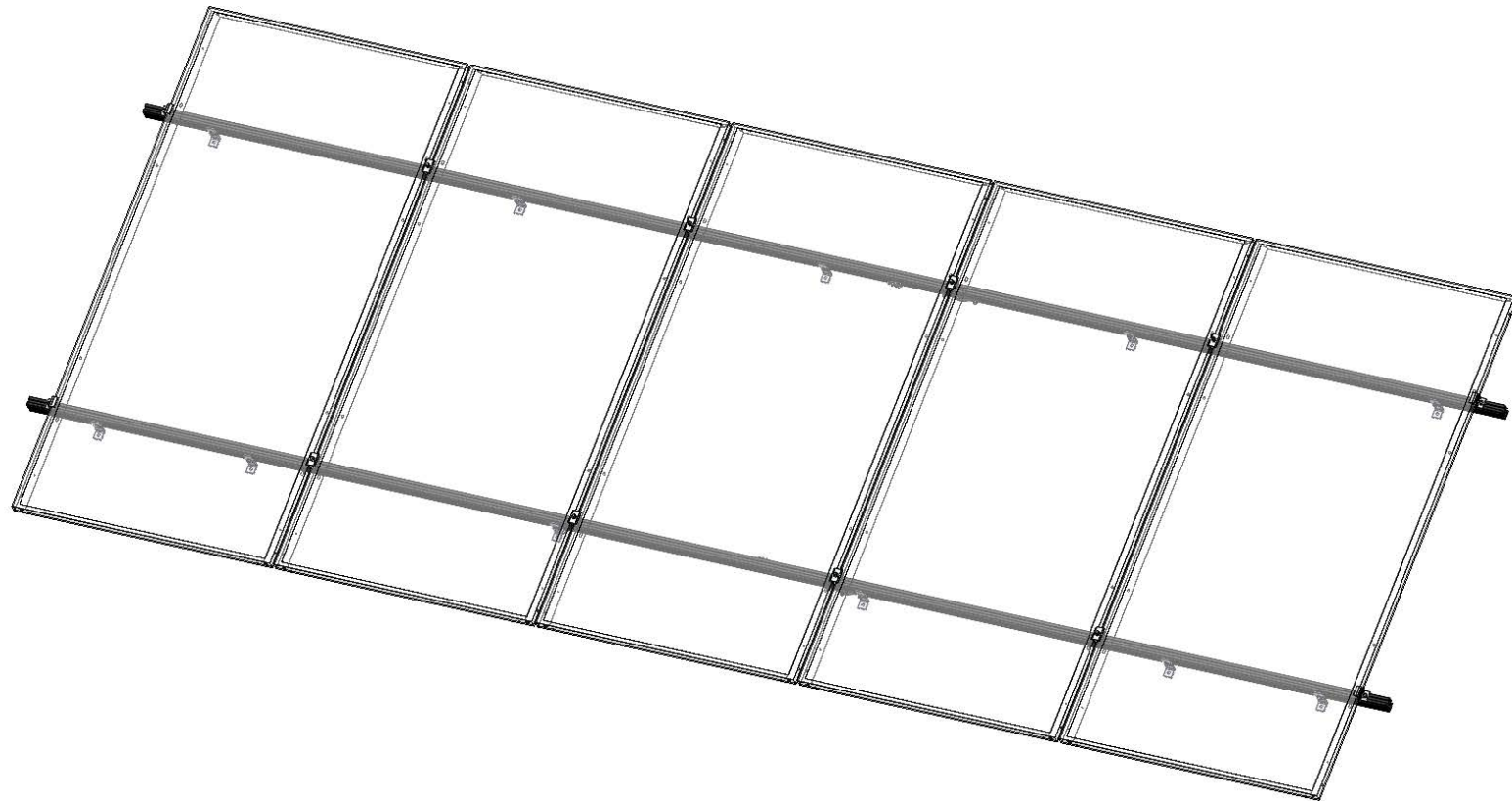


FR Ultra- Installation Manual

SLOPED ROOF MOUNT





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Introduction

This manual is an illustrated guide on how to install a Fast-Rack Ultra flush 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.

Maintenance

The Fast-Rack mounting system should be routinely inspected and maintained to ensure all connections are tight and that all components are in safe working order.

- Any loose components or fasteners shall be re-tightened in accordance with this installation guide.
- Any components showing signs of damage that compromise safety shall be replaced immediately.

Compliance

The Fast-Rack photovoltaic mounting system has been certified and listed to the UL 2703, Ed. 1 and TIL No. A-40 standards (Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for use with Flat-Plate Photovoltaic Modules). This standard includes electrical bonding and mechanical load testing and approval. The Fast-Rack Ultra system has additionally been designed and certified to the NBCC by 3rd party engineers. The Fast-Rack mounting system is Not Fire Rated.

- Max Overcurrent Protective Device (OCPD) Rating: 20A
- Max Module Size: 27.5 sqft
- Mechanical Load Ratings: 16.8 psf downward, 16.8 psf upward, 5.0 psf lateral
- True structural capacity and spans defined by PEng stamped letters in accordance with NBCC





Personal Safety

Prior to starting 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 a sloped roof installation are:

- Fall Hazards – Ensure compliance with OSHA regulations for working at height. Use fall protection, or fall prevention equipment and practices as necessary.
- Electrical Hazards – Observe the location of overhead and rooftop 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, on the roof and lifting between the ground and roof.
- 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

If necessary, obtain a structural analysis of the roof to determine its capacity before installing solar PV modules. Failure to do so may result in overloading the roof and could lead to costly upgrades of the existing structure.

Most municipalities in Canada have recognized that the distributed load of a Solar PV array (typically less than 4 PSF) is a small fraction of most residence's snow load capacity and often do not require a structural analysis for permitting. Familiarize yourself with local municipalities' building permit requirements. Larger commercial and industrial projects will typically require a structural assessment prior to the issue of a building permit.

