

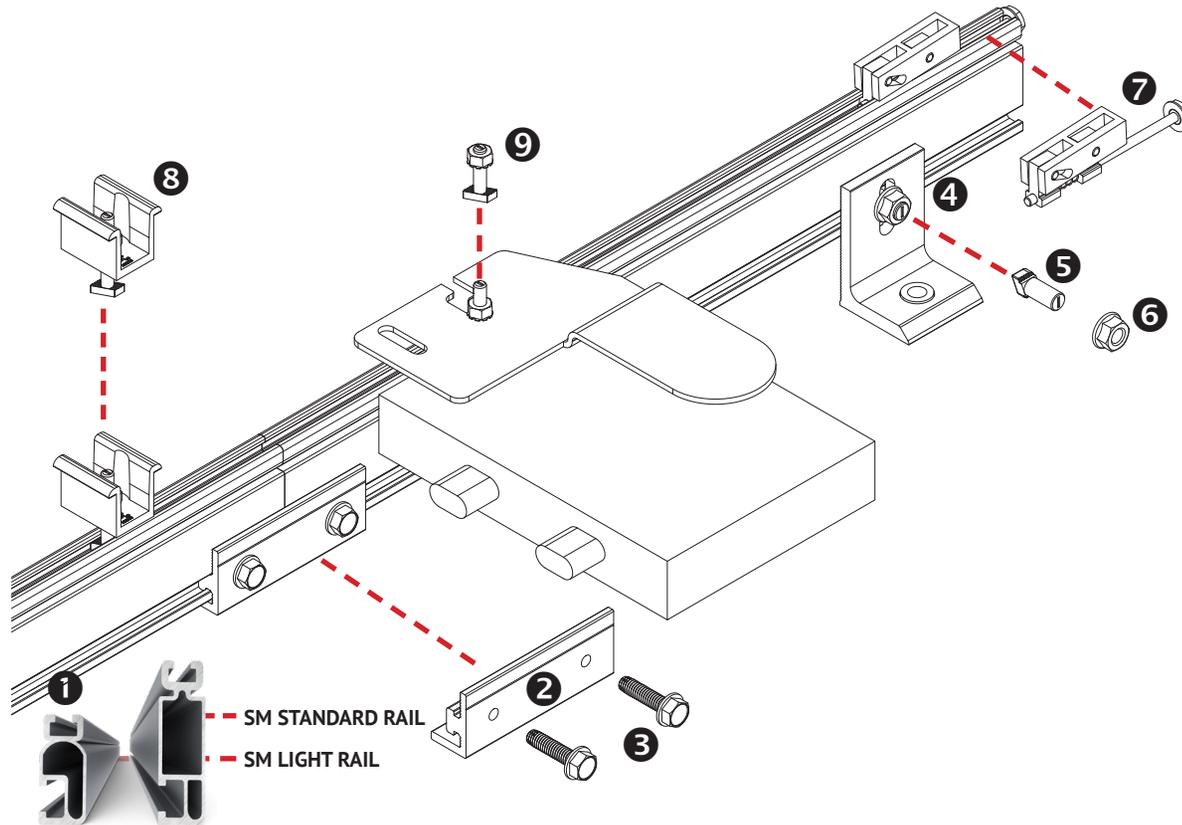


INSTALLATION GUIDE

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1 RAIL: Supports PV modules. Use at least two per row of modules. Aluminum extrusion, available in mill, clear anodized, or dark anodized.

2 RAIL SPLICE: Non structural splice joins, aligns, and electrically bonds rail sections into single length of rail. Forms a rigid splice joint, 4 inches long, preassembled with bonding hardware. Available in dark anodized or mill finish.

4 L-FOOT: Use to secure rails through roofing material to building structure. Refer to loading tables or U-Builder for spacing.

5 L-FOOT T-BOLT: (3/8" x 3/4" or 1") – Use one per L-foot to secure rail to L-foot. Stainless steel. Supplied with L-foot in combination with flange nut, provides electrical bond between L-foot and rail.

6 SERRATED FLANGE NUT: Use one per L-foot to secure and bond rail to L-foot. Stainless steel. Supplied with L-foot.

7 MODULE ENDCLAMP: Pre-assembled universal clamp that secures module to rail at module flange by tightening 1/2" hex head bolt.

8 MODULE MIDCLAMP: Pre-assembled clamp provides module to module and module to rail bond. Aluminum clamp with stainless steel bonding pins and T-bolt. Available in clear or dark finish.

9 MICROINVERTER MOUNTING BOLT: Preassembled bolt, nut, and captive star washer attaches and bonds microinverter to rail.

NOTE - POSITION INDICATOR: T-bolts have a slot in the hardware end corresponding to the direction of the T-Head.

Wrenches and Torque		
	Wrench or Socket Size	Recommended Torque (ft-lbs)
Mid Clamp	1/2"	11
MLPE Mount	1/2"	10
End Clamp	1/2"	3
L-Foot to Rail	1/2"	30
Rail Splice	1/2"	10

Anti-Seize 6 9	
Stainless steel hardware can seize up, a process called galling. To significantly reduce its likelihood:	
1. Apply minimal lubricant to bolts only where indicated in installation process, preferably Anti-Seize commonly found at auto parts stores (Anti-seize has been factory applied to mid clamp bolts)	
2. Shade hardware prior to installation, and	
3. Avoid spinning stainless nuts onto bolts at high speed.	

PLANNING YOUR SOLARMOUNT INSTALLATIONS

The installation can be laid out with rails parallel to the rafters or perpendicular to the rafters. Note that SOLARMOUNT rails make excellent straight edges for doing layouts.

Center the installation area over the structural members as much as possible.

Leave enough room to safely move around the array during installation. Some building codes and fire codes require minimum clearances around such installations, and the installer should check local building code requirements for compliance.

The length of the installation area is equal to:

- the total width of the modules,
- plus 1" inch for each space between modules (for mid-clamp),
- plus 0 to 1" (0 to ½ inches for each Endclamp)

LAYING OUT L-FEET FOR TOP CLAMPS

L-feet, in conjunction with proper flashing equipment and techniques, can be used for attachment through existing roofing material, such as asphalt shingles, sheathing or sheet metal to the building structure.

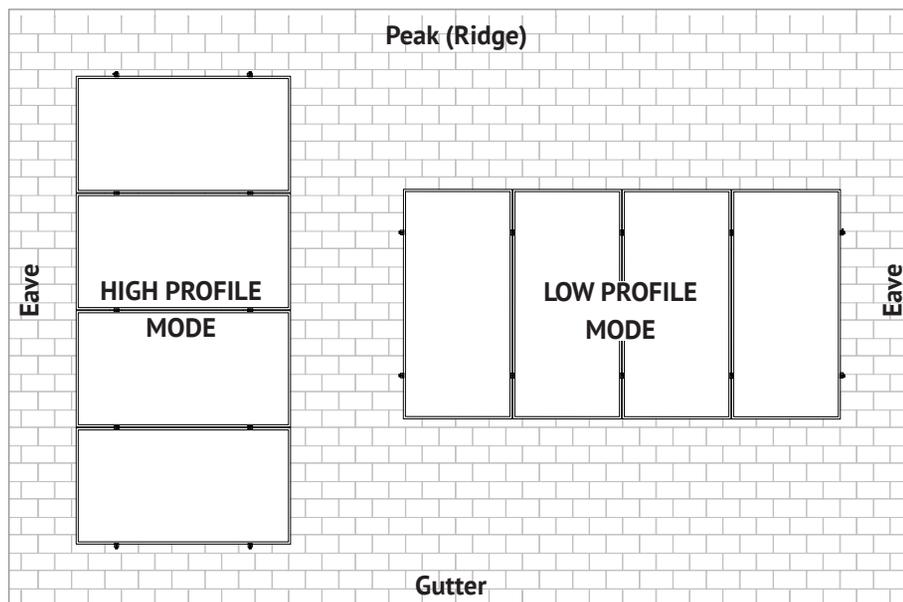
Locate and mark the position of the L-feet lag screw holes within the installation area as shown below. Follow manufacturer module installation guide for rail spacing based on appropriate mounting locations

NOTE: FOR EXPANSION JOINT REQUIREMENTS, REFER TO PAGE I. RAIL LENGTHS AND LOCATIONS OF L-FEET FOR EXPANSION JOINTS WILL NEED TO BE DETERMINED AT THIS STAGE IN PLANNING SYSTEM LAYOUT.

