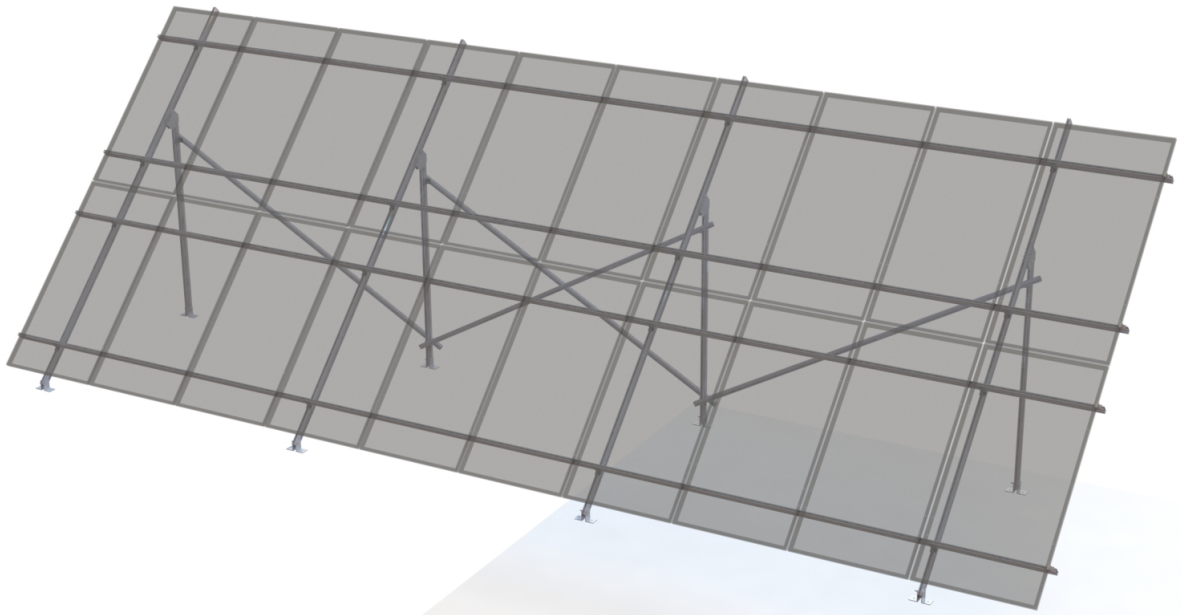
Version: FR-GMX-4000

GMX - Installation Manual

Fixed Ground Mount



Install Solar Faster

www.fast-rack.ca

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1.0 Using this Manual

Introduction

This manual is an illustrated guide on how to install a Fast-Rack GMX ground-mount system. It is meant to cover each individual step of the assembly process. Throughout the guide, references will be called to the parts list in order to assist in easily identifying the items required for a specific section. The guide is broken into several sections, each covering the milestone assembly steps, with sub assembly steps in-between where necessary. Each assembly step will include an illustrated list of hardware to be used during that assembly process. Where specified, some assembly sections include a preparation process. It is necessary to follow these preparations in order for the installation to continue smoothly, with no need for back tracking.

Throughout the guide there are reference markings for warnings, and recommendations, identified by these symbols:

Be sure to look for and read these markings. They will provide information such as guidelines to prevent damage to equipment, safety measures to prevent serious injury or bodily harm, and advice on how to make the assembly quicker.

Liability

The installer and/or contractor or developer of each project shall be responsible and liable for safe and proper installation of each system, and also to initiate, maintain and supervise all safety programs and precautions for each project and project site, and to provide all required protection to prevent damage, injury, loss or death to any or all persons, property and work present or located on the project site.

Fast-Rack does not install any portion of its mounting systems and therefore will not have, and hereby specifically disclaims, any duty or responsibility for safe and proper installation of any mounting system or jobsite safety as to any jobsite where installation of any of its mounting systems occurs. Please follow the drawings and instructions, and report any issues or discrepancies to Fast-Rack.

Compliance

The Fast-Rack photovoltaic mounting system meets the requirements of CSA LTR AE-001-2012 and the bonding components of the system are individually certified to CSA C22.2#41:2013 ED.6

Personal Safety

Prior to starting the installation, it is important to identify all potential hazards and implement a safety plan denoting how to deal with these hazards.
Examples of some potential personal hazards which may be encountered during an installation are:

• Fall Hazards – Ensure compliance with OHSA regulations for working at height. Use fall protection, or fall prevention equipment and practices as necessary.
• Electrical Hazards – Observe the location of overhead and underground conductors/electrical equipment. When possible disconnect/lockout circuits in the work area.
• Lifting Hazards – Use proper lifting techniques to prevent work place injuries when moving components on the ground and lifting between the ground and array location.
• Environmental Hazards – Rain, snow, wind, sun and heat. All of these have the potential to injure personnel and property if not properly prepared for.

Once the hazards specific to the installation have been identified, it is critical to devise a plan should a workplace accident occur. Some things to have prepared and discussed prior to start of work are:

• Location of nearest hospital, emergency phone number
• Trained and certified on-site first-aid attendant and location of first-aid kit
• Devise method for extracting injured personnel
• Communication and awareness of potential hazards
• Trained and certified fall protection training for all personnel working at height

Fast-Rack offers regular training courses for Fall Protection Awareness, while Occupational First Aid courses can be found in most municipalities often through local fire departments.

Site Safety

Evaluate and identify potential safety hazards and injuries that could occur on the job site. This includes specific work situations and understanding the potential injuries from the identified hazards. Maintaining safety policies and general jobsite safety practices goes a long way to ensuring a smooth and safe install.

Ground-mounted installations often involve the use of heavy equipment for moving materials, grading or clearing land and installing foundations. Ensure machines are being used properly by trained professionals and all workers are familiar with the safety risks of working on a site that uses heavy equipment.

To mitigate the risk of injury and theft on the jobsite, proper fencing, signage and policies should be used. Ensure all construction practices are being implemented as per the Ministry of Labour. Workers, supervisors and employers are all responsible for safety.

