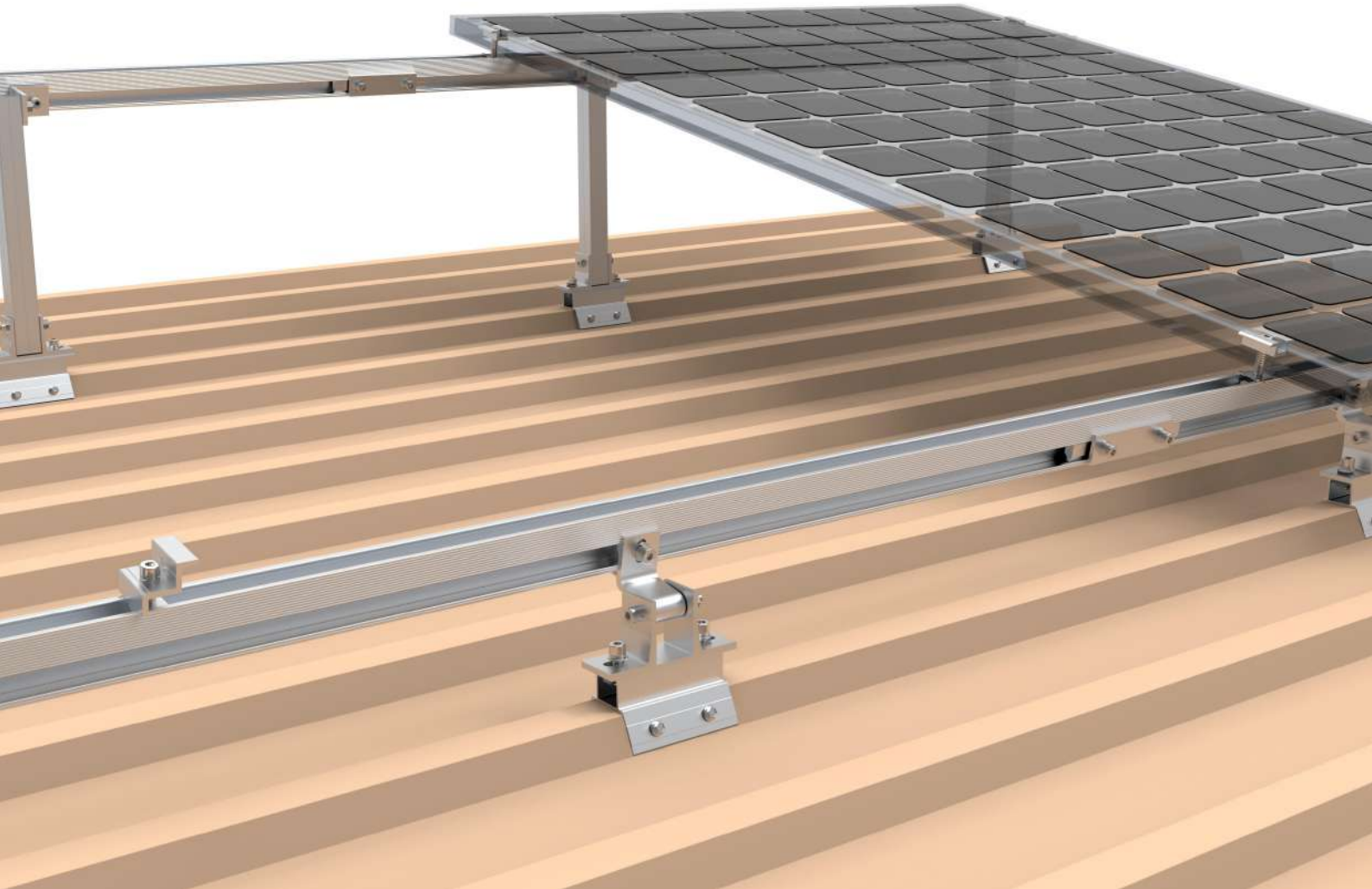
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INSTALLATION GUIDE

TILT MOUNT
PENETRATIVE ROOF MOUNTING SYSTEMS



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Contents

1. Introduction
2. Planning
3. Tools and components
4. System Overview
5. Installation Instructions



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Introduction

The Lumasol tilt mount system, with penetrative metal roof clamps, offers a cost-effective and time-efficient installation solution for inclining panels on metal roofs.

Please review this manual thoroughly before installing your solar system.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any updates that may supersede this manual.
- Ensuring that The Tilt mount with Penetrative Metal Roof Clamp System and other products are appropriate for the installation and the installation environment.
- Using only the correct Lumasol components for the mounting structure installation (substitution of parts or mixing products from different brands may void the warranty)
- Recycling: Recycle according to the local regulation.
- Ensuring that there are no less than two professionals working on the panel installation.
- Ensuring the installation of related electrical equipment is performed by licensed electricians.
- Ensuring safe installation of all electrical aspects of the PV array. This includes adequate earth bonding of the PV array and the TILT-MOUNT SYSTEM components.
- Ensuring that the roof, its rafters/purlins, connections, and other structural support members can support the array under building live load conditions.
- Verifying the compatibility of the installation considering prevent metal electrochemical corrosion between dissimilar metals. This may occur between structures and the building, between structures, fasteners, and PVmodules.
- Verifying atmospheric corrosivity zones of the installation site or consult with local construction business to determine appropriate products and installations.
- Removal: Reverse installation process.

Product Warranty:

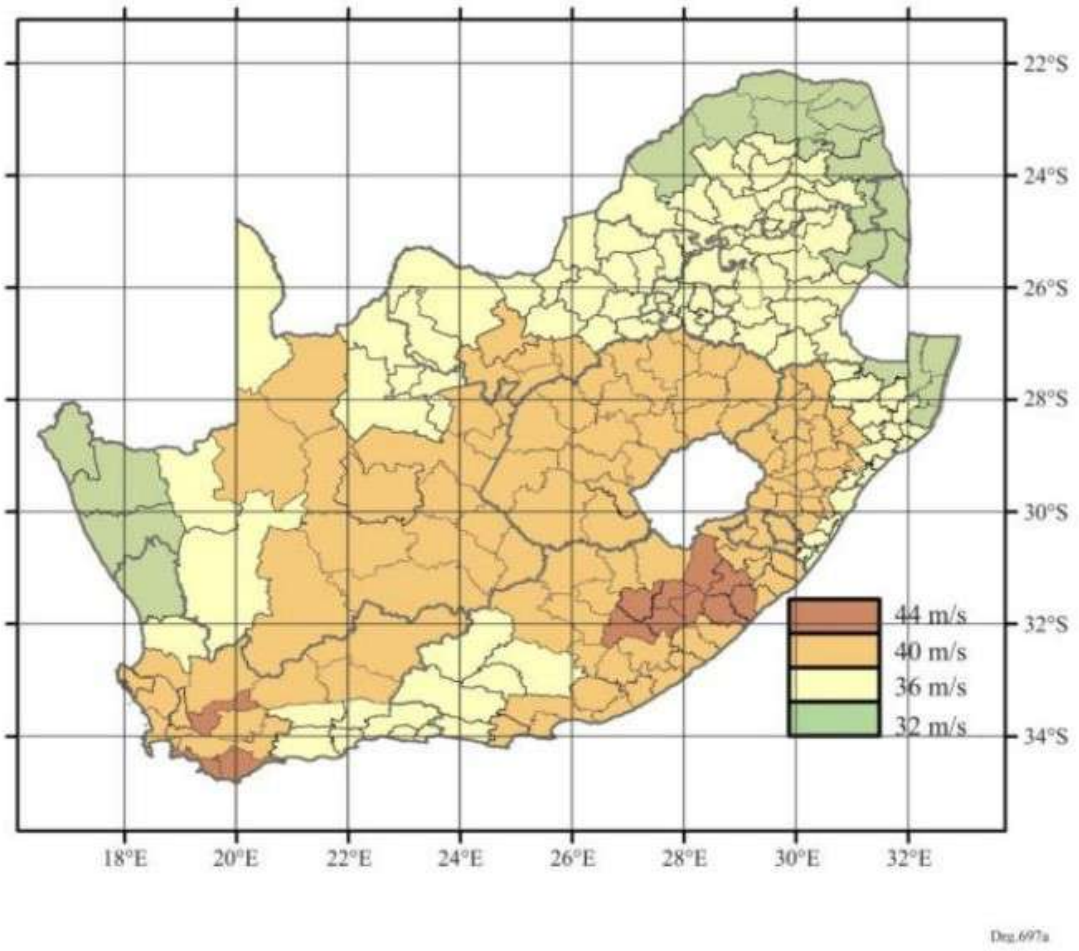
Please refer to the Lumasol product warranty and register your product warranty on our website at https://lumasol.co.za/warranty-registration/ or request information from our team, sales@lumasol.co.za / admin@lumasol.co.za.

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Planning

Determine the Region Definition & Terrain Category

SANS 10160-3:2019
Edition 2.1



Dng.697a

NOTE 1 This map results from comprehensive statistical research. (Strong winds in South Africa: Part 1 and Part 2) and is based on 3 second gust wind speed. Tabularised information, per municipality, is provided in table A.1 of annex A.

NOTE 2 This map should be used in combination with the partial factor for wind loading as stipulated in SANS 10160-1. For structures particularly sensitive to wind action, detailed investigation on an appropriate partial action factor may be required.

Figure 1 — Map of the fundamental value of the basic wind speed, $v_{b,0}$

a. Region A which indicates a Regional Wind Velocity of 32 m/s with wind average recurrence of 50 years.

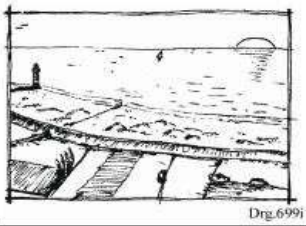
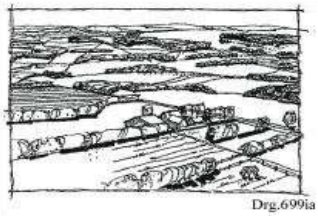
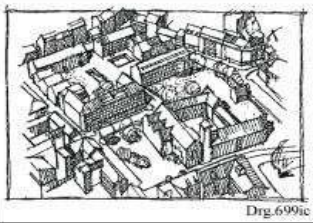
b. Region B which indicates a Regional Wind Velocity of 36 m/s with wind average recurrence of 50 years.

c. Region C which indicates a Regional Wind Velocity of 40 m/s with wind average recurrence of 50 years.

d. Region D which indicates a Regional Wind Velocity of 44 m/s with wind average recurrence of 50 years.

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Table 2 — Terrain categories

1	2	3
Category	**Description**	**Illustration**
A	Flat horizontal terrain with negligible vegetation and without any obstacles (for example coastal areas exposed to open sea or large lakes)	 Drg.699i
B	Area with low vegetation such as grass and isolated obstacles (for example trees and buildings) with separations of at least 20 obstacle heights	 Drg.699ia
C	Area with regular cover of vegetation or buildings or with isolated obstacles with separations of maximum 20 obstacle heights (such as villages, suburban terrain and permanent forest)	 Drg.699ib
D	Area in which at least 15 % of the surface is covered with buildings and their average height exceeds 15 m	 Drg.699ic
NOTE 1 A certain amount of a reduction in loading for category D can be obtained (see 7.3.5) by using a procedure described in A.5, which takes into account the vertical displacement of the peak wind pressure profile, within an environment with closely spaced obstructions.		

Lumasol Rooftop Solar mounting systems are assessed for terrain category C and D. If your installation site is within a “category A or B” location, the interface spacing must be reduced accordingly.