In addition to determining the structural suitability of the building it is also important to protect the building when working on the roof. Adhere to best practices when working on different roof membranes to prevent damage to the roof and the potential for water penetration.

If necessary, work with an experienced roofer to install roof penetrations according to roof manufacturer's specifications.

It is the responsibility of the installer/owner to ensure the racking and solar system (including installation) meets local building and electrical codes along with requirements for local power distribution companies.



Components

ID	PART	CODE
1	L Foot	FR-FOOT-ROS-KIT
2	Rail	FR-RAIL-UL-XX
3	Splice	FR-SPLICE
4	End Clamp	FR-END-XX
5	Mid Clamp	FR-MIGS-XX
6	Ground Lug	FR-GNDLUG-C
7	Bond Strap	FR-BJ-8.0-KIT
8	Accessory Bond Kit	FR-MGH-16/25
9	Hidden End Clamp	FR-HEC

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

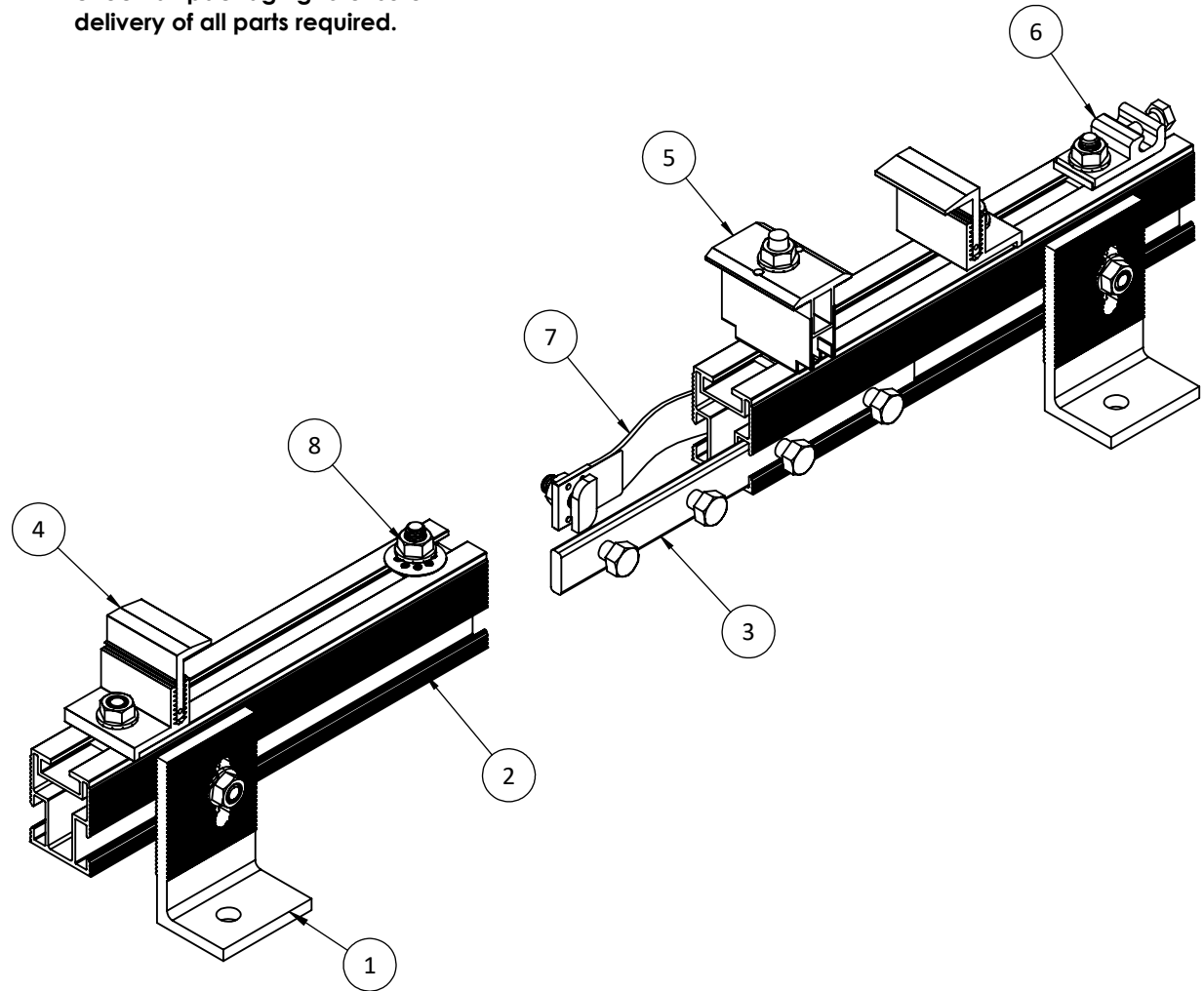
Hardware

ID	SIZE	TYPE
A	M8 x 25	T-Bolt
B	M8	Flanged Hex Nut

***all hardware included in component kits**

Tools

- Drill/driver
- 13mm Open end wrench, socket and ratchet
- Torque wrench
- Wire snips/side cutters
- String line/chalk line
- Tape measure
- Level
- Stud finder
- Hand or chop saw

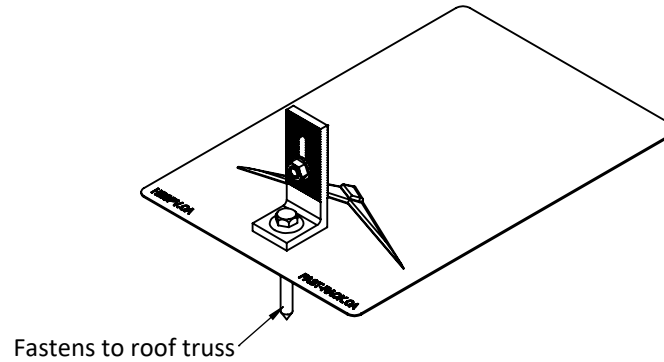




The Fast-Rack Ultra system can be fastened to your roof using a range of attachment options. Choose the attachment that is most suitable for your roof type.

