can evaluate their assigned tasks and recognize possible risks.
- To ensure that those commissioned to perform the work are familiar with the system components.
- To ensure that the installation manual is available during installation. The installation manual is an integral part of the product.
- Ensure that the installation manual, and in particular the safety instructions, are read and understood by the relevant personnel before installation.
- Ensure that the permissible operation conditions are observed. Mounting systems is not liable for damage occurring when these conditions are not adhered to.
- Ensure the durability of all connections and the attachment of the system.
- Ensure that suitable lifting gear is used for installation.
- Ensure that only Mounting System components are used when parts need to be replaced. Otherwise any warranty claim is null and void

2. Planning

2.1 Installation Location

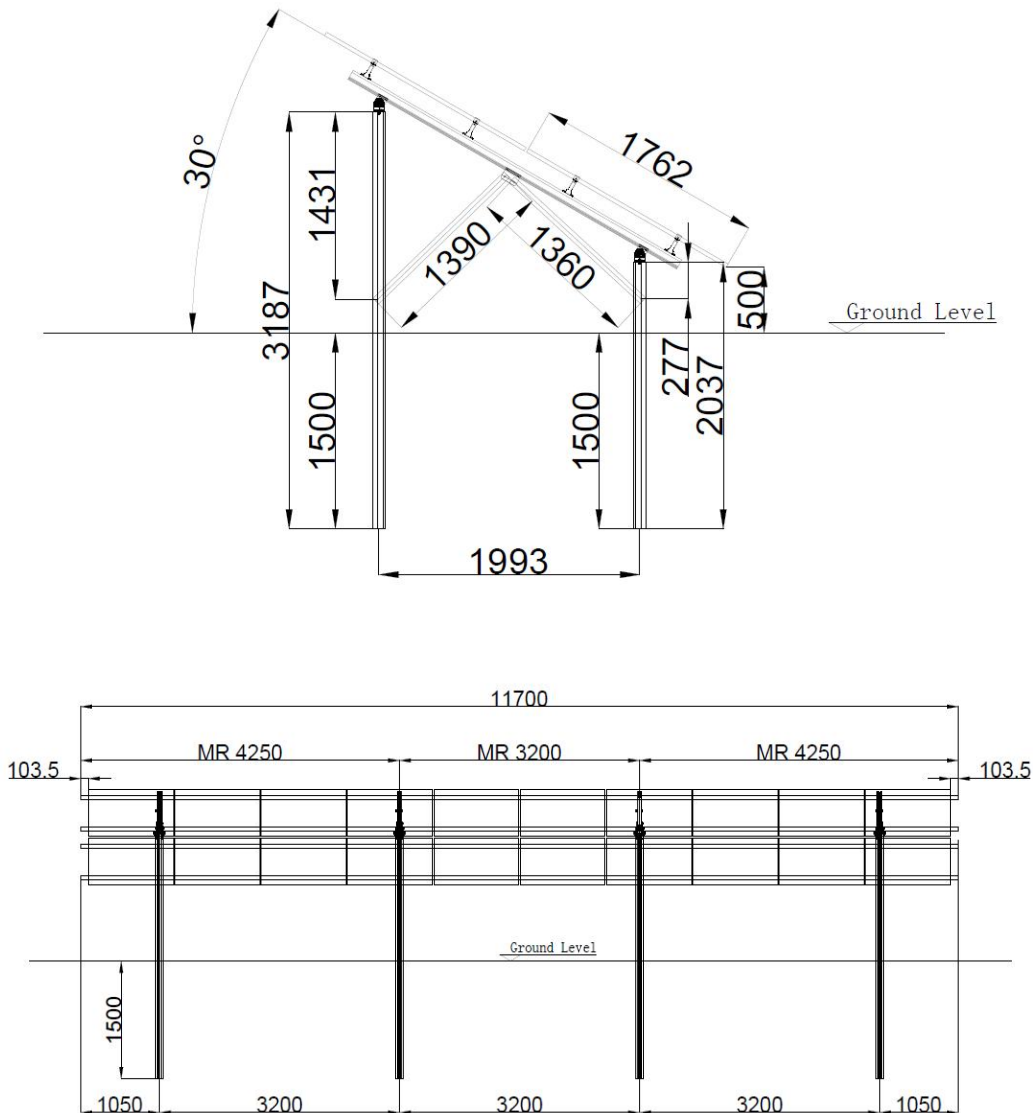
The Pile-Ground Mounting System is application for the particular location, such as non-sandy soil with dense enough. Therefore you have to produce an accordant static and a geotechnical expertise to define the pile length for the Open Column.

It is recommended to consult with the local engineer to do it before the beginning of the project.

2.2 Layout Drawing

A general layout drawing will be made for every system before delivery. This drawings show the accordant admeasurements and the position of every components and also the type of the connectors.

For example, when the module size is 1762x1134x30mm, the array configure is 2x10, which is placed portrait, the tilt angle 30deg and the front pile length is 2037mm and the rear pile length is 3187mm. Therefore, the planning drawing shown as follows.