Verify Atmospheric Corrosivity Zone of Installation Site

Refer to ISO 9223:2012 - ***Corrosion of Metals and Alloys - Corrosivity of Atmospheres - Classification, Determination, and Estimation*** to verify the corrosivity category of the installation site. This will help determine the appropriate products and interface spacing. When standard products are installed in high-corrosivity zones such as C4 or C5, a reduction factor must be applied to the interface spacing.
For installations in ISO corrosivity category C4, reduce the interface spacing by 5%.
For installations in ISO category C5, reduce the interface spacing by 25%.

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Table C.1 — Description of typical atmospheric environments related to the estimation of corrosivity categories

Corrosivity category[a]	Corrosivity	Typical environments — Examples[b]	
		Indoor	Outdoor
C1	Very low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices, schools, museums	Dry or cold zone, atmospheric environment with very low pollution and time of wetness, e.g. certain deserts, Central Arctic/Antarctica
C2	Low	Unheated spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution, e.g. storage, sport halls	Temperate zone, atmospheric environment with low pollution (SO_2 < 5 µg/m^3), e.g. rural areas, small towns Dry or cold zone, atmospheric environment with short time of wetness, e.g. deserts, subarctic areas
C3	Medium	Spaces with moderate frequency of condensation and moderate pollution from production process, e.g. food-processing plants, laundries, breweries, dairies	Temperate zone, atmospheric environment with medium pollution (SO_2: 5 µg/m^3 to 30 µg/m^3) or some effect of chlorides, e.g. urban areas, coastal areas with low deposition of chlorides Subtropical and tropical zone, atmosphere with low pollution
C4	High	Spaces with high frequency of condensation and high pollution from production process, e.g. industrial processing plants, swimming pools	Temperate zone, atmospheric environment with high pollution (SO_2: 30 µg/m^3 to 90 µg/m^3) or substantial effect of chlorides, e.g. polluted urban areas, industrial areas, coastal areas without spray of salt water or, exposure to strong effect of de-icing salts Subtropical and tropical zone, atmosphere with medium pollution
C5	Very high	Spaces with very high frequency of condensation and/or with high pollution from production process, e.g. mines, caverns for industrial purposes, unventilated sheds in subtropical and tropical zones	Temperate and subtropical zone, atmospheric environment with very high pollution (SO_2: 90 µg/m^3 to 250 µg/m^3) and/or significant effect of chlorides, e.g. industrial areas, coastal areas, sheltered positions on coastline

Determine the Height of the Installation Site:

This document provides adequate guidance for installing the Tilt mount with Penetrative Metal Roof Clamp System at heights up to 20 meters. For installations above 20 meters, a project-specific engineering certificate must be obtained to ensure proper support.

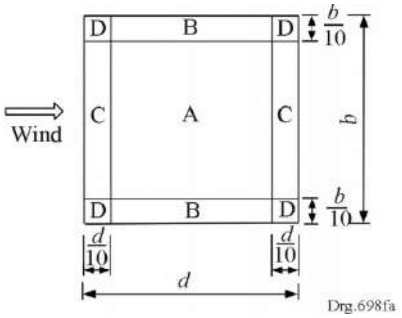
Determine Roof Slope:

The Tilt mount with Penetrative Metal Roof Clamp System is suitable for roof slopes up to 30°. Ensure that the slope of the installation site roof is within the 0° to 30° range.

Determine the Maximum Rail Support Spacing

The conditions for achieving a maximum installation interface spacing of 1.5m with the Lumasol Tilt mount with Penetrative Metal Roof Clamp System are as follows:

1. The roof height ≤ 15m.
2. The roof tilt angle + panel tilt angle ≤ 5 degrees.
3. The installation is located in roof zone A (see image to the right).
4. The site is located within Terrain Category D.
5. The minimum pull-out force of the roof clamp is 3.5kN.
6. The site is in wind region A or B (max wind speed is 36m/s).



Any installation that does not comply with the restrictions above requires that the installation interface spacing is reduced accordingly.

Verify Maximum Rail End Overhang

Rail end overhang is the distance from the last interface to the end of the panel. The maximum allowable rail end overhang is 40% of the installed spacing of the last interface. For instance, if the maximum interface spacing as per the engineering certificate is 1500mm, and the actual installed spacing of the last interface is 1500mm, the maximum allowable rail end overhang would be 600mm. Refer to the picture below for clarification.



Determine the Clamping Zone of the PV Modules

Please refer to the installation manual of the PV module manufacturer and consider the design angle as well as purlin spacing.



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Tools and Components

Tools

		
Screwdriver	Drill Bits for M8 bolts	Torque spanner
		
5m Tape	Marker pen	String

Components

		
LMS-PRO-RAIL47 PV Mounting ProRail47 3150mm, 4150mm, 4400mm 4700mm, 5150mm	**LMS-PRO-RAIL47-SP-KIT** Splice Kit for ProRail47	**LMS-FL-KIT** Front Leg Kit

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LMS-EC30-35-KIT-BP
End Clamp 30 & 35 Kit
(Bonding Pin)



LMS-IC30-35-KIT-BP
Inter Clamp 30 & 35 Kit
(Bonding Pins)



LMS-ARL5/10/20-KIT
Rear Leg Kit 5/10/20 Degrees



LMS-IBR3-KIT
IBR Side-Fix Tilt Support Kit



LMS-RN-M8x20-KIT
Rail Nut Kit M8x20



LMS-MRAIL-PRO-KIT
Mini Rail H55



LMS-IBR1-KIT
IBR Cleat Kit



LMS-TILT-SPLICE-KIT
Splice for Tilt Kits

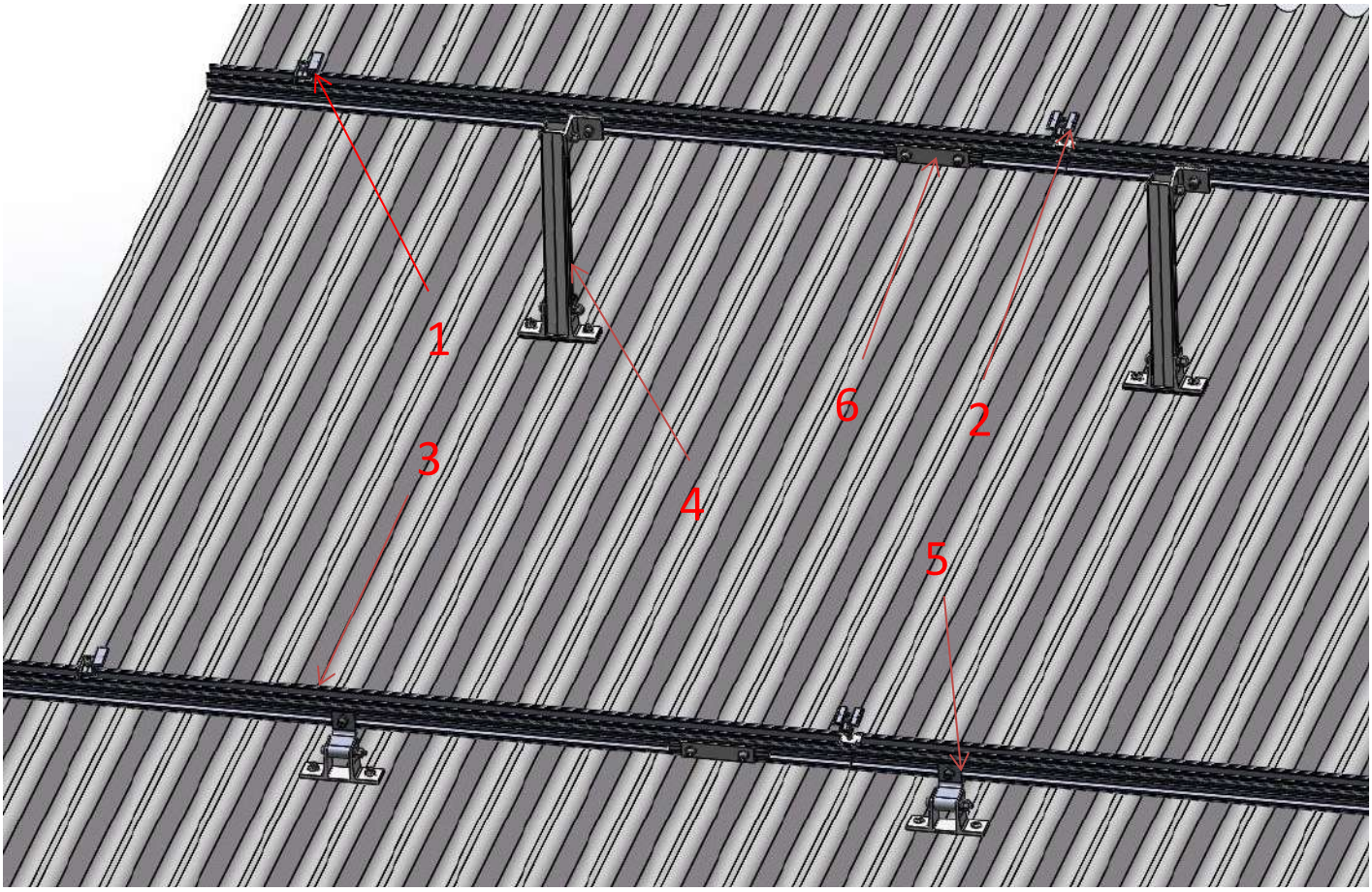


LMS-CB-300-KIT
Cardwell Bracket - Universal

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System overview – Tilt Leg – Penetrative Clamp System