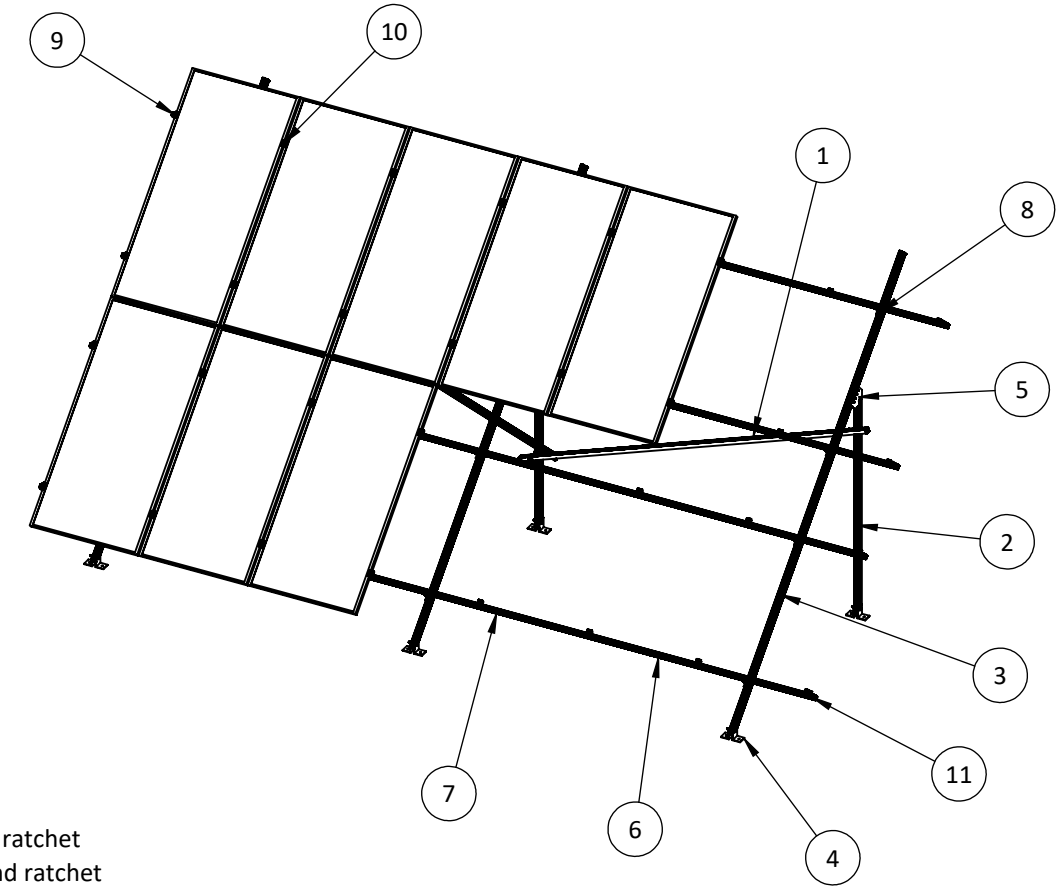
3.0 Scope of Delivery

Components

ID	PART	CODE
1	Cross Brace	FR-RAIL-UL-139
2	Back Leg	FR-RAIL-HD-7D
3	Front Leg	FR-RAIL-HD-173D
4	Foundation Foot	*FR-2T-GMX-LEGS
5	Pivot Plate	*FR-2T-GMX-LEGS
6	Rail	FR-RAIL-HD-173D
7	Splice	FR-SPLICE
8	L Foot	*FR-2T-GMX-LEGS
9	End Clamp	FR-END-XX / FR-CL-END-XX
10	Mid Clamp	FR-MIGS-XX / FR-MIG-CL-13XX
11	Ground Lug	FR-GND-LUG-C
12	Bond Strap	FR-BJ-8.0-KIT
13	Accessory Bond Kit	FR-MGH-16/20

*ALL INCLUDED IN FR-2T-GMX-LEGS KIT

Upon receipt of goods, make sure to check all packaging to ensure delivery of all parts required.



Hardware

ID	SIZE	TYPE
A	0.4375 x 2.500	Hex Bolt
B	0.4375	Flat Washer
C	0.4375	Lock Washer
D	0.4375	Hex Nut
E	M8 x 25	T-Bolt
F	M8	Flanged Hex Nut

Torque Specifications

SIZE	TORQUE
M8	10 lbs.ft
7/16"	31 lbs.ft

Tools

- 5/8" Open end wrench, socket and ratchet
- 13mm Open end wrench, socket and ratchet
- Torque wrench

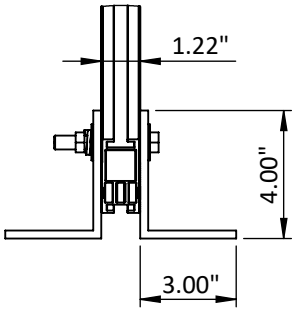
4.0 Base Layout

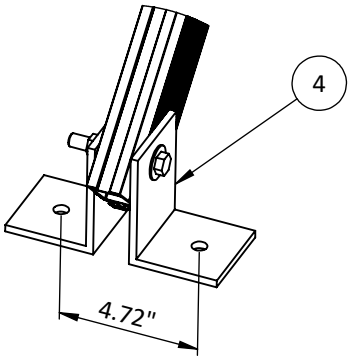
The foundation feet should be spaced out in the pattern shown. Each anchor point has two Foundation Feet that fasten down to the foundation using 7/16" hardware.

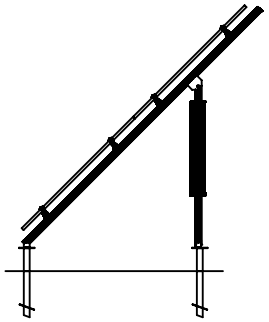
Common foundation options include helical piles, reinforced concrete piers and pads, and concrete precast blocks. Alternative foundation options may be used if approved by an engineer.

Spacing of the foundations must be followed to ensure the racking fits togethor properly.

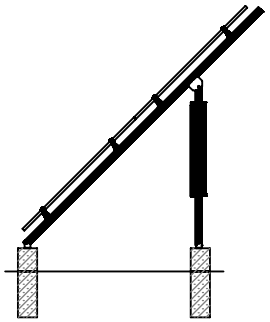
Consult with an engineer before proceeding with the base installation



