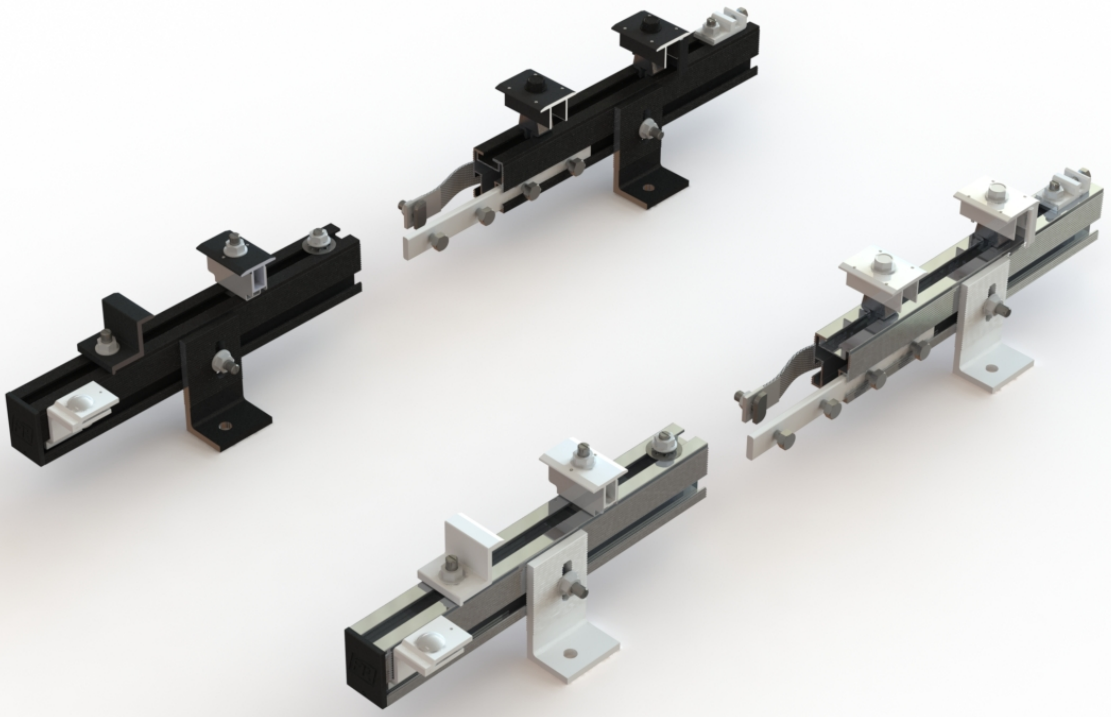
Version: FR-ULT-4000B

FR-Ultra - Installation Manual

Sloped Roof 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 Ultra flush mount system. It covers each individual step of the assembly process. Throughout the manual, 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 manual 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.

Throughout this manual other technical documents are referenced. These are available online at www.fast-rack.ca

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 Ultra 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.

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2.0 Safety

Personal Safety

Prior to starting installation is it 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 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 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 is 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.

3.0 Scope of Delivery

Components

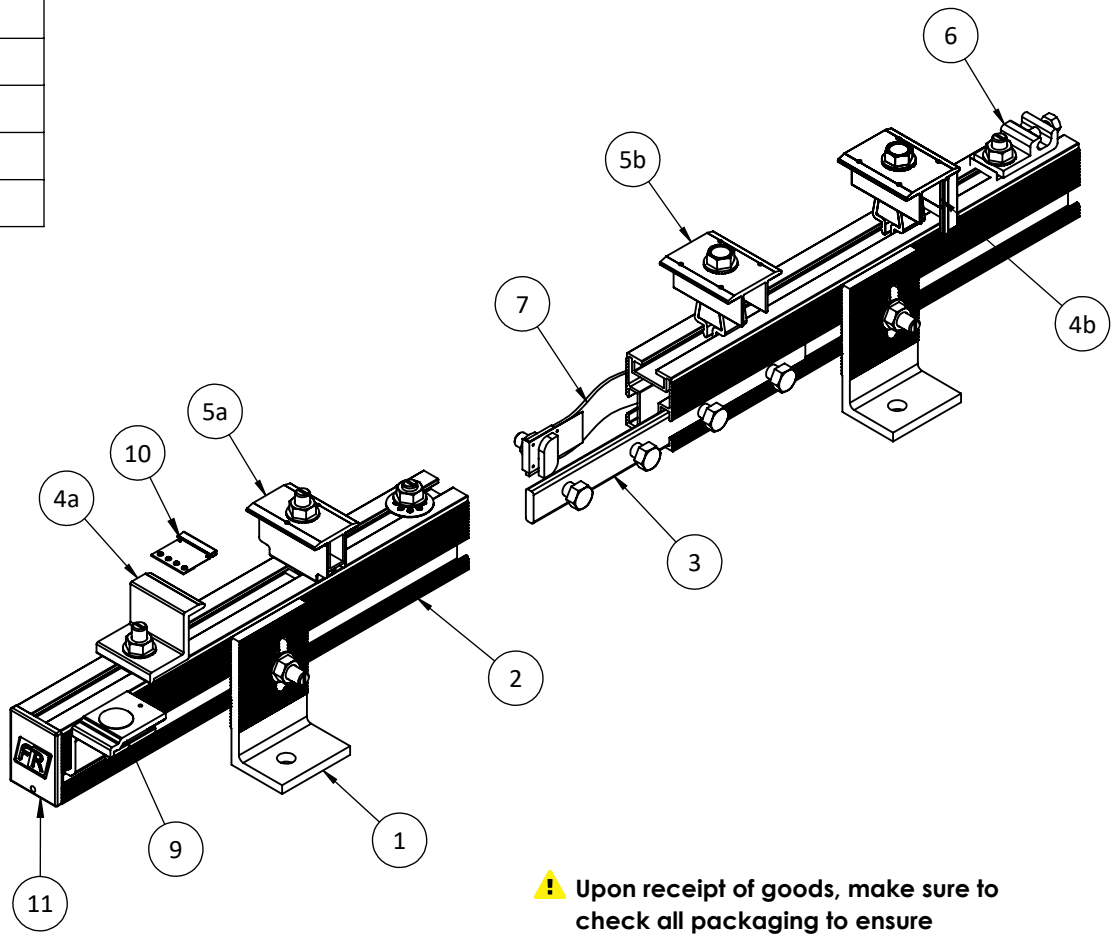
ID	PART	CODE
1	L-Foot / Black L-Foot	FR-ACC-1100/1101
2	Rail	FR-RAIL-21XX
3	Splice	FR-RAIL-1XXX
4	End Clamp (a)/ Stopper (b)	FR-CLP-12XX / FR-CLP-23XX
5	Mid Clamp (a)/ Click-Lock (b)	FR-CLP-11XX / FR-CLP-13XX
6	Bond Lug	FR-ACC-1405
7	Bond Strap	FR-BJ-8.0-KIT
8	Accessory Bond Kit	FR-ACC-1401/1402/1403
9	Hidden End Clamp*	FR-CLP-1500
10	Bond Washer MF*	FR-ACC-3400
11	End Cap*	FR-ACC-3200