1. End Clamp **2.**Mid Clamp **3.** Rail **4.** Rear Leg **5.** Front Leg **6.** Rail Joiner

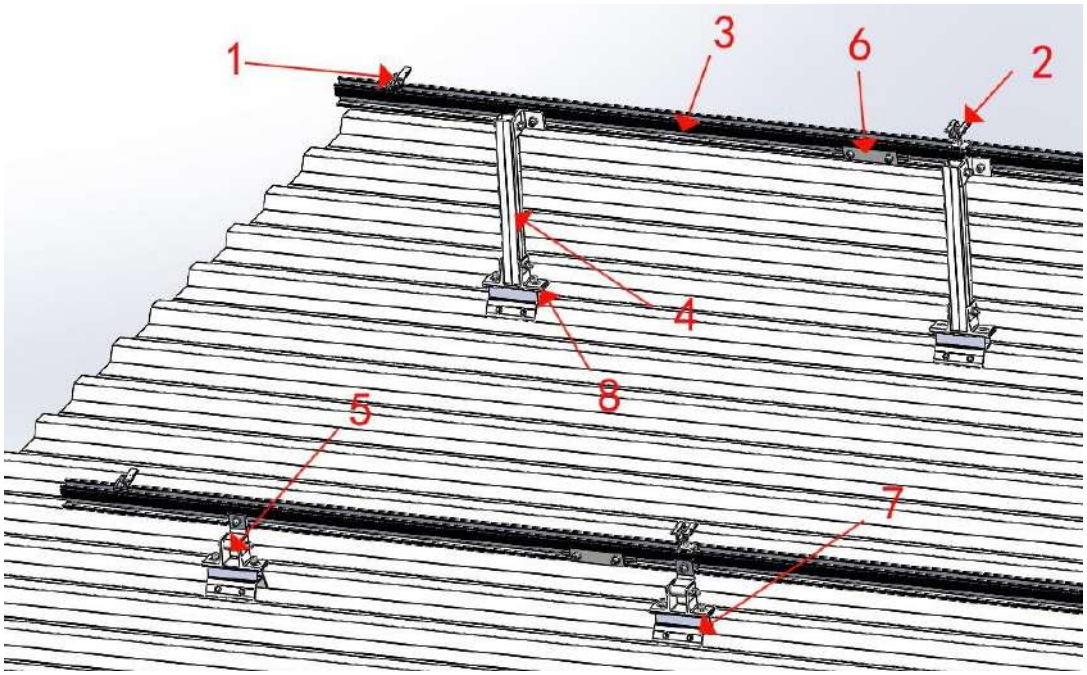


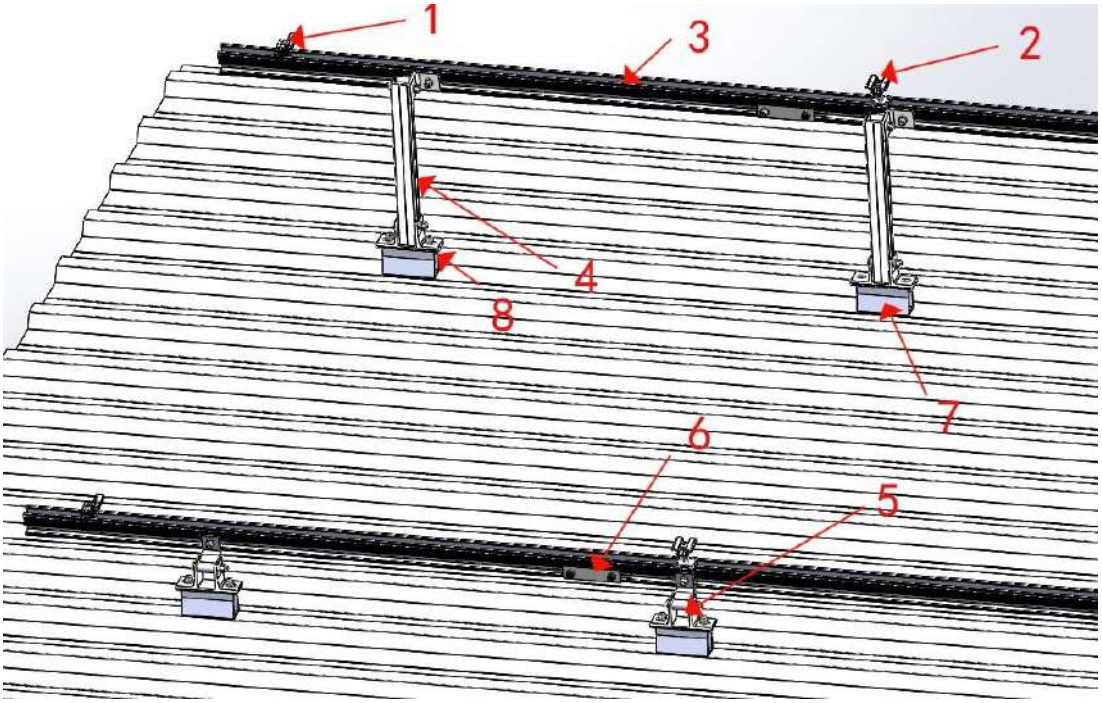
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System overview – Tilt Leg – Penetrative Clamp – Mini Rail

1. End Clamp **2**. Mid Clamp **3.** Rail **4.** Rear Leg **5.** Front Leg **6.** Rail Splice **7.** Mini Rail

8. Splice for Tilt Kit



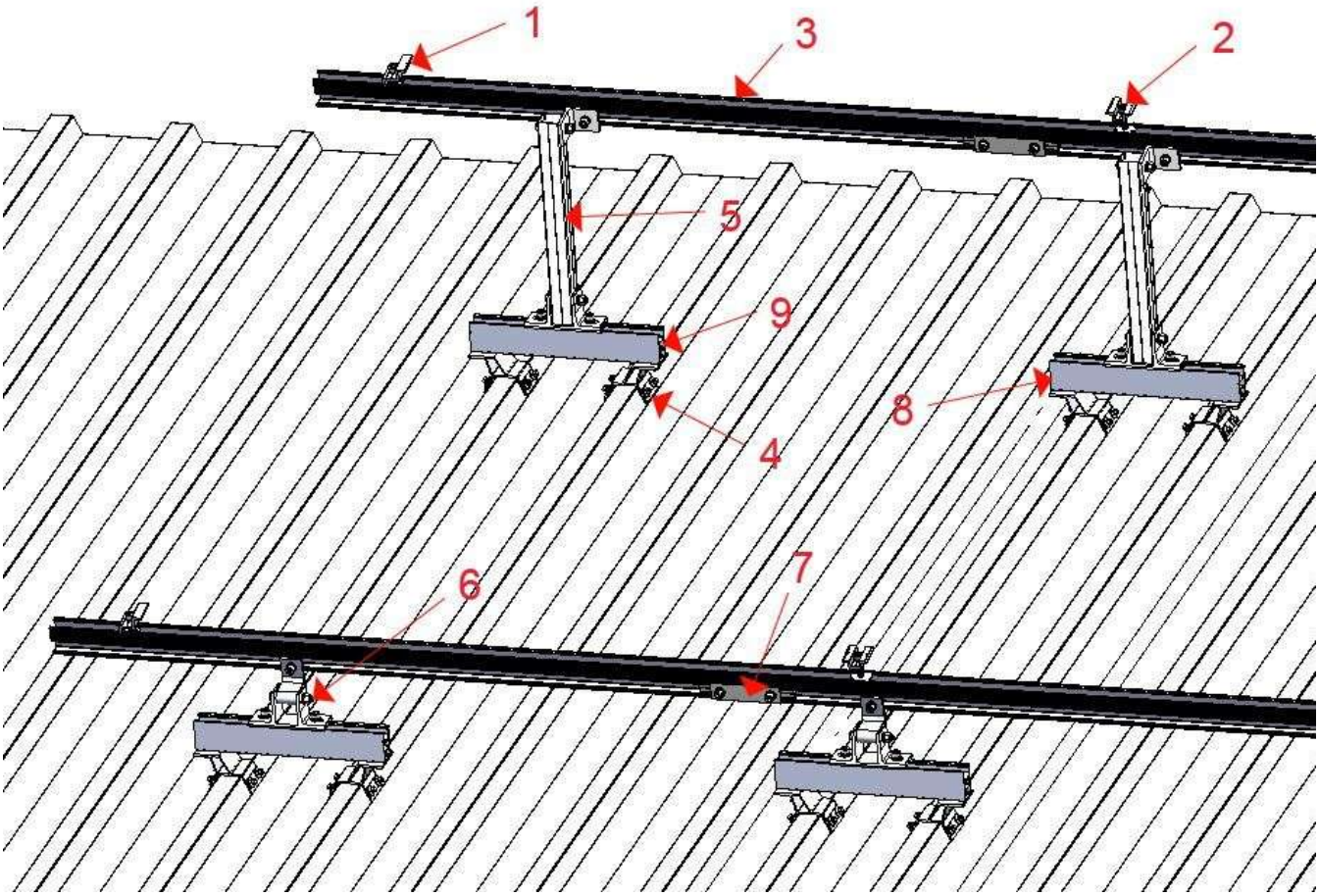


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System overview – Tilt Leg – Penetrative Clamp – Cardwell Bracket

1. End Clamp **2**. Mid Clamp **3.** Rail **4.** Roof Clamp **5.** Rear Leg **6.** Front Leg **7.** Rail Splice

8. Rail Nut Kit **9.** Cardwell Bracket



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Precautions During Stainless Steel Fastener Installation

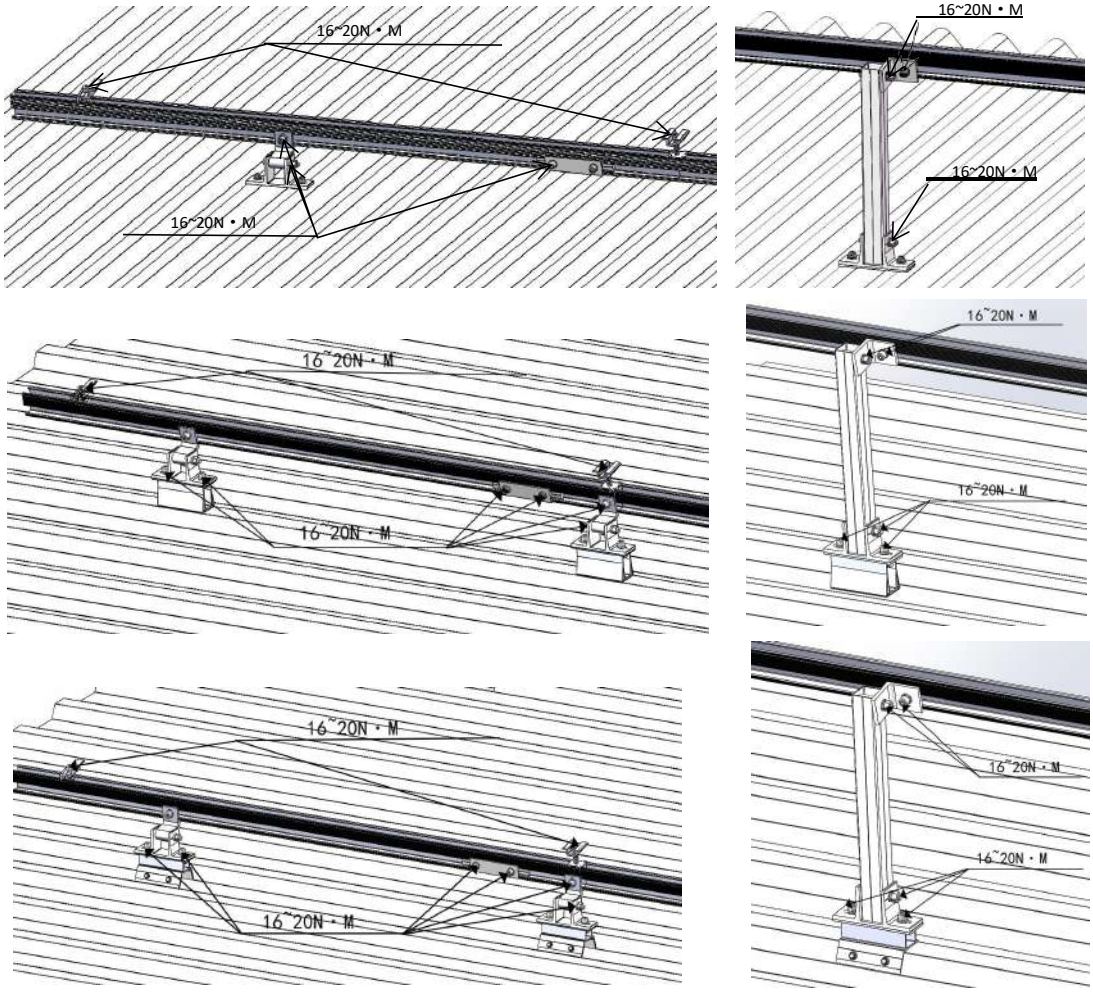
Improper installation can lead to the seizing (galling) of nuts and bolts. Follow the steps below to reduce the risk of thread galling when assembling stainless steel nuts and bolts.

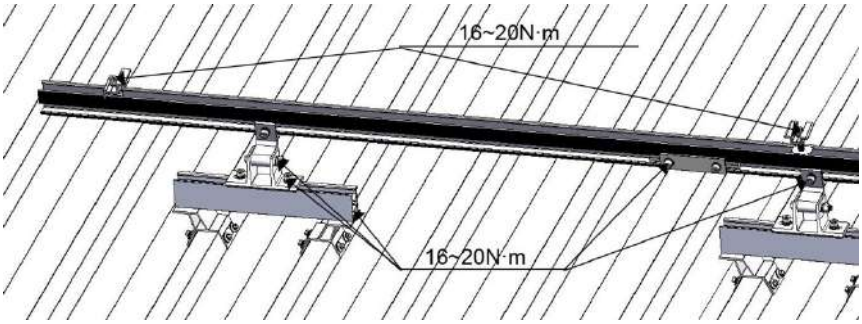
General Installation Instructions

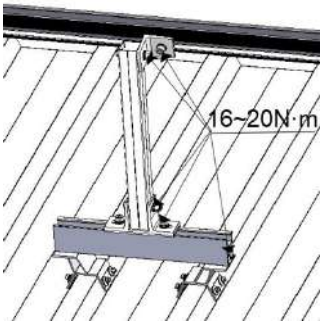
- Apply force to fasteners in the direction of the thread.
- Apply force evenly to achieve the required torque.
- Use professional tools for better control and accuracy.
- If desired, to prevent galling or seizing of threads, apply a lubricant (such as grease or oil).