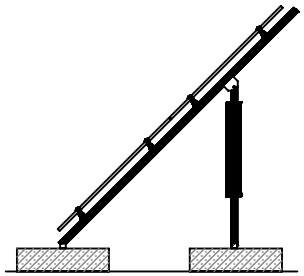




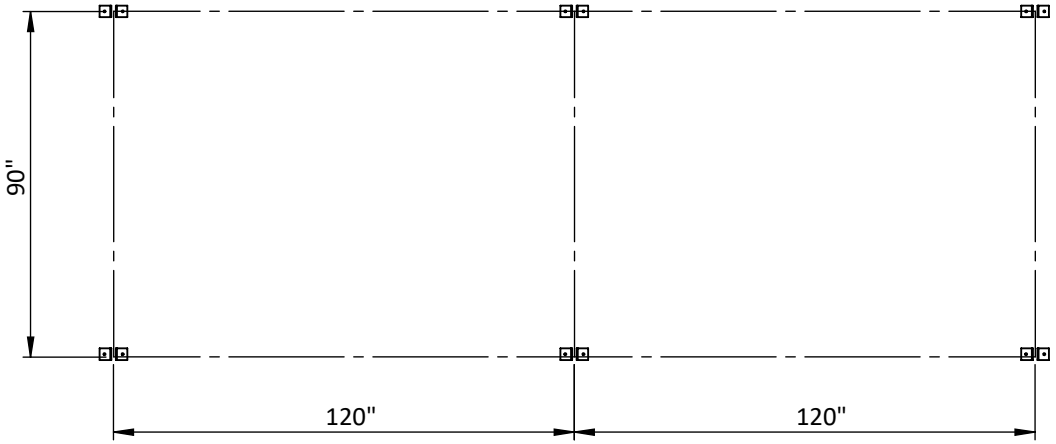
Piles



Concrete Piers



Concrete Pads



5.0 Leg Assembly

E
M8 x 25mm
T-Bolt

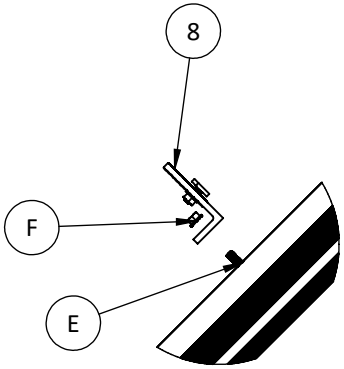
F
M8
Flanged Hex Nut

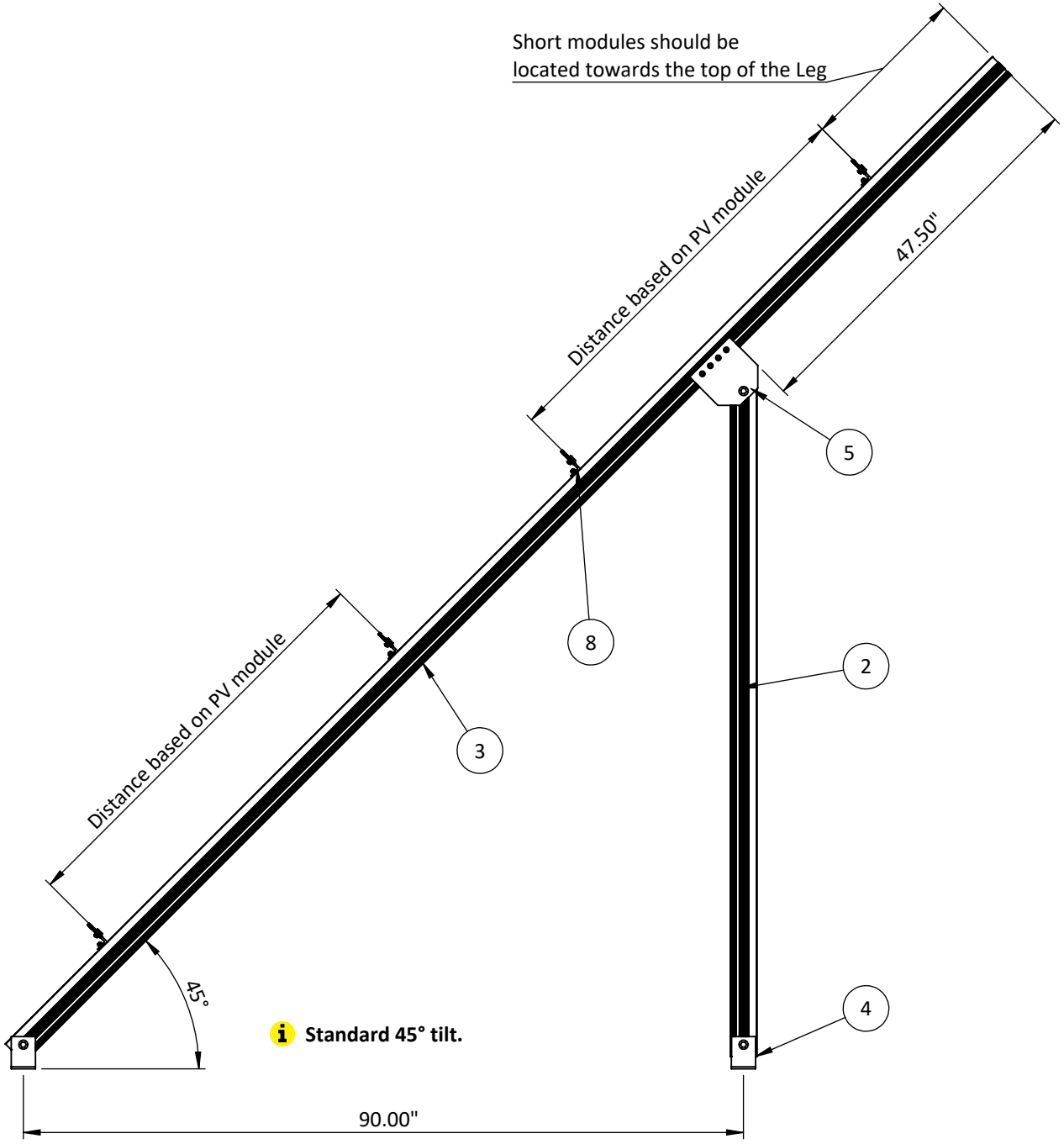
Position the L-Feet on the legs with the L facing down. The feet connect to the leg using a T-Bolt and should be spaced in accordance with the PV module clamping zones

The bottom end of the leg connects to the foundation feet using a through-bolt. The top end connects with the two mounting plates which accomodate the connection to the back leg.

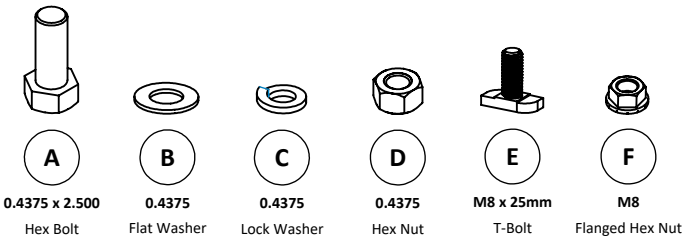
Take into account the module overhang to ensure there is enough clearance at the bottom end