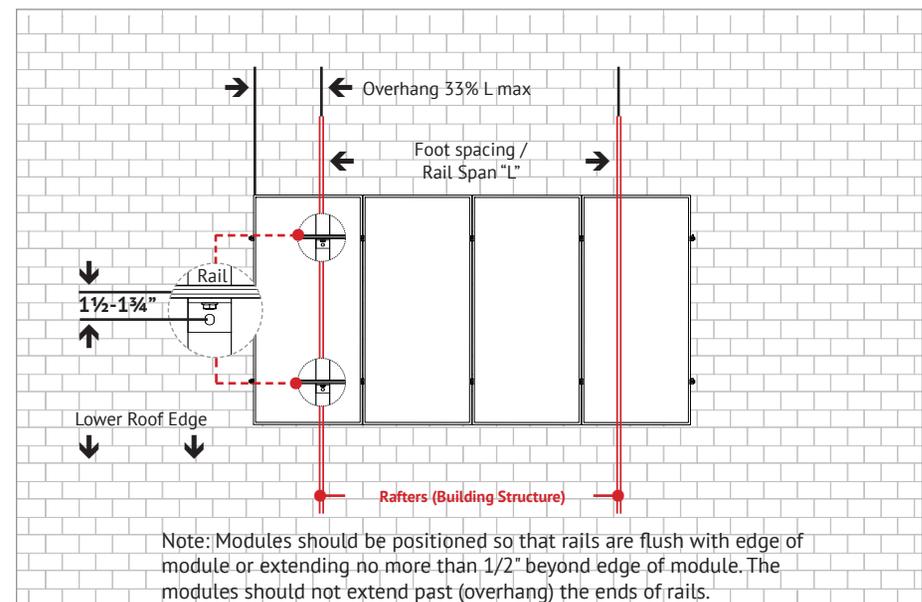
If multiple rows are to be installed adjacent to one another, it is not likely that each row will be centered above the rafters. Adjust as needed, following the guidelines below as closely as possible.

Refer to Unirac Solarmount D&E Guide & U-Builder for allowable spans and cantilevers.

RAILS MAY BE PLACED PARALLEL OR PERPENDICULAR TO RAFTERS



LAYOUT WITH RAILS PERPENDICULAR TO RAFTERS (RECOMMENDED)



SYSTEM LEVEL FIRE CLASSIFICATION

The system fire class rating requires installation in the manner specified in the SOLARMOUNT Installation Guide. SOLARMOUNT has been classified to the system level fire portion of UL 1703. This UL 1703 classification has been incorporated into our UL 2703 product certification. SOLARMOUNT has achieved system level performance for steep sloped roofs. System level fire performance is inherent in the SOLARMOUNT design, and no additional mitigation measures are required. The fire classification rating is only valid on roof pitches greater than 2:12 (slopes \geq 2 inches per foot, or 9.5 degrees). The system is to be mounted over fire resistant roof covering rated for the application. There is no required minimum or maximum height limitation above the roof deck to maintain the system fire rating for SOLARMOUNT. Module Types & System Level Fire Ratings are listed below:

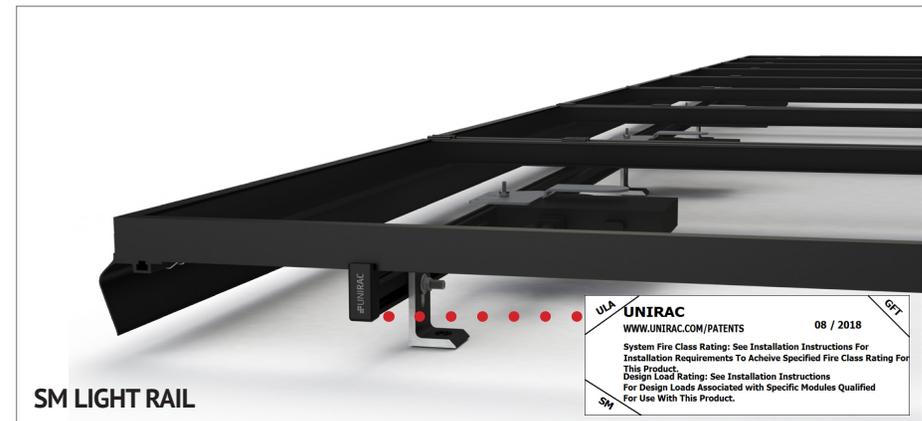
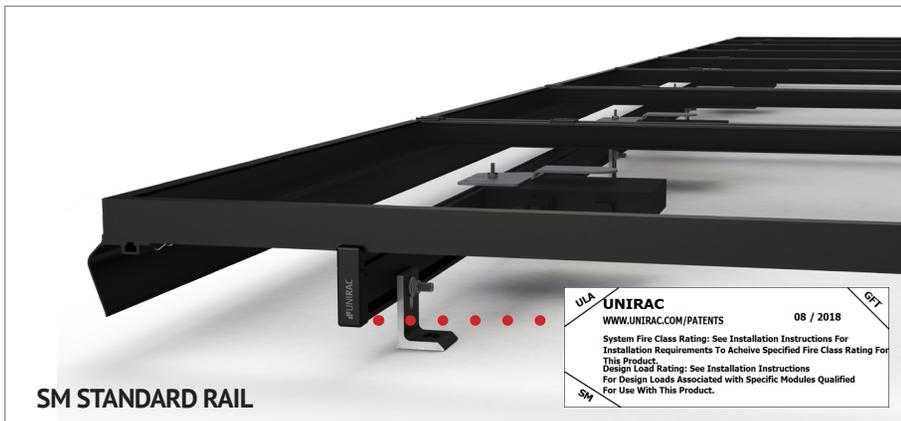
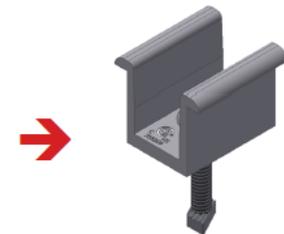
Rail Type	Module Type	System Level Fire Rating	Rail Direction	Module Orientation	Mitigation Required
Standard Rail	Type 1, Type 2, Type 3 & Type 10	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required
Light Rail	Type 1 & Type 2	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required

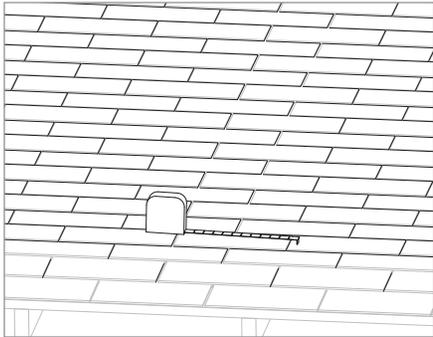
This racking system may be used to ground and/or mount a PV module complying with UL1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

UL2703 CERTIFICATION MARKING LABEL

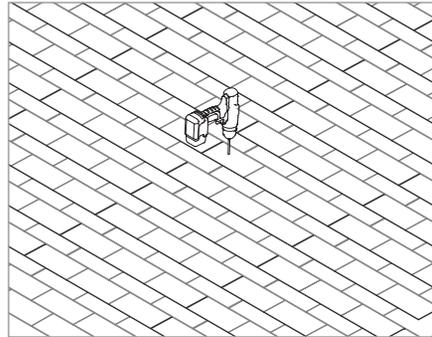
Unirac SOLARMOUNT is listed to UL 2703. Certification marking is embossed on all mid clamps as shown. Labels with additional information will be provided. After the racking system is fully assembled, a single label should be applied to the SOLARMOUNT rail at the edge of the array. **Before applying the label, the corners of the label that do not pertain to the system being installed must be removed so that only the installed system type is showing.**

Note: The sticker label should be placed such that it is visible, but not outward facing.





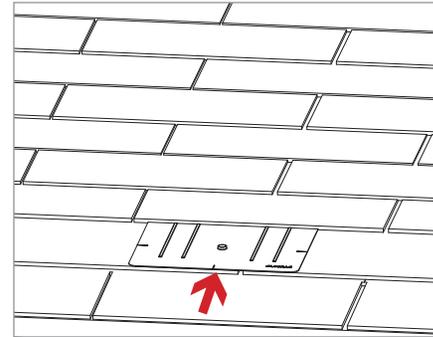
ROOF PREPARATION: Layout and install flashing at rafter locations determined per Design and Engineering Guide.