Safe Torques

Refer to the safe torque values provided in this guide and the accompanying figures. If power tools are necessary, use them at low speeds. High-speed or impact drivers increase the likelihood of galling. If galling occurs and fasteners need to be cut, ensure there is no load on the fastener before cutting. Take care not to damage anodized or galvanized surfaces.







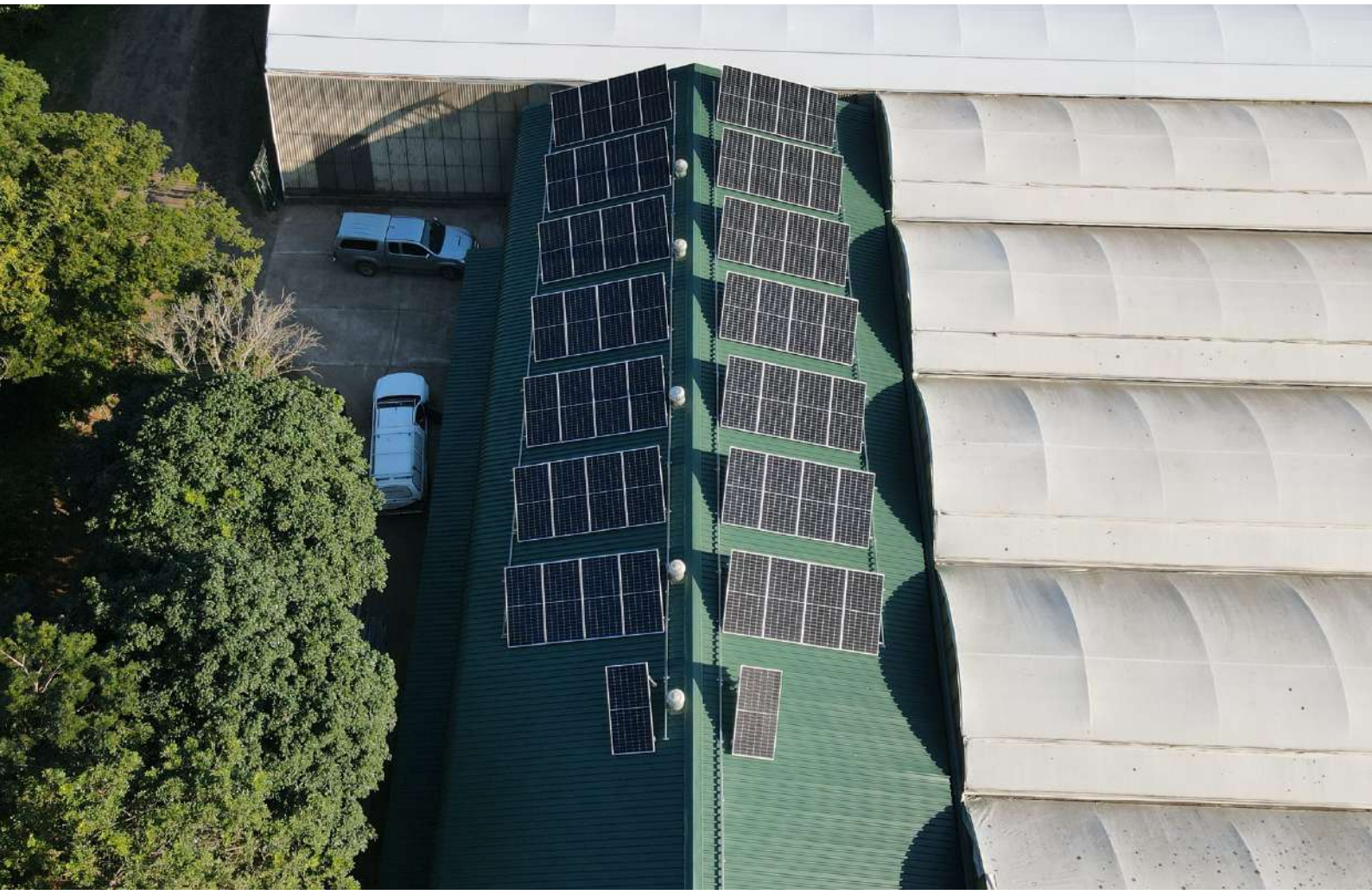
Item	Panel Clamps	Rail Splice	Tilt Splice Kit	Tilt Leg Kits
Product code	LMS-EC30-35-KIT-BP LMS-IC30-35-KIT-BP	LMS-PRO-RAIL47-SP-KIT	LMS-TILT-SPLICE-KIT	LMS-ARL5/10/20-KIT LMS-FL-KIT
Safe torques (N.m)	16-20	16-20	16-20	16-20

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Installation Instructions

All drawings and dimensions in this Installation Guide are for generic reference only. The Tilt mount with Penetrative Metal Roof Clamp System must be tailored to meet the specific conditions of each project and documented in a construction drawing.
The installation process outlined in this guide remains consistent, even if component sizes vary.

For any on-site modifications or alterations, please submit marked-up drawings or sketches to Lumasol for review, comment, and approval prior to making changes.



- Determine the number of modules in the horizontal direction by using the module width, allowing for at least 20mm spacing between modules for the inter clamps.
- Assess the horizontal spacing of the Metal Roof Clamps which varies according to wind loading.
- Assess the vertical spacing of the Roof Brackets, which should be approximately 1/2 to 3/4 of the module height.

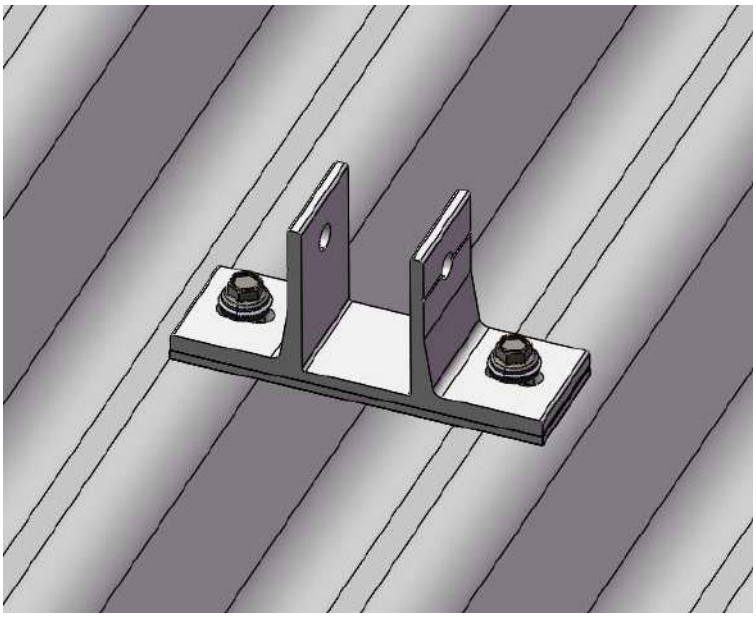
Always check the installation manual of the PV-Module you use to determine the allowed fixing points on the module frame.

Tilt Kit Base Installation:

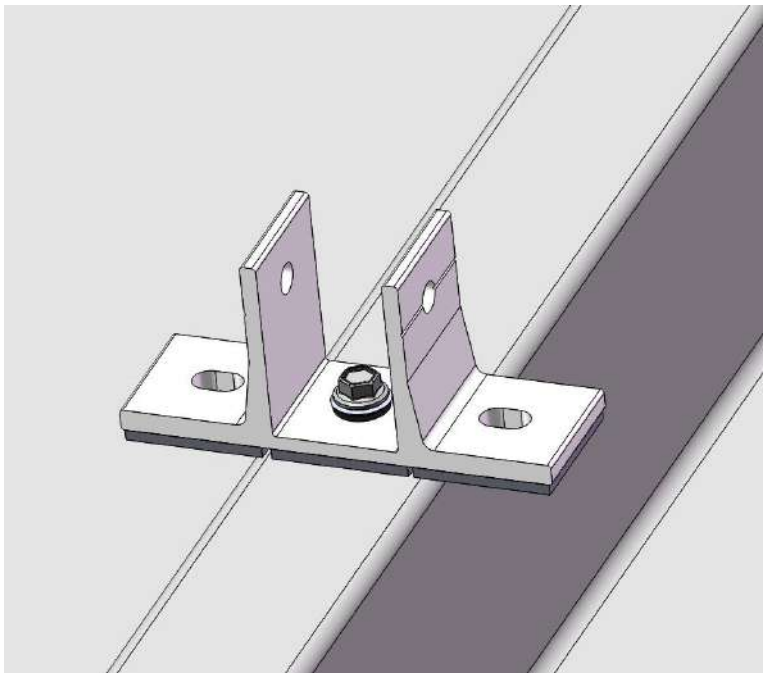
To secure the tilt-kit base, use the self-tapping screws **to secure the base to the sub-structure beneath the roof sheeting**. Please refer to the installation guide for the self-tapping screws **below.**

There are two methods to install the base **to** the metal or wooden purlins **beneath the roof sheeting.**

Method 1: Secure by screwing through the holes on both sides of the base.

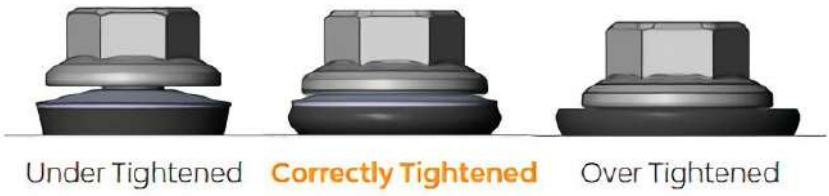


Method 2: Secure through the hole in the middle of the base. To ensure waterproofing, make sure there is EPDM rubber underneath the base.



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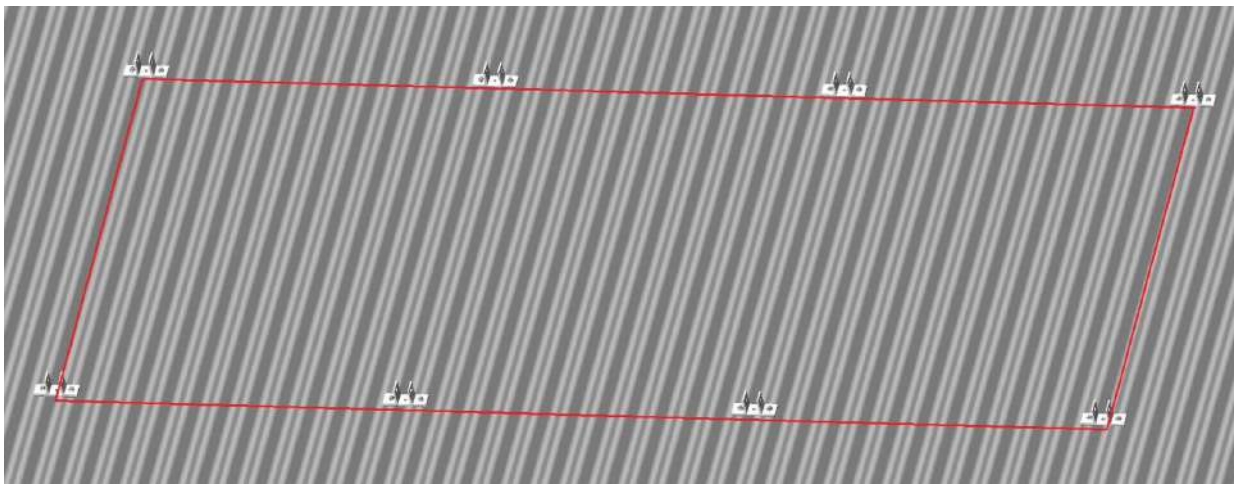
Installation Guide for Self-Tapping Screws



- Use a 3/8" hex socket.
- Operate a drill with a maximum drive speed of 300 RPM.
- Insert the screw into the screwdriver.
- Apply consistent end-load pressure to the screwdriver until the screw is securely fastened.
- Tighten the screw with the waterproof washer as shown in the referenced image. Ensure the screw is neither over-tightened nor under-tightened, and maintain a perpendicular alignment with the interface to prevent washer deformation.
- The purlin thickness must be between 0.42 mm and 2.4 mm.