Alternate tilt angles may be reviewed by engineering





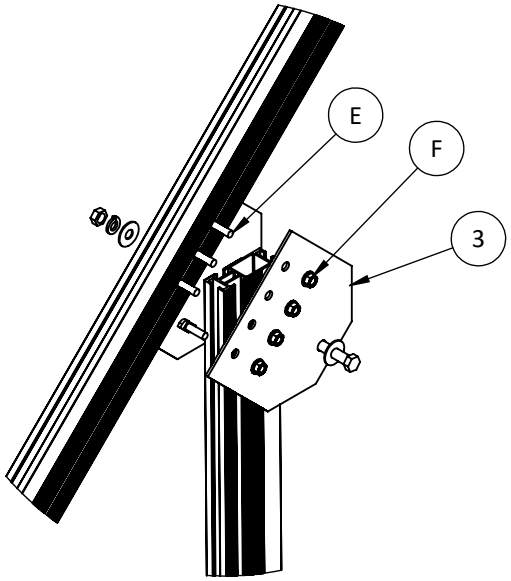
5.1 Front Leg Connections

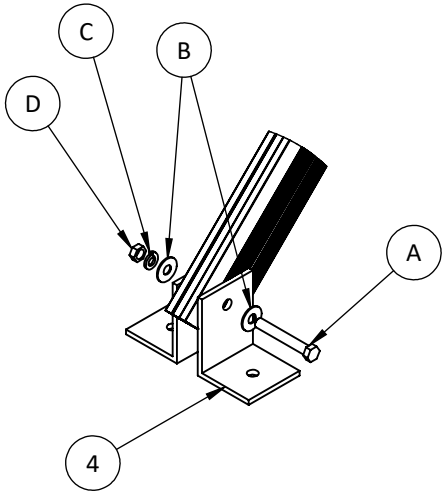


The bottom end of the Leg will connect to two of the Foundation Feet. These through-bolt to the Leg using the mounting hole located at the end of the Leg.

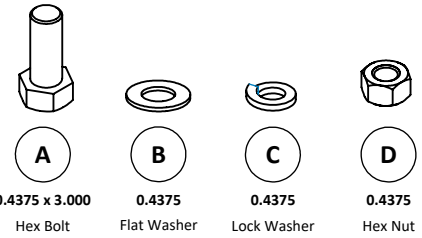
On the top end, two Pivot Plates are fastened to either side of the Leg. Ensure they are aligned with each other and spaced properly from the end of the Leg.

It is recommended to attach all feet and brackets with the Leg sitting flat on the ground. Once attached, lift into position.



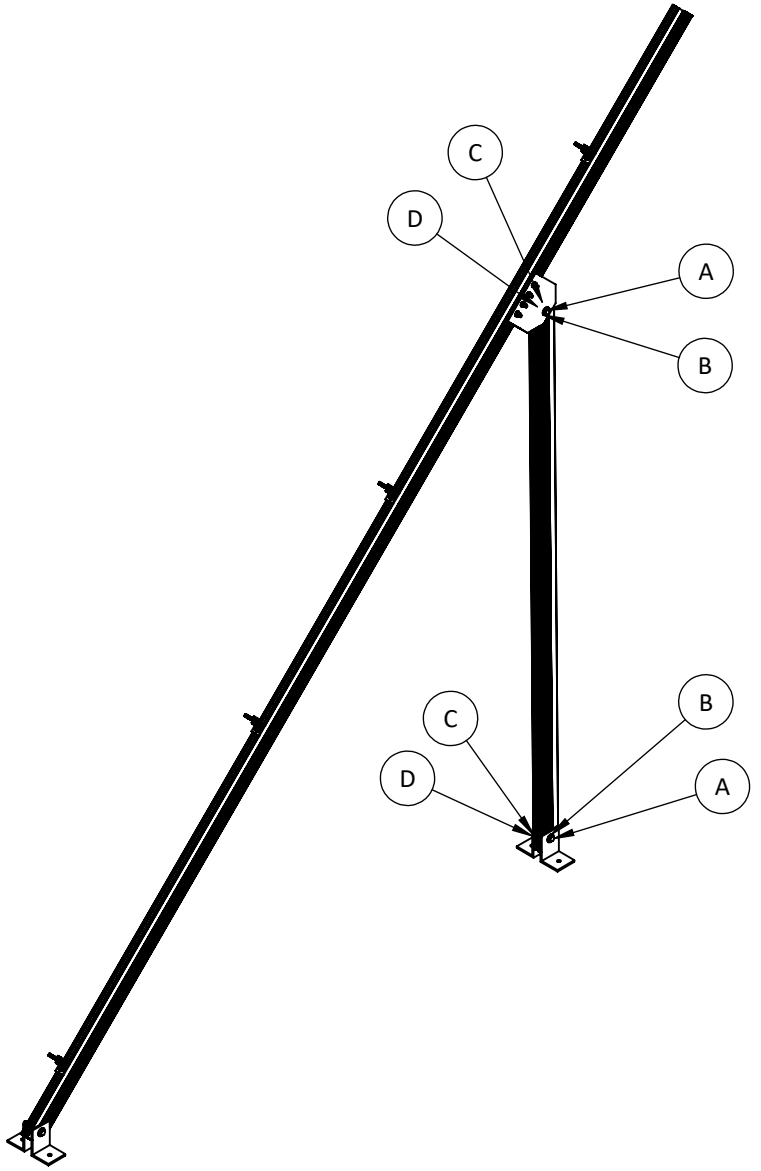


5.2 Back Leg Connections



With the Front Leg assembled and Pivot Plates attached, proceed to install the Back Leg. It will connect to the back set of Foundation Feet, and then to the Pivot Plate. Using the hardware provided, through-bolt both connections and torque all hardware.

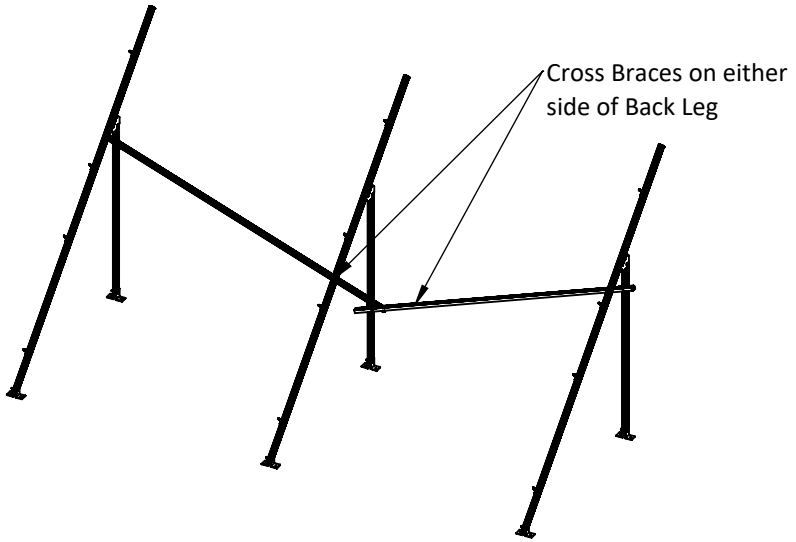
The Back Leg should be in a vertical position once installed. Verify the measurements of all legs in the array at this stage to ensure the system is aligned and square.