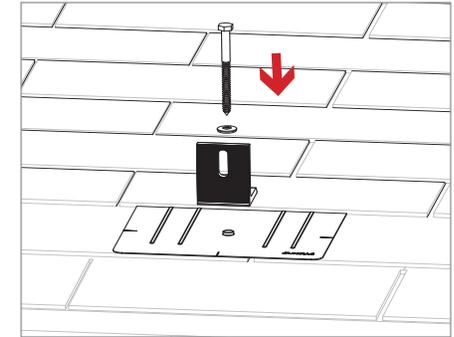
DRILL PILOT HOLES: Center the roof attachment over the rafter and drill a pilot hole(s) for the lag bolt(s).

NOTE: Determine lag bolt size and embedment depth.

Quick Tip: Pre-drill the pilot hole through the flat flashing lag bolt location for easier installation.

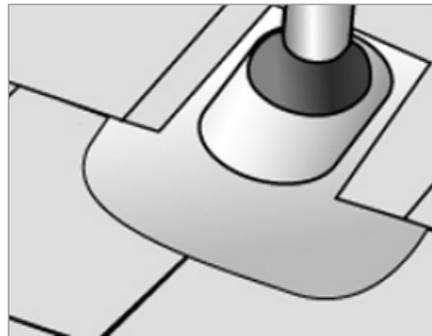


FLASHING INSTALLATION: Insert the flashing so the top part is under the next row of shingles and the hole lines up with the pilot hole.



INSTALL LAG BOLTS & L-FOOT: Insert the lag bolt through the L-Foot in the order shown in the illustration. Verify proper orientation before tightening lag bolts.

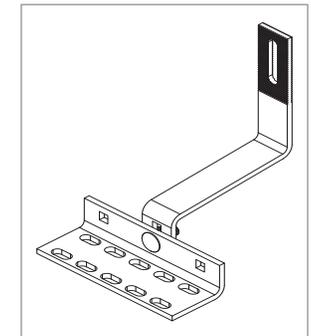
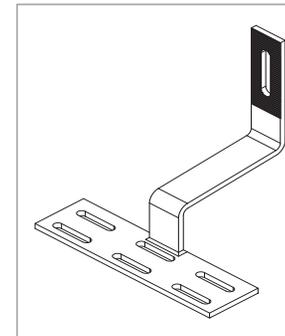
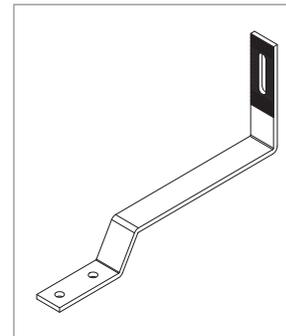
[See Appendix B for Additional Details](#)



2 PIECE ALUMINUM STANDOFF WITH FLASHING & L-FOOT:

- If necessary cut an opening in the roofing material over a rafter to accommodate the flashing riser.
- Install the standoff, ensuring that both lag bolts are screwed into the rafter.
- Insert the flashing under the shingle above and over the shaft of the standoff. (No-Calk™ collar does not require sealing of the flashing and standoff shaft)
- Add L-Foot to top with bolt that secures the EPDM washer to the top of the standoff.

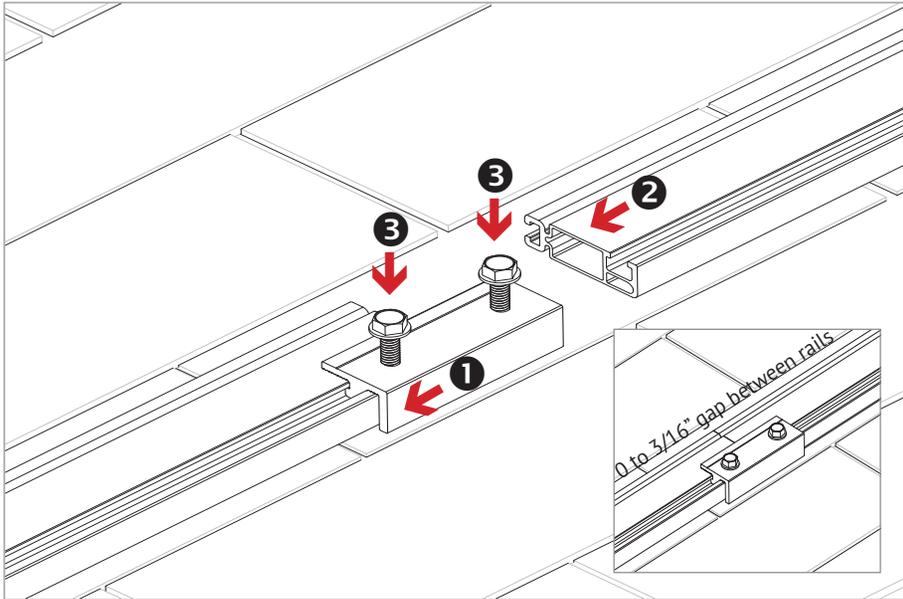
[See Standoffs & Flashings Installation Manual 907.2 for Additional Details.](#)



SIDE MOUNT SOLARHOOK:

- Remove or slide up the roof tile, position the roof hook above the roof rafter
- Place SolarHook in the middle of the underlying interlocking tile's valley. Drill 3/16 inch pilot holes through the underlayment into the center of the rafters. Securely fasten each tile hook to the rafters using included lag screws.
- Slide down or re-insert the tile.

[See Unirac Solarhook Installation Manual for Additional Information.](#)



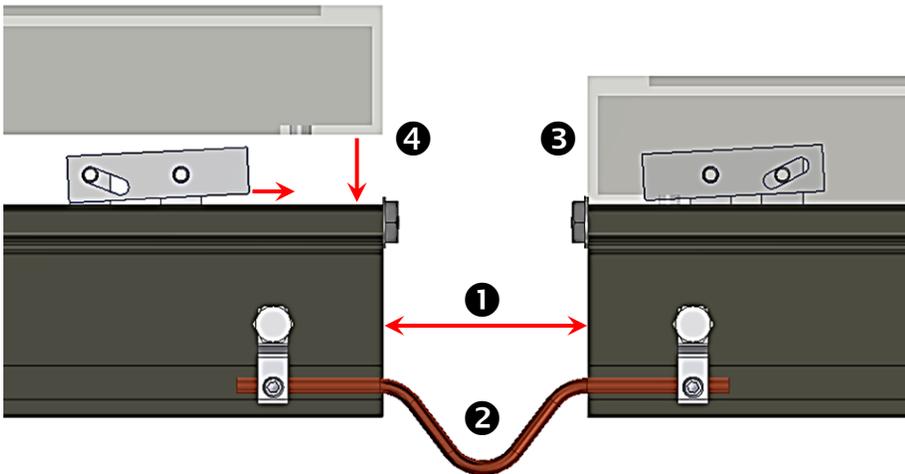
SPLICE INSTALLATION (IF REQUIRED PER SYSTEM DESIGN)

If your installation uses SOLARMOUNT splice bars, attach the rails together before mounting to the L-feet / footings. Use splice bars only with flush installations or those that use low-profile tilt legs. A rail can be supported by more than one footing on both sides of the splice. There should be a gap between rails, up to 3/16" at the splice connections. To install, slide T-feature on splice into the T-slot on each rail, centering the splice between the two rails. Tighten each bolt until the bolt-head is flush against the splice and torqued to 10 ft-lbs. Installation is complete when the bonding hardware penetrates the opposite side of the rail and the assembly torque is achieved. T-bolts should not be placed less than a distance of 1" from the end of the rail regardless of a splice.

TORQUE VALUE (See Note on PG. A)

Hex head socket size 1/2" - Do not exceed 10 ft-lbs. Do not use Anti-Seize.

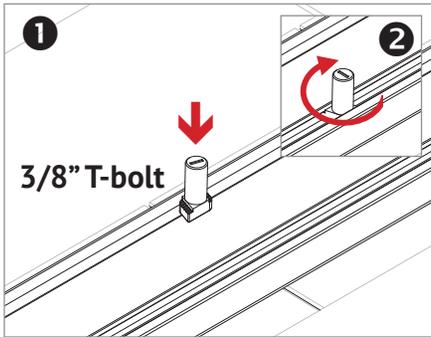
Max length of spliced rail is 40 ft. An expansion joint is required > 40 ft.