***End caps, Hidden End Clamps & clamp style are optional**
**** Refer to section 8.1 for components required with black anodized rail.**

Hardware

ID	SIZE	TYPE
A	M8 x 20	T-Bolt
B	M8	Flanged Hex Nut

***all hardware included in component kits**



Torque Specifications

SIZE	TORQUE
M8	10 lbs.ft

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

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

4.0 Mounting Options

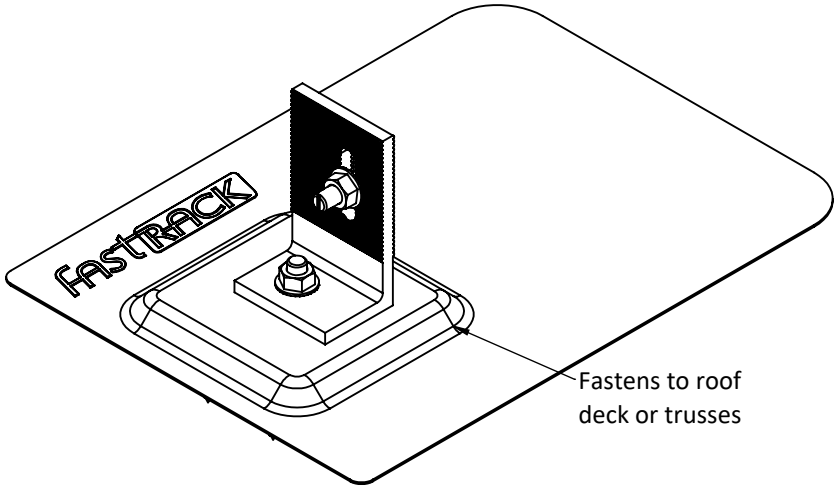
The Fast-Rack Ultra system can be fastened to your roof using a wide range of attachment options. Choose the attachment that is most suitable for your roof type.

Talon XE:
The Fast-Rack Talon XE is recommended for asphalt roofs. The Talon connects directly to the roof deck (rafterless), or into trusses.

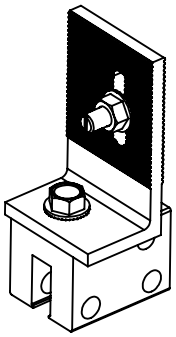
Refer to the Fast-Rack Talon XE manual

Metal Roof Clamps
If you have a steel roof, there is a wide range of standing seam and corrugated roof clamps available that are compatible with the Ultra system.

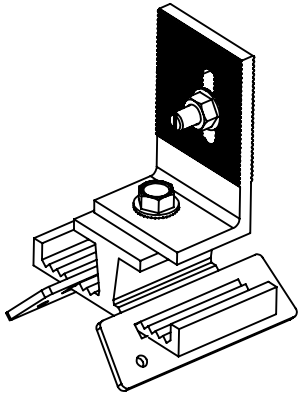
The FR-Ultra is compatible with most 3rd party roof attachments. Contact us to confirm.



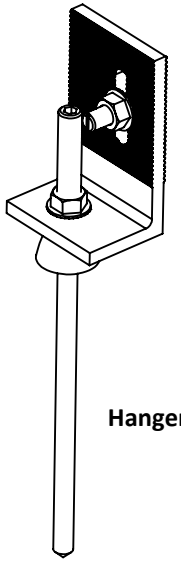
Talon XE - Asphalt Roofs



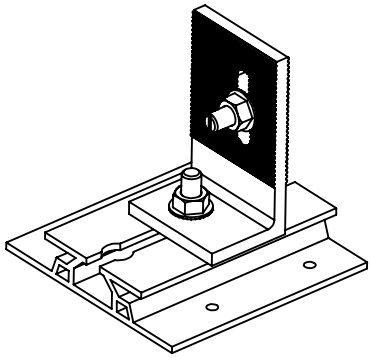
Standing Seam Roof Clamp



Corrugated Steel Roof Clamp



Hanger Bolt



Other Anchors

4.1 Mounting Foot Spacing

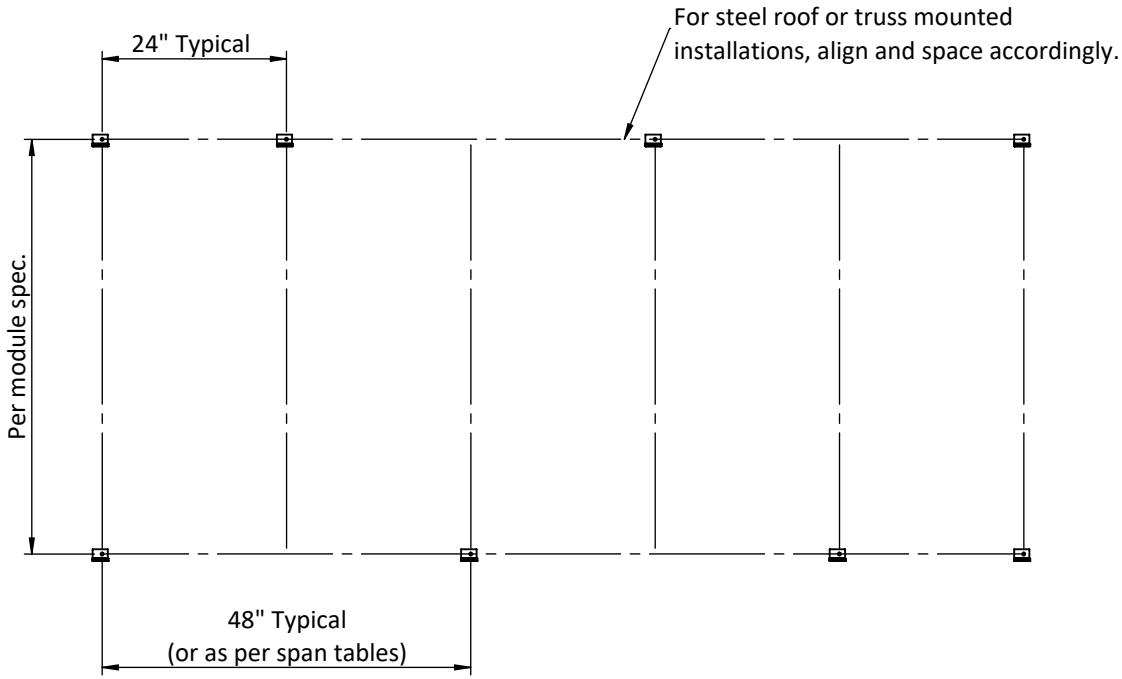
1. Align and install the attachments. A staggered pattern (as shown) is recommended, but any pattern is possible provided maximum spans are not exceeded.
2. Refer to FR-Ultra Span Letter or consult with an engineer to determine maximum spans for your project.
3. Ensure adequate setbacks from roof edges are considered (24" min. typically).
4. Factor in the width of the modules plus the mid clamps and 2" on either end for the end clamps. For height of the array, include a 1/2" gap between modules.
5. Verify and mark all mounting locations prior to fastening the roof anchors.