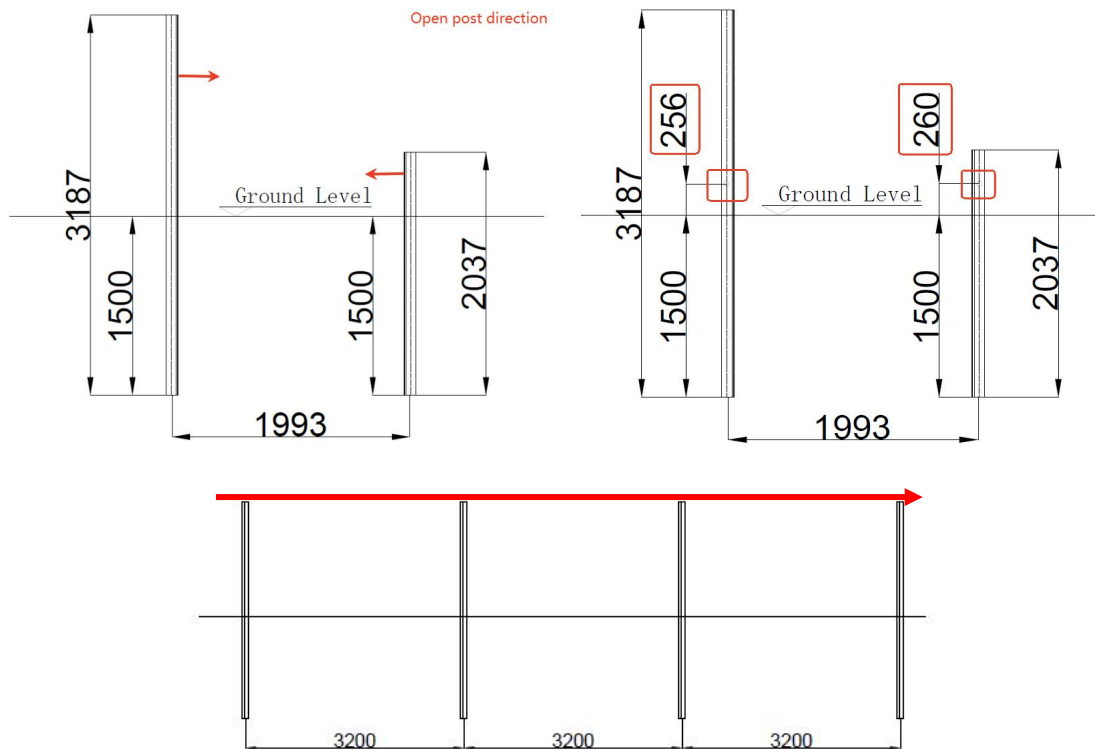
2.3 Grounding Planning

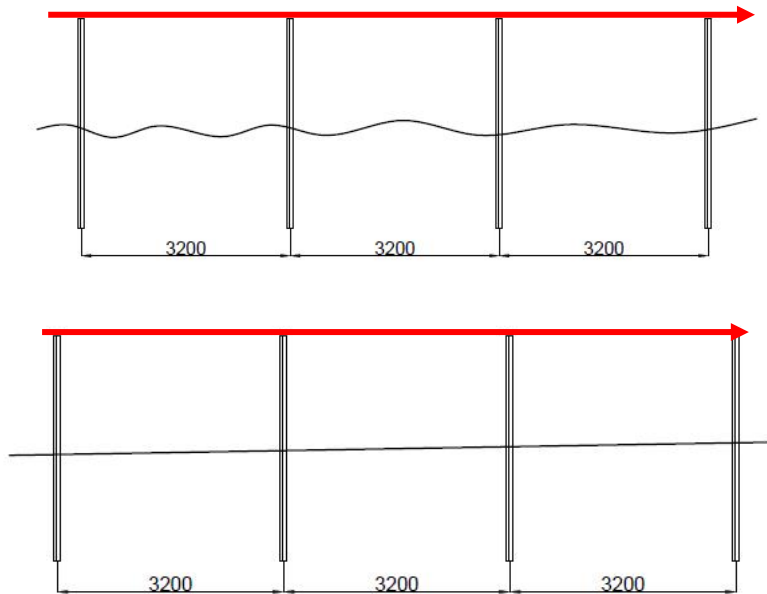
The grounding work has to be carried out by business specializing in grounding. Based on our design of the units you have to compile grounding plans so that the works flow smoothly. These plans have to be completed at least a week before the beginning of the grounding work. These plans have to show the position of the piles and have to dimension it accordingly. Furthermore, you have to mark the first and the last pile of every line with a dowel. If a line is longer than 50m there will be markings (dowels) necessary within the lines.

After planning and confirming the driving position of the pile, according to the drawing, drive the pile to a depth of 1500mm and drive the open post perpendicular to the horizontal plane. Please note that the opening directions of the two columns are in different direction. Pls see the drawings as below.

Because the ground may be uneven or have a small slope, it is necessary to ensure that the top of the column is on the same horizontal plane to facilitate subsequent installation. This needs to be adjusted by the construction team according to the on-site conditions during installation. Since there are holes on the column for connecting the diagonal brace, pay attention to the driving depth of the column and do not bury the hole to affect the installation.

The driving depth and the schematic diagram of pile driving on horizontal ground, uneven ground, and sloped ground are as follows:





2.3.1 Tolerance by grounding:

The grounding company should keep the following tolerances to provide a good basis for the further mounting.

Height	Slop (North-South)	Slop (East-West)
±10mm	±1 deg	±1 deg

Tolerance grounding

2.3.2 Grounding with difficult surface:

- Notice that grounding profiles have to be marked clearly and they have to be hold in a grounding plan.
- Irregularities by grounding that may affect the pile adhesive have to be noted (e.g. inclination, decrease with a following sudden rise of the penetration velocity, swift penetration velocity of the pile while grounding.

- Every action that departs from the guidelines for pile-grounding has to be cleared up with the engineer
- If a pre-drilling is necessary because of possible grounding bars (boulder in the ground or high laid bedrock level), it has to be proceeded as follows:
 - Pre-drilling down to the designed grounding depth
 - The drilling product has to be exhausted,
 - Fill the blast hole 0.80 m with compressed concrete (quality min. C16/20) and compact it in two steps (each with 0.40m), fill the remaining height with drilling product and compact it
 - ground the pile within 3 hours.
 - Test loading on 10 finished grounding piles that are picked arbitrary.
 - The test loading is applied by hanging dynamometer or by accordant appropriate measuring system. The piles need to be tested for compression and pull-out resistance to see if they meet the project requirements.. Please send the results to engineer in a test chart. Furthermore it is important that the construction management on-site is readily identifiable in the test chart. The construction manager has to guarantee for the correctness of the measurement with his signature. Among the grounding work please do also document the values of the tested piles in a printout.

2.3.3 Treatment after grounding

After the grounding the upper parts of the piles have to be coated with zinc dust primer (ca. 3 cm).

Attention!

Only a special color (Zinc Dust Primer) will give the needed protection and is accredited according to the standards. Simple zinc color-sprays will not give long-term protection!

2.4 Installation Tools

Allen Key 6mm



Coach Wrench
(for M10~M12 Hex Bolts)



torque Wrench



Power Tool



Power Tool Bit For Hex Bolt M10
and M12



Drill Bit for Power Tool (5mm)