The Lumasol Tilt Kits Systems are suitable for installations in the Internal Roof Zones.

Install the Tilt Kit Bases in a straight line as seen below.



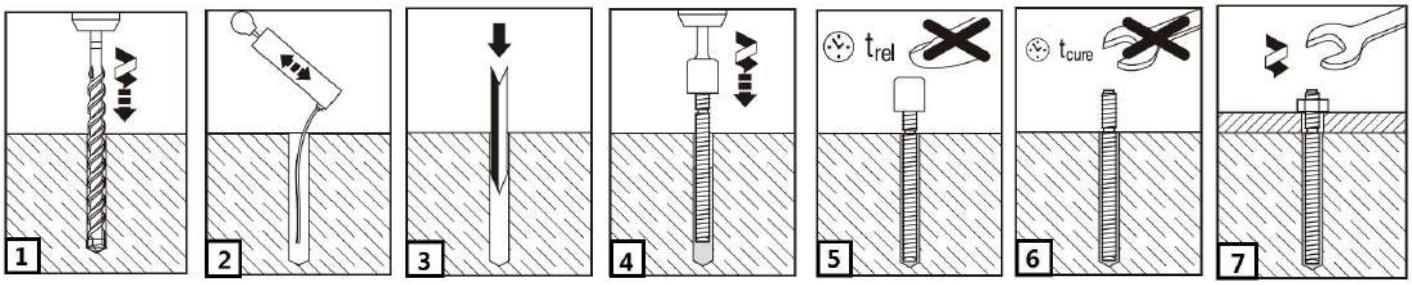
When installing the Lumasol Tilt Leg system on flat concrete roofs, chemical anchors or expansion bolts may be required. Below is the installation guide for both:

Information to Obtain from the Chemical Anchor / Expansion Bolt Product Specifications Sheet:

Parameter	Chemical Anchor	Expansion Bolt
Diameter	D	D
Height	H	H
Tightening Torque	T_{inst}	T_{inst}
Standing Time	t_{rel}	N/A
Curing Time	t_{cure}	N/A

Ensure all specifications are reviewed and adhered to during installation for optimal performance and safety.

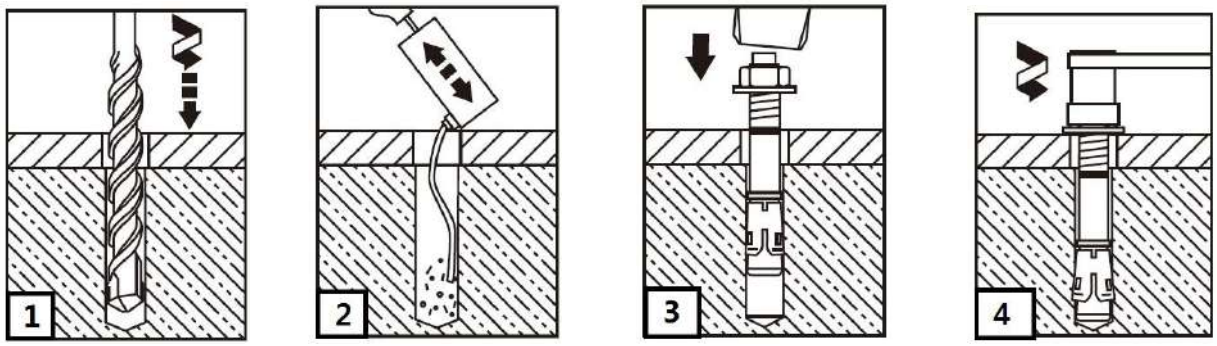
Chemical Anchor Installation



1. Use an electric drill to create the holes, ensuring the diameter D and depth H match the specifications provided in the product datasheet.
2. Clean the holes thoroughly using a blow pump or compressed air to remove dust and water. Ensure the holes are free of ice, oil, or other contaminants.
3. Insert the chemical anchor capsule or glass tube into the hole.
4. Slowly drive the anchor into the hole until it is fully seated, ensuring no adhesive overflows.
5. Avoid moving the anchor until the specified standing time (trel) has elapsed.
6. Do not apply any load or tightening torque until the curing time (tcure) has been reached.
7. The anchor will achieve its designed force capacity once the curing process is complete.

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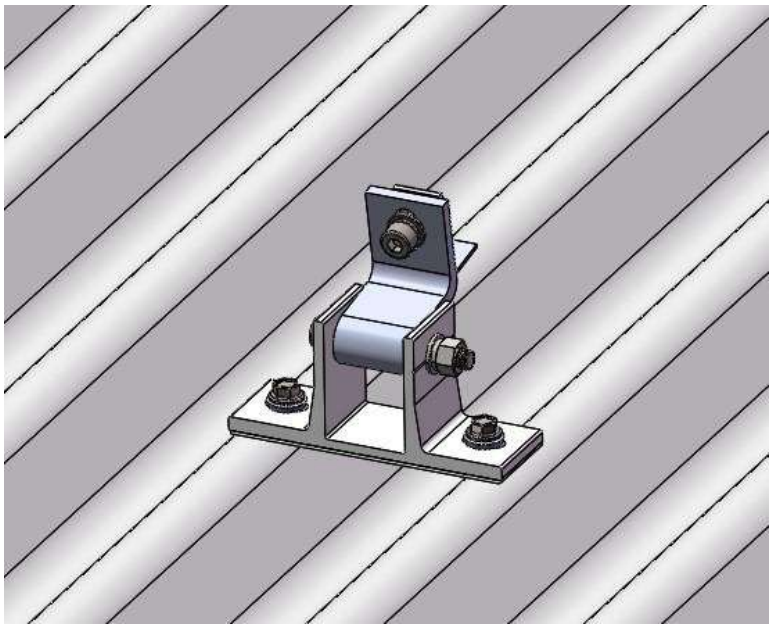
Expansion Bolt Installation

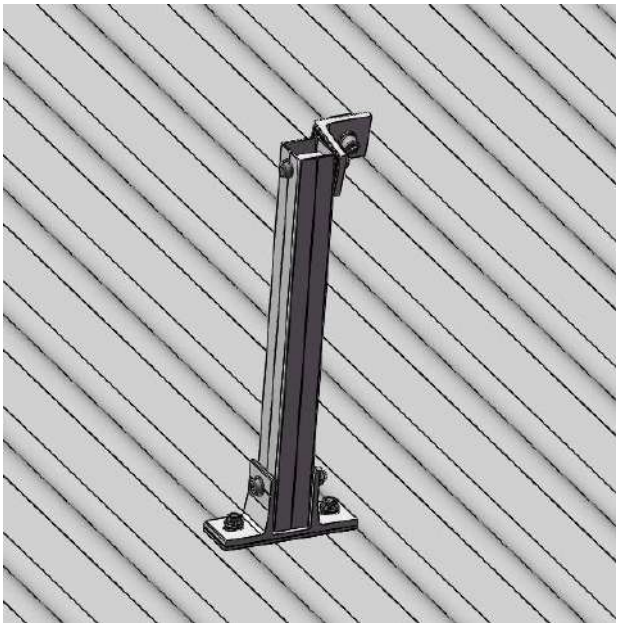


1. Use an electric drill to create holes, ensuring the diameter D and depth H align with the specifications in the product datasheet.
2. Clean the holes thoroughly using a blow pump or compressed air to remove dust and water. Ensure the holes are free from ice, oil, or other contaminants.
3. Insert the expansion bolt into the hole and drive it in using a hammer.
4. Achieve the designed force capacity by applying the specified tightening torque.

Front and Rear Leg Installation:

Position and align the front and rear legs according to the specified direction in the installation plan. Avoid fully tightening the fasteners at this stage; final tightening should be performed after the angle adjustment is completed.



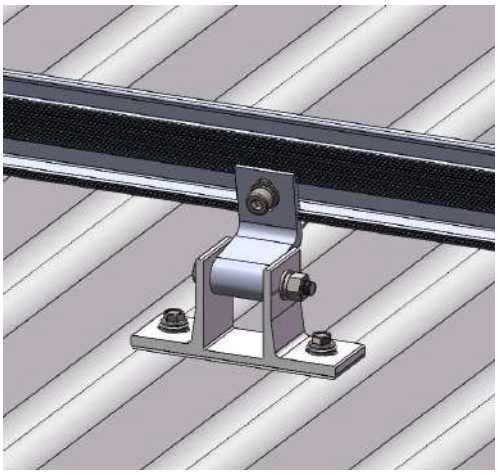


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Rail Installation

Once the front and rear tilt kits have been positioned correctly, secure the rails to the tilt kits by fastening the rail nut kits (16-20 Nm torque).

Make sure the grooves on the rail mesh with the grooves on the tilt kits.





Splice Installation

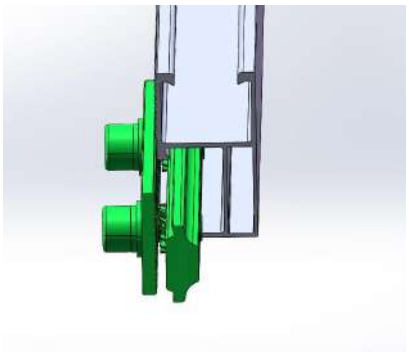
Determine the mounting position of the rail based on the installation plan.

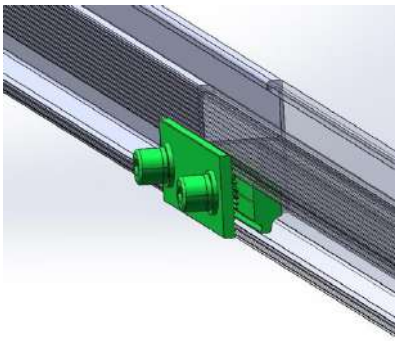
To connect multiple rails, use the rail joiner / splice kit as seen in the image below. Tighten the M8 bolts using an Allen key.

The splice provides an electrical connection between the two rails via the star washers, which penetrate the rails anodising layer.

Rail splice connectors should not be installed directly above support points or at the midpoint between two adjacent supports. It is recommended to install the connector at a distance within 1/4 of the rail span from a support.

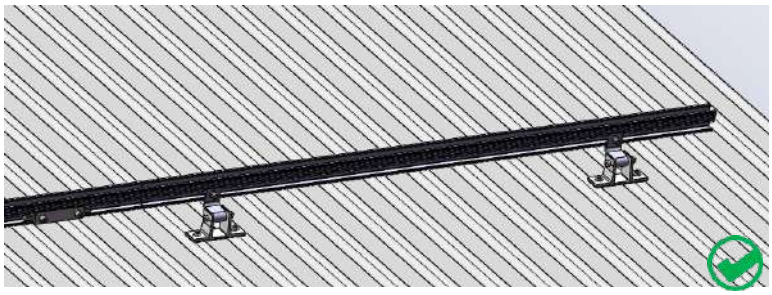
The recommended torque is 16-20 N·m.