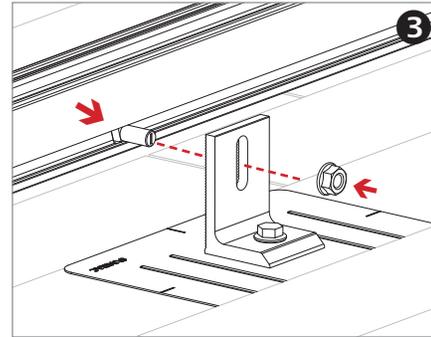
EXPANSION JOINT USED AS THERMAL BREAK

Expansion joints prevent buckling of rails due to thermal expansion. Splice bars may be used for thermal expansion joints. To create a thermal expansion joint, slide the splice bar into the footing slots of both rail lengths. Leave approximately 1/2" between the rail segments. Secure the splice bar with two screws on one side only. Footings (such as L-feet or standoffs) should be secured normally on both sides of the splice. No PV module or mounting hardware component should straddle the expansion joint. Modules must clearly end before the joint with mounting hardware (top mount Endclamps) terminating on that rail. T-bolts should not be placed less than a distance of 1" from the end of the rail regardless of a splice. The next set of modules would then start after the splice with mounting hardware beginning on the next rail. **A thermal break is required every 40 feet of continuously connected rail. For additional concerns on thermal breaks in your specific project, please consult a licensed structural engineer. Runs of rail less than 40 feet in length, with more than two pairs spliced together, are an acceptable installation for the SOLARMOUNT systems.**

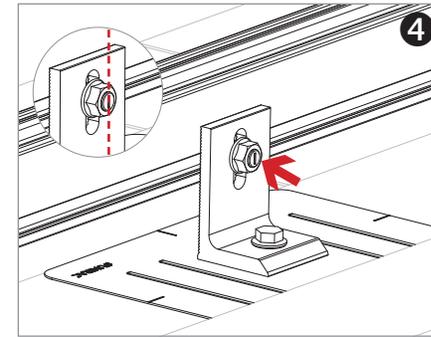
Bonding connection for splice used as a thermal break. Option shown uses two Ilco lugs (Model No. GBL-4DBT P/N GBL-4DBT - see product data sheet for more details) and solid copper wire.



1 PLACE T-BOLT INTO RAIL & SECURE BOLT: Insert 3/8" T-bolt into rail at L-foot locations. Apply Anti-Seize to bolt. Rotate T-bolt into position.

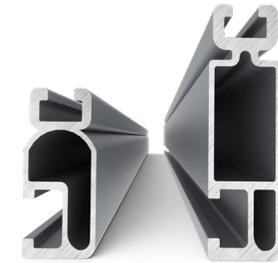


3 SECURE T-BOLT: Apply Anti-Seize to bolt. Rotate T-bolt into position.



4 ALIGN POSITION INDICATOR: Hand tighten nut until rail alignment is complete. Verify that position indicator on bolt is vertical (perpendicular to rail)

TORQUE VALUE (See Note on PG. A)
3/8" nut to 30 ft-lbs

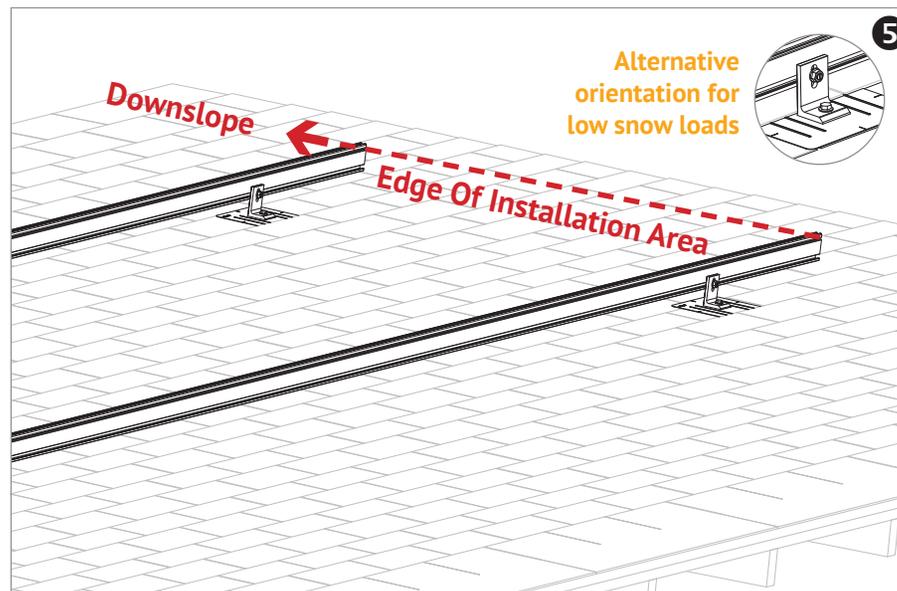


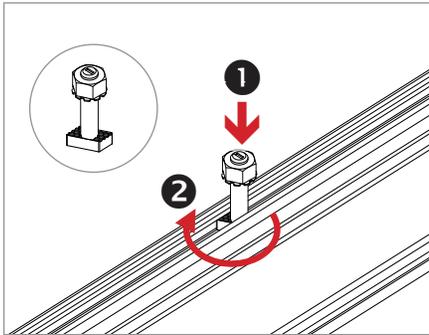
Note:
Allowable L-foot slot locations for SM Standard & Light Rail.

ALIGN RAILS: Align one pair of rail ends to the edge of the installation area. The opposite pair of rail ends will overhang installation area. Do not Trim them off until the installation is complete. If the rails are perpendicular to the rafters, either end of the rails can be aligned, but the first module must be installed at the aligned end.

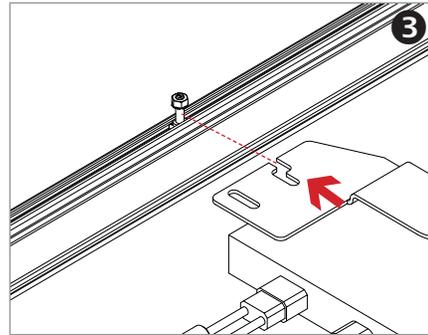
If the rails are parallel to the rafters, the aligned end of the rails must face the lower edge of the roof. Securely tighten all hardware after alignment is complete.

Mount modules to the rails as soon as possible. Large temperature changes may bow the rails within a few hours if module placement is delayed.

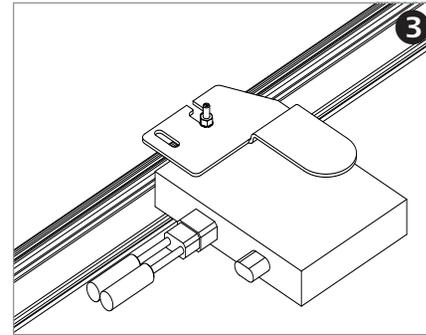




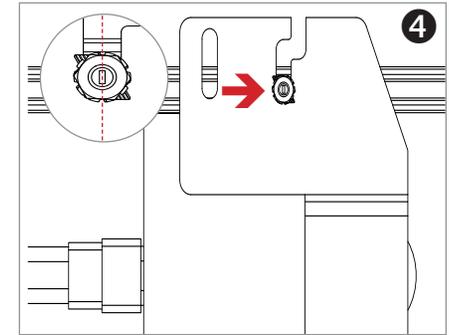
INSTALL MICROINVERTER MOUNT T-BOLT: Apply Anti-Seize and install pre-assembled 1/4" dia. bonding T-bolts into top 1/4" rail slot at microinverter locations. Rotate bolts into position.