Tape Measure



Rope



Wood Hammer



Laser Theodolite

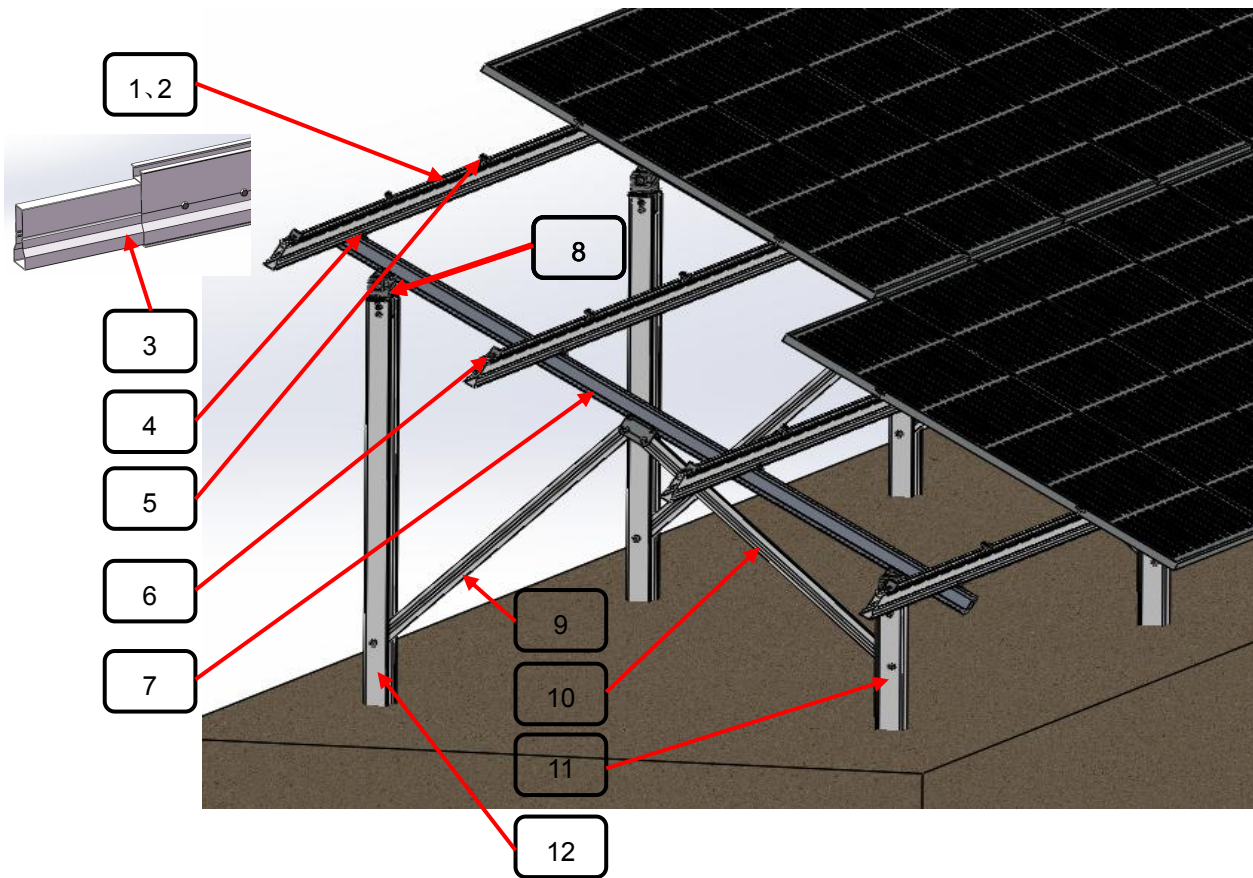


Pile Machine



Note: the Laser Theodolite and the Pile Machine is chose according to the actual requirement.

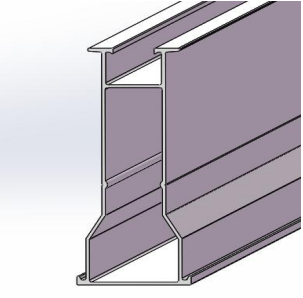
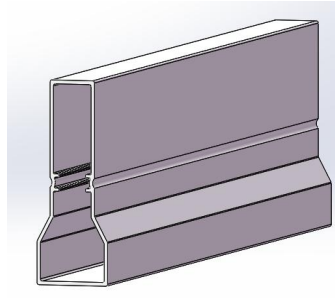
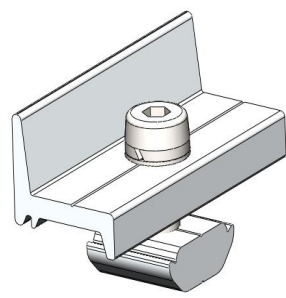
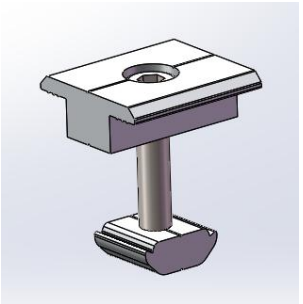
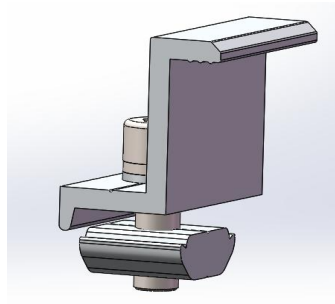
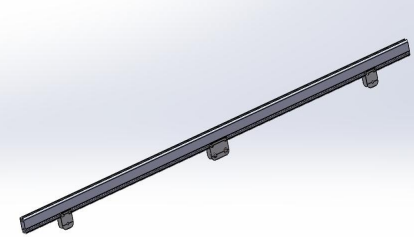
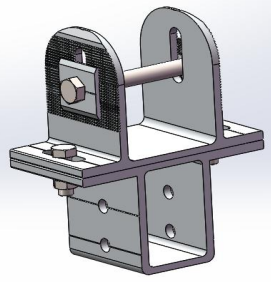
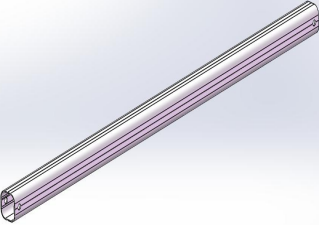
2.5 Structure appearance



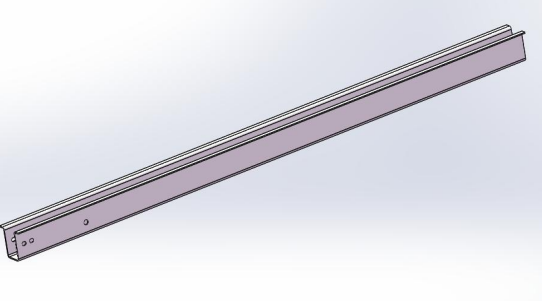
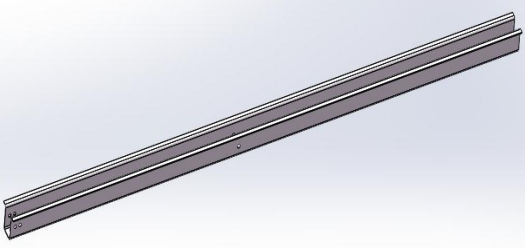
The system overview shows all system parts..

Item	Code	Description	Spec
1	GS-MR-3200-Q01	MR-Rail	3200 mm
2	GS-MR-4250-Q01	MR-Rail	4250 mm
3	GS-MR-SP-8ST-Q01	MR-Rail Splice	400 mm
4	GS-MR-C60-Q01	MR-Rail Clamp	60 mm
5	GS-IC-F30-Q01	Inner Clamp Kit	30 mm
6	GS-EC-F30-Q01	End Clamp Kit	30 mm
7	GS-PG5-NB29-3H-Q01	Assembly of Support Beam	2900 mm
8	GS-PG-TC02-Q01	Aluminum Top Cap	150 mm
9	GS-T6060-1390-Q01	Inclined strut, Tube 1390	1390 mm
10	GS-T6060-1360-Q01	Inclined strut, Tube 1360	1360 mm
11	GS-OP99-2037-Q01	Open column 2037	2037 mm
12	GS-OP99-3187-Q01	Open column 3187	3187 mm

2.5.1 Aluminum Parts

		
MR-Rail	MR-Rail Splice	MR-Rail Clamp
		
Inner Clamp Kit	End Clamp Kit	GS-PG5-NB29-3H-Q01
		
GS-PG-TC02-Q01	GS-T6060-1390/1360-Q01	

2.5.2 Galvanized Steel Parts

	
GS-OP99-2037-Q01	GS-OP99-3187-Q01

3. Installation Steps

CAUTION:

Install care while working around the structure during assembly;

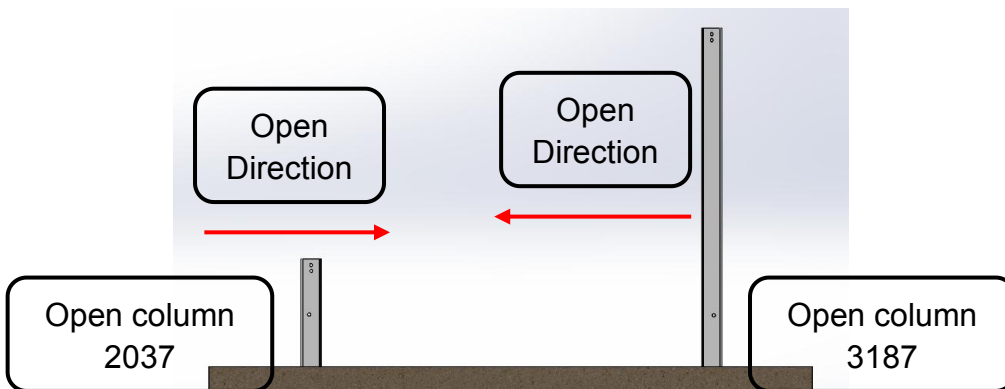
There could be components that create hazards or obstruct free moment causing serious bodily injury; many at head/eye level. Move slowly and with care around the work area.