Recommended to use a chalkline to align rows of L-feet.

Measure the spacing carefully to ensure the anchors are properly spaced, and engage with roof trusses when required.

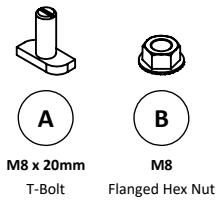
Spacing may vary when using alternative attachment options.

When using rafterless attachments like the Talon XE, aligning with roof trusses is optional.



Staggered Pattern

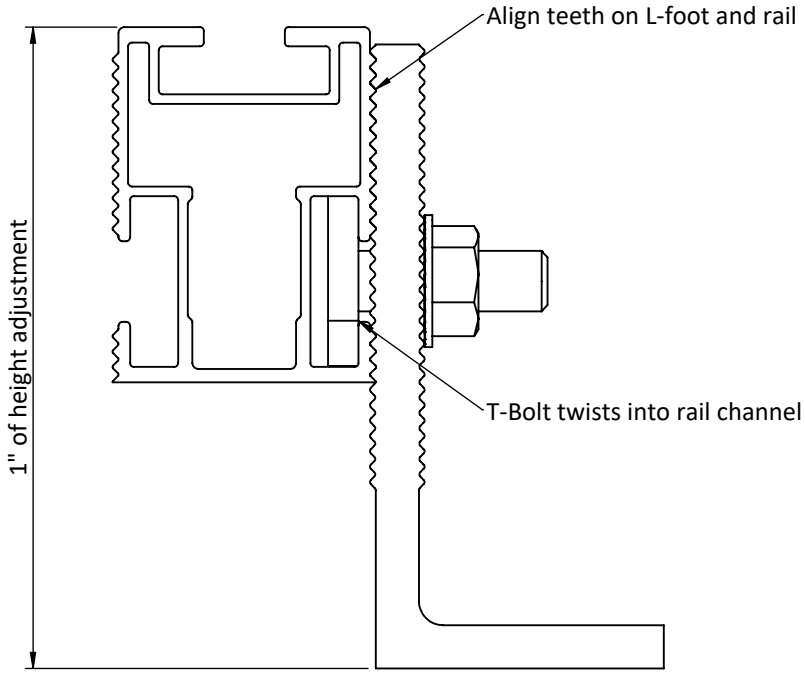
5.0 Rail Attachment

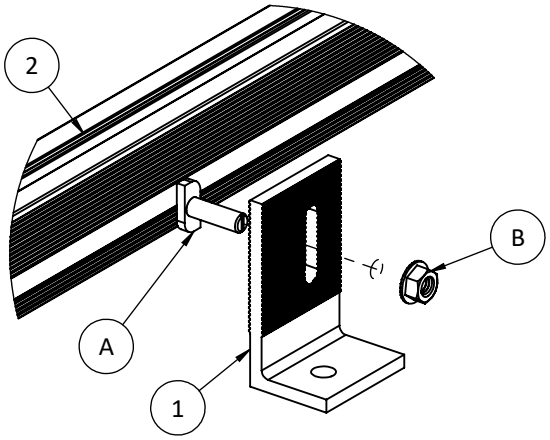


A — **M8 x 20mm** T-Bolt

B — **M8** Flanged Hex Nut

1. Insert the T-bolt into the side channel of the rail.
2. Twist it clockwise behind the L-foot and fasten with the M8 nut.
3. The teeth on the rail and L-foot should lock together. Adjust height as required to level the rail.
4. 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.



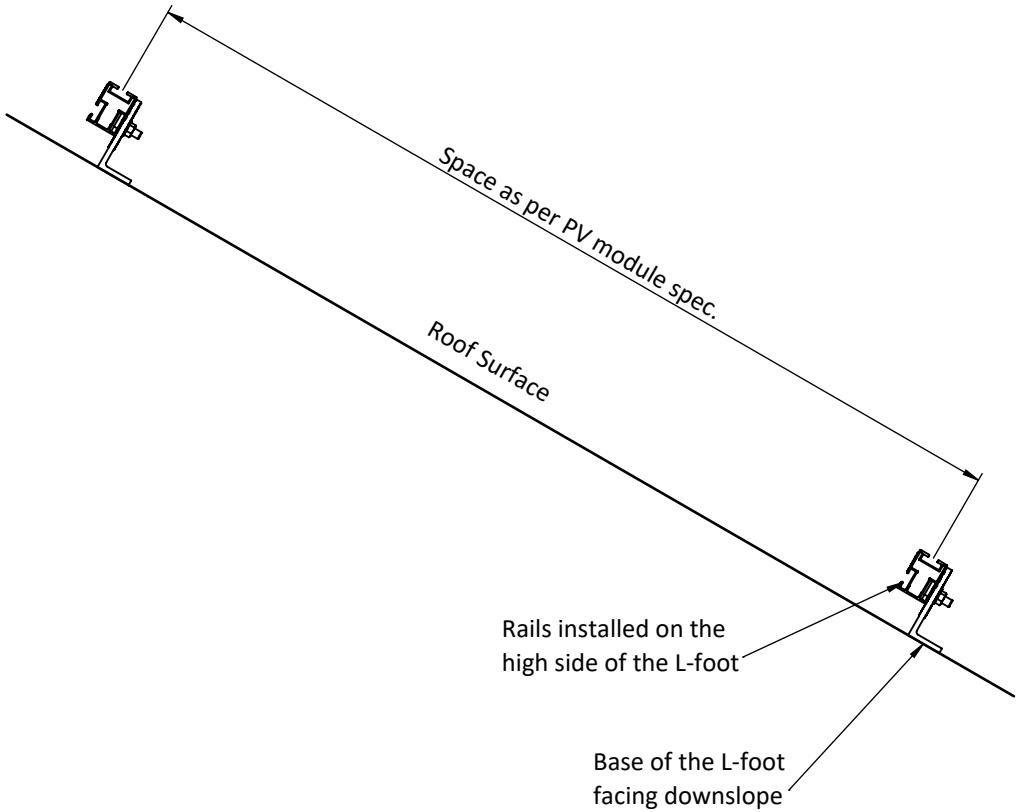


5.1 Rail Spacing

Refer to the module installation manual for your specific module.