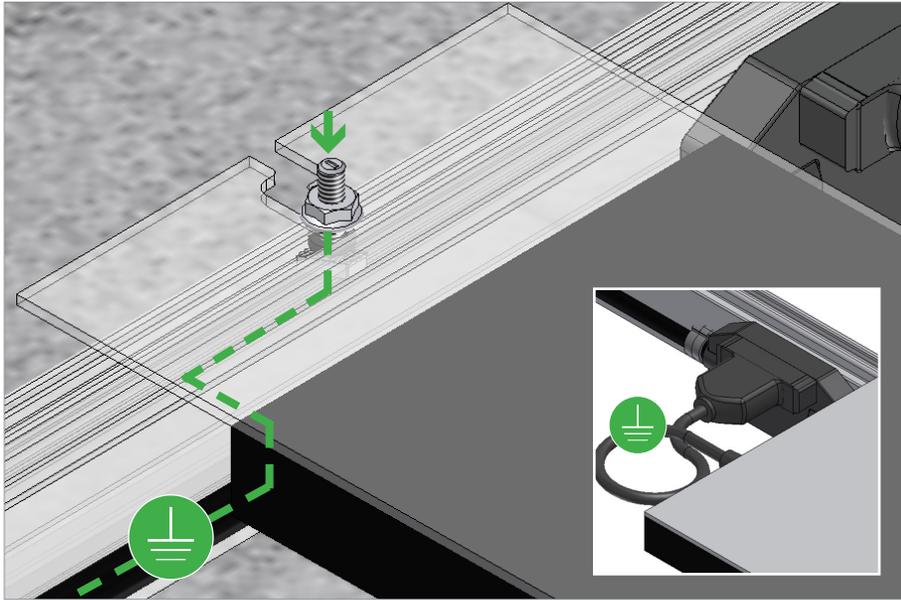
INSTALL MICROINVERTER: Install microinverter on to rail. Engage with bolt.



INSTALL MICROINVERTER:
TORQUE VALUE (See Note on PG. A)
1/4" nut to 10 ft-lbs w/Anti-Seize



ALIGN POSITION INDICATOR: Verify that position indicator on bolt is perpendicular to rail.



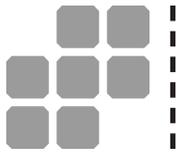
SM EQUIPMENT GROUNDING THROUGH ENPHASE MICROINVERTERS

The Enphase M215 and M250 microinverters have integrated grounding capabilities built in. In this case, the DC circuit is isolated from the AC circuit, and the AC equipment grounding conductor (EGC) is built into the Enphase Engage integrated grounding (IG) cabling.

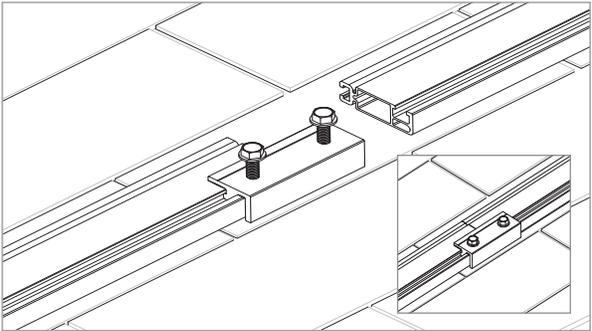
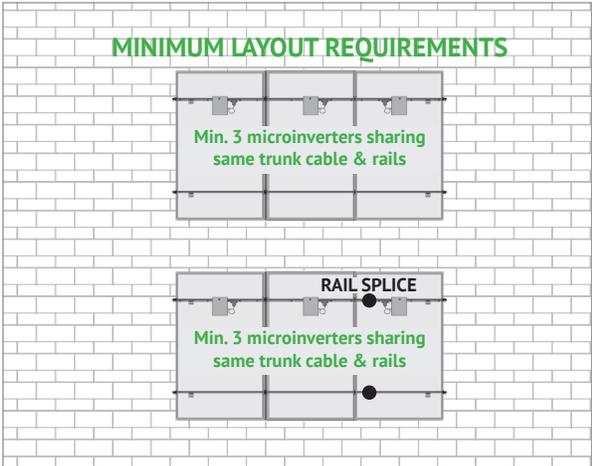
In order to ground the SOLARMOUNT racking system through the Enphase microinverter and Engage cable assembly, there must be a minimum of three PV modules connected to the same trunk cable within a continuous row. Continuous row is defined as a grouping of modules installed and bonded per the requirements of this installation guide sharing the same two rails. The microinverters are bonded to the SOLARMOUNT rail via the mounting hardware. Complete equipment grounding is achieved through the Enphase Engage cabling with integrated grounding (IG). No additional EGC grounding cables are required, as all fault current is carried to ground through the Engage cable.



SOLARMOUNT INTEGRATED BONDING ADVANTAGE
 WITH SYSTEM GROUNDING THROUGH ENPHASE MICROINVERTERS AND TRUNK CABLES
LOSE ALL THE COPPER & LUGS

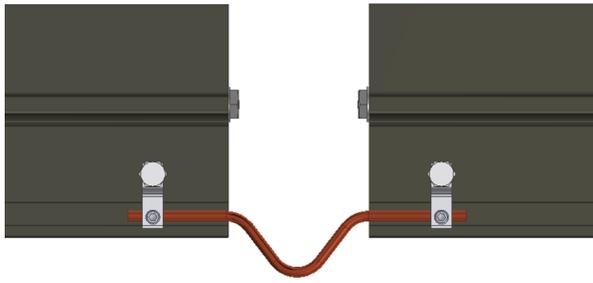
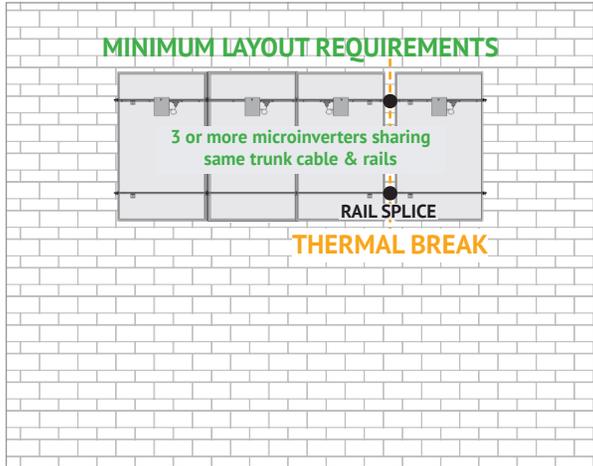


CONTINUOUS RAIL & ELECTRICAL BONDING SPLICE
Enphase Microinverter (MI) Requirements (Model No. M215 & M250)
3 Microinverters sharing same trunk cable & rails



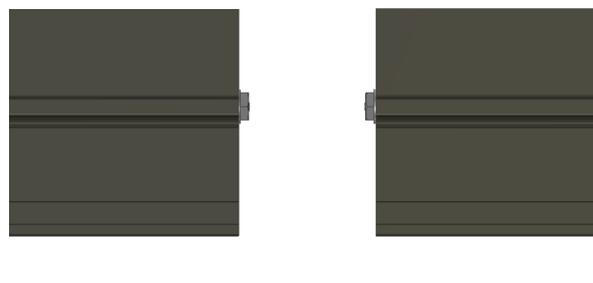
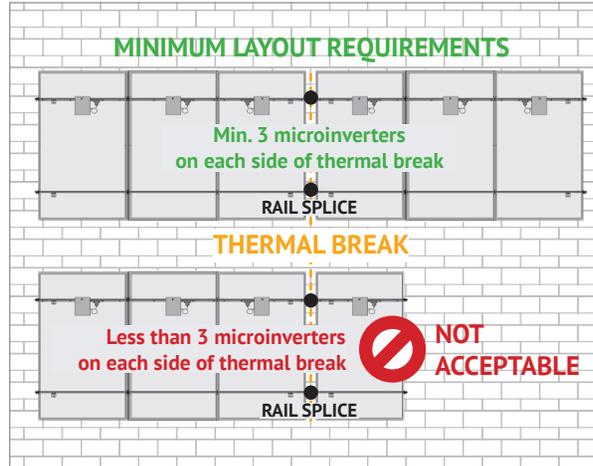
ELECTRICAL BONDING SPLICE

EXPANSION JOINT W/GROUNDING LUGS & COPPER JUMPER
Enphase Microinverter (MI) Requirements (Model No. M215 & M250)
3 or more Microinverters sharing same trunk cable & rails