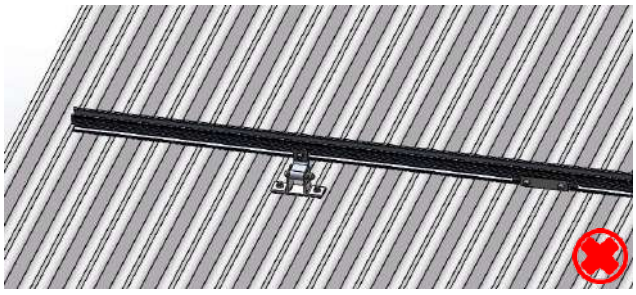






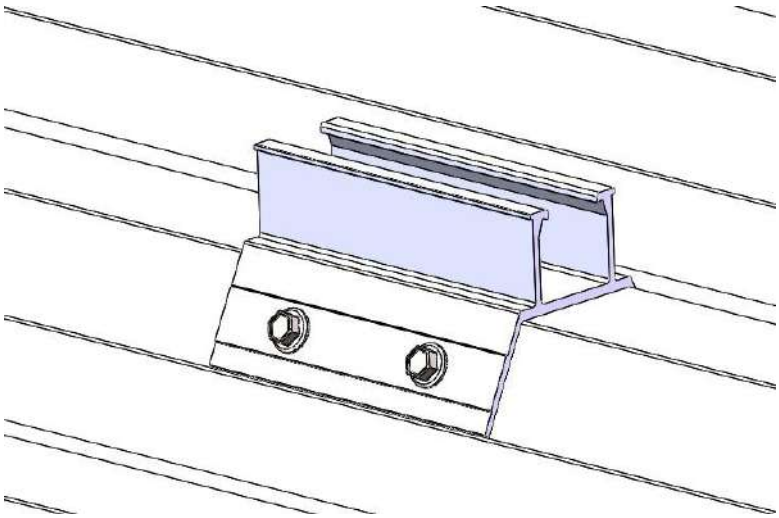
Note : To ensure the strength of the rail and splice connection, each rail must be supported by at least two clamps as seen in the image below;

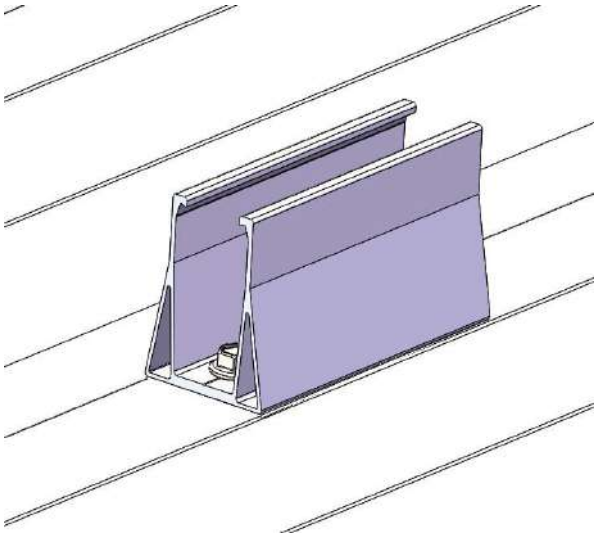


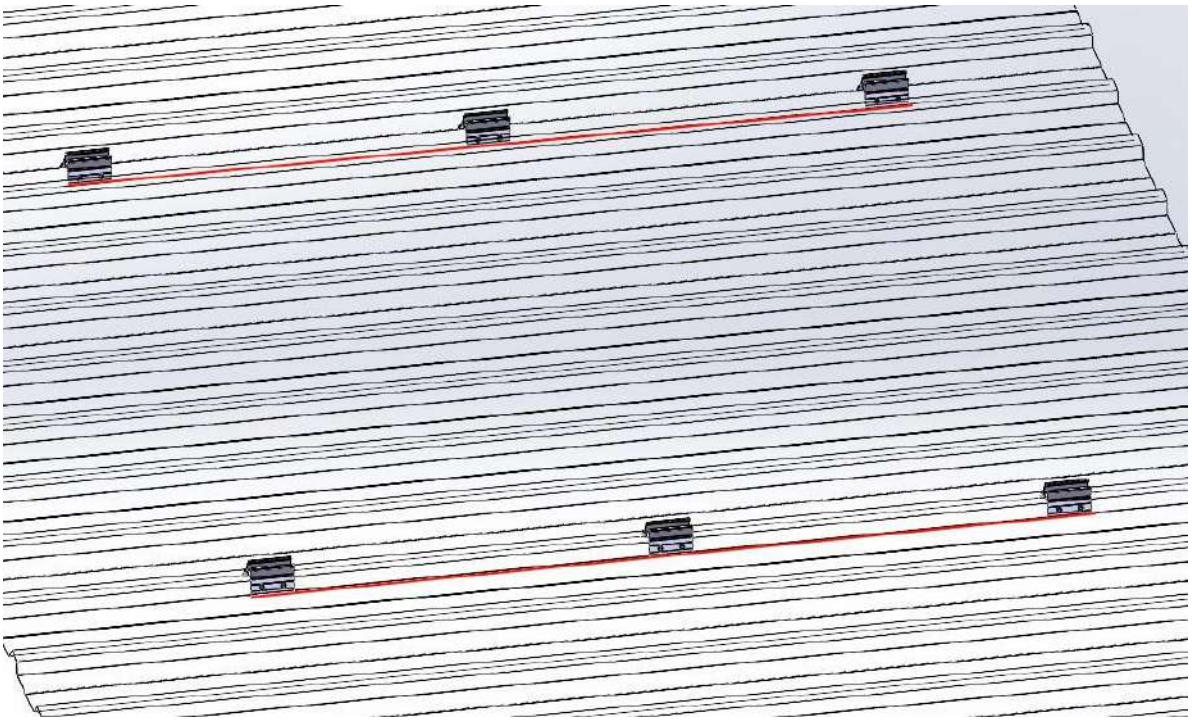


Mini Rail Installation

1. Position the mini rails in a straight line, according to the installation plan, as seen in the image below.







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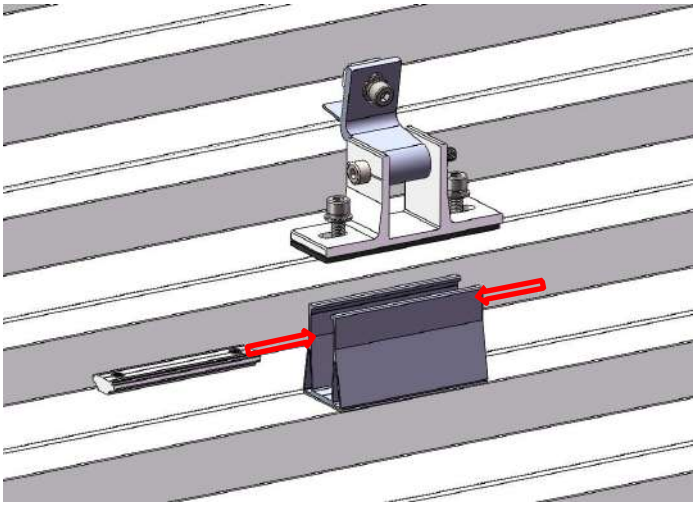
2. Fix the mini rails to the roof sheet using the self-tapping screws.

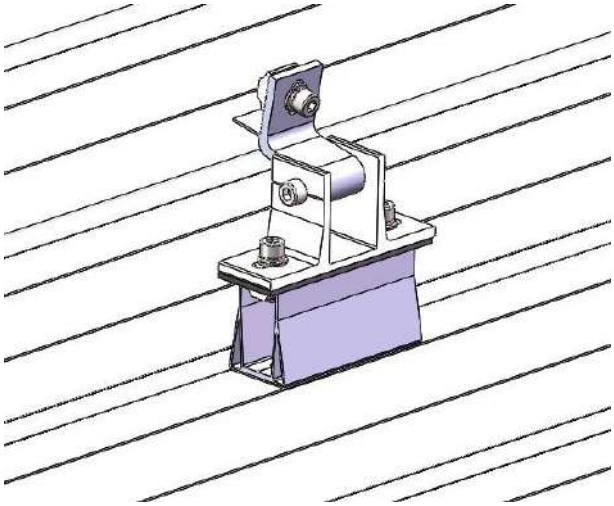


- Use a 3/8" hex socket.
- Operate a drill with a maximum drive speed of 300 RPM.
- Insert the screw into the screwdriver.
- Apply consistent end-load pressure to the screwdriver until the screw is securely fastened.
- Tighten the screw with the waterproof washer as shown in the referenced image. Ensure the screw is neither over-tightened nor under-tightened, and maintain a perpendicular alignment with the interface to prevent washer deformation.
- The purlin thickness must be between 0.42 mm and 2.4 mm.

Front and Rear Leg Installation

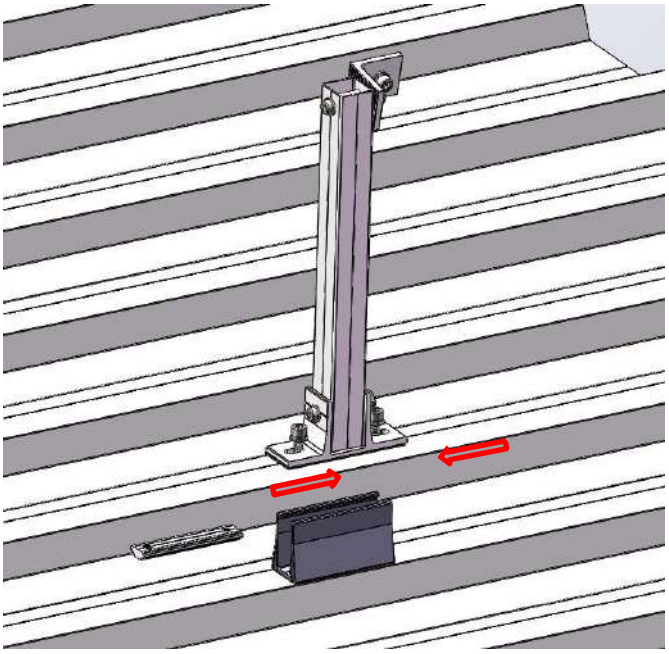
Position and align the front and rear legs according to the specified direction in the installation plan.
Avoid fully tightening the fasteners at this stage; final tightening should be performed after the angle adjustment is completed.