6.0 Cross Bracing

E — **M8 x 25mm** T-Bolt

F — **M8** Flanged Hex Nut

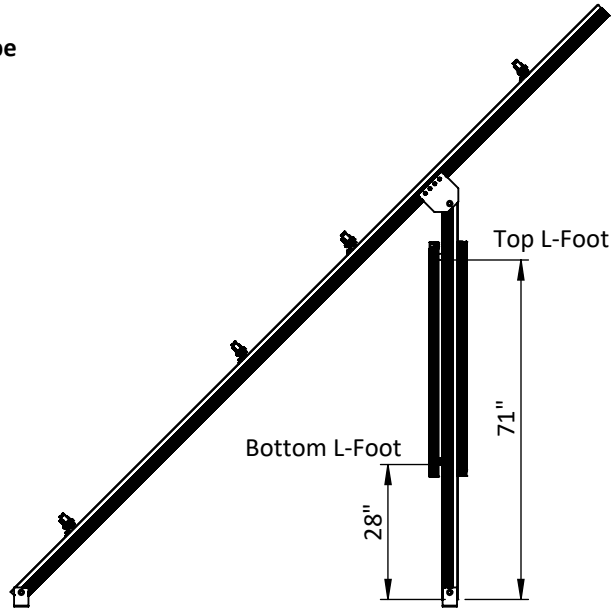


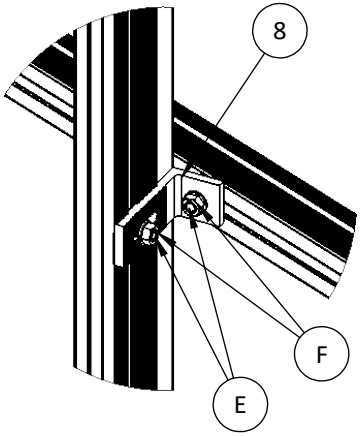
Once the legs have been fastened in position, attach the Cross Braces diagonally to the back Legs as shown.

Attach the L-Feet to the Back Legs first. Ensure they are positioned properly and are flush with the edge of the rail. Measure from the bottom of the Back Leg.

Install the Cross braces with one on either side of the Back Leg. This ensures they do not interfere with one-another. Center the Cross Braces to provide a clean uniform look.

Excess rail from the Cross Braces may be trimmed later to create a cleaner look.



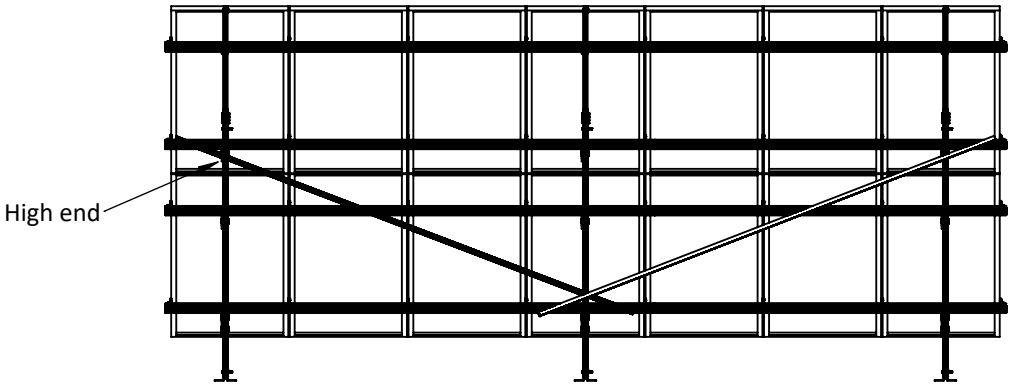


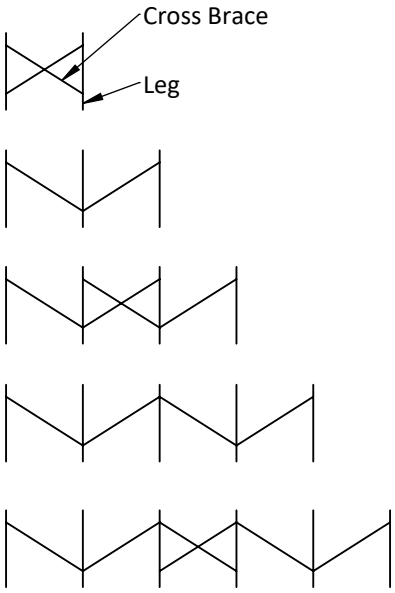
6.1 Cross Brace Layouts

The Cross Brace is to be installed in a zig-zag pattern. For arrays with an even number of legs, the middle bay should get a dual cross brace. Cross Braces always connect at the high-end on the outside legs of the array as shown.

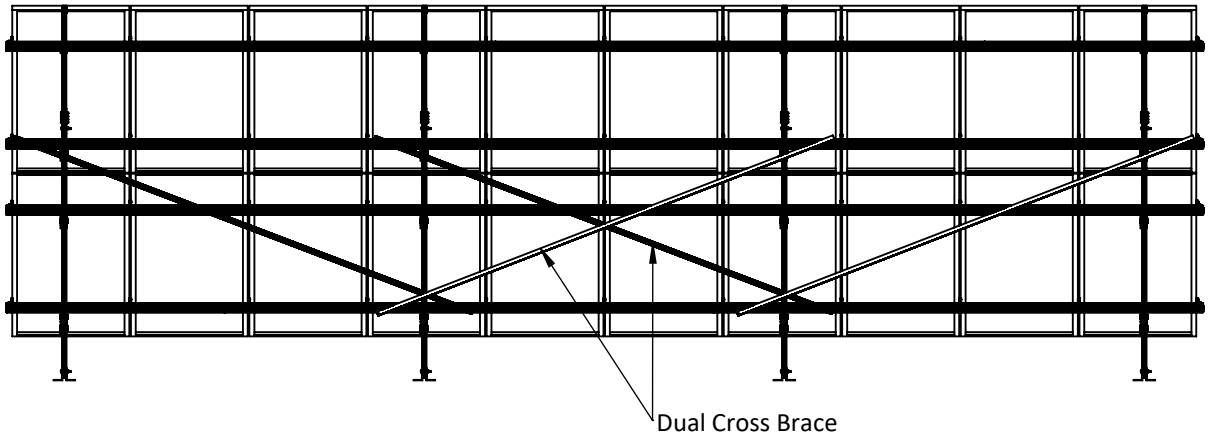
Cross braces go on either side of the Back Leg; one on the inside, and one on the outside. This allows them to cross without interfering with one another. All connections are done with L-Feet and T-Bolts.

The high end of the Cross Brace should always start at the end legs of the array.

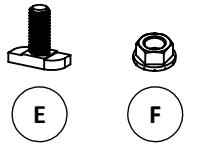




Standard Cross Brace Configurations



7.0 Rail Attachment



M8 x 25mm
T-Bolt

M8
Flanged Hex Nut

Once the Legs and Cross Braces are secured, begin installing the Rails. They run horizontally across the legs and will support the PV Modules.