Ultra Flash:

Standard Ultra Flash attachment anchors directly to your roof trusses and uses a flashing underneath the shingles to create a watertight seal.



Ultra Flash
FR-ULTRA-FLASH

Talon:

The Fast-Rack Talon is an option for asphalt roofs that allows a rafterless installation. The Talon connects directly to the roof deck, eliminating the need to penetrate into trusses.

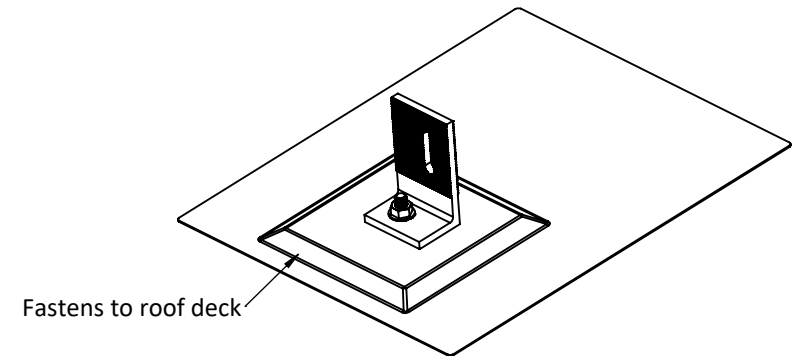
i Refer to the Fast-Rack Talon manual

S-5!

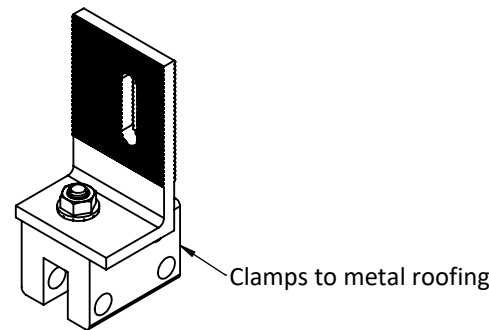
If you have a steel roof, there are a wide range of S-5! clamps available that are designed to fit specific roof profiles. This solution clamps to the roofing seams and is penetration free.

i Refer to www.s-5.com for manuals

i Options for steel, tile and other unique roofing materials can be available upon request.



Talon
FR-TALON



S-5! Clamp



4.1 Mounting Foot Spacing

The Feet can be installed in either a continuous or a staggered pattern. Locations with higher wind & snow loading should use the continuous pattern. An engineer should advise which configuration is appropriate for your roof.

The Ultra Rails should not span more than 48". Every truss should be used, and Feet are required at each end.

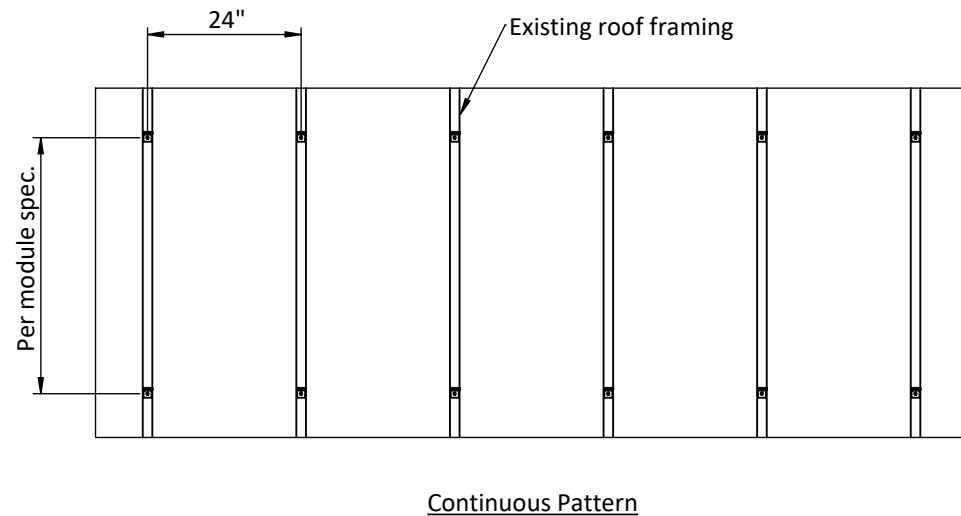
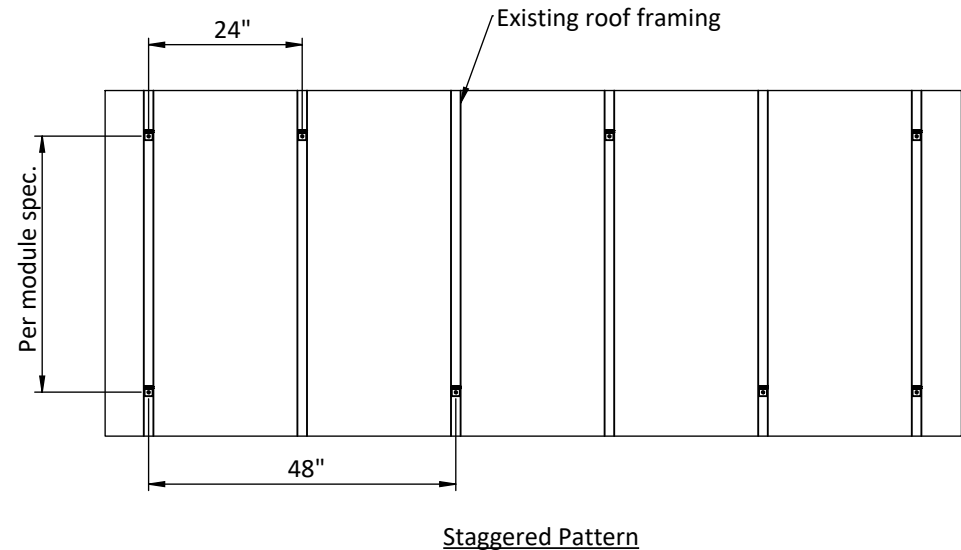
i Use a chalkline to align rows of feet

i Measure the spacing carefully to ensure the lag screw is properly engaged in the roof framing