1. Space the two rails according to the manufacturer requirements of the PV module.
2. The rails should align with the designated clamping zones (green zones) of the module.
3. 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.

Ensure the rails are level by adjusting up and down on the L-foot

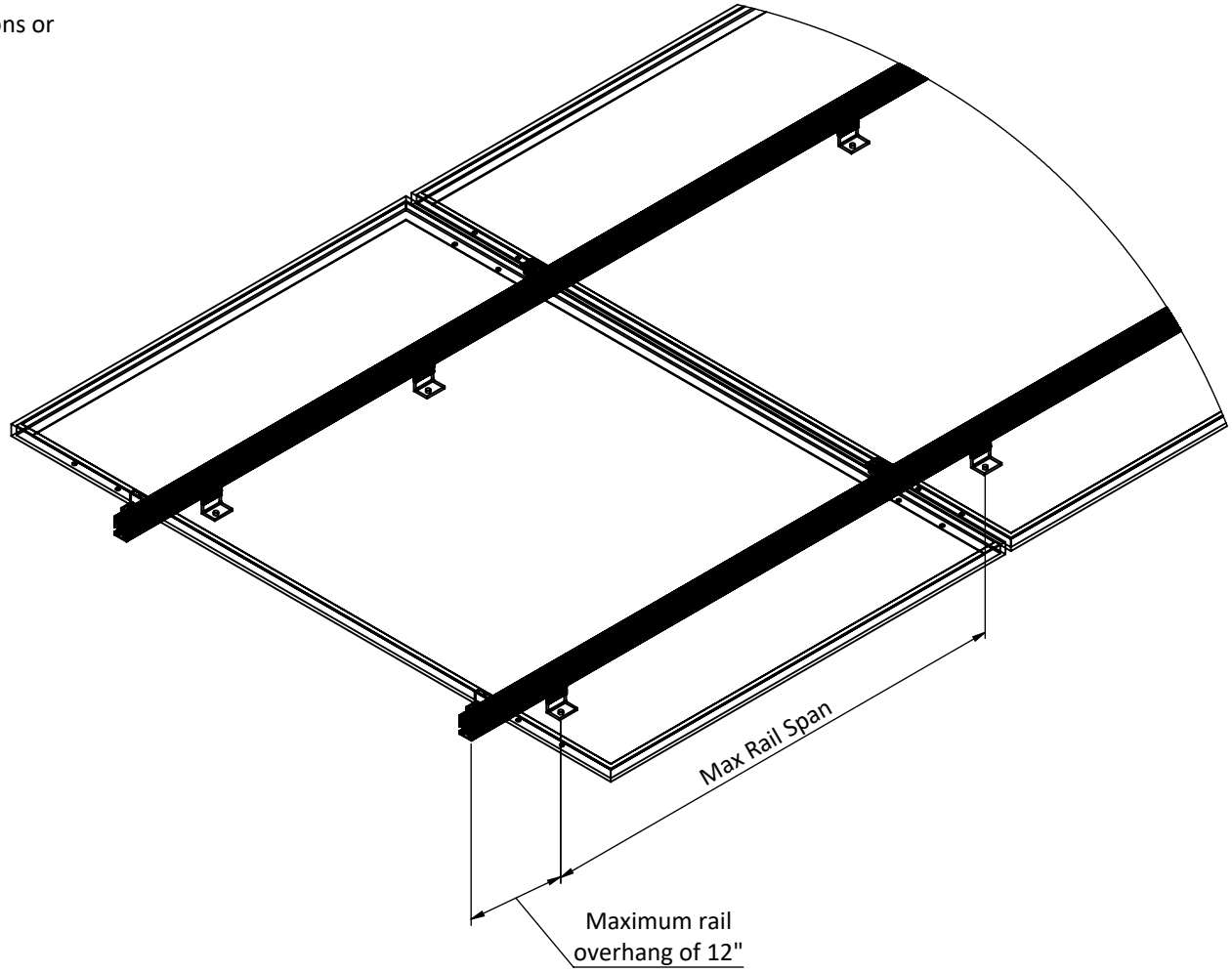


5.2 Rail Spans

1. Attach the rails to the L-feet and level along the row as described in section 5.0.
2. Adjust the rail positioning to ensure the array is properly located and aligned on the roof.
3. Confirm rail spans. Rails are designed to span up to 48" between L-feet. Shorter spans may be required for high-load locations or within certain roof zones.
4. Confirm rail overhang. Rails may overhang at both ends. Maximum overhang of 12" is permitted.
5. Additional L-feet and roof attachments may be added as required to stay within these limits.

Maximum rail spans to be compliant with Fast-Rack Ultra Span Letter

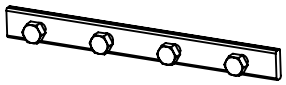
Maximum rail overhang is 25% of max span up to 12"



5.3 Rail Splice and Thermal Expansion Joint

7

Bond Strap



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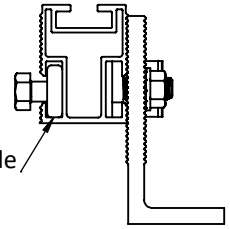
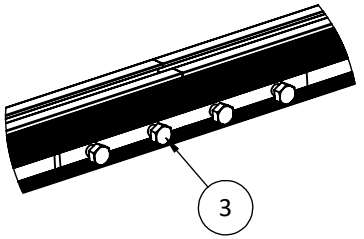
Rail Splice





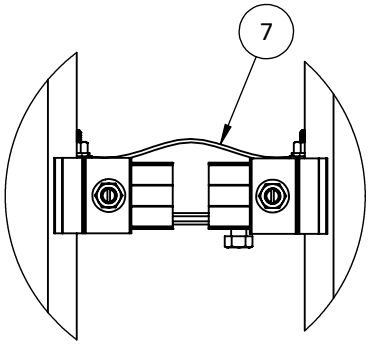
Standard Splice Joint

Standard Splice

1. Install a rail splice at all rail junction points, centered between the two rails. Slide in the rail side channel from the end with 1/2 the splice length in each rail.
2. Push the rails together so that they are touching end-to-end. The splice aligns and bonds the rails.

Thermal Expansion Joint

1. Thermal expansion joints should be used every 50ft to allow for expansion and contraction.
2. Bonding straps and rail splices should be used at the thermal expansion joint locations.
3. For thermal expansion joints, install the splice with only two fasteners to allow movement as the aluminum expands and contracts with temperature change.
4. Maintain a 4.75" gap between modules and a 0.75" gap between rails during the expansion joint installation process.