The Rails attach the the L-Feet which should already be installed on the Legs. Fasten the Rail to the high side of the L-Feet as shown.

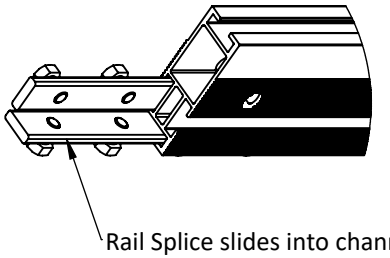
Confirm your Rail configuration ahead of time to ensure there is an even overhang on either side

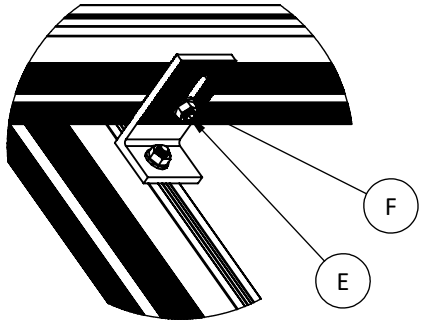
Use the Rail splices provided at every joint between adjacent Rails. Center the Splice using the side-channels on the rails and torque all hardware. Install one Splice in the side channel and the other in the bottom channel of the Rail.

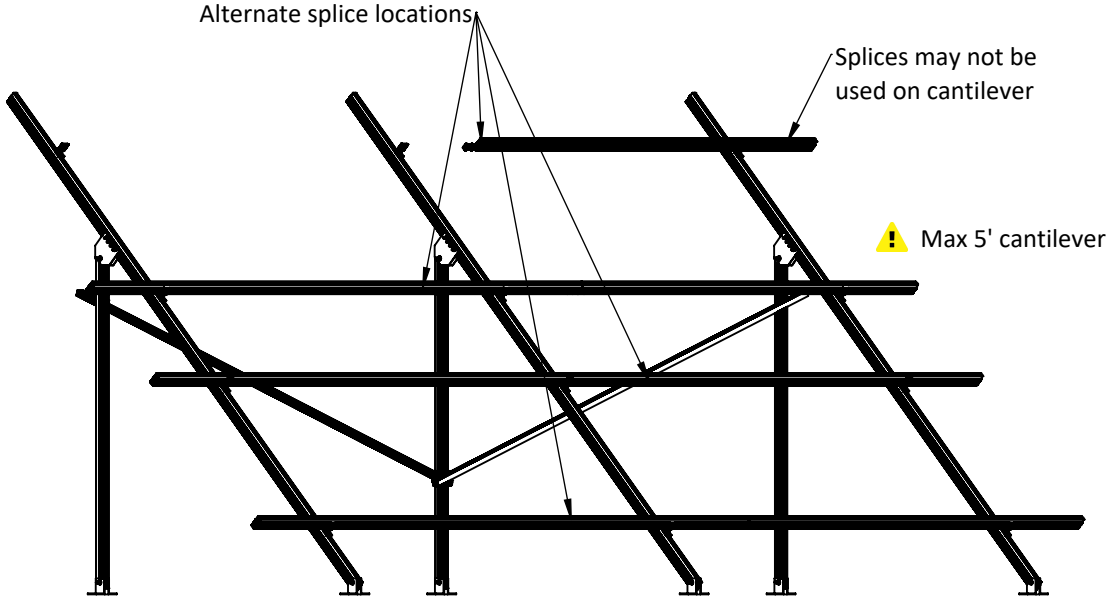
Alternate splice locations so they do not line up. This improves strength of the rails and splices.

Ensure the splice position does not interfere with top clamp locations.

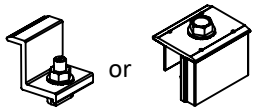
Only one splice per leg span permitted.