When measuring your array, ensure adequate setbacks from the roof edges are considered (18" min. typically). Ensure you factor the width of the modules plus mid clamps, including 2" on either side for end clamps. For height of the array, factor in a 1/2" gap between modules.

Verify and mark all mounting locations prior to penetrating the roof. This ensure you are hitting the roof trusses and get it right on the first try every time.

i Spacing may vary when using alternative attachment options





A

M8 x 25mm
T-Bolt



B

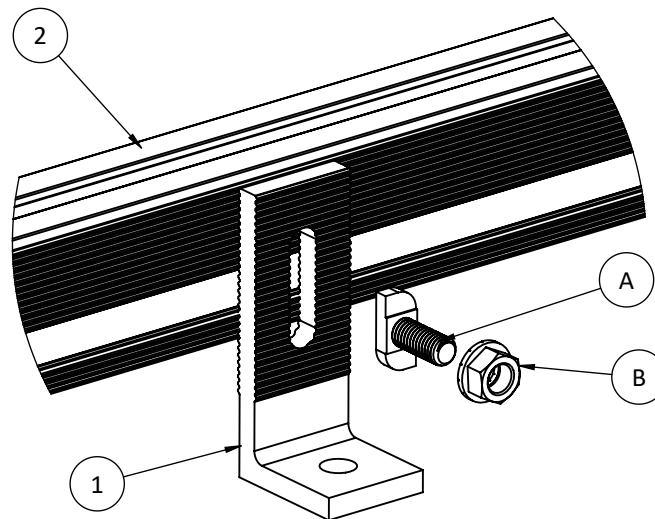
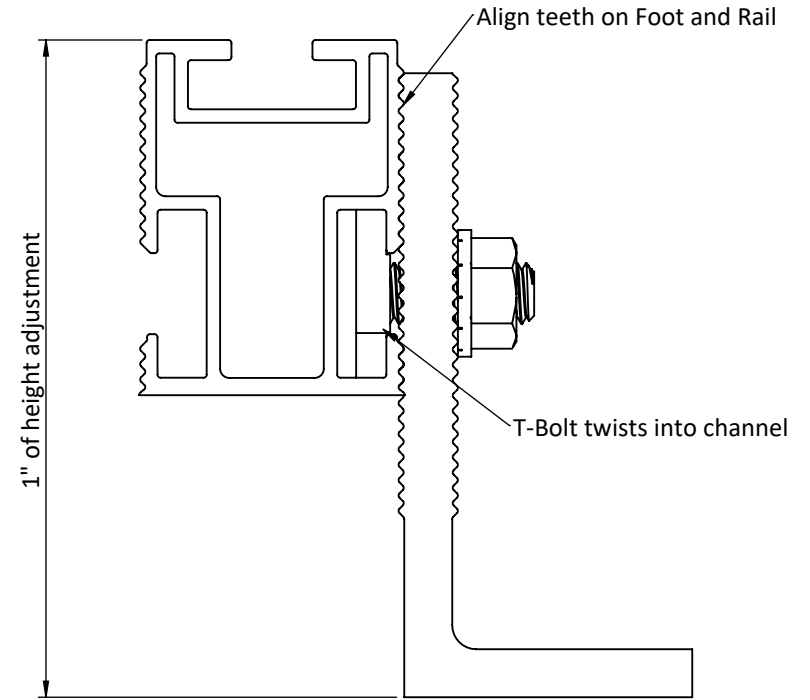
M8
Flanged Hex Nut

Insert the T-Bolt into the side channel of the Rail. Twist it clockwise in behind the Foot and fasten with the M8 nut.

The teeth on the Rail and Foot lock together, allowing adjustments in height to ensure the Rail is straight and level across the roof. Adjust the height as required to level the Rail.

Ensure the Rail is level and in-line with the adjacent Rails. Installing the Rail Splice at this stage can help align the Rails as you build down the row.