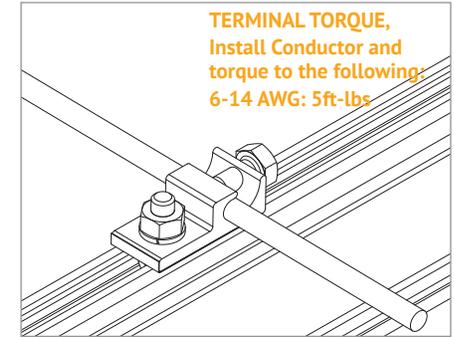
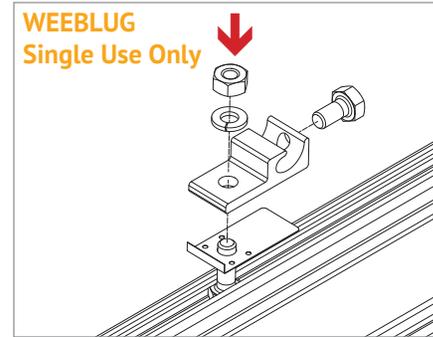
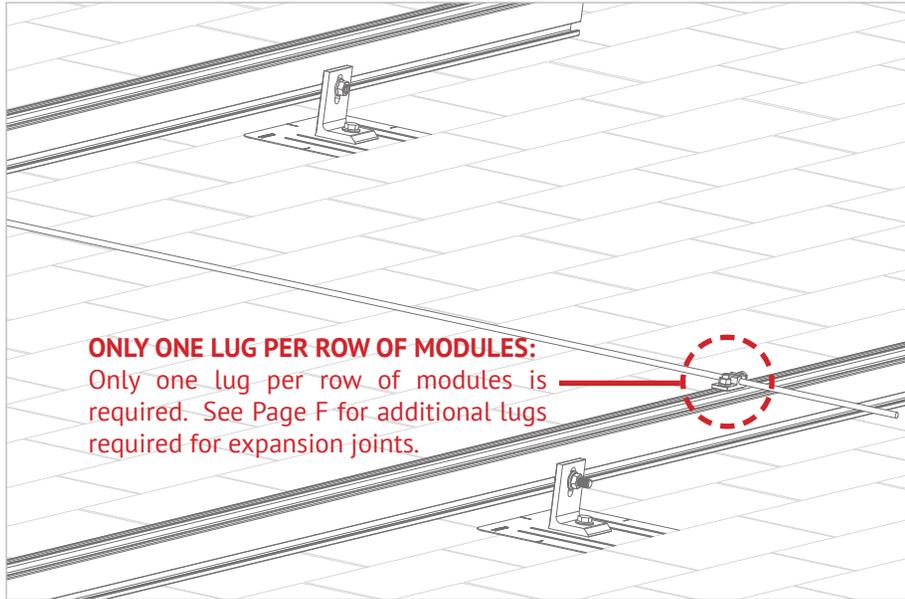
EXPANSION JOINT USED AS THERMAL BREAK W/ GROUNDING LUGS & COPPER JUMPER

EXPANSION JOINT W/O ELECTRICAL BONDING CONNECTION
Enphase Microinverter (MI) Requirements (Model No. M215 & M250)
Min. 3 Microinverters on each side of thermal break



EXPANSION JOINT USED AS THERMAL BREAK W/O ELECTRICAL BONDING CONNECTION

NOTE: THE ABOVE IMAGES ARE SAMPLE CONFIGURATIONS TO ILLUSTRATE THE REQUIREMENTS FOR SM SYSTEM GROUNDING THROUGH ENPHASE MICROINVERTERS DESCRIBED ON PAGE I-2



WEEBLUG CONDUCTOR - UNIRAC P/N 0080025:

Apply Anti Seize and insert a bolt in the aluminum rail and through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless steel flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug.

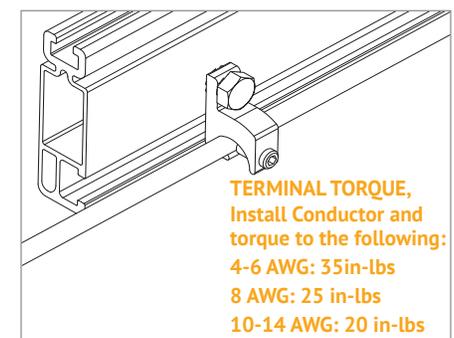
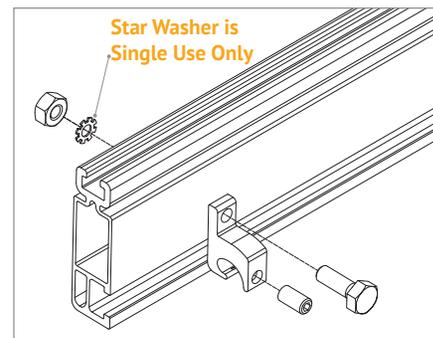
TORQUE VALUE 10 ft lbs. (See Note on PG. A)

See product data sheet for more details, Model No. WEEB-LUG-6.7

GROUNDING LUG MOUNTING DETAILS:

Details are provided for both the WEEB and IlSCO products. The WEEBLug has a grounding symbol located on the lug assembly. The IlSCO lug has a green colored set screw for grounding indication purposes. Installation must be in accordance with NFPA NEC 70, however the electrical designer of record should refer to the latest revision of NEC for actual grounding conductor cable size.

Required if not using approved integrated grounding microinverters



ILSCO LAY-IN LUG CONDUCTOR - UNIRAC P/N 008009P: Alternate Grounding Lug - Drill, deburr hole and bolt thru both rail walls per table.

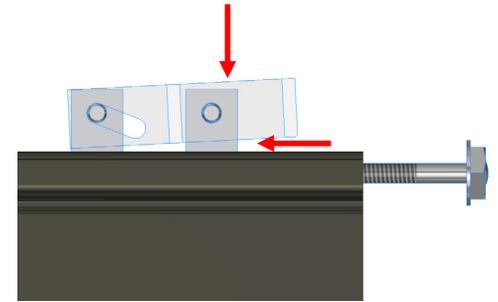
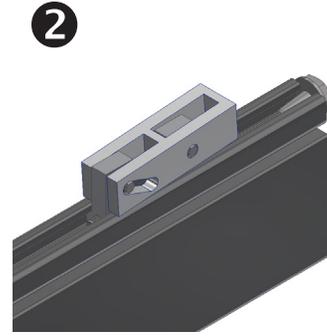
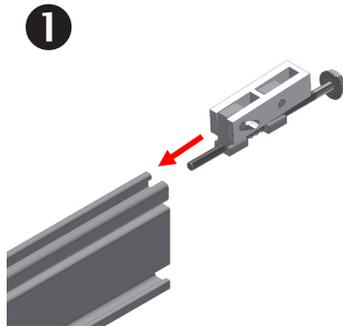
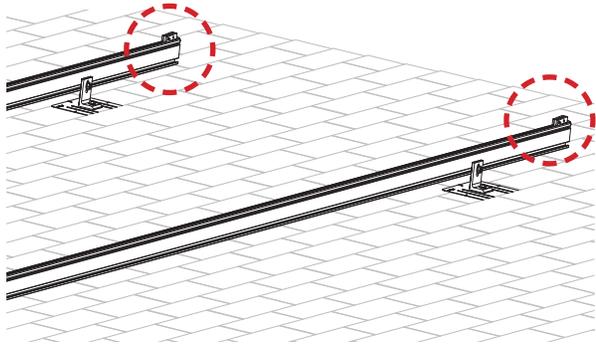
TORQUE VALUE 5 ft lbs. (See Note on PG. A)

See ILSCO product data sheet for more details, Model No. GBL-4DBT.

GROUNDING LUG - BOLT SIZE & DRILL SIZE		
GROUND LUG	BOLT SIZE	DRILL SIZE
WEEBLug	1/4"	N/A - Place in Top SM Rail Slot
ILSCO Lug	#10-32	7/32"

- Torque value depends on conductor size.
- See product data sheet for torque value.

NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION

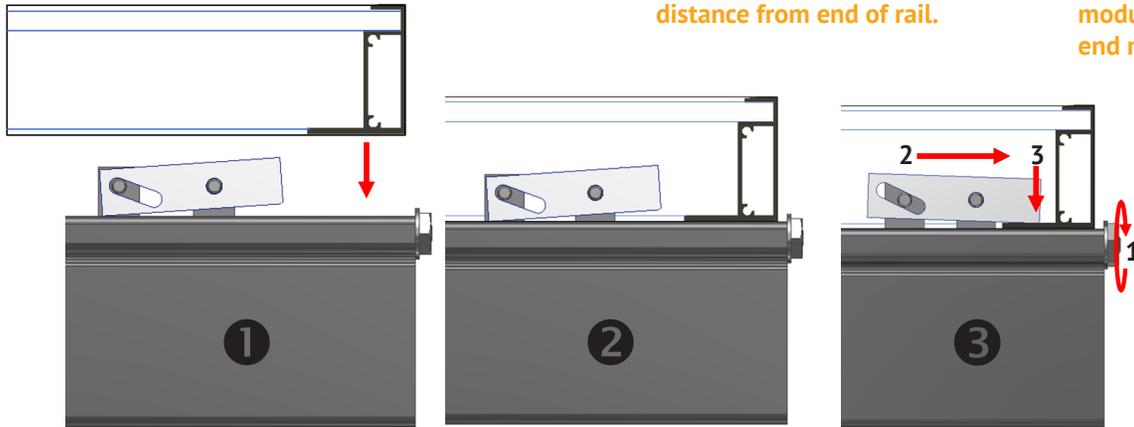


INSTALL MODULE END CLAMPS: The End clamp is supplied as an assembly with a 1/2" hex head bolt that is accessible at the ends of rails. The clamp should be installed on the rails prior to installing end modules.