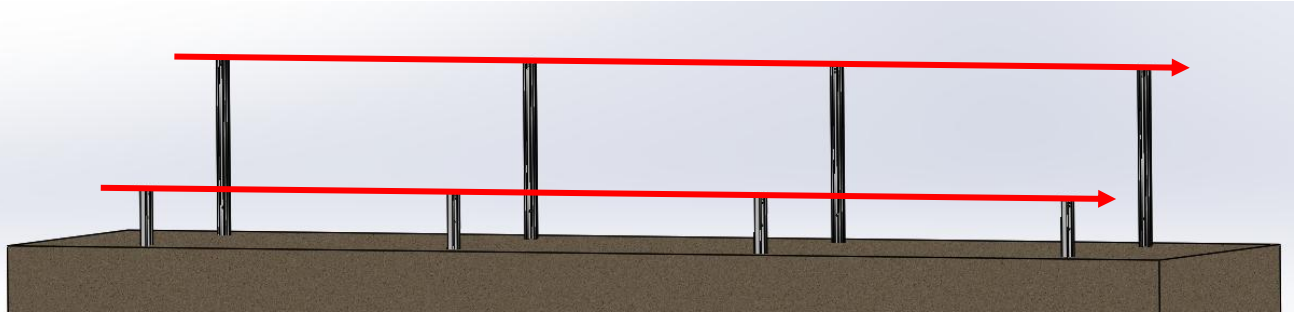
Step 1: Pile the Open Column

- a) According to the layout drawing, mark out the pile point on the installation site.
- b) Piling the Open column into the ground comply with the Chapter 2.3.
- c) Make sure the Open Column is in a line and on the same height by the Laser Theodolite. Ensure that the central axes of the open columns in the same row or column coincide.
- d) The opening directions of the two columns are opposite. The opening direction of the 2037mm long open column faces away from the low point of the component, and the opening direction of the 3187mm long open column faces the low point of the component.



Step 1.b

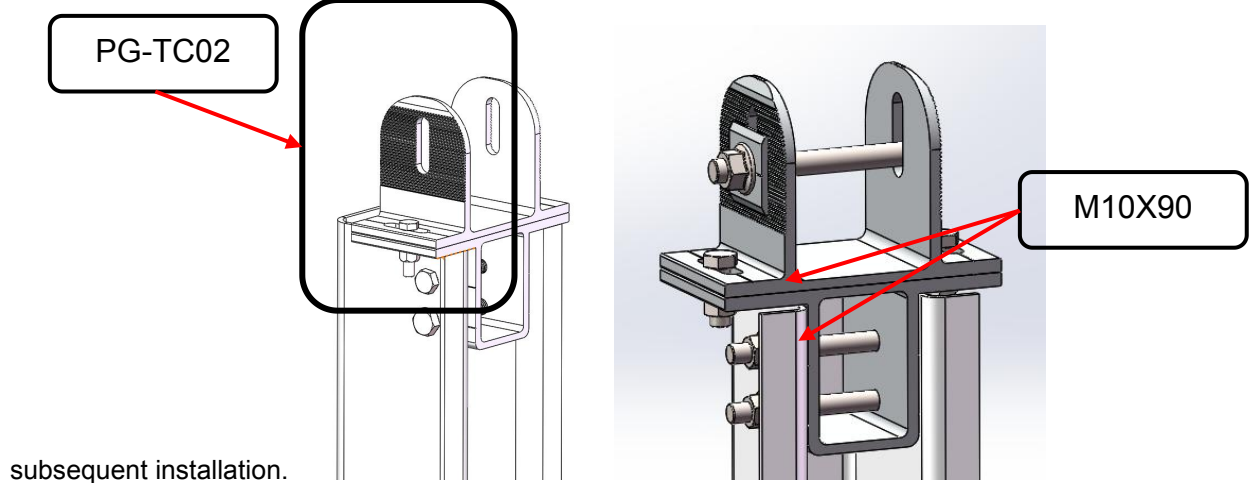




Step 1.c

Step 2: Install the Assembly of Beam

- a) Insert the GS-PG-TC02-Q01 into the inner of the Open Column. Fixed by two Hex Bolt M10x90mm.
- b) Open the Assembly of Beam, We provide pre-assembly for this part, which includes longitudinal beam, three jackets, and two T6060 tubes, to facilitate installation on site.
- c) Fix the pre-assembled two-side jackets on GS-PG-TC02-Q01 with M12x110 bolts. Pay attention to the installation direction of the longitudinal beam. The lengths of the two diagonal braces are different. Reverse installation is prohibited.
- d) Fix the Brace with the bottom hole of the Open Column by the Hex bolt M12x90.
- e) After completing the above steps, check whether the bolts are tightened and the longitudinal beam is firm.
- f) Install other longitudinal beams, keeping both ends of all longitudinal beams in the same plane to facilitate

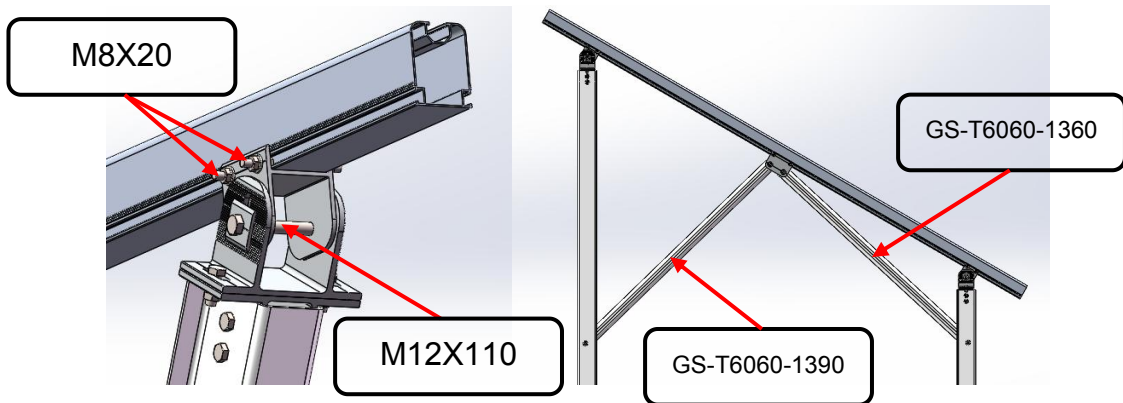


subsequent installation.