i Ensure the Rails are level by adjusting up and down on the Foot



i Torque to 15 lbs.ft



5.1 Rail Spacing

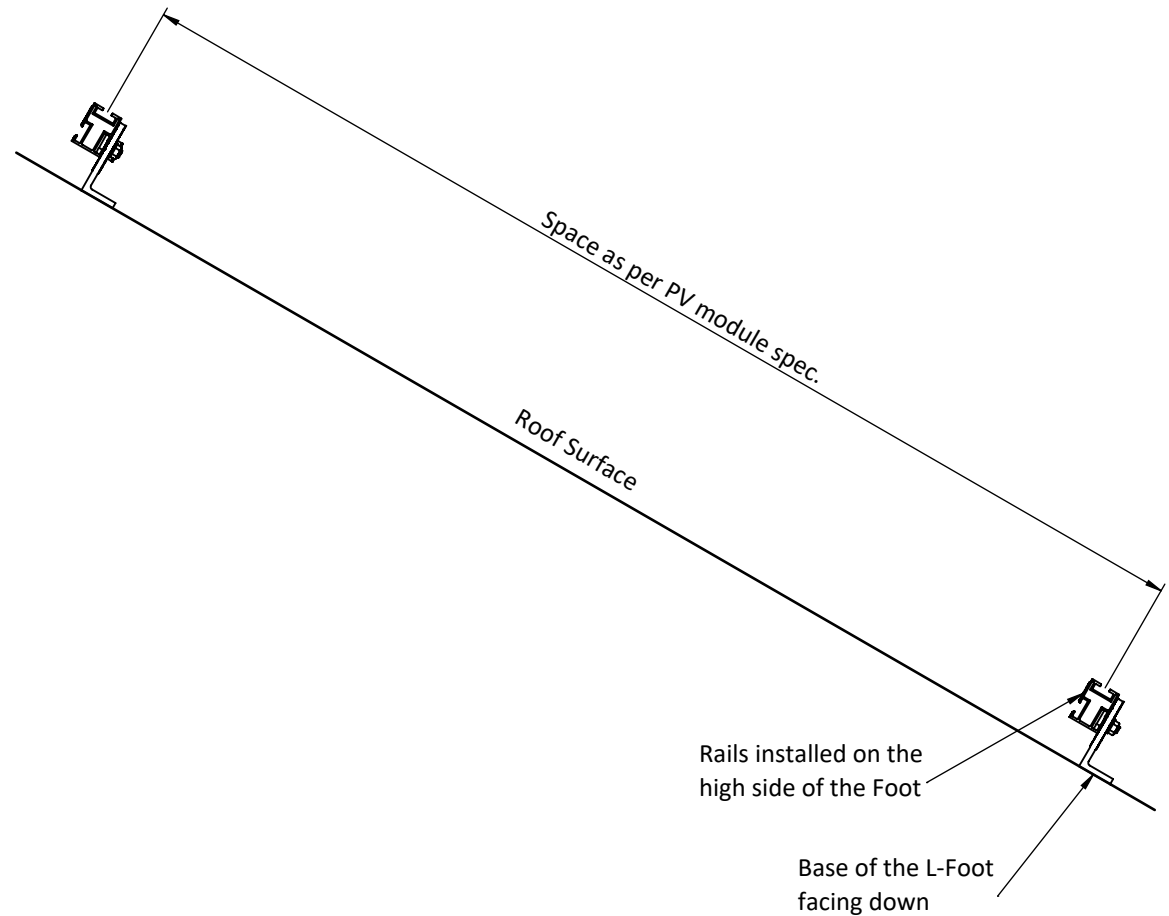
Space the two Rails according to the requirements of the PV module. Refer to the installation manual for your specific module. The Rails should align with the designated clamping zones of the module.

i **Ensure the Rails are level by adjusting up and down on the Foot**

Ensure the module overhangs have been accounted for to properly space adjacent rows. When calculating for height of the array, include 1/2" air gap between rows.

As a quick reference, follow the 20%, 60% 20% rule of thumb. This means approximately 60% of the module should land between the rails, and 20% should overhand on either end.

i **Review module installation manuals for specific details on mounting zones.**





5.2 Rail Splice

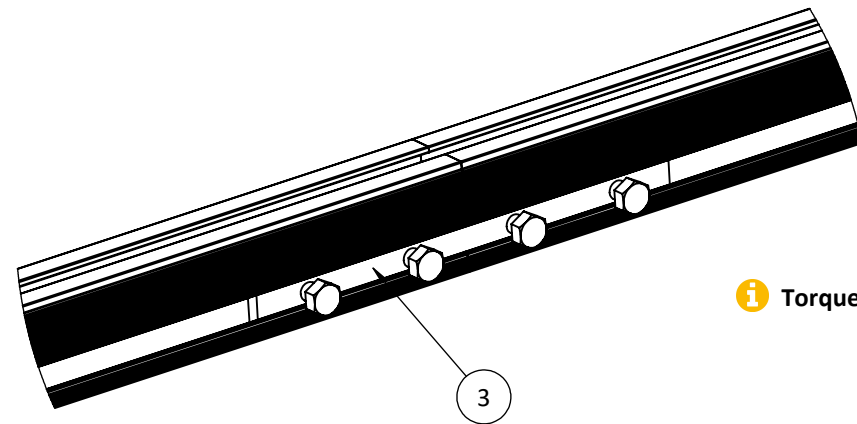
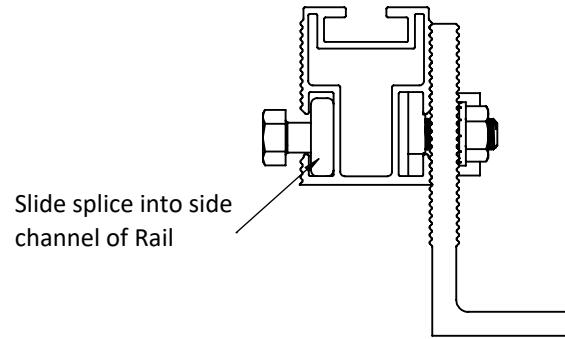
A Rail Splice should be installed at all Rail junction points. The Splice is used to connect the Rails together, and ensure they stay aligned. The Splice slides in from the end of the Rail into the side channel. The Splice bonds adjacent rails when all four bolts are properly torqued.

- i** Slide the splice into place before installing the adjacent Rail

In large arrays, gaps should be left to allow for expansion and contraction. Splices may be omitted, or installed with only two fasteners (2 left or 2 right). This allows a small amount of movement within the system as the aluminum expands and contracts with temperature change.

- ⚠** At expansion joints, the splice does NOT bond the rails and the bonding strap must be used.