INSTALL END CLAMPS ON RAIL: Slide end clamp on to rail by engaging the two t-guide brackets with the top slot of the rails. **Ensure bolt is extended as far as possible so that clamp is positioned at max. distance from end of rail.**

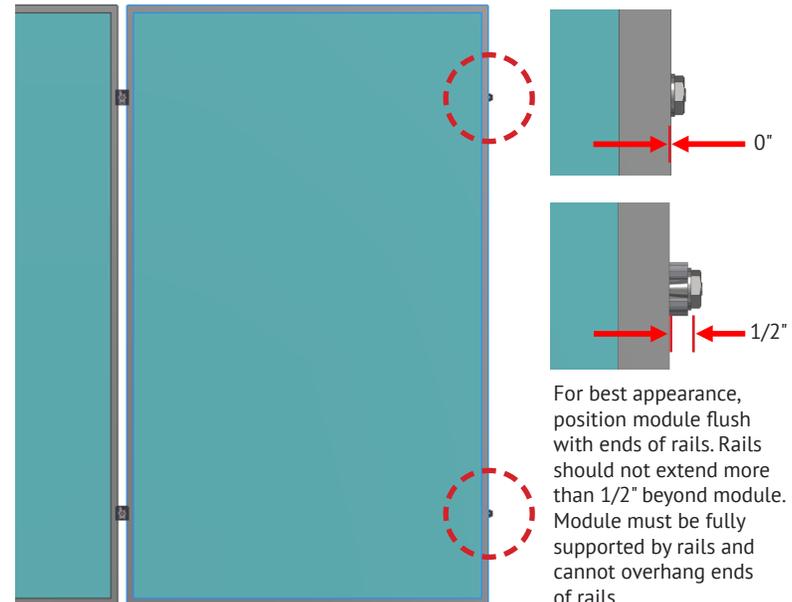
POSITION END CLAMPS: Slide end clamp assembly on to rail until bolt head engages with end of rail. **End clamps are positioned on rails prior to the first end module and prior to the last end module.**

NOTE: To assist insertion of clamp into rail slot, Pressure may be applied to top or side of bracket as shown. **Do not force clamp into rail by pushing on bolt with excessive force.**

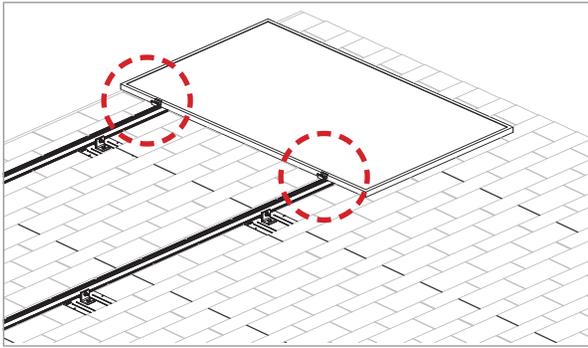


INSTALL FIRST MODULE: Install the first end module onto rails with the flange of the module frame positioned between end clamps at ends of rails.

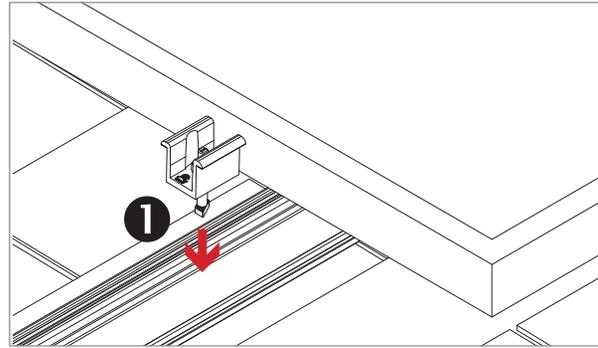
ENGAGE CLAMP: While holding module in position and with flange in full contact with rail, rotate end clamp bolt until clamp engages with flange to provide clamp force. **To ensure bolt is not over-torqued, use low torque setting on drill or If using an impact driver, stop rotation as soon as impact action of driver begins.** **TORQUE VALUE (See table and notes on PG. 1)** **End clamp bolt to 3 ft-lbs, No anti-seize**



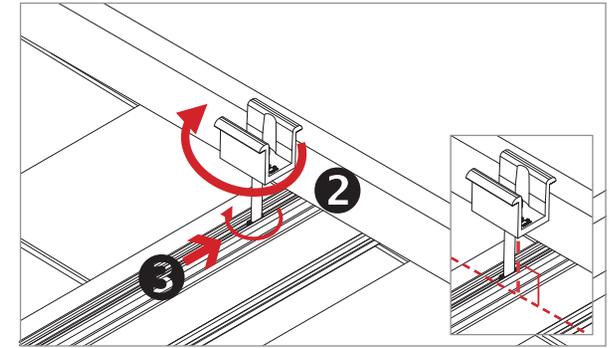
For best appearance, position module flush with ends of rails. Rails should not extend more than 1/2" beyond module. Module must be fully supported by rails and cannot overhang ends of rails.



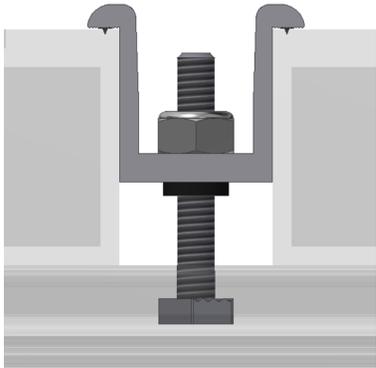
INSTALL MIDCLAMPS: Midclamp is supplied as an assembly with a T-bolt for module installation. Clamp assemblies may be positioned in rail near point of use prior to module placement.



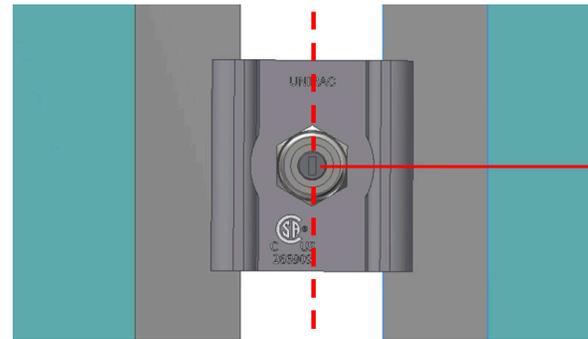
INSERT MIDCLAMP ASSEMBLY: Insert 1/4" T-Bolt into top slot of rail



MIDCLAMP: Rotate midclamp assembly and slide until clamp is against module frame. Do not tighten nut until next module is in position. Ensure bolt is perpendicular to rail.

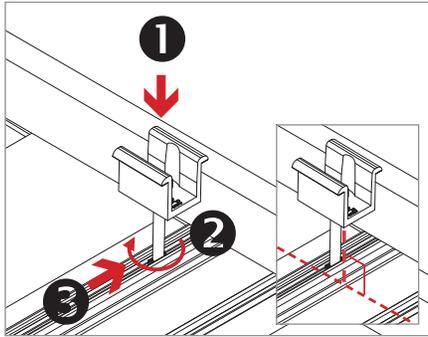


PLACE ADJACENT MODULE AGAINST CLAMPS: Modules must be tight against clamps with no gaps. Tighten nut to required torque.

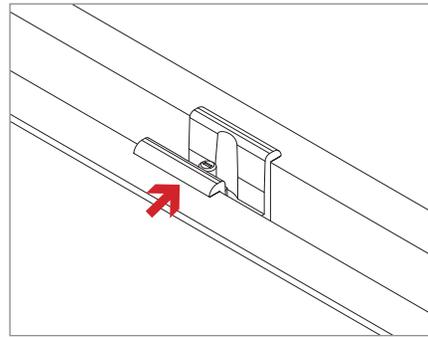


POSITION INDICATOR - SERRATED T-BOLT: Verify the T-bolt position indicator is perpendicular to the rail.

TORQUE VALUE (See table and notes on PG. A)
11 ft-lbs. No anti-seize.

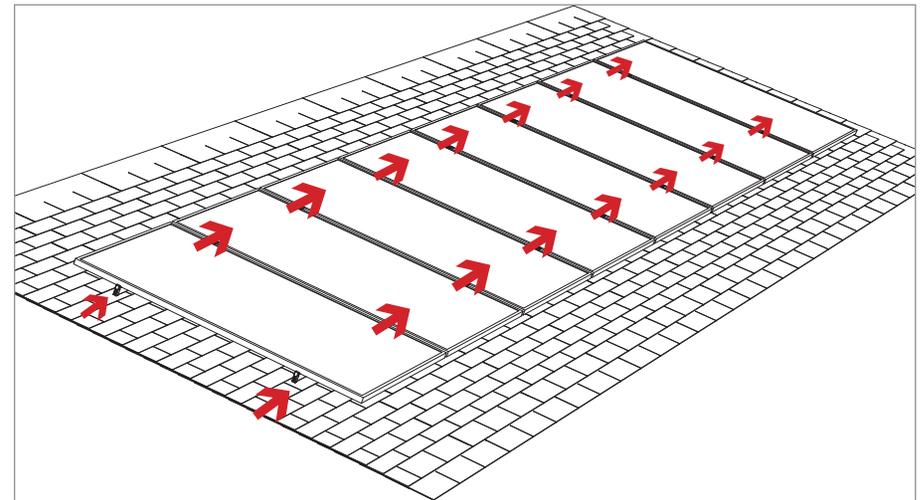


INSTALL REMAINING MID-CLAMPS:
Proceed with module installation.
Engage each module with previously positioned Midclamp assemblies.

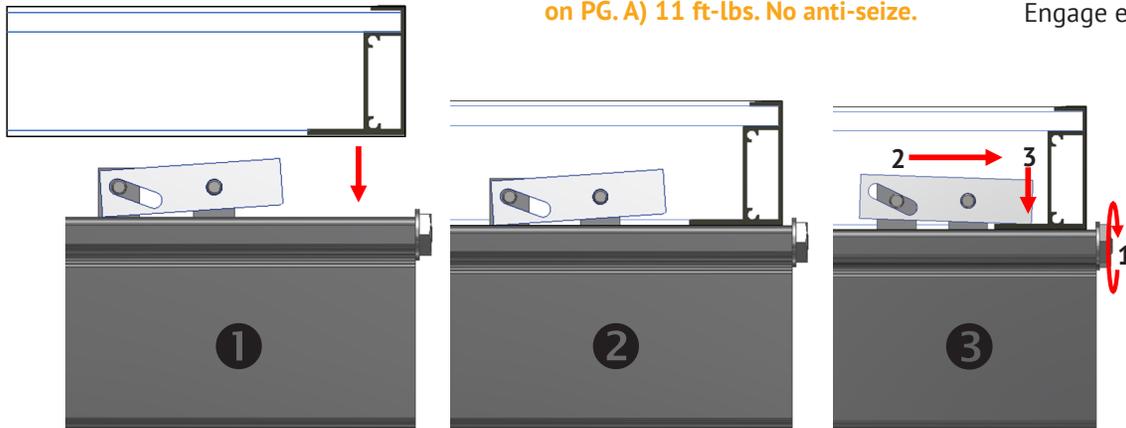


POSITION T-BOLT ALIGNMENT MARKS:
Verify that the position indicator(s) & T-bolt shaft(s) are angled in the correct position. Tighten to final torque.

TORQUE VALUE (See table and notes on PG. A) **11 ft-lbs. No anti-seize.**

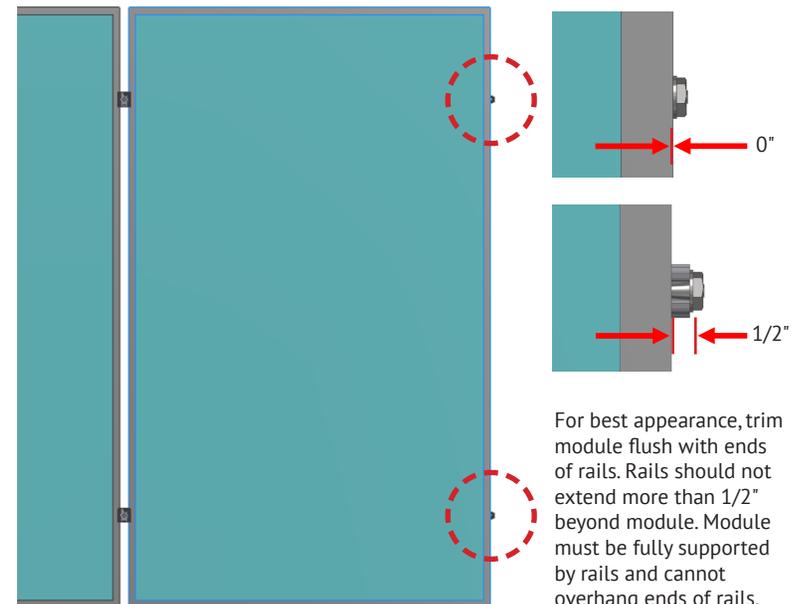


FINISH MODULE INSTALLATION: Proceed with module installation.
Engage each module with the previously positioned clamp assembly:

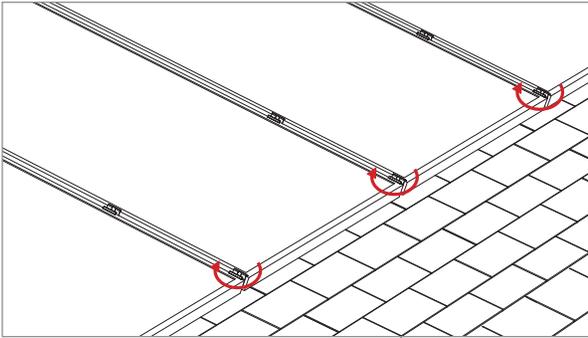


INSTALL LAST MODULE:
After trimming rails to required length (0" to 1/2" beyond module), insert end clamps into rail slots. Install the last end module onto rails with the flange of the module frame positioned between end clamps and ends of rails.

ENGAGE CLAMP: While holding module in position and with flange in full contact with rail, rotate end clamp bolt until clamp engages with flange to provide clamp force. **To ensure bolt is not over-torqued, use low torque setting on drill or If using an impact driver, stop rotation as soon as impact action of driver begins.**
TORQUE VALUE (See table and notes on PG. 1) **End clamp bolt to 3 ft-lbs, No anti-seize.**

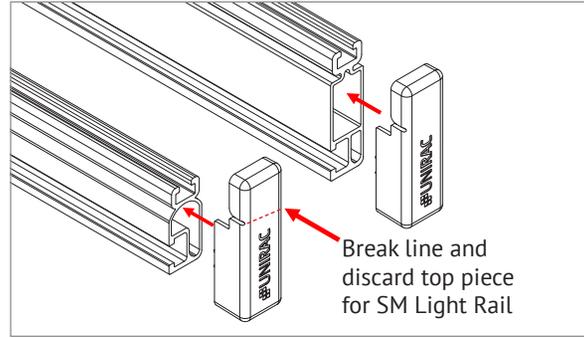


For best appearance, trim module flush with ends of rails. Rails should not extend more than 1/2" beyond module. Module must be fully supported by rails and cannot overhang ends of rails.

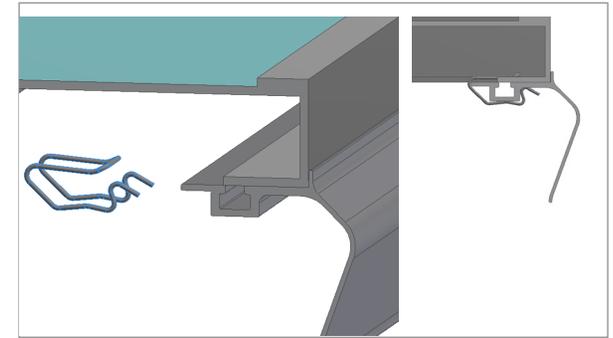


TRIM MIDCLAMPS: Ensure Trim lip is in contact with module face and verify alignment marks on T-bolts are in proper position, tighten midclamp on Trim, repeat at each gap between modules.

