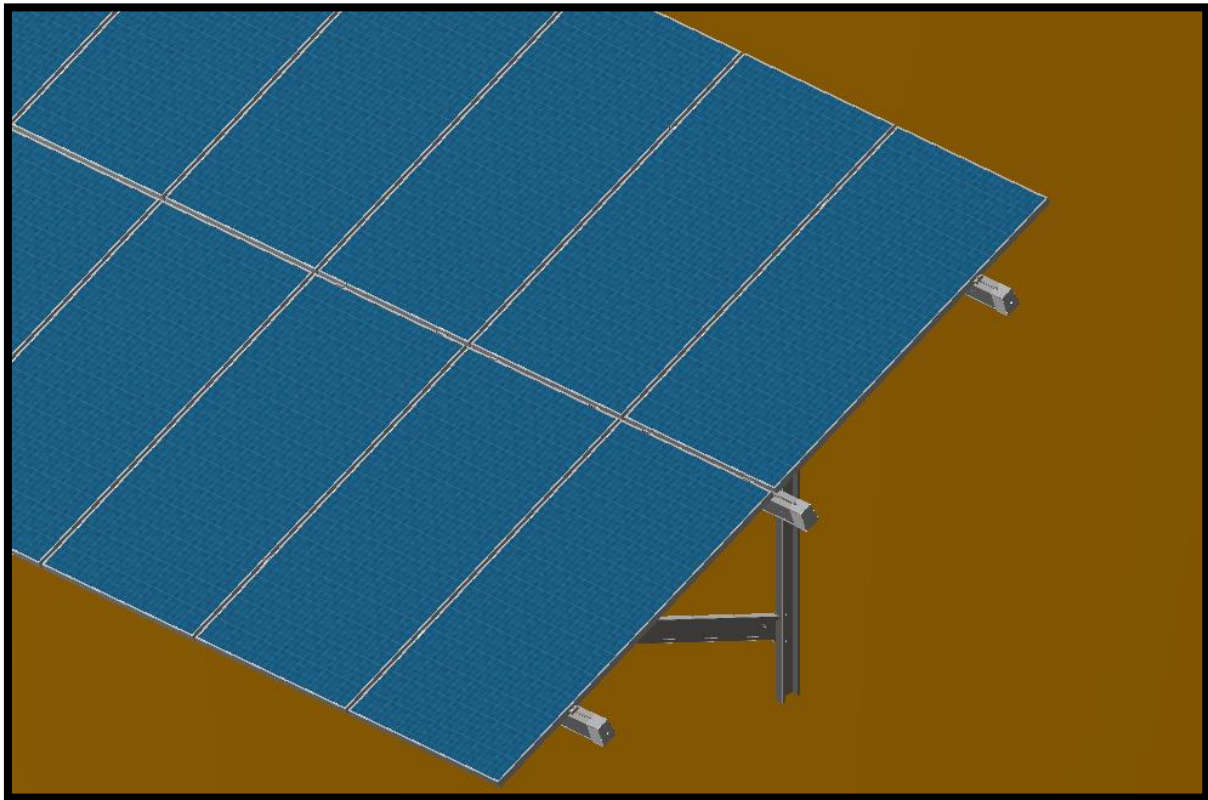


Installation Manual

IM_AXE_GM_ECO

Economical Tilted Ground Mounting System

For framed PV modules in portrait orientation



Declaration

- 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 setup of the Axestruct ground mounting system tilted in open fields.
- Any unique structural features must be documented so that the unique features of the terrain can be taken into account when planning the layout.
- Always fasten the bolted connection by turning the bolt head. Do not turn the nut, just hold it.

Contents

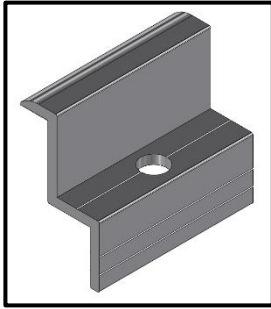
① Components	3
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① Components

End Clamp

AXE_AL_CE_AP_40

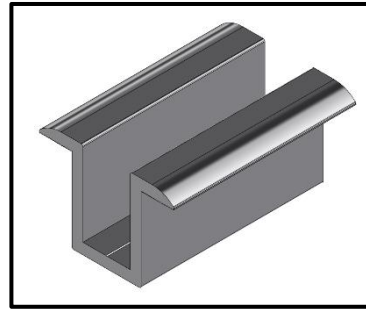
For PV modules with 30mm, 35mm and 40mm frame heights



Mid Clamp

AXE_AL_CM_AP

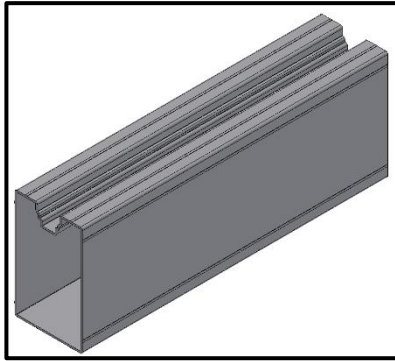
Clamping down any framed PV modules



Rail Splice

AXE_AL_EX_120_76

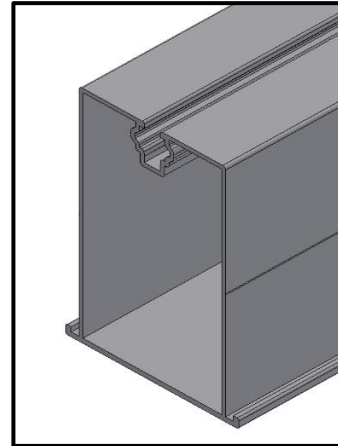
Extending Rails



Rail

AXE_AL_L_R_120_76

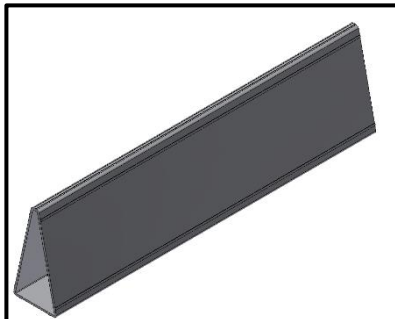
6 to 10m lengths



Rail Splice

AXE_AL_EX_120_70

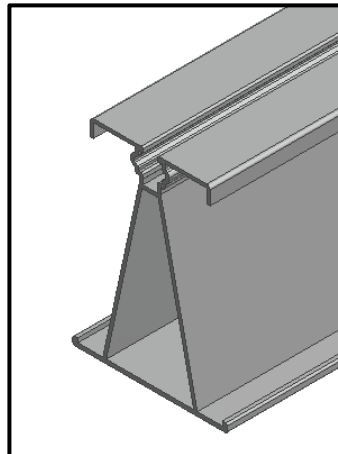
Extending Rails



Rail

AXE_AL_L_R_120_70

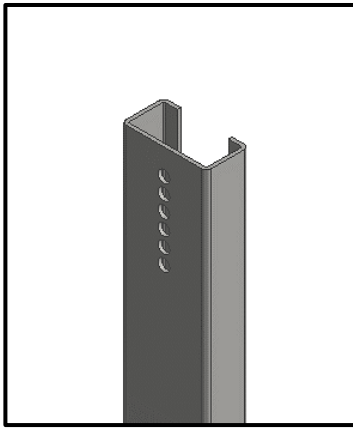
6 to 10m lengths



Pile

AXE_GS_L_LC

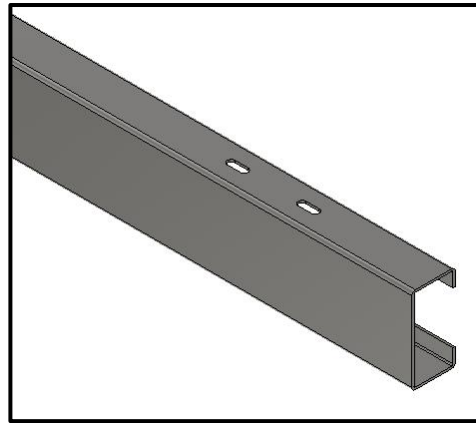
Ramming profile for ground upright support