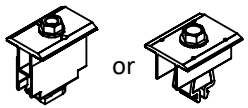




8.0 Module Attachment



9
End Clamp

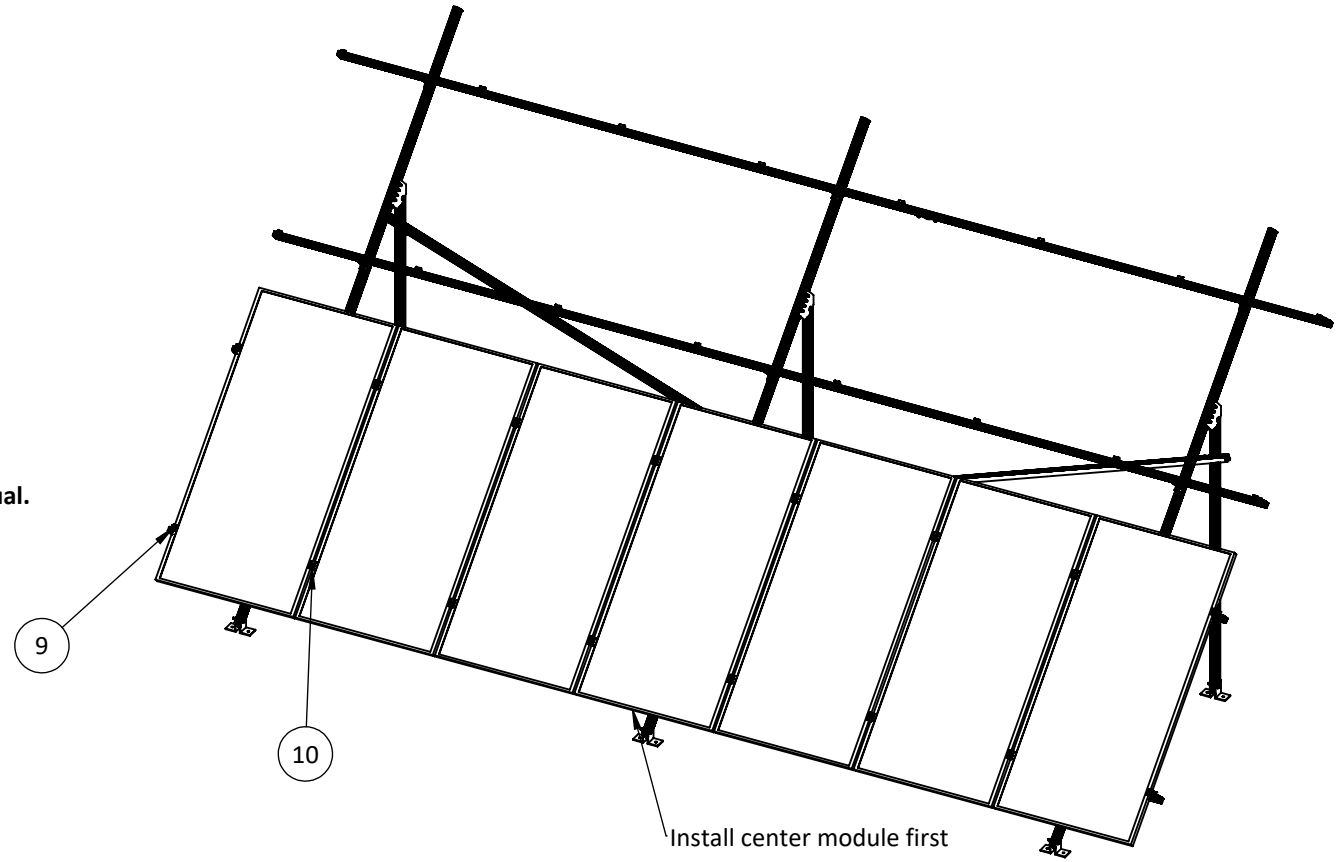


10
Mid Clamp

Position the PV modules on the Rails in portrait orientation as shown. It is recommended to start from the bottom center and work outwards.

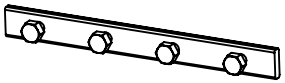
The modules are secured to the Rails using Mid Clamps and End Clamps. The End Clamps are used at the end of the row and are designed to bottom out on the Rail. Mid Clamps are designed to secure two adjacent modules at the same time.

- **Ensure the first module is properly aligned before proceeding with the full row**
- **Confirm the Rails are supporting the modules at the clamping zones as per the module installation manual.**



9.0 Expansion Joint

12
Bond Strap



7
Rail Splice

A Rail Splice should be installed at all Rail junction points. The Splice is used to connect the Rails together, and ensure they stay aligned. The Splice slides in from the end of the Rail into the side channel. The Splice bonds adjacent rails when all four bolts are properly torqued.

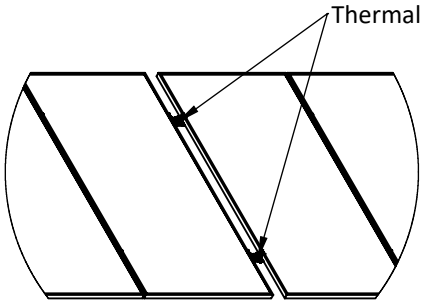
Slide the Splice into place before installing the adjacent Rail

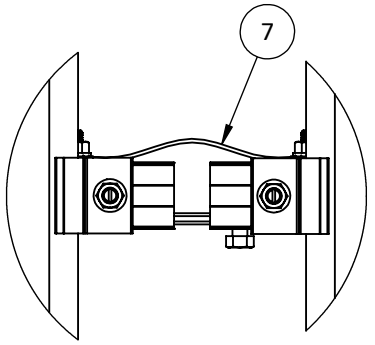
Center the Splice between the two Rails

Thermal expansion joints should be used every 50ft to allow for expansion and contraction. Bonding Straps and Rail Splices should be used at the thermal expansion joint locations. Install the Splice with only two fasteners to allow movement within the system as the aluminum expands and contracts with temperature change. Maintain a 4.75" gap between modules and a 0.75" gap between Rails during the installation process.

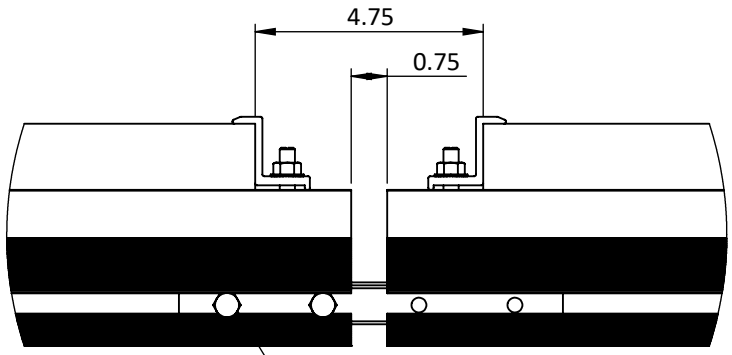
At expansion joints, the Splice does NOT bond the Rails and the Bonding Strap must be used.

Ensure Bonding Strap is installed with a droop to allow for thermal expansion.





Thermal Expansion Joint

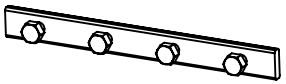


Thermal expansion joint with splice installed with two bolts secured and two bolts removed to ensure alignment is maintained.

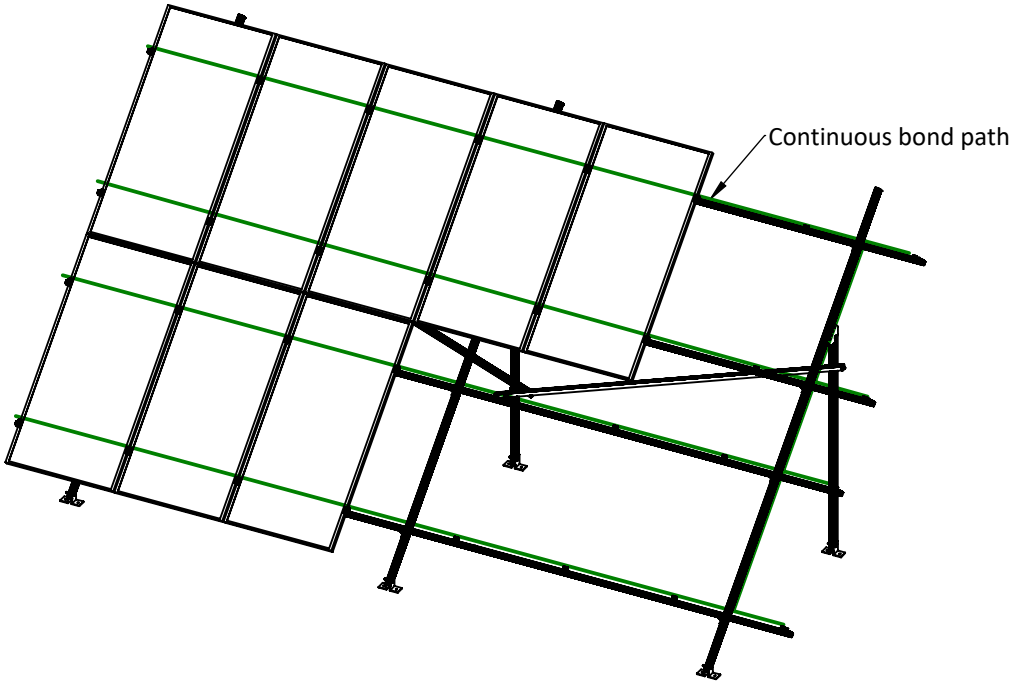
10.0 Bonding

11
Ground Lug

12
Bond Strap



7
Rail Splice



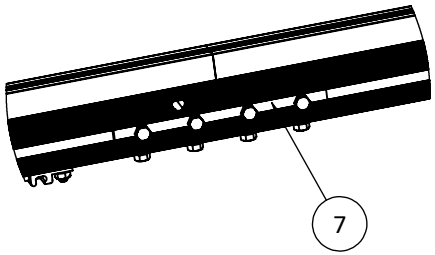
Ground lugs and #6 bare copper wire are used to bond rows togethor. All rows of modules must be bonded together and back to the main ground for the system. Fasten the bond lug to the bottom of the rail using the T-Bolt provided.