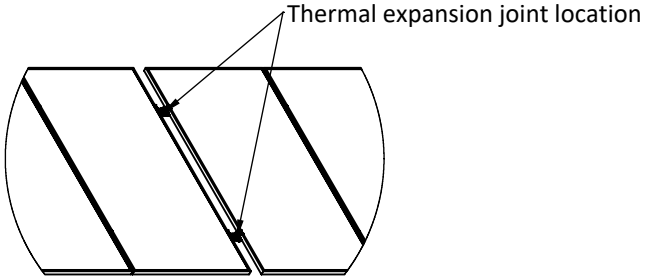


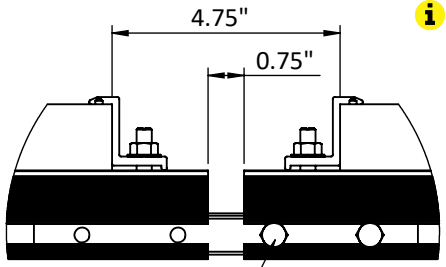
Thermal Expansion Joint

Ensure bonding strap is installed with a droop to allow for thermal expansion.

Slide the splice into place before installing the adjacent rail

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





Thermal expansion joint has two bolts secured and two bolts removed to ensure alignment is maintained

Applicable for all module clamp styles

6.0 Accessories

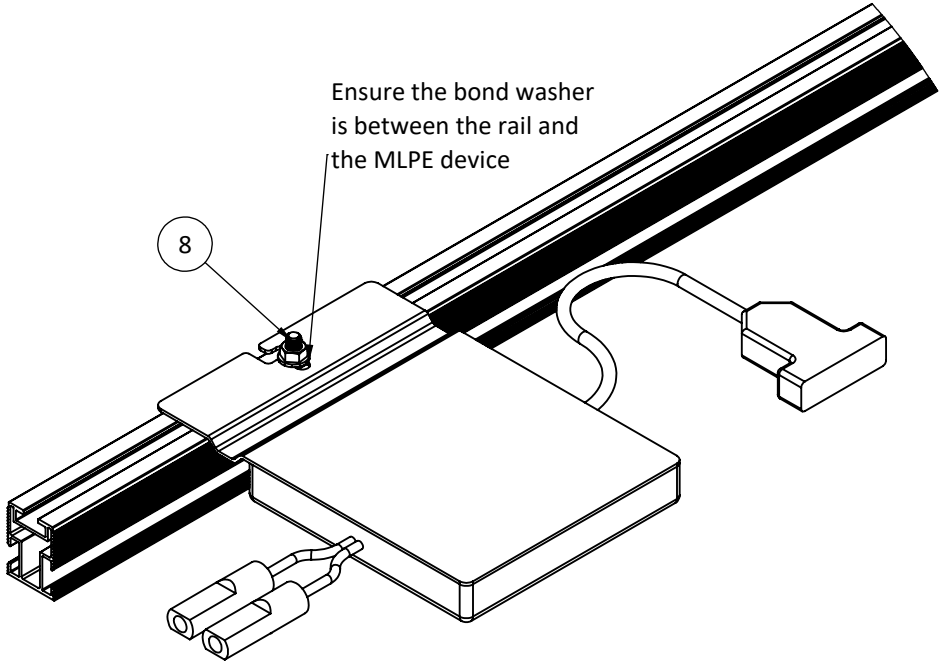
8

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 pre-assembled kit to fasten and bond accessories to the rail.

1. Select the correct MGH Kit for the equipment you are attaching. They are available with T-bolt lengths of 16mm, 20mm and 25mm.
2. 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.
3. 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



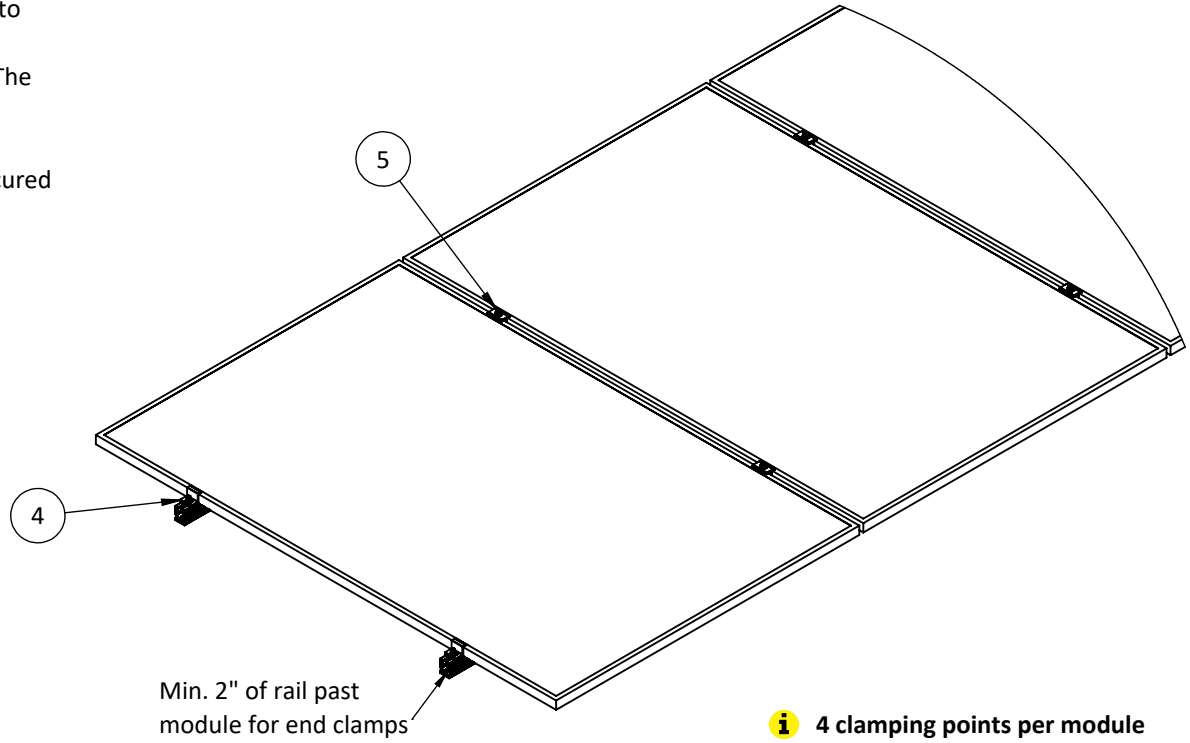
7.0 Module Installation

1. Place the PV Module across the set of rails.
2. Adjust the position so the rails land within the clamping zones of the module.
3. Position the module clamps and fasten into the top channel of the rail. (Do not tighten until the adjacent module has been set into position.)
4. End clamps are used for the first and last module in the row. The mid clamps will go between adjacent modules.
5. Complete electrical connections between modules and any inverters/optimizers as you go. Ensure cables are properly secured before the modules are clamped down.