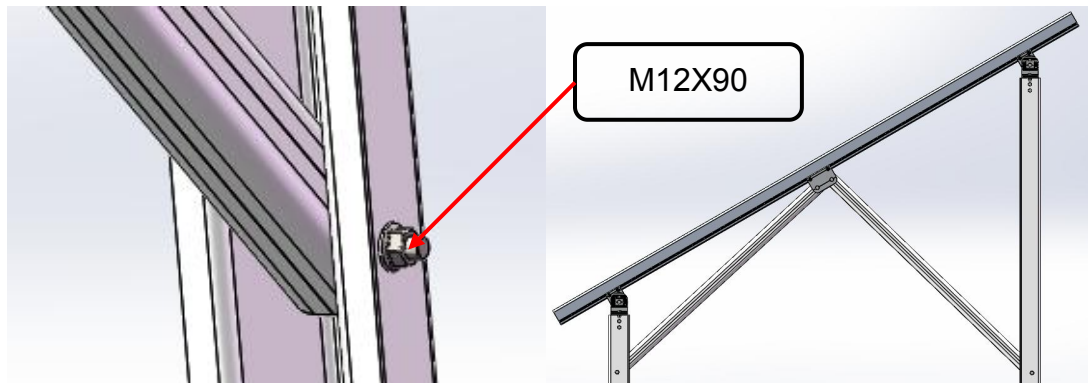
Step 2.a



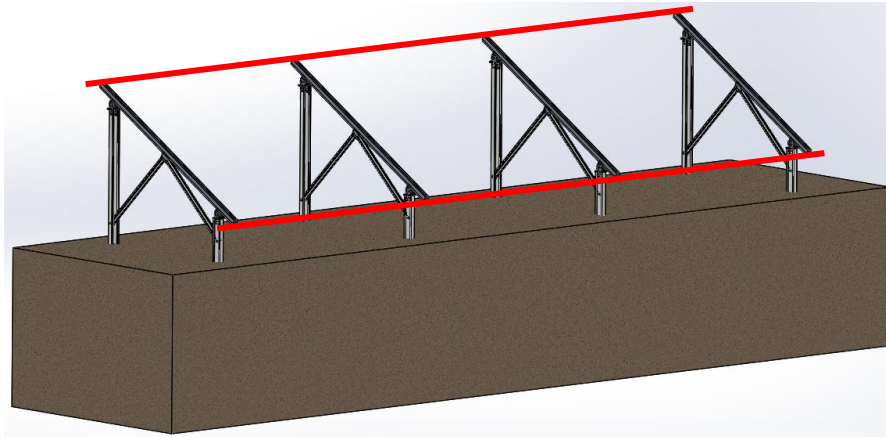
Step 2.b



Step 2.c



Step 2.d

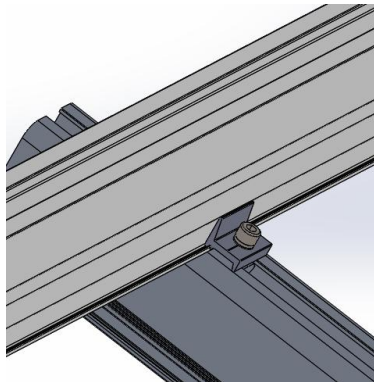


Step 2.e、f

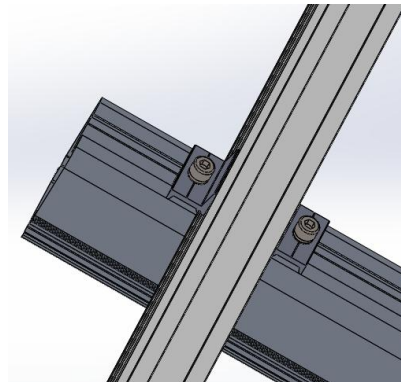
Note: you can release the Hex Head Bolt M12x110 to adjust the space of the TC02 and Beam.
you can release the Hex Head Bolt M8x20 to adjust the space of the top and bottom bracket.

Step 3: Install the MR-Rail on the Beam

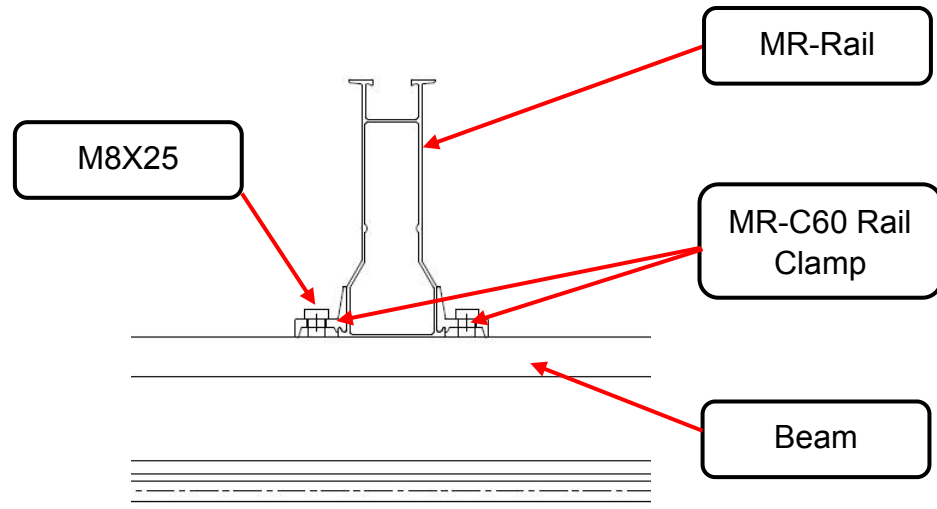
a) Clamp the MR-Rail both side by the MR-C60 Rail Clamp. Place the MR-Rail comply with the planning.



Tilt in the MR-Rail Clamp

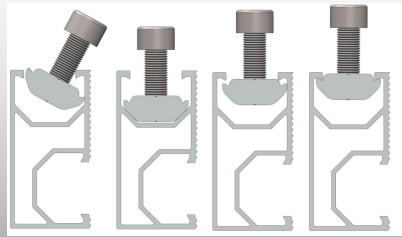


Clamp the MR-C60 Rail Both Side

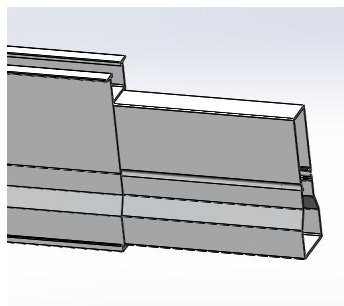


Easy Installation for D-Module:

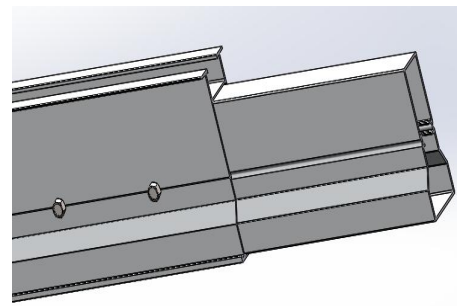
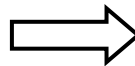
Four Step to put the D-Module into Rail easily;