- i** Center the Splice between the two Rails



- i** Torque to 15 lbs.ft



8

GND Kit

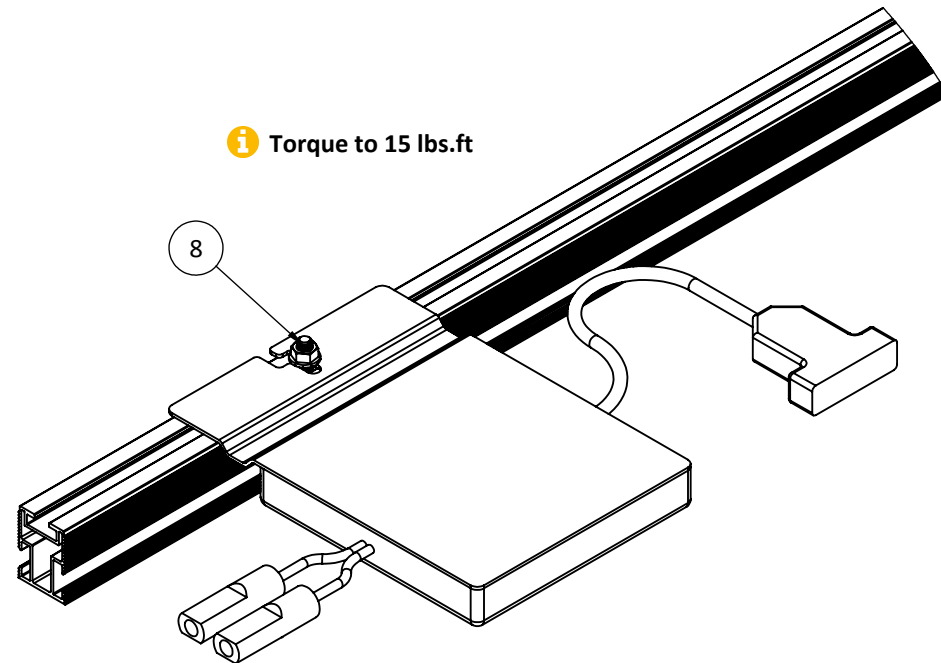
Microinverters and optimizers can be mounted directly to the Rail. The T-Bolt and bonding washer are supplied in a GND Kit to fasten and bond accessories to the Rail.

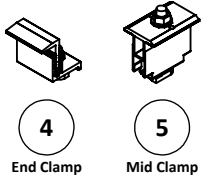
The mounting plates can vary with different microinverters and optimizers. Some may require multiple T-Bolts.

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.

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

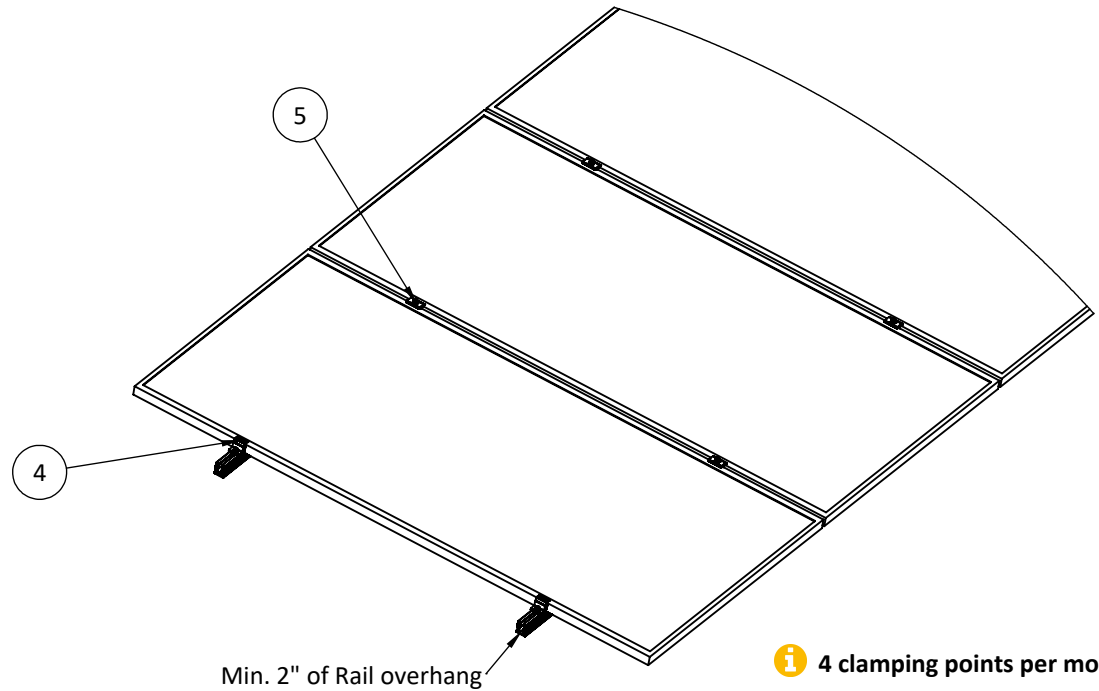
Use cable ties or cable management clips to keep wires secured and off the roof surface. Loose cables can wear against the roof surface over time, potentially causing damage or failure to the system





Place the PV Module across the set of Rails. Adjust the position so the Rails land within the clamping zones of the module.

Place the module Clamps and fasten the T-Bolt into the channel of the Rail. End Clamps are used for the first and last module in the row. The Mid Clamps will go between each module. Do not tighten until the next module has been set into position.