Rail splices are used to bond adjacent Rails. When the splice is not fully fastened for an expansion joint, the bond strap must be used.

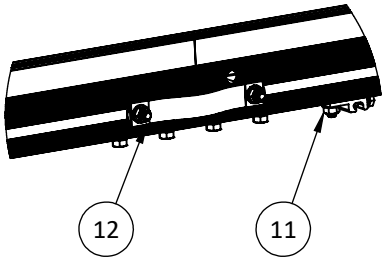
Bond strap is only required for expansion joints.

Module Mid Clamps have integrated bonding pins to bond modules to Rails.

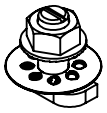
Standard Splice Joint



Expansion Joint



11.0 Accessories



8

MGH Kit

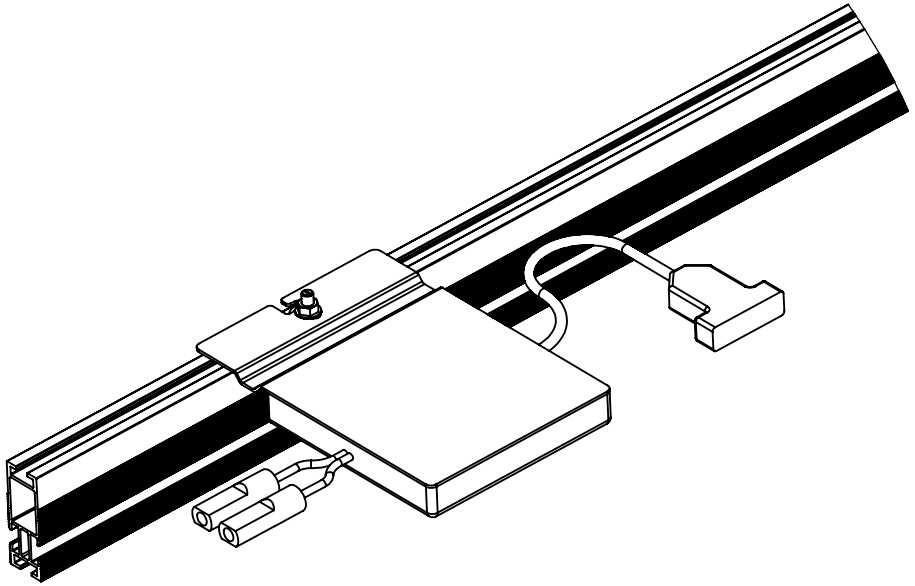
Microinverters, optimizers and other module level electronics can be mounted directly to the Rail. The T-Bolt and bonding washer are supplied in a kit to fasten and bond accessories to the Rail.

The mounting plates can vary with different equipment. Some may require longer or multiple T-Bolts.

Align the T-Bolt with the top Rail channel and fasten the component at the desired location. Ensure they do not conflict with the module frames.

Mount as close to the module frame as possible to prevent interference with module junction boxes

Use cable ties or cable management clips to keep wires secured and off the roof surface. Loose cables can wear against the roof surface over time, potentially causing damage or failure to the system



12.0 Inspection & Maintenance

Introduction

The primary purpose of regular inspection and maintenance is to ensure the safe and efficient operation of your ground mount solar racking system. By following these guidelines, you can identify and address issues before they lead to performance degradation or safety concerns.

Safety Precautions

Before conducting any inspection or maintenance activities, adhere to the following safety precautions:

- Safety Gear: Wear appropriate personal protective equipment (PPE), including safety glasses, gloves, and a hard hat.
- Secure Access: Ensure you have safe and secure access to the solar racking system. Use ladders or scaffolding when necessary, and be aware of potential fall hazards.
- Electrical Safety: If inspecting electrical components, follow electrical safety procedures. Always de-energize and lockout/tagout electrical systems before inspection.
- Teamwork: Whenever possible, work with a partner who can assist with safety measures and procedures.

Regular Inspection

Visual Inspection

Perform visual inspections on a regular basis to identify any visible issues:

- Check for loose or missing bolts, nuts, or fasteners.
- Inspect for signs of corrosion or rust on steel and aluminum components.
    - Replace components with excessive corrosion as needed.
    - Remove surface corrosion with a light abrasive.
- Examine the overall condition of the racking structure for any damage.
- Ensure that the solar panels are securely fastened and not damaged.

Torque Check

Regularly check the torque of bolts and nuts to maintain the structural integrity of the system:

- Use a torque wrench to verify that all fasteners are tightened to the manufacturer's specifications.

Electrical Inspection

Inspect electrical components to ensure safe and efficient operation:

- Examine electrical connections for signs of wear, corrosion, or loose wires.
- Check the condition of junction boxes, wiring, and connectors.
- Monitor the performance of inverters and other electrical equipment as per the manufacturer's recommendations.

Structural Integrity

Ensure the structural integrity of the racking system:

- Check for any signs of settling or shifting of foundations.
- Inspect for any signs of stress or damage to the mounting rails and supports.

Frequency

Regular inspection intervals are essential to maintain the reliability of your solar racking system. Consider the following recommended inspection frequencies:

- Annually: Electrical inspections, structural integrity checks, bolt torque check, and a comprehensive visual inspection.

However, it's essential to adapt the inspection frequency to your specific environmental conditions. If your system is exposed to harsh weather or other challenging factors, more frequent inspections may be necessary.

13.0 Design Limitations

MODULE CHORD LENGTH	STANDARD GMX	HIGH LOAD GMX
Less than 1,756 mm (69.13in)	2.30 kPa (48.06 psf)	3.21 kPa (67.11 psf)
Less than 2,133 mm (83.98 in)	1.93 kPa (40.27 psf)	2.69 kPa (56.25 psf)
Less than 2,217 mm (87.28 in)	1.82 kPa (38.06 psf)	2.55 kPa (53.16 psf)
Less than 2,257 mm (88.86 in)	1.79 kPa (37.38 psf)	2.50 kPa (52.21 psf)

Refer to the GMX High Load Installation Manual

The above table presents the design load limitations of the Standard GMX and High Load GMX systems. The values represent maximum combined wind and snow loads factored as per the NBCC 2015 and exclude the dead load associated with the modules.