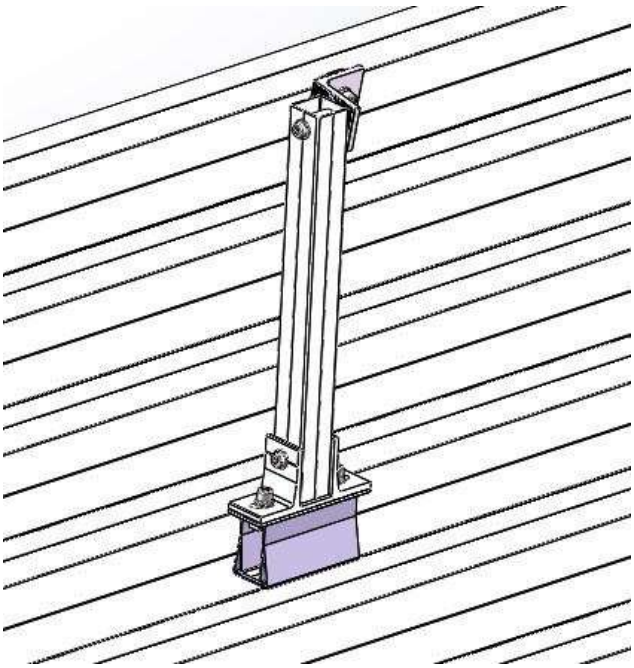


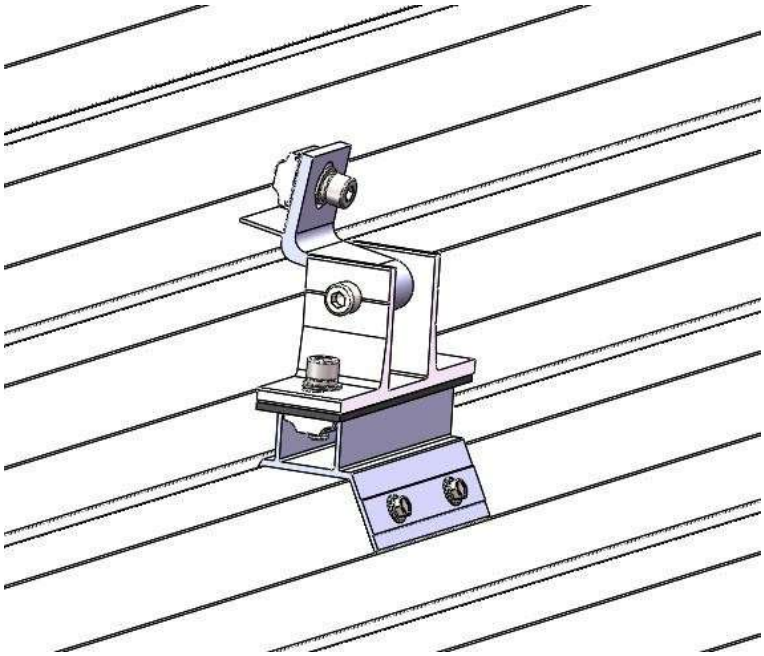


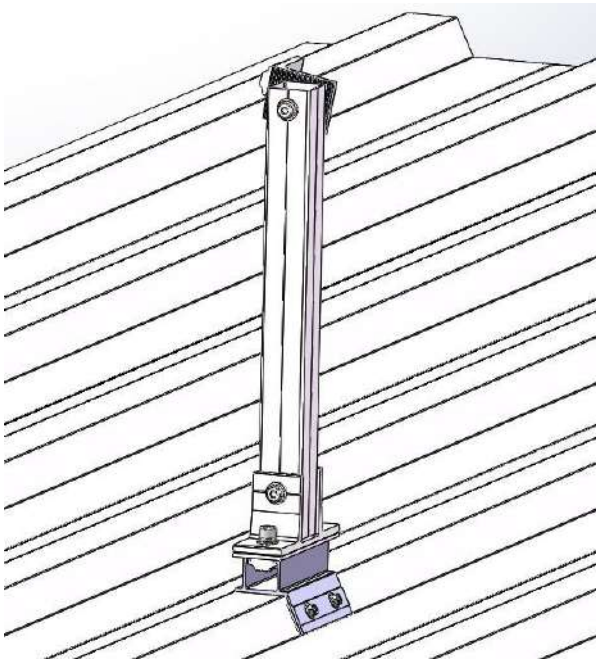
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Secure the Front and Rear Leg Tilt Kits to the Mini Rails by using the Tilt Splice Kits as seen below.





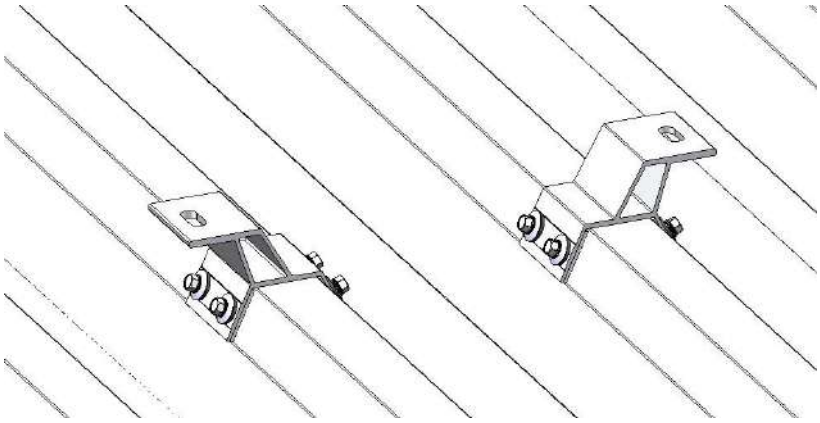




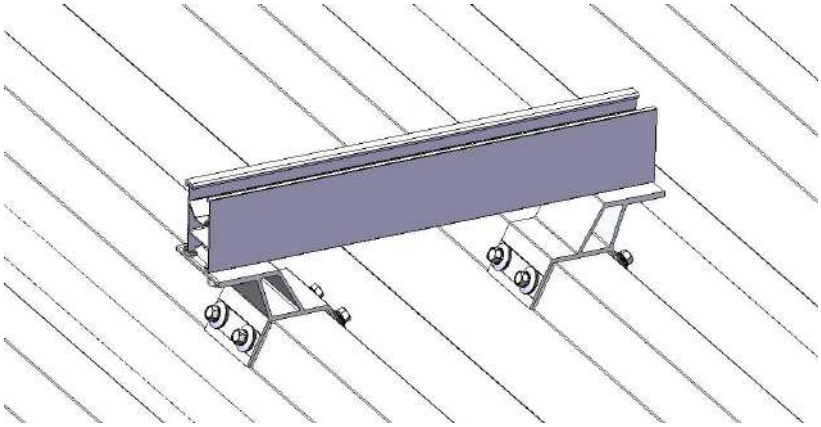
Follow the Rail And Splice Kit installation instructions as seen earlier in the manual.

Cardwell Bracket Installation:

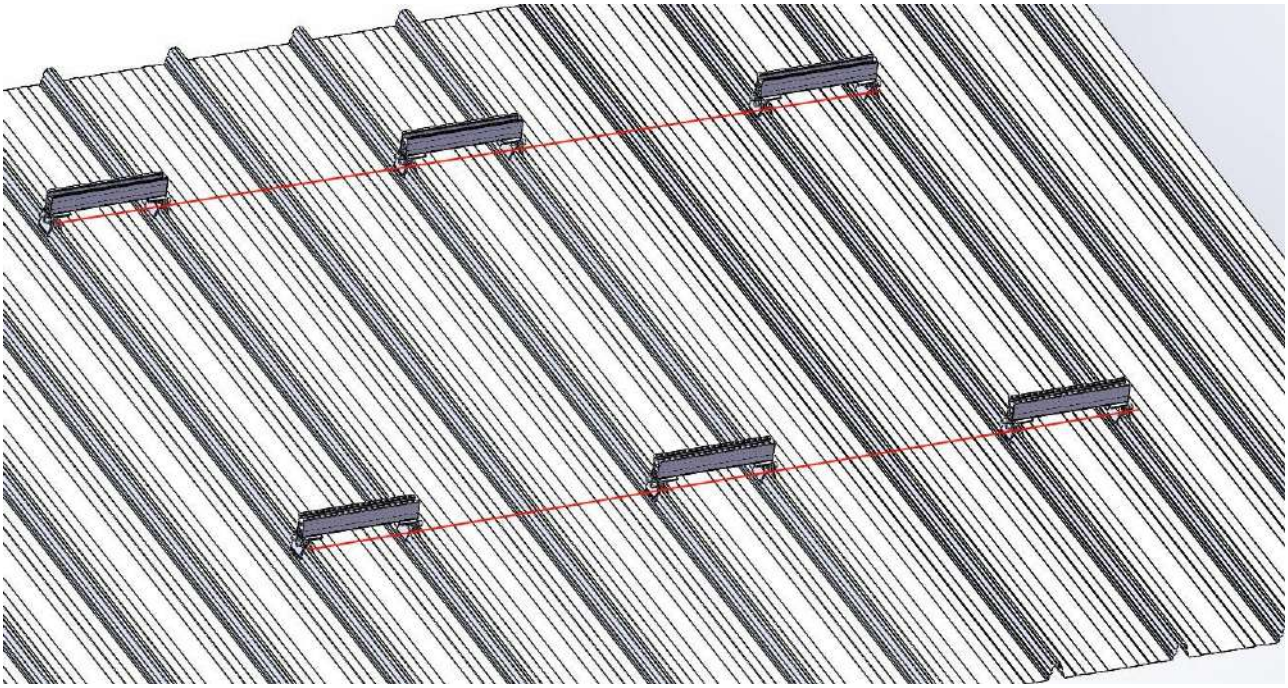
Position the first set of Metal Roof Clamps according to the installation plan and fasten them to the rib of the metal roof sheet.



Connect the Cardwell Bracket to the roof clamps using the rail nut kits provided (16-20Nm torque).



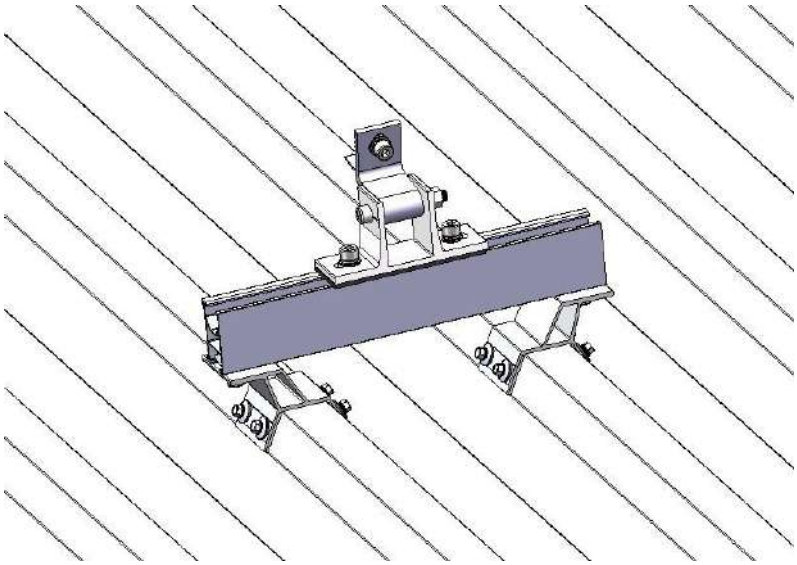
Continue securing the Roof Clamps and Cardwell brackets to the roof sheeting in a straight line as seen below.

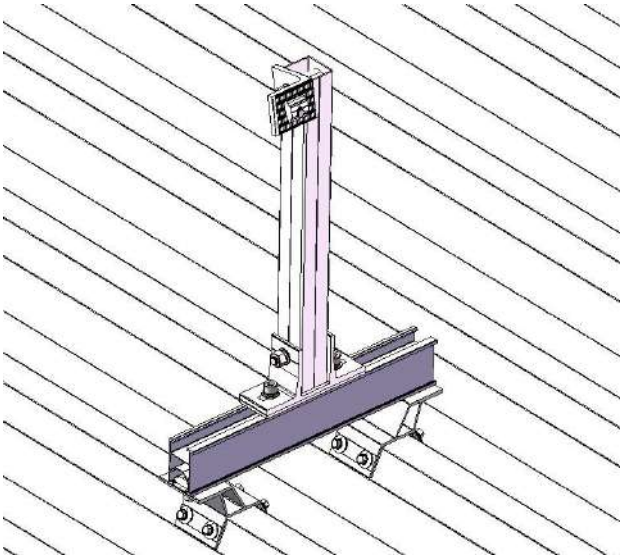


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Front and Rear Leg Installation

Fix the base of the front and rear tilt kit on to the Cardwell Bracket using the tilt splice kit. Ensure that the base faces the correct direction to receive the rail.