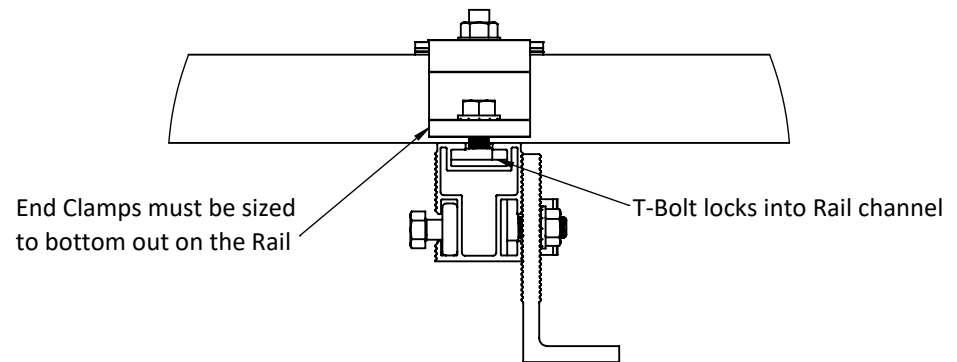
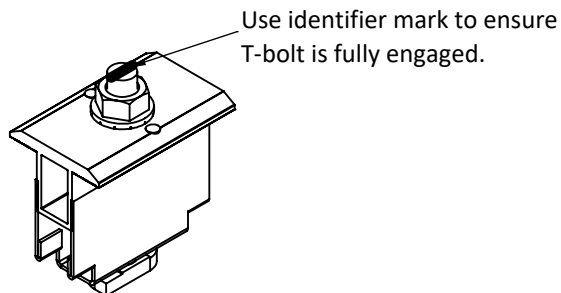
i Check alignment as you go to ensure the array is square

w Ensure module is located with Rails under the "mounting zones" of the modules

i 4 clamping points per module

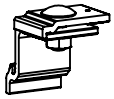
Complete electrical connections between modules and any inverters/optimizers are you go. Ensure cables are properly secured before the modules are clamped down.

i Torque to 15 lbs.ft





7.1 Hidden End Clamp



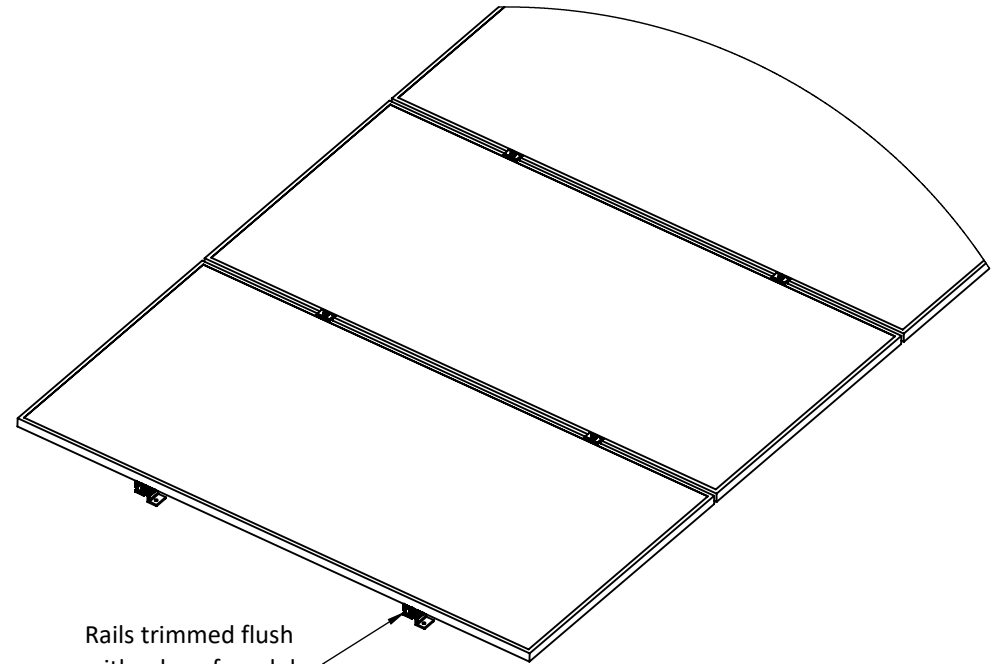
9
HEC

The Hidden End Clamps (HEC's) are used for the first and last modules in a row. They are positioned underneath the module, allowing the rails to be trimmed flush.

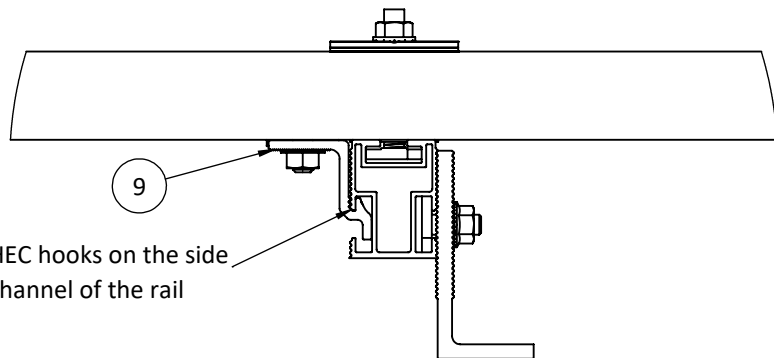
Position the module at the very edge of the rail. Roll the HEC into the side channel of the rail. Slide forward until the upper part of the clamp overlaps the inner module frame.

i The HEC can be configured as a "left" or "right" by simply loosening the bolt and turning the top portion of the clamp 180°

i Torque to 15 lbs.ft

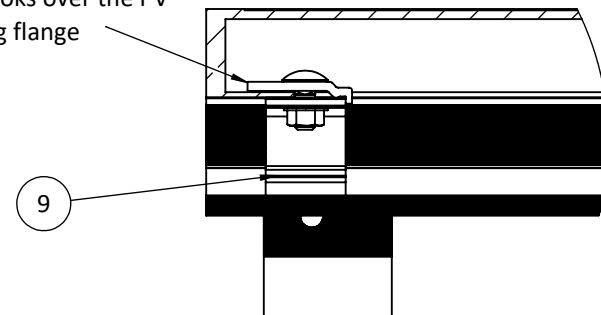


Rails trimmed flush with edge of modules



HEC hooks on the side channel of the rail

HEC clips into side channel of the rail and hooks over the PV module bolting flange