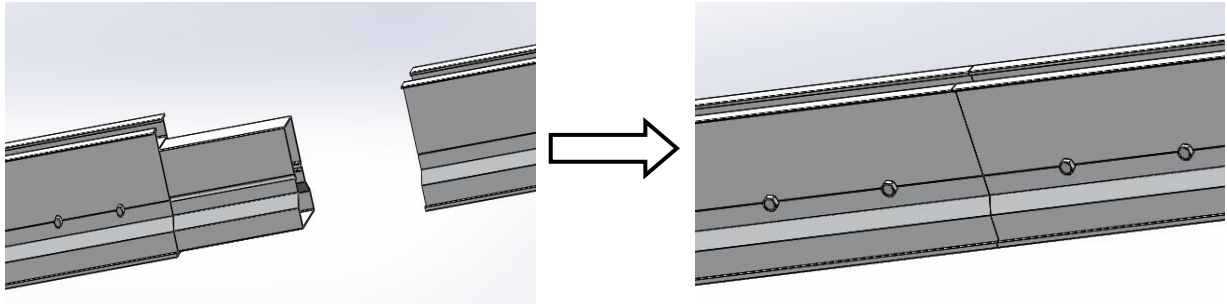
- b) Connection of two MR Rails. At first, insert half of the MR Rails Splice (about 200mm) into one of the MR Rail, drill two 5mm holes and fixed by two self-drill screw st6.3x25. Secondly, insert the other MR Rails into the other end of splice, drill two 5mm holes and fixed by the self drill screw too.



Insert the Splice into Rail (about 200mm)



Fixed by the two self-drill screw st6.3

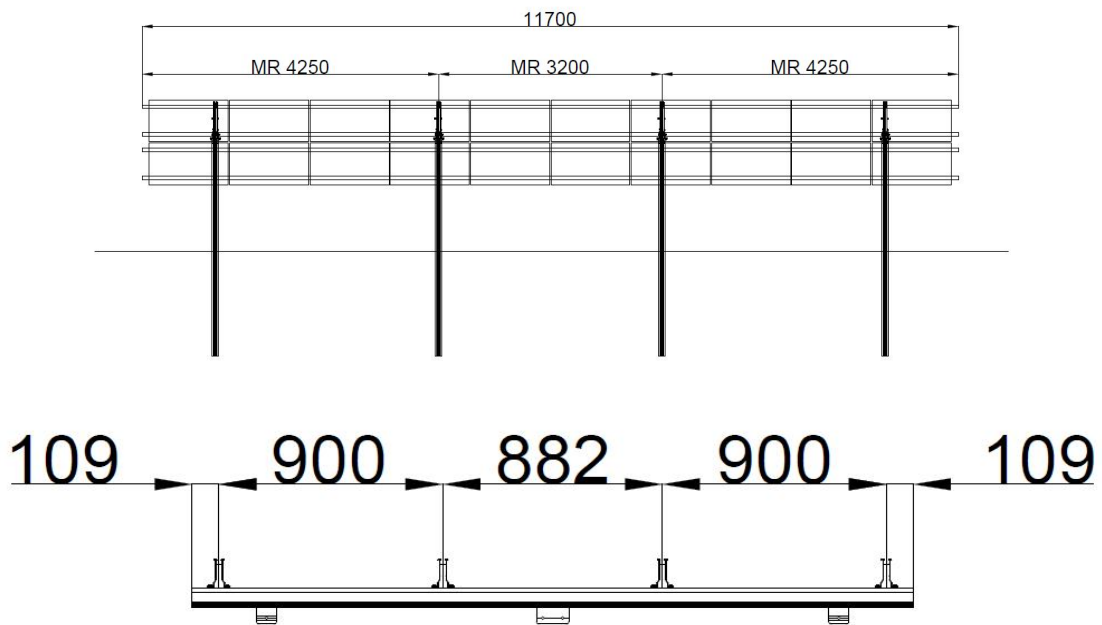


Insert the other Rail

Fixed other Rail by the self-drill screw

Note: Four self-tapping screws are driven into each side of the rail. The self-tapping screws driven into the two sides of the rail should be staggered to avoid interference.

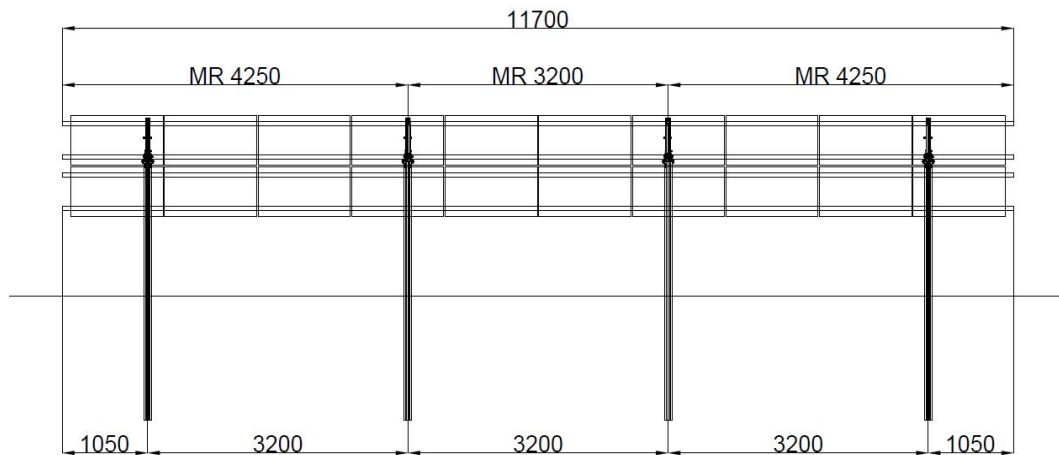
- c) Then install each rail according to the position of the rail in the design drawing.



- d) Make sure the rail ends are on the same plane.

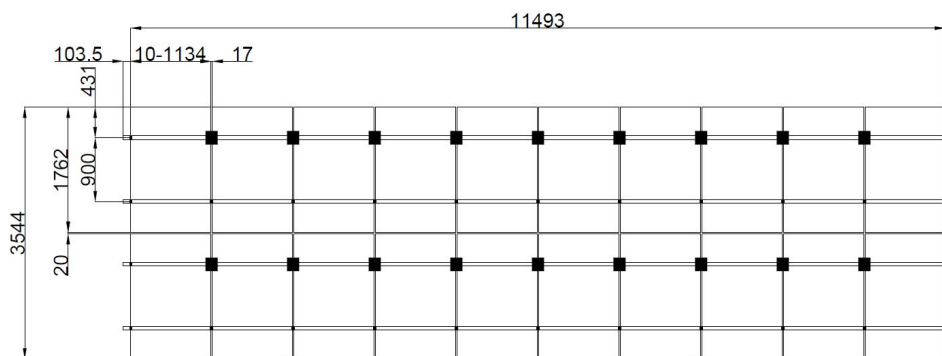


Looking at the bracket from the front, the distance from the end of the rail to the center of the support beam and the column is 1050mm.