Check alignment as you go to ensure the array is square

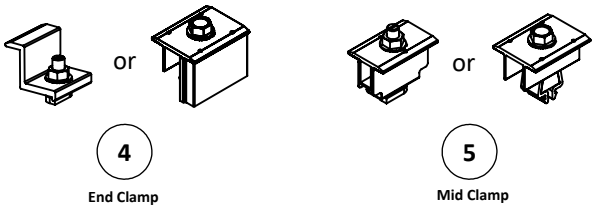
Ensure modules are positioned with the rails within the approved "green zones"

Install with bonding washers under modules when using black rails (refer to Section 8.1).



4 clamping points per module

7.1 Module Clamps



Module clamps are available in a T-bolt or Click-Lock model and fasten to the top channel of the rail.

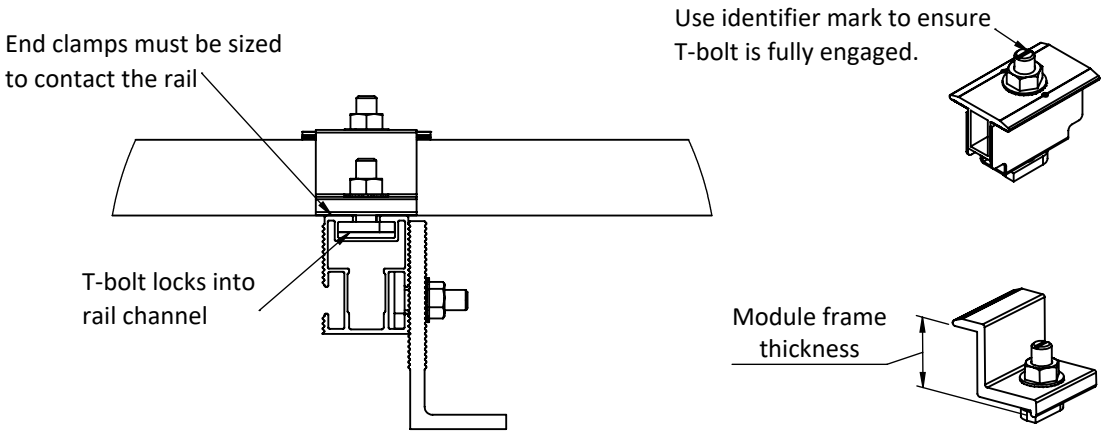
T-Bolt Clamps

1. T-bolt clamps are installed by inserting the T-bolt into the top rail channel.
2. Once engaged, twist 90 degrees until the T-bolt is firmly in place in the rail channel.
3. End clamps are specific to the module frame thickness and must seat fully against the rail when installed.

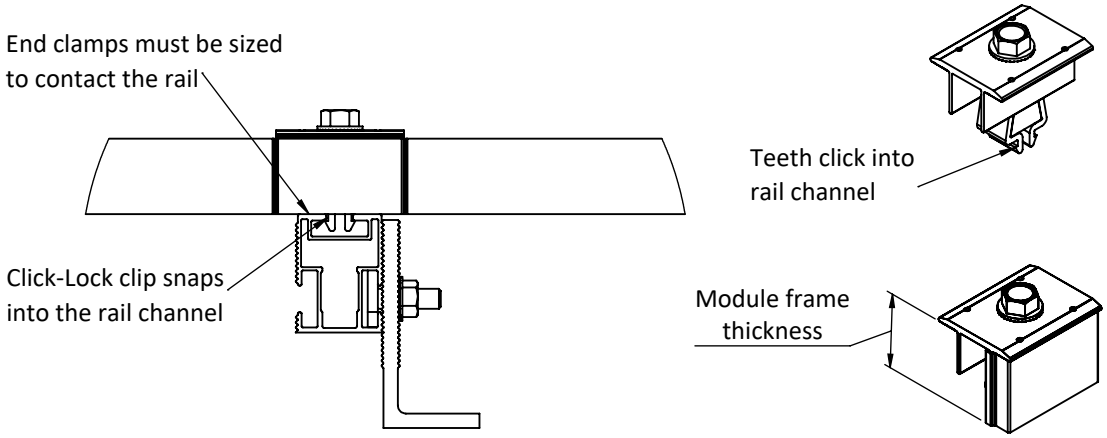
Click-Lock Clamps

1. Click-Lock clamps snap into the top channel of the rail.
2. As the bolt is tightened, the teeth on the clip will spread and engage with the rail.
3. End clamps come equiped with a stopper that slides onto the clamp and is sized according to the module frame thickness.
4. The stopper should seat fully against the rail when installed.