8.0 Bonding



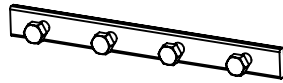
6

Ground Lug



7

Bond Strap



3

Rail Splice

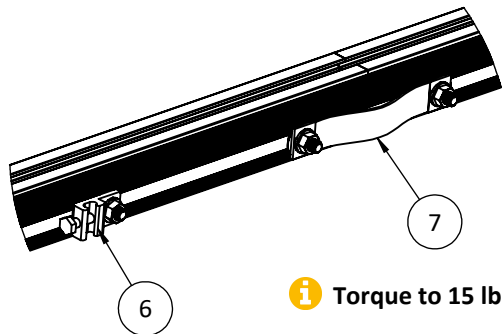
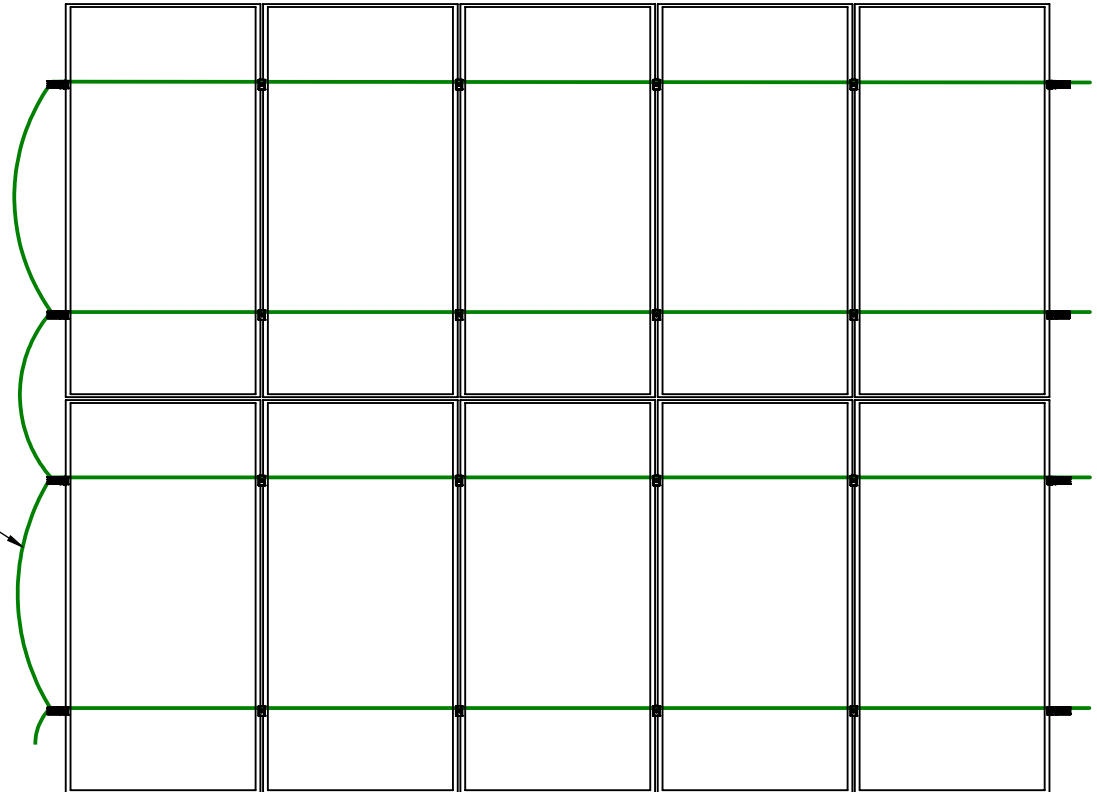
Ground lugs and #6 bare copper wire are used to bond rows together. All rows of modules must be bonded together and back to the main ground for the system. Fasten the bond lug to the top or side of the rail using the T-Bolt provided.

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.

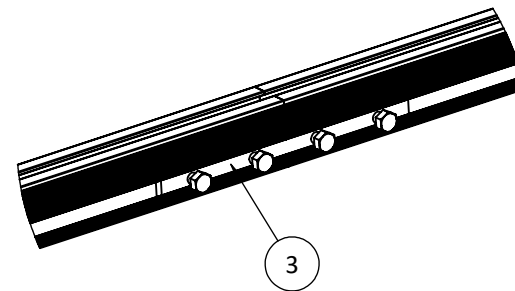
i Module Mid Clamps have integrated bonding pins to bond modules to Rails.

! When installing a single module (all end clamps), ensure a bond lug is used to bond the module to the Rails.

#6 Copper Wire



i Torque to 15 lbs.ft



i Torque to 15 lbs.ft



The Fast-Rack photovoltaic mounting system has been certified and listed to the UL 2703, Ed. 1 and TIL No. A-40 standards (Mounting Systems, Mounting Devices, Clamping/Retention Devices , and Ground Lugs for use with Flat-Plate Photovoltaic Modules). This standard includes electrical bonding and mechanical load testing and approval.

Specific modules were selected for this testing and are intended to provide a broad range of acceptability. PV modules may have a lower mechanical rating than the PV mounting system. Refer to the PV modules installation guide for specific information pertaining to the module. The following list has all modules that were reviewed for compliance. This list includes all wattages within the specified series.

Make	Model
Longi	LR4-60HPB LR4-60HPH LR4-72HBD LR4-72HPH LR5-72HBD LR5-72HPH LR5-54-HPB LR5-54HPH
Q.CELLS	Q.PEAK DUO BLK ML-G10 Q.PEAK DUO XL-G10.2
Trina	TSM-DE09.05