Step 4: Install the Solar Panels

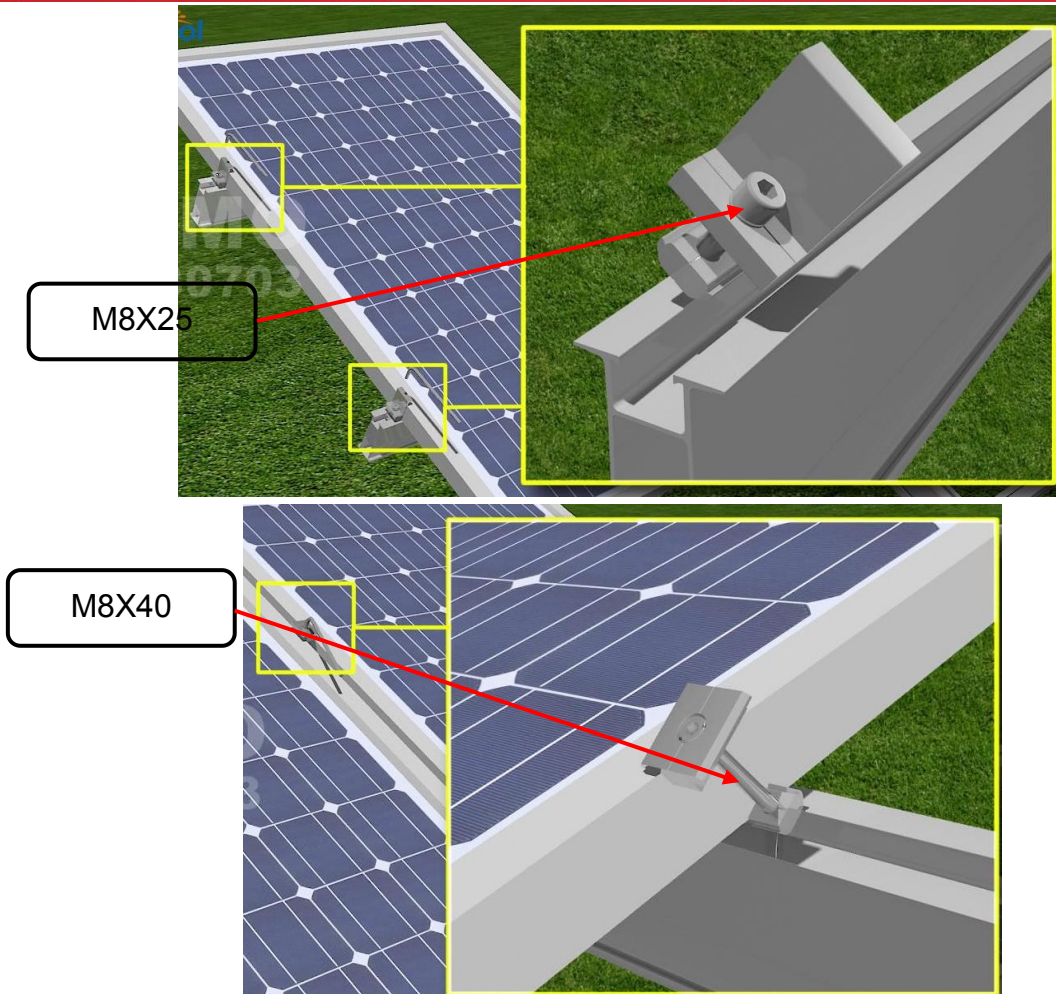
- a) Install the Solar Panels from one side to the other side.
- b) On the end, fix the solar panels by the End Clamp Kit.
- c) Between two panels, fix by the Inner Clamp Kit.



End Clamp Kit

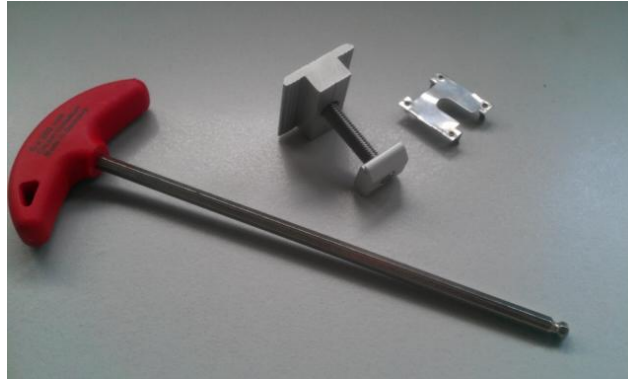


Inner Clamp Kit



When installing mid clamp, you also need to install a grounding clips(GS-G-GC-Q01) to ground the panel for protection. The installation method is to place the grounding clips under the panel so that the raised spikes of the grounding clips pierce the aluminum alloy oxide coating on the surface of the panel and the rail, as shown in the figure below.

Install the Ground Clip



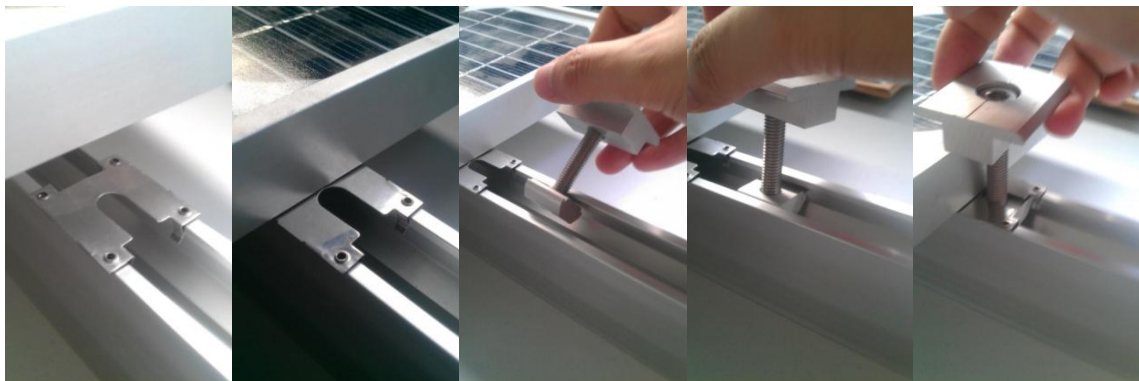
1. Prepare the tool and the parts
Tool: Allen key 6mm
Parts :Inner Clamp Kit and Ground Clip



Tilt in

press

move



Uplift

down

install inner clamp

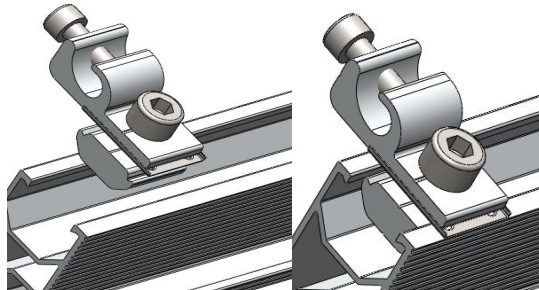
2. Insert the open of the Ground Clip into the bolt of the Inner clamp. Adjust and press the Clip to fit with the Module.



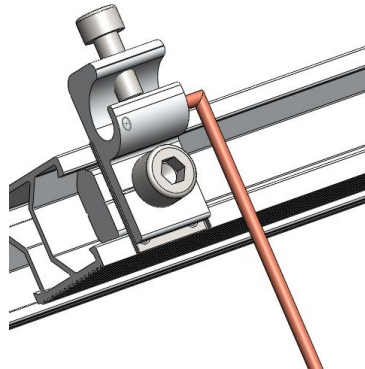
3. Put the other panels into the other side of the inner clamp. On the right position, fasten the bolt by Allen Key

NOTE :The same row of components is equipped with two rows of medium pressure blocks, and only one row of medium pressure blocks is equipped with Ground Clip (GS-G-GC-Q01) .

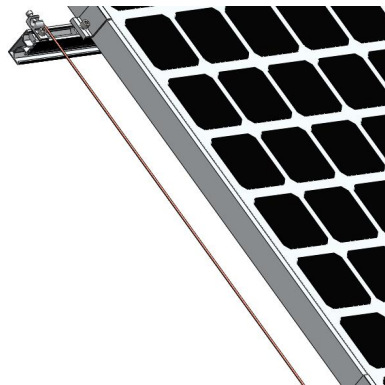
Install the Ground Lug



1. Put the Ground Lug into the planning position of the top channel of Rail



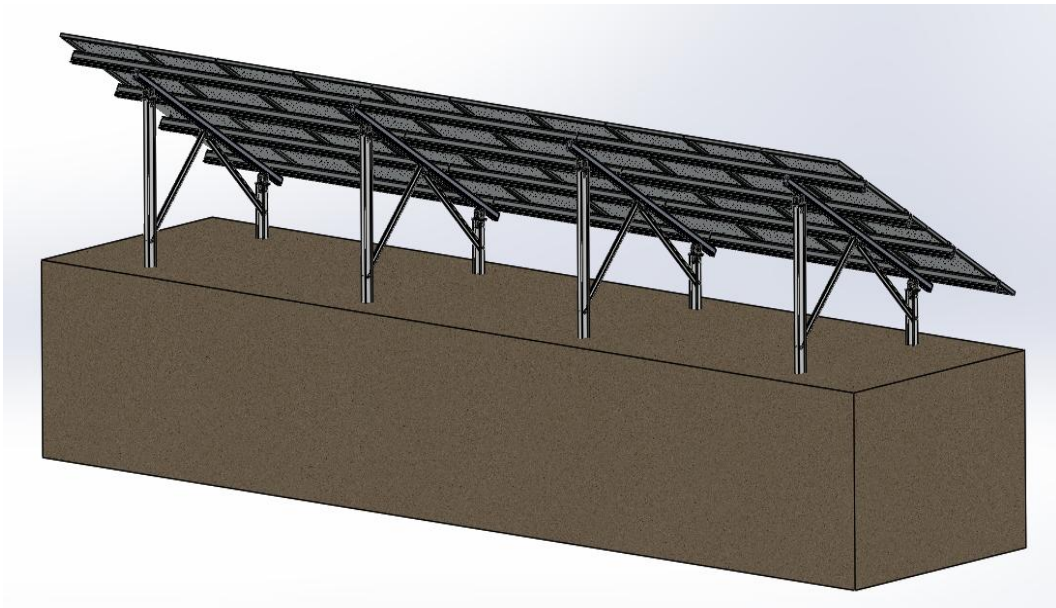
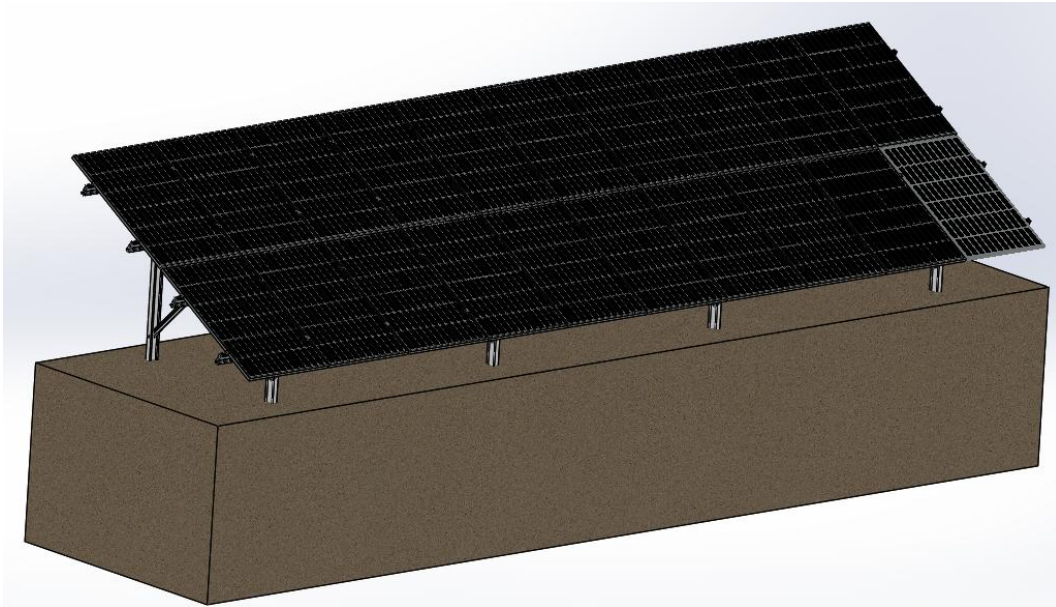
2. Install the grounding lug on one end of the rail where the grounding gasket is installed.(GS-G-GL-Q01), Insert the copper wire into the open of the Ground lug. And fasten the side bolt M6 to fix the wire.

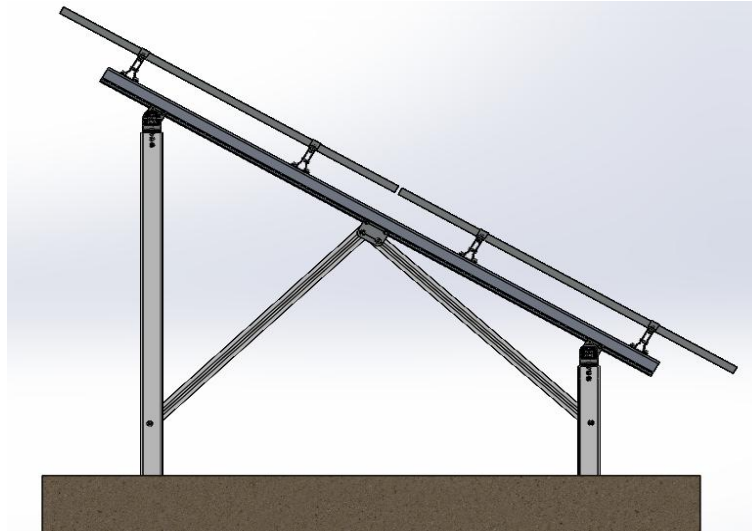


3. Comply with the Step 2 to install the wire into the other Ground Lug, then connect the grounding lugs assemblies on the two rails with wires and then ground them.

4. Completed assembly

After assembly is complete, tighten all bolts to ensure platform stable and safety.





NOTE:

The tighten torque for the A2-70 bolt is listed as below:

M8 Bolt: 16~20 N*m

M10 Bolt: 35~40N*m

M12 Bolt: 50~55 N*m

Bolt Torque

Refer to the following for bolt tightening torque values.

Application	Bolt specification	Torque values
MR-C60 Rail Clamp, MR Rail End Clamp Kit, MR Rail	M8×25	16 ~ 20N*m
Inner Clamp Kit, MR Rail	M8×40	16 ~ 20N*m
Open column ,PG-TC02	M10×90	35 ~ 40N*m
Open column, T6060-1390/1360	M12×90	50 ~ 55N*m
Assembly of Beam, PG-TC02	M12×110	50 ~ 55N*m

Note: When checking with a torque wrench at the end, if it cannot be fixed, please fix it with the maximum torque.