End clamps and stoppers must be properly sized for the module frame thickness

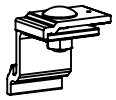


T-Bolt Clamps



Click-Lock Clamps

7.2 Hidden End Clamp



9

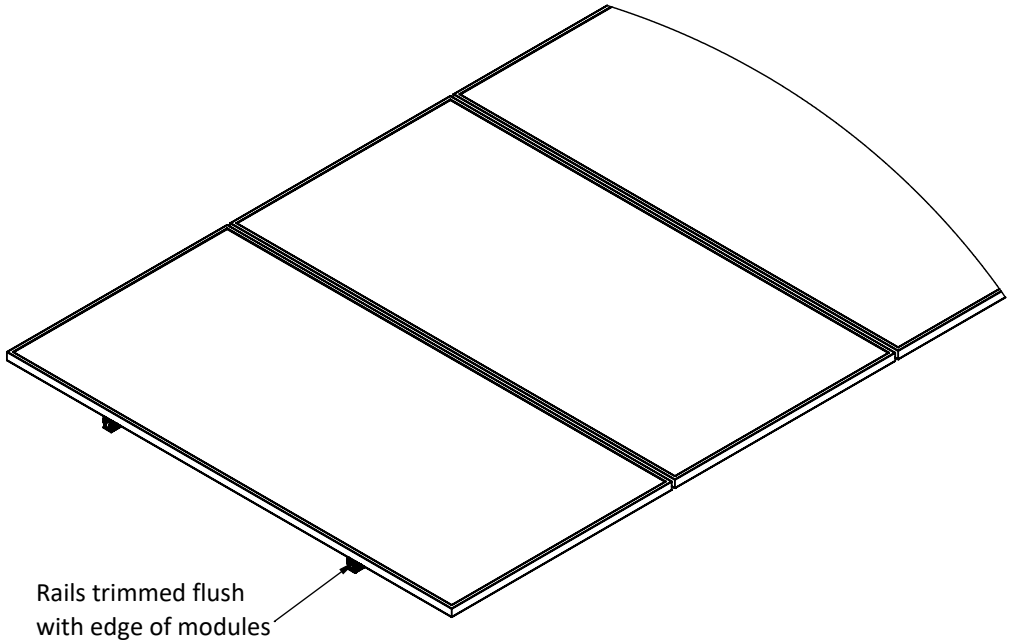
HEC

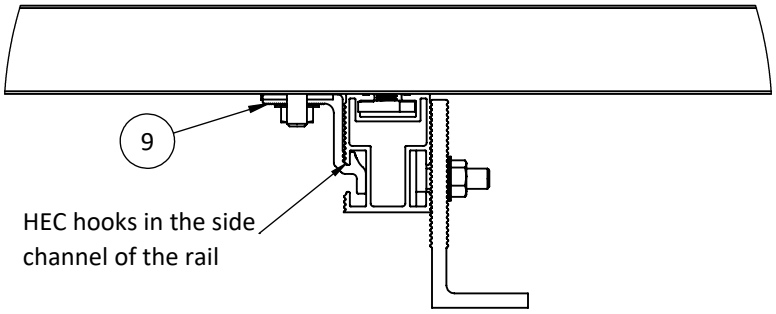
The Hidden End Clamps (HEC's) may be used for the first and last modules in a row. They are installed underneath the module, allowing the rails to be trimmed flush with the edge of the module.

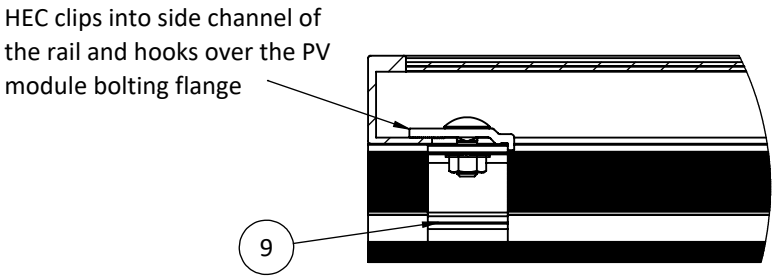
1. Position the module at the end of the rail.
2. Slide the HEC forward until the upper part of the clamp overlaps the inner module frame.

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

It is recommended to install the rails, mark the edge of the module, and trim off in place.







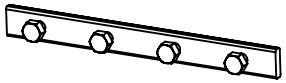
8.0 Bonding

6

Bond Lug

7

Bond Strap



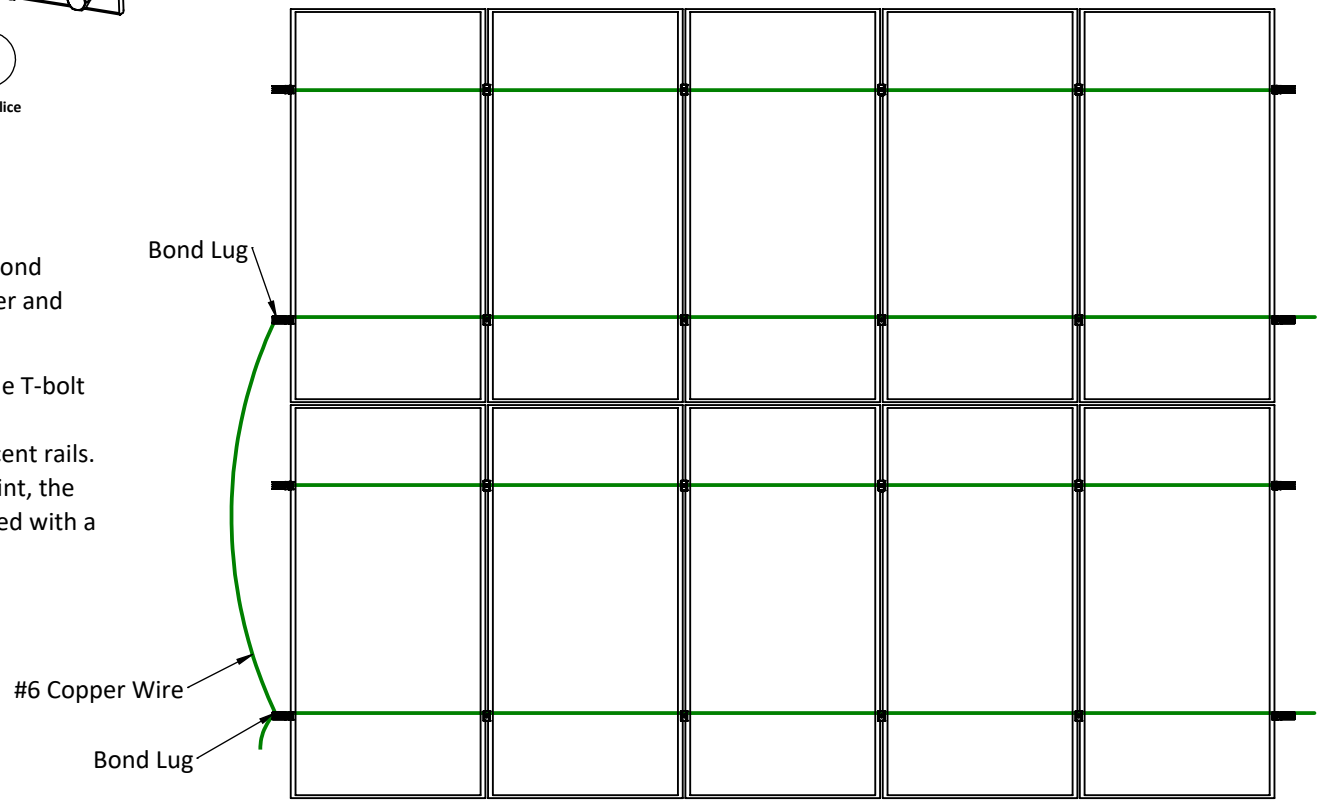
3

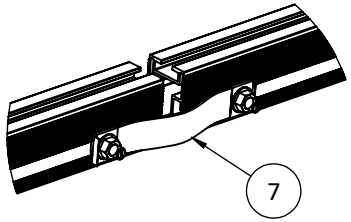
Rail Splice

Bond lugs and #6 bare copper wire are used to electrically bond rows together. All rows of modules must be bonded together and back to the main ground for the system.

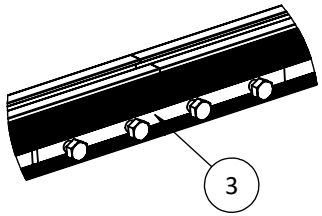
1. Fasten the bond lug to the top or side of the rail using the T-bolt provided.
2. At standard rail joints, rail splices are used to bond adjacent rails.
3. When the splice is not fully fastened for an expansion joint, the bond strap must be used. Ensure bonding strap is installed with a droop to allow for thermal expansion.