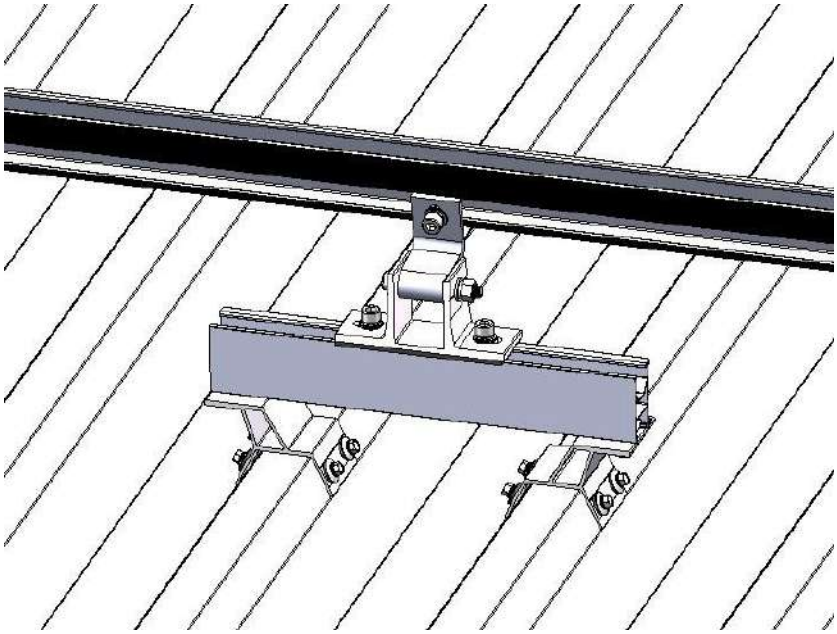


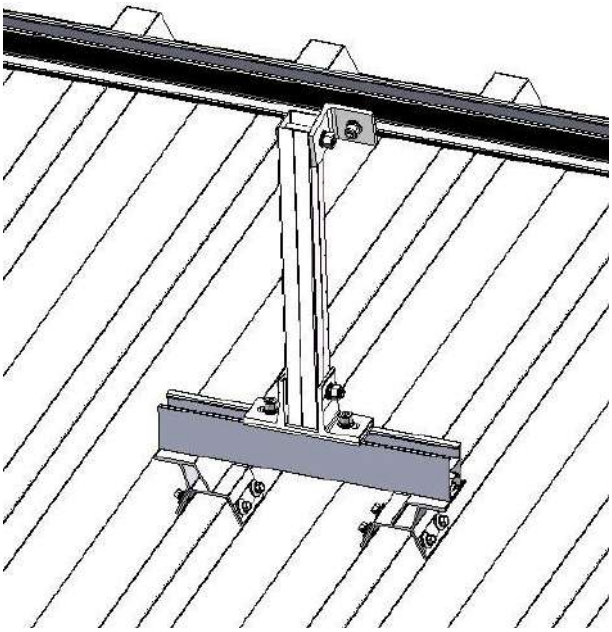


Rail Installation

Once the front and rear tilt kits have been positioned correctly, secure the rails to the tilt kits by fastening the rail nut kits (16-20 Nm torque) as seen in the images below.

Make sure the grooves on the rail mesh with the grooves on the tilt kits.



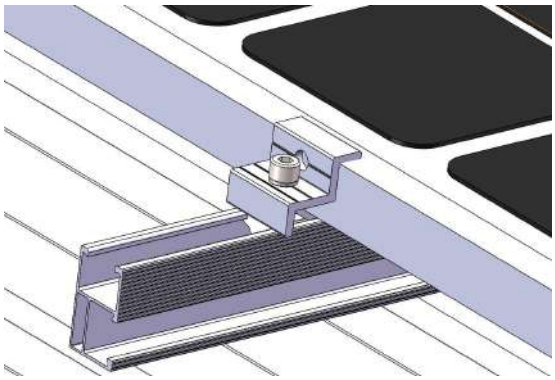


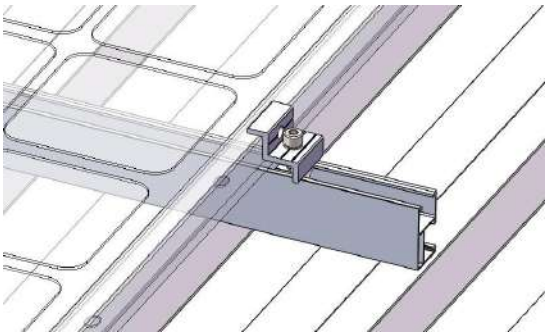
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Mid and End Clamp Installation:

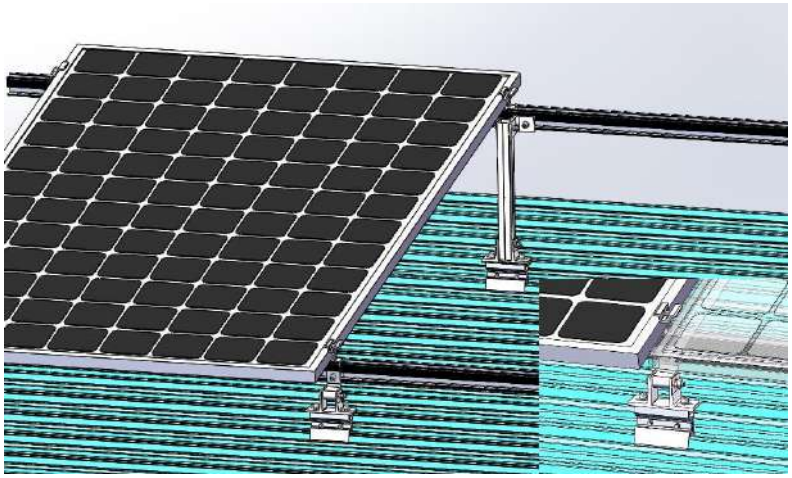
Step 1:

Place the first PV Module on the rail according to your plan and fix it in place using an End Clamp. Fasten lightly until final positioning can be confirmed.

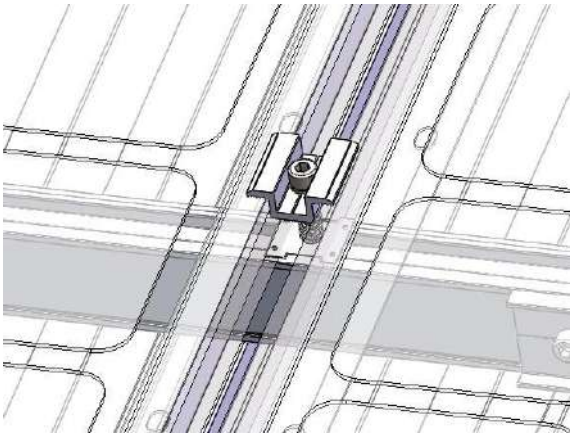




Step 2: Slightly lift the PV Module and slide Mid Clamps and Earthing Clips into position. The teeth on Earthing Clip will automatically align when the Mid Clamp is properly installed as seen in the image.



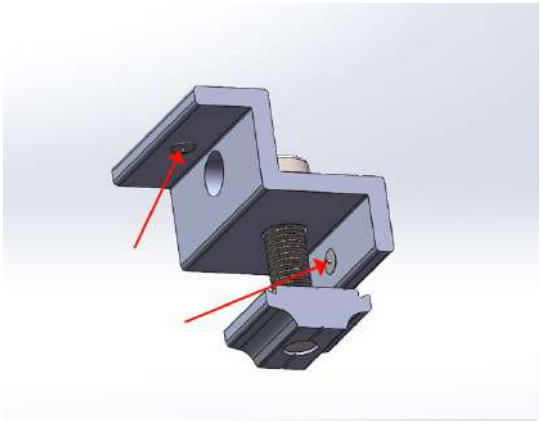
Step 3: Place the next PV Module into the other side of the Mid Clamp and Earthing Clip as shown in the image.



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Notes:

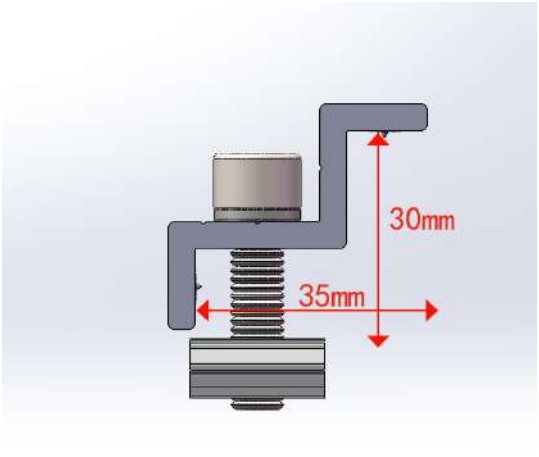
- When fastening the bolts, the bonding pins on the mid and end clamps pierce the anodized layer of the PV module, enabling electrical conductivity, as shown in the image.



- During mid clamp installation, ensure that the earthing clip is positioned between the panel and the rail. This ensures that, once the bolts are fastened, the earthing clip pierces the anodized layer of both the rail and the panel simultaneously, achieving proper conductivity.



- The two holes on the end clamp allow for switching between two panel thicknesses—30mm and 35mm, as shown in the image.



Important Notes:

- Ensure PV module frames are fully pressed against end and mid clamps, as well as earthing clips. Visually check that earthing clips are correctly positioned. **Earthing clips are for single use only**.
- Fasten bolts with a torque of 16-20 N·m only once the PV module position is finalized. (Slightly tighten bolts to hold modules in place before final adjustment).
- Replace earthing clips when replacing defective PV modules.
- When removing defective PV modules, ensure enough earthing clips remain to maintain continuity with the rail. Install earthing clips under end clamps if needed.
- For arrays with more than two rows of rails, use the same layout and quantity of earthing clips as for two rows.

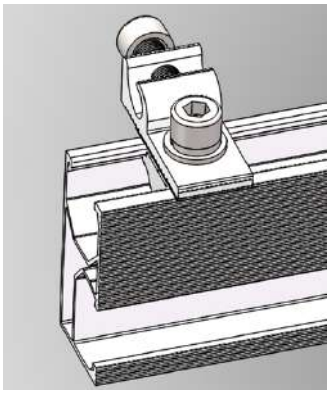
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Grounding Lug Installation

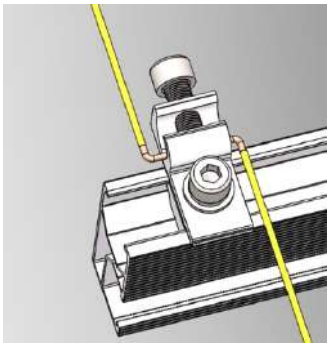
Installation Requirement:

Install one grounding lug per rail row.

Use a recommended fastening torque of
16-20 N·m for M8x25 bolts.

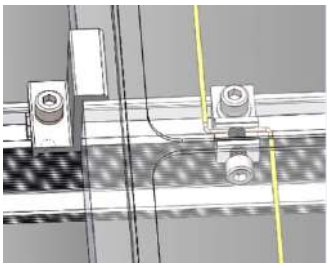


Cable Connection: After fixing the grounding lug to the rails, strip the earthing cable (max size: 35 mm²). Insert the conductor into the channel and tighten the M8x20 bolt to 8-12 N·m to secure the cable.



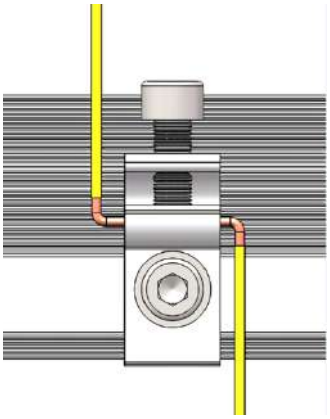
Note: Check the electrical resistance between the rail and earthing cable conductor to ensure proper bonding.

Grounding Lug Installation Options:



Option 1:
Mount the grounding lug in the top channel of the rail.

Option 2:
Mount the grounding lug in the top channel of the rail, just below the PV module. This option accommodates PV modules up to 30 mm in height.



Option 3:
Mount the grounding lug in the side channel of the rail.