Rafter

AXE_GS_L_LC

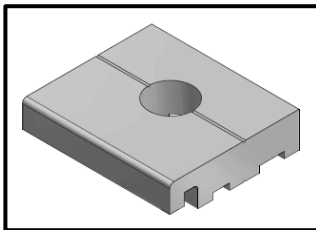
Support for Rails, connection to Piles



Rail Clip

AXE_AL_CP_GM

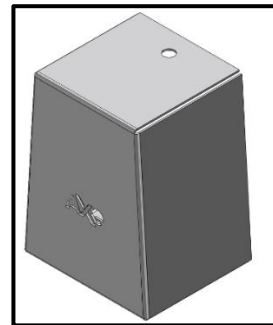
Holding Rail to Rafter



End Cap

AXE_AL_EC_120_76

Rounding of Rail ends



Post Connector

AXE_GS_PC

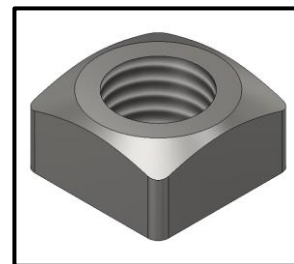
Connecting the Support to Pile



M8 Square Nut

AXE_SS_NSQ_8

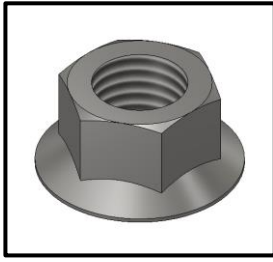
PV Module connection to Rails



M10 Hex-flange Nut

AXE_SS_NHF_10

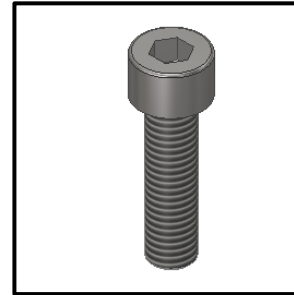
Rail Clip connection to Rafter



M8 Hex-cap Screw

AXE_SS_CS_8

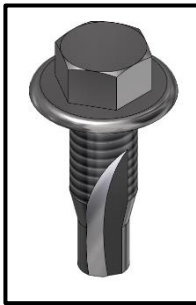
PV module connection



Self Drilling Tek Screw

AXE_GS_ST_6.3

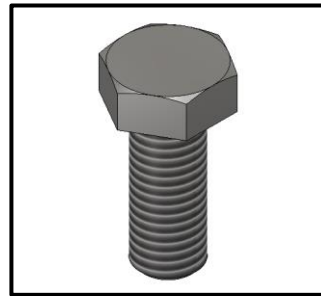
Splice connection



M10 or M12 Hex Bolt

AXE_GS_BH_10/12

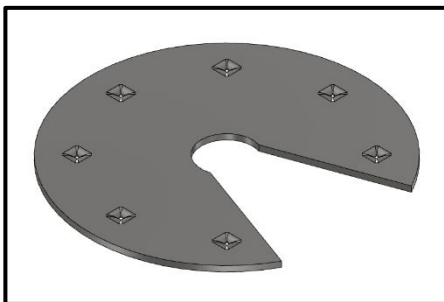
Pile-Rafter and Rail connection



Earthing Plate

AXE_SS_EP

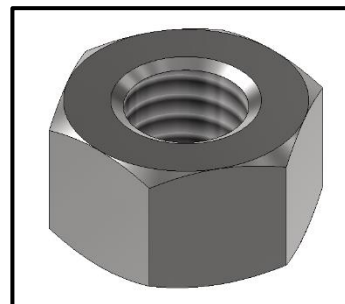
Breaking the anodising layer on PV Module at Clamp connection



M12 Hex Nut

AXE_SS_NH_12

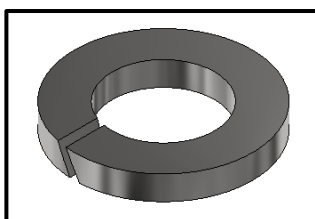
Pile-Rafter connection



M8, M10 or M12 Spring Washer

AXE_GS_WS_8/10/12

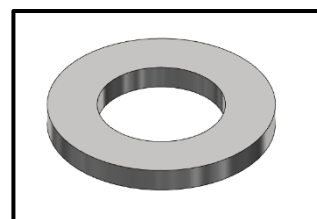
PV module, Bracket or Pile-Rafter connection



M12 Large Flat Washer

AXE_SS_WF_12

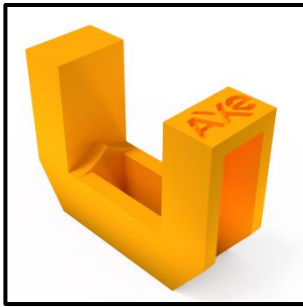
Pile-Rafter connection



Nut Stopper

AXE_PP_NST_8

Guiding M8 Square nut into position



Seizing (Galling) Prevention

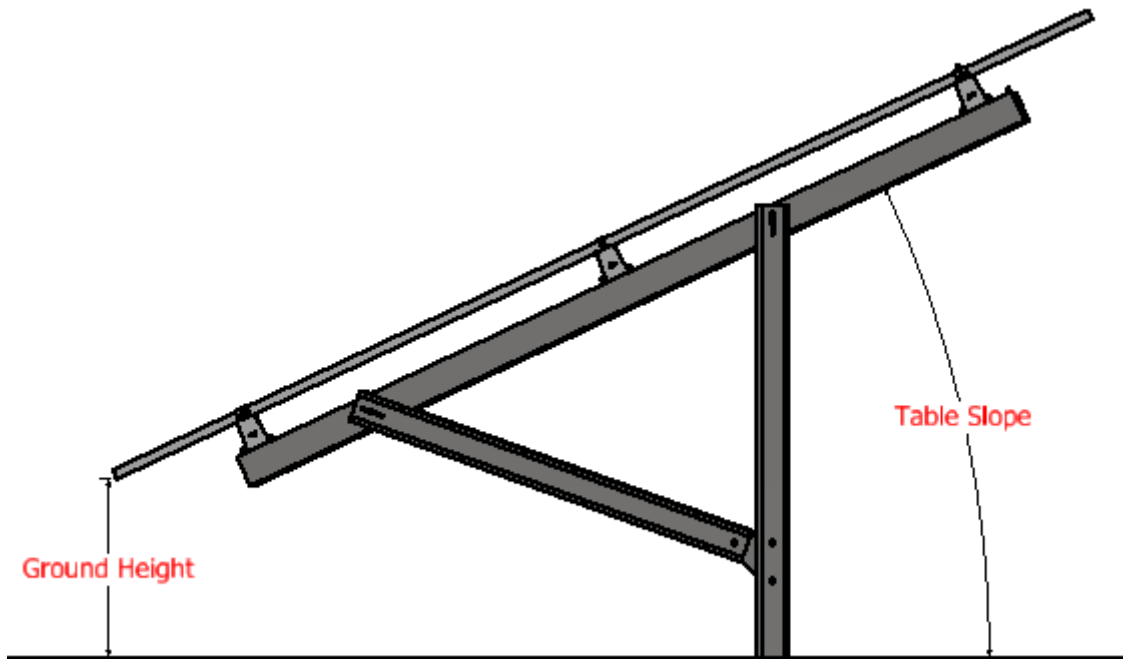
It is recommended that Copper Slip paste is applied in all threaded connections, specifically Stainless-Steel fasteners. This will prevent fasteners from seizing and promotes good practice. A further step to prevent seizing is to tighten fasteners at low rpm's, without interruptions and apply steady pressure.

② Layout positioning

Profile cross sections and the span between Piles varies per selected PV module and site conditions. This must be determined by structural analysis. A geotechnical report is required to determine and regulate the pile driving (ramming) depth.

A minimum distance of 19 mm must be kept between PV modules. Mid Clamps can be used as spacing to maintain this distance.

The ground mount system is designed according to the selected table slope, number of PV modules per table and table height from ground level.



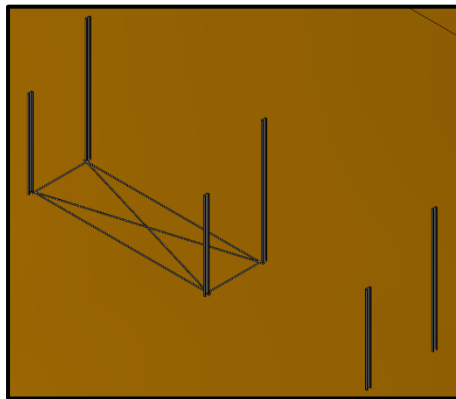
Terrain geography must be conveyed to the designer in order to maintain the requested table slope and PV module ground clearance height. The East – West terrain slope must be within 5° tolerance and for the North – South terrain slope it must be lower than 25°.

③ Foundation fixings

Mark out positions of Pile locations. It should be considered that the open side direction of the channel is determined through the layout view. Tolerances should be considered to ensure that the Piles are lined up correctly.

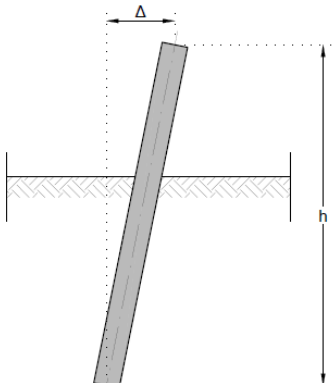
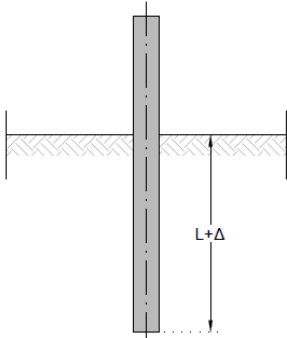
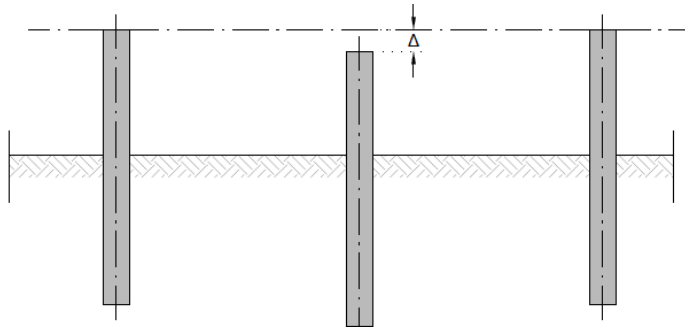
Recommendation

- Ensure the open side of the pile channel is facing a direction to accommodate the rafter orientation. The holes in the rafter accommodating the rails must face upwards while the overhang of the rafters must be as per construction drawing dimensions
- If unexpected obstacles obstruct pile driving operations, the target depth must be predrilled, filled in layers with compressed concrete of strength C16/20 and compacted before driving the pile in the position.



Tolerances to consider when driving in Piles are as follow (measured at ground level):

Description	Depiction	Tolerance
Individual pile position relative to the reference point (RP)		$\Delta 1 = \pm 10\text{mm}$ $\Delta 2 = \pm 10\text{mm}$
Individual pile spacing relative to adjacent piles		$\Delta = \pm 10\text{mm}$
General pile alignment relative to the reference line (RL)		$\Delta = \pm 10\text{mm}$

Individual pile inclination		$\Delta = h/200$
Individual pile depth		$\Delta = \pm 100\text{mm}$
Individual pile level relevant to adjacent piles		$\Delta = \pm 20\text{mm}$

Images in the above table are based on driving in of piles, however these principles can also be applied to posts which are casted into the concrete or connected to concrete foundations with base plates.

④ Foundation connection

Three methods of connecting the posts to the foundations can be followed.

Option 1 – Pile driven into the soil:

A suitable hammer machine is used to drive in the piles.

The top of the ramming profile must be painted to protect against surface damage after the pile driving activity. The paint has to cover $\pm 3\text{cm}$ of the top of the profile.

Option 2 – Post casted into concrete base:

Before the concrete is casted into the boxed shattered area, piles can be positioned into position. It is recommended that each post is integrated to the rebar reinforcement. This can be done by either welding the pile to the rebar rods, or drilling holes through the post, secure rods through these holes and integrate to the existing rebar rods.

Recommendation

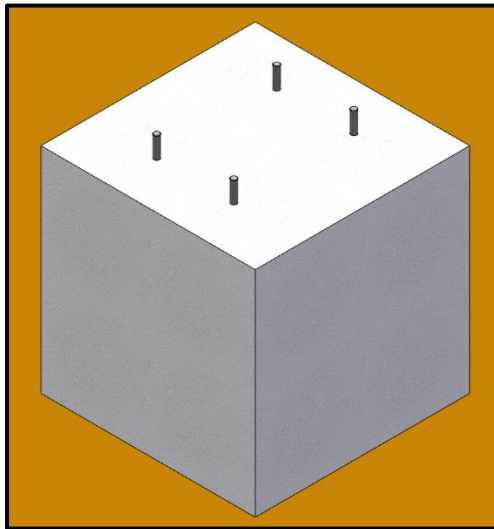
- If the anchor bolts are doweled in bases, it is extremely important to drill the proper size bore hole for the appropriate anchor bolt. Avoid “dog leg” or “rifled” holes, they will hinder anchor installation. It is also important to avoid letting the drill dwell at the bottom of the hole. This can cause an enlargement at the bottom of the hole and result in a loss of anchorage strength.

Option 3 – Treaded rods onto a base plate:

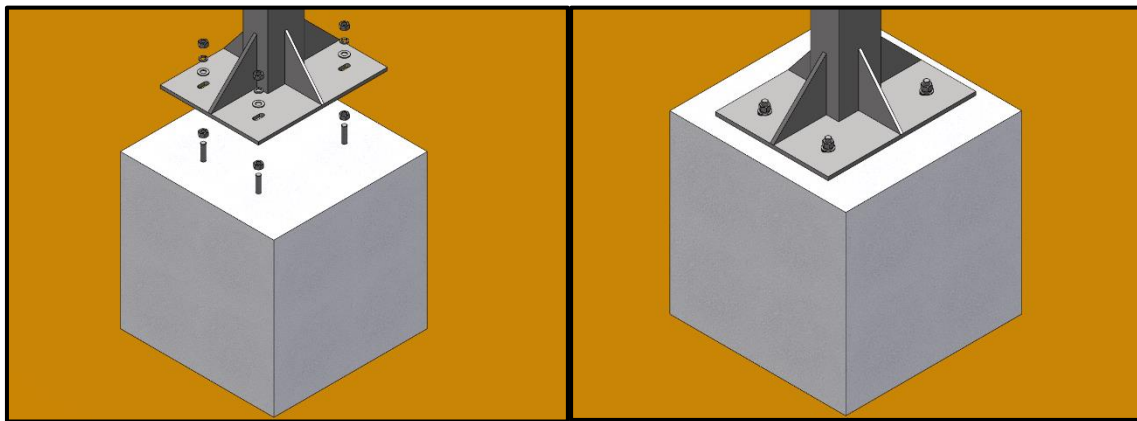
Use guide plate and dowel in four threaded rods per concrete base. Treaded Rods must be pre-casted or doweled in the Concrete Bases to anchor Piles onto bases. Treaded Rods must be of size M18.

Foundation connection

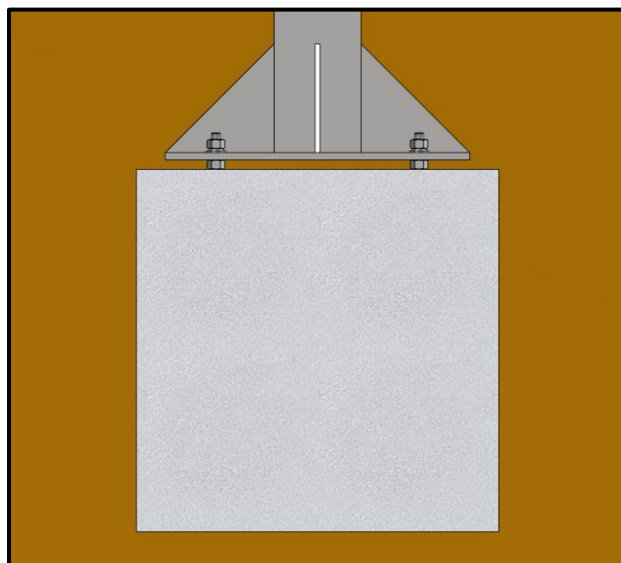
We strongly advise to pre-cast the M18 Threaded rods in the concrete base with a bolted washer that has an OD of 80mm and a thickness of 4mm. This washer should sit lower than the midpoint of the base depth. At own risk, an alternative method can be pursued by utilizing chemical anchors. The specifications and installation methods of suppliers should be strictly adhered to.



Piles are fixed on the Concrete Bases through the Treated Rods. M18 Hex Nuts are placed underneath the baseplate to vertically align Piles. Piles are fixed with M18 Flat Washers and M18 Hex Nuts.

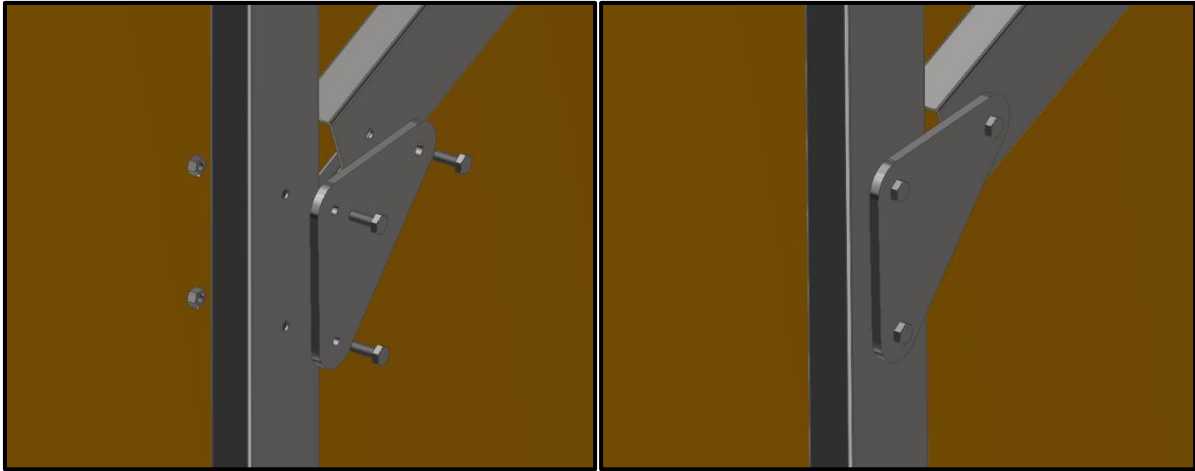


The Gap between the Concrete Base and the Baseplate of the Piles must be filled with Grout once the Pile is fixed into position.



⑤ Connecting Supports

The Pile and Support are connected using the Post Connector Plate. Use M12x30 Hex Bolts, M12 Spring Washers, M12 Flat Washers and M12 Hex Nuts to line up the connection.

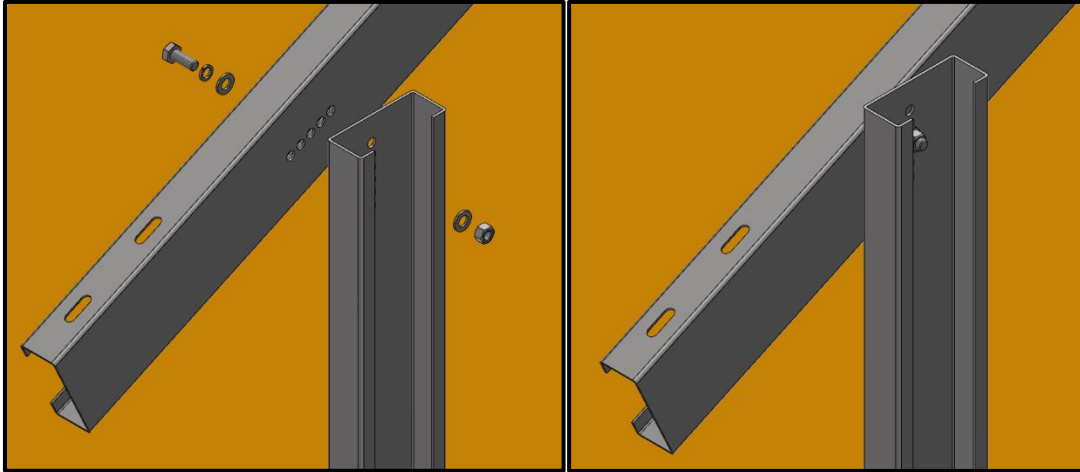


⑥ Mounting Rafters

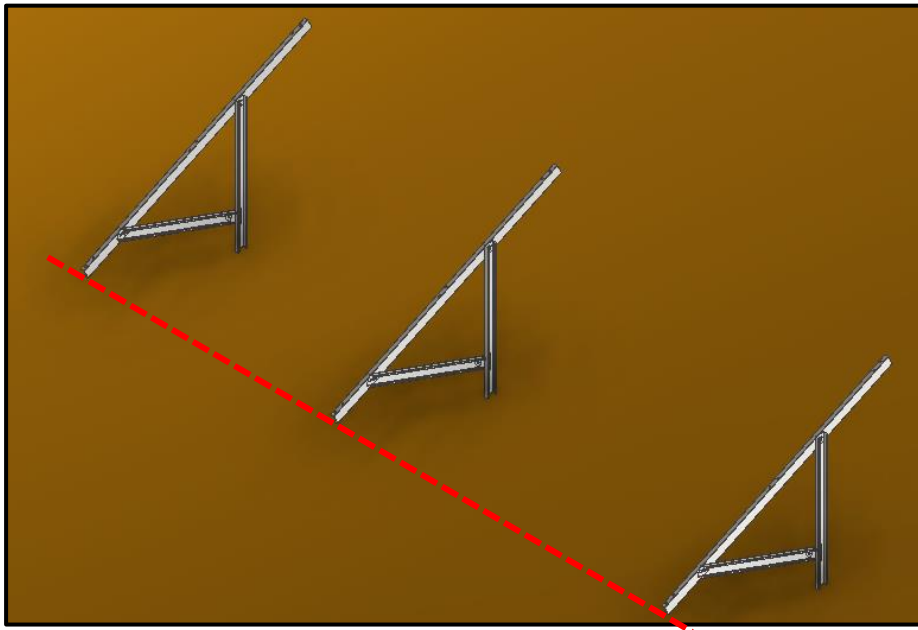
Rafters are connected to the Front short Pile and corresponding Back long Pile. Use M12x30 Hex Bolts, M12 Spring Washers, M12 Flat Washers and M12 Hex Nuts to line up the connection.

Recommendation

- Use the middle holes on the rafter and pile to connect the first rafter and last rafter on each table. Once each table's outer rafters are assembled, a gut line must be stretched between these rafters. Rafters in the middle of the table between the outer rafter assemblies can then be aligned with the gut line as a reference using the adjustment holes on the piles and rafters.



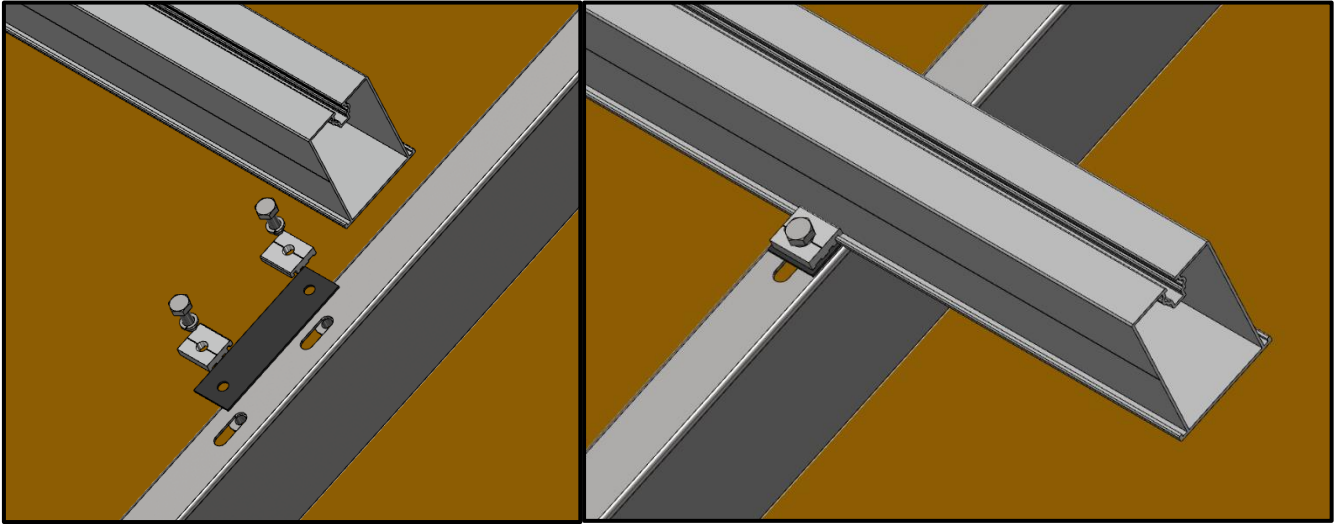
The M12 bolt and nut connections are torqued to 100 N.m. once all the Rafters have been aligned on a single table. This alignment must be done for both the bottom and top end of the Rafters in a vertical and horizontal plane.



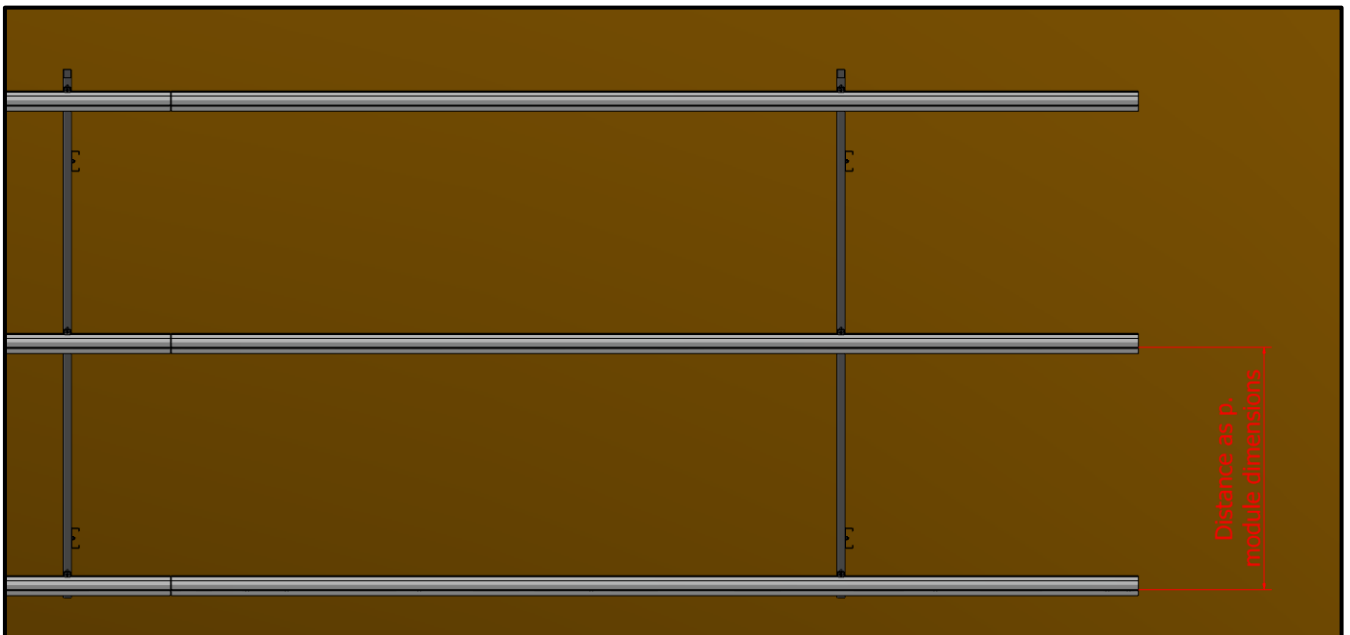
The Rafters must be aligned so that there will be no stresses in the PV module upon installation.

⑦ Mounting Rails

Position Rails on top of the Isolation Pads and place on the Rafters with slotted holes visible on each side of the rail. Connect Rail Clips to rail and line up with slots on Rafters. Use M10x30 Hex Bolts, M10 Spring washers and M10 Hex Flange Nuts to tighten connection at 38 N.m. Spring washers are added to each connection configuration to ensure connection will not loosen over time.

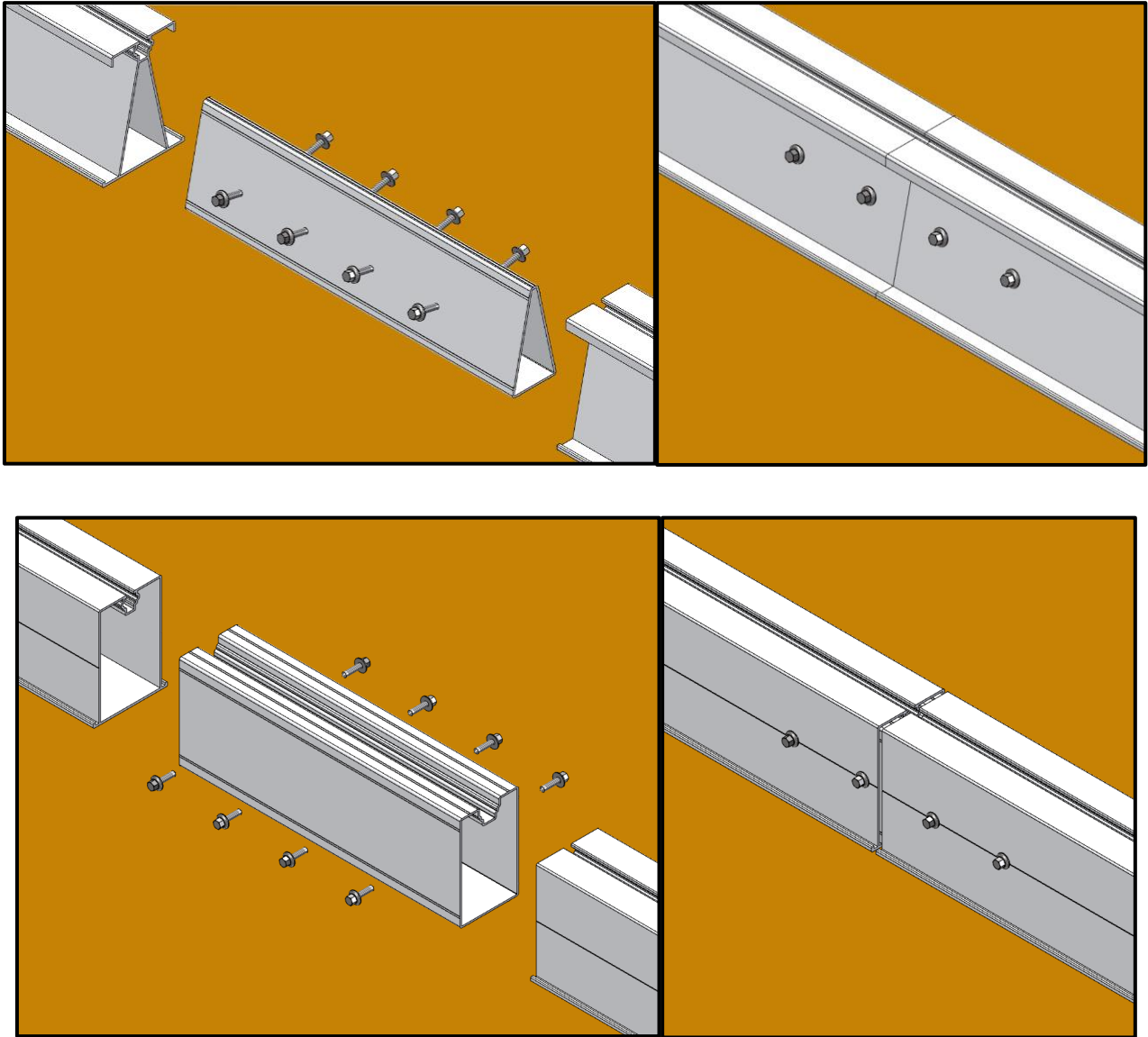


The rail spacings are dependent on the dimensions of the PV module used. PV module installation manuals indicate supporting requirements.



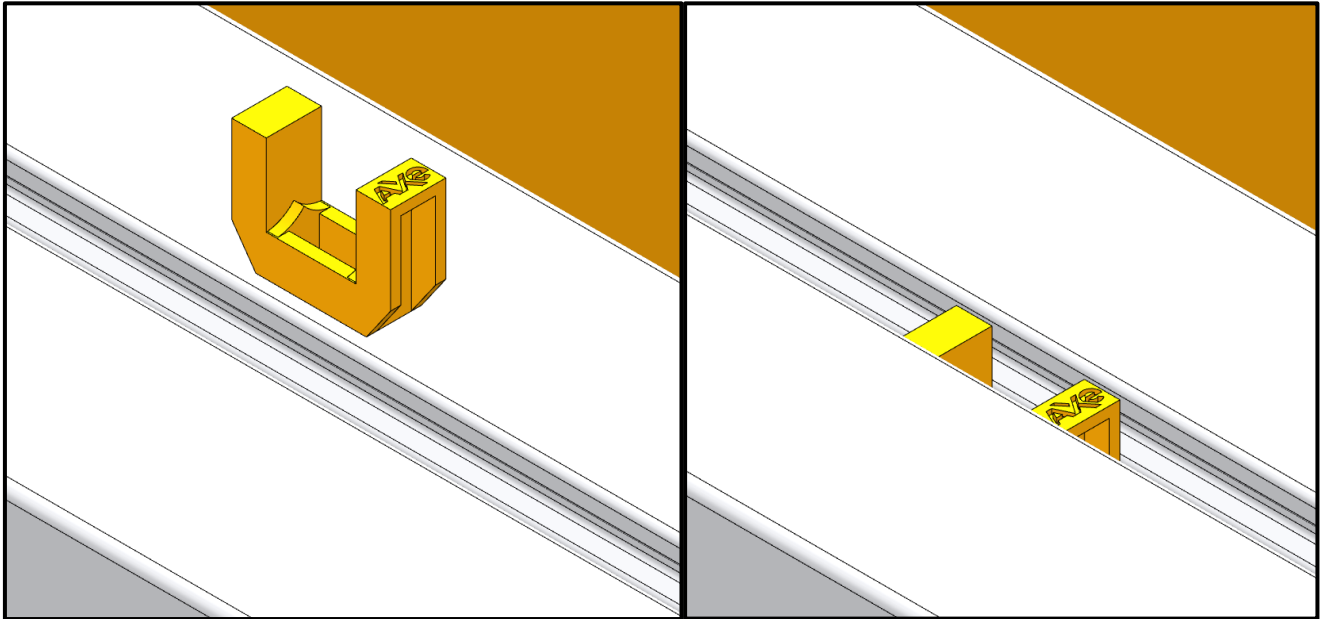
⑧ Joining Rails

Slide Rail Splice halfway, indicated on Rail Splice with a marker, into each adjoining Rail. Use 8 x M6.3 Self Drilling Tek Screws to tighten the connection.

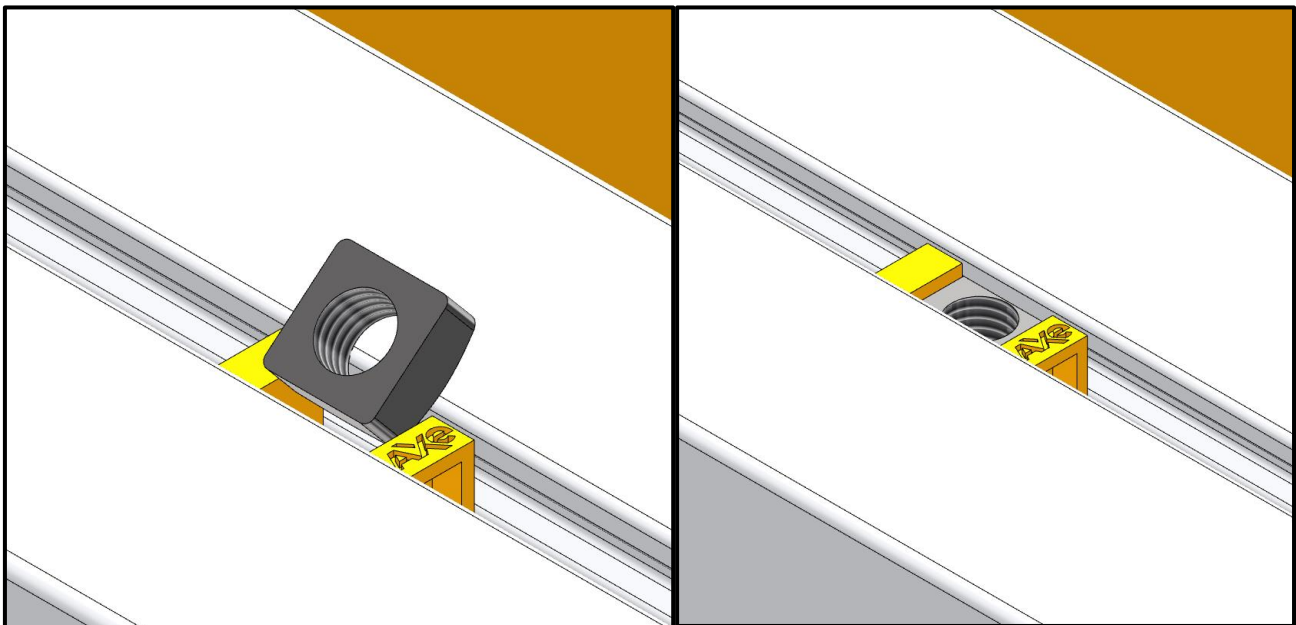


⑨ PV module installation

Insert Nut Stoppers into rail gap where the installation of PV module Clamps will be.

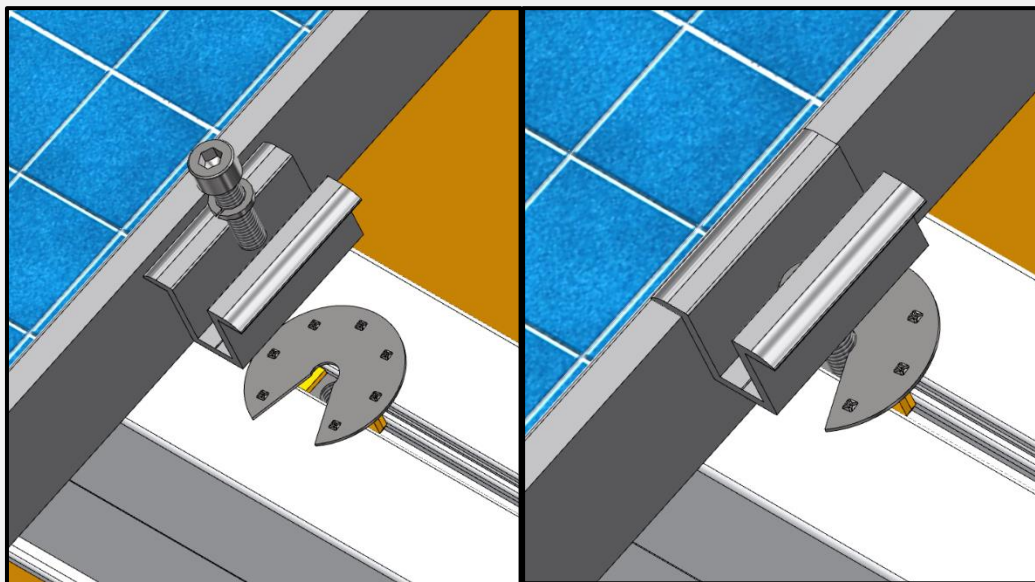


Position an M8 Square Nut at each Nut Stopper. Slide M8 Square Nut at an angle into Rail cavity so that it falls vertically with the flat side facing upwards.

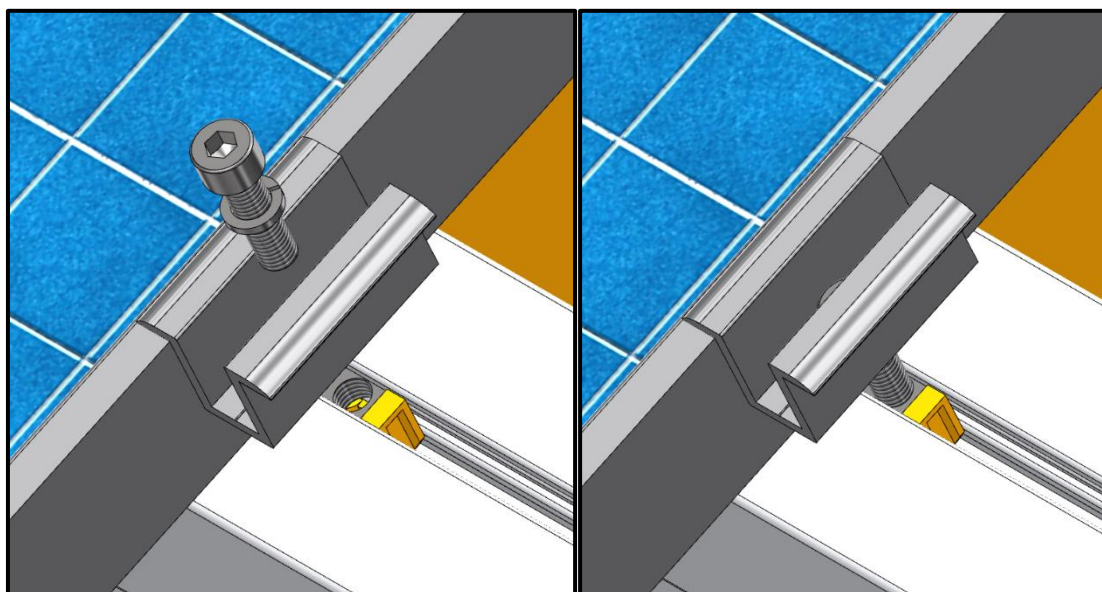


Earthing insurance

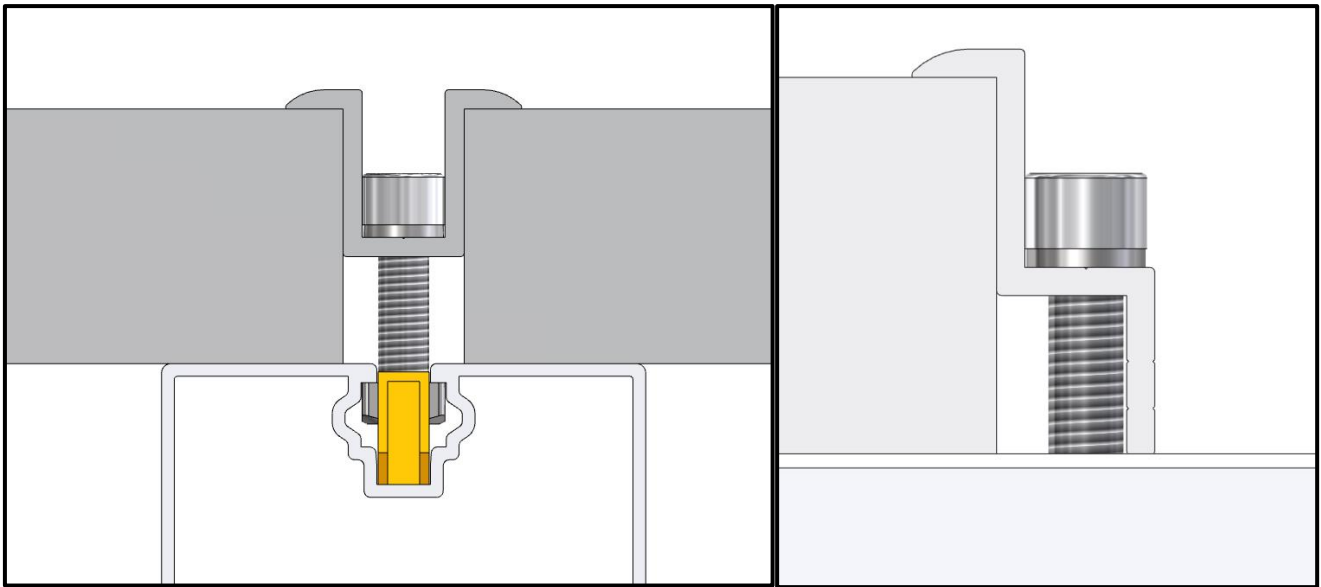
In order to ensure continuity for conduction of the earth system, the anodising layer on the PV module frames must be broken by installing Earth Plates. The Nut Stopper and Square Nut configuration must first be positioned ready for the PV module's clamping configuration. An Earth Plate is then placed on the Rail with the long lip in the rail cavity and behind the Nut Stopper. The PV module is slightly lifted, and the Earth Plate is then slid along the rail cavity up to the PV module until the short lip of the Earth Plate touches the side of the PV module. The PV module is then dropped on top of the spikes of the Earth Plate. This will align the Square Nut with the centre hole in the Earth Plate.



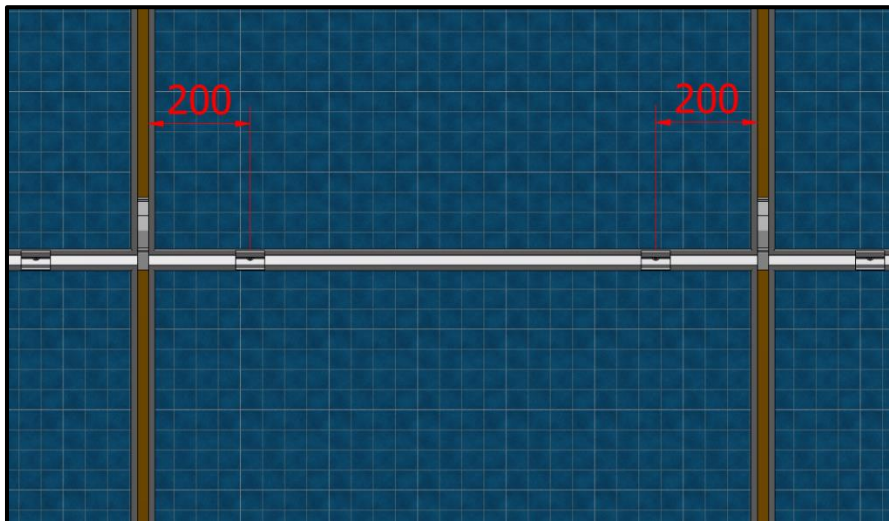
PV modules are laid onto Rails in portrait view so that each PV module is supported by 2x rail lengths. Install PV module Clamps on the sides of the PV module so that each PV module is fixed on 4x locations. 1x clamp per opposing long side and 2x clamps on the short side will hold each PV module down to the Rails. Torque M8 Hex-Cap Screws at 18 N.m. Ensure to add the spring washers to each clamp configuration.



Mid Clamps are used between 2x PV modules and End Clamps at the end of a row of PV Modules. Make sure to mount Clamps flash against PV module sides.

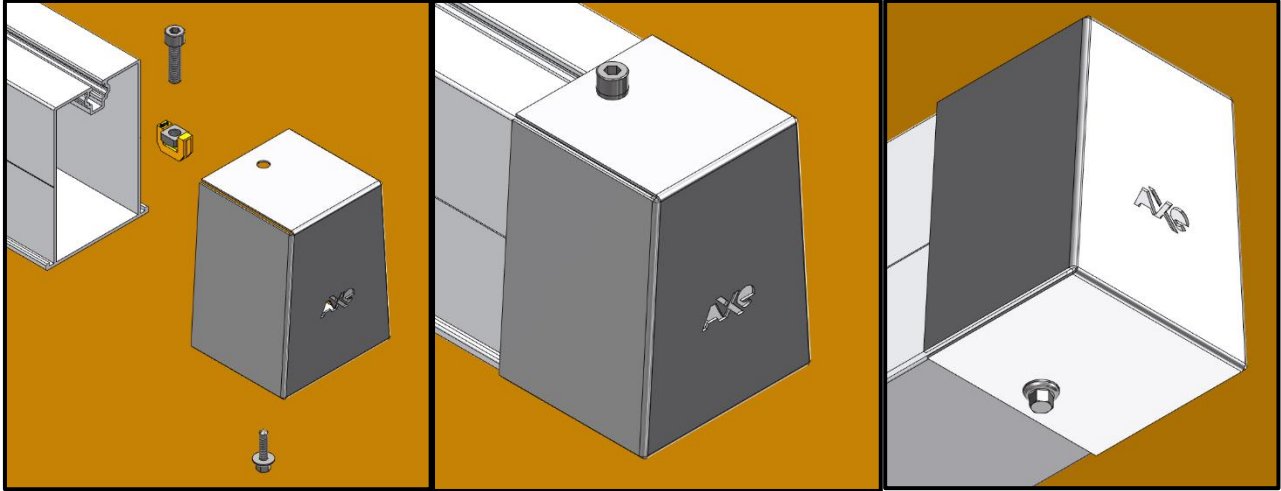


Mid Clamps' centre on the PV modules' short sides must be installed $\pm 200\text{mm}$ from the PV module's side edges.



⑩ End Caps

Slide End Caps over the end of Rails for neat aesthetics. Position Nut Stopper and Square Nut configuration close to the end of a Rail. Slide End Cap over and tighten with M8x20 Hex Cap Screw. An M6.3 Self Drilling Tek Screw can be installed at the bottom of the End Cap for additional security.



⑪ Maintenance

The products are to be inspected annually in the form of a visual inspection of the whole installation. Axe Struct must be notified of any first appearances of rust and abnormal deformations.

Annual spot checks are to be done on fasteners to ensure that the minimum required torque moment specified in this Manual is met.

Zinc paint touch-ups must be done where galvanising layers have been damaged.

Cleaning of the product must be done with water with a pH between 6 and 10, and without chemicals.

⑫ Liability

Axe Struct can accept no liability for damage arising due to improper use, installation, operation or maintenance. Liability is further excluded if Axe Struct is not at fault due to gross negligence or intent.

The text and images in this Installation Manual correspond to the state of the art upon printing. Subject to change.