Module clamps have integrated bonding pins to bond modules to rails.

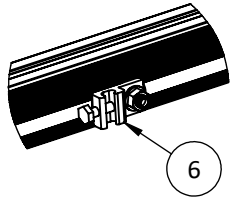




Thermal Expansion Joint Bonding



Splice Joint Bonding



Adjacent Row Bonding

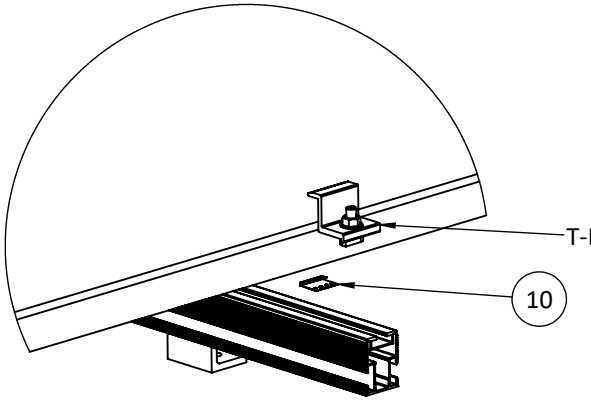
8.1 Black Rail Bonding

10

Bond Washer

6

Bond Lug



Clip the bond washer onto the module frame before clamping down.

T-Bolt Clamps

Installations with black rails require an additional bonding washer beneath all end clamps to create a continuous bond between the module and the rails. To be used with T-bolt style clamps.

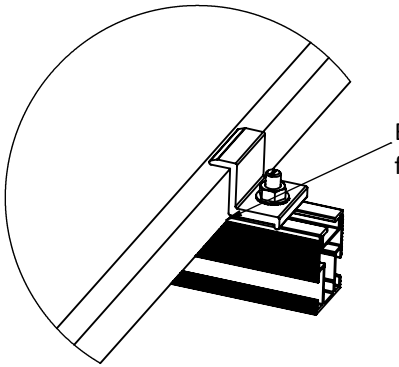
1. Clip the bonding washer onto the module frame where it will be sandwiched between the module and rail.
2. Secure the module end clamps. As they are tightened, the bond washer pierces the rail coating, completing the bond path.

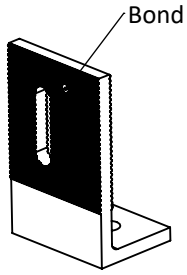
Two bond washers required per end-module when using black rails. (under each end clamp)

Clicklock or HEC Clamps

1. Bond the rails to the module using a certified bonding device such as a UL467 certified bond lug.
2. Install bond lugs at both ends of every row next to the end clamps.

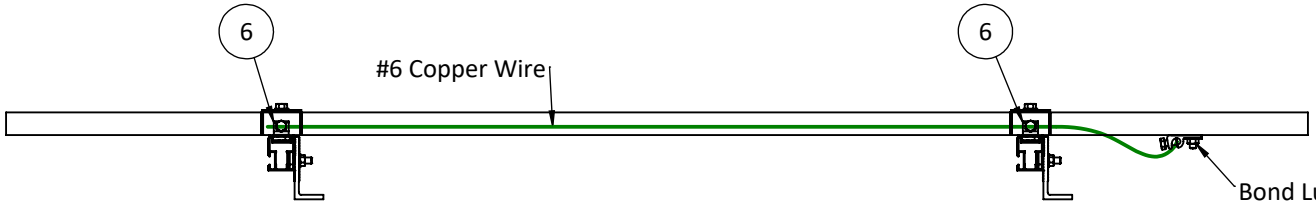
Bond washers are not required for Clicklock and HEC clamp installs





Black L-Foot

Black rail systems should always be paired with the black L-foot.



Clicklock & HEC Bonding Method

9.0 Inspection & Maintenance

Introduction

The primary purpose of regular inspection and maintenance is to ensure the safe and efficient operation of your 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 components.
- Examine the overall condition of the racking structure for any damage.
- Ensure that the solar panels are securely fastened and not damaged.
- Check that T-bolts are properly engaged (T-bolt slot perpendicular to rail)

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 rails or anchors.
- 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:

- Quarterly: Electrical inspections, structural integrity checks, and a comprehensive visual inspection should be conducted every three months.
- Annually: A more thorough inspection, including rust prevention measures, should be performed at least once a year.

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.

10.0 UL 2703 Certification & Ratings

Conforms to UL 2703 Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels.

Scope of evaluation includes bonding, grounding and mechanical loading.
Max Module Area Tested: 27.5 sqft

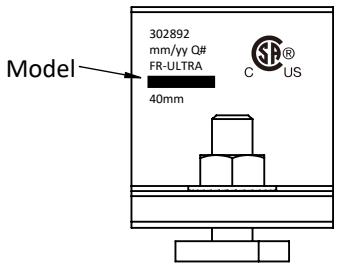
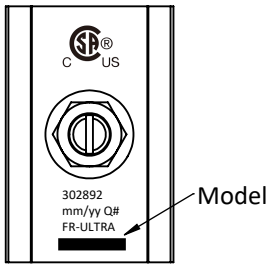
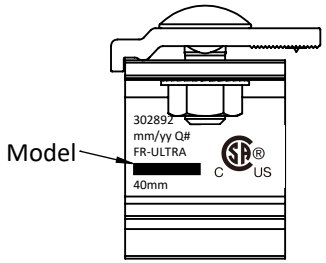
Certified to CSA TIL No. A-40 Photovoltaic Module Racking Systems
System was tested and approved to the following load ratings.

Downward Design Load:	0.80 kPa (16.8 psf)
Upward Design Load:	0.80 kPa (16.8 psf)
Down-Slope Load:	0.24 kPa (5.0 psf)

In addition to the UL 2703 load testing, the Fast-Rack Ultra system has been analyzed and tested by professional engineers beyond the requirements of certification tests to determine allowable loads and compatibility with larger modules.

Certified to UL 2703 for Bonding & Grounding
The bonding & grounding of the system is in compliance with the National Electrical Code, NEC 250 & 690 and in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part I.

Ground & bond conductors to be:
#6 AWG Cu, Bare or RW90 (Green). Max temperature rating of 90˚C

Module Compliance
Refer to document "FR-ULT-4001-PV_MODULE_LIST" for PV module compliance with the FR-Ultra racking system.

Marking
Certification marking is located on the End clamps and Mid clamps. Cross out the non-applicable model with a permanent marker at the time of installation to identify the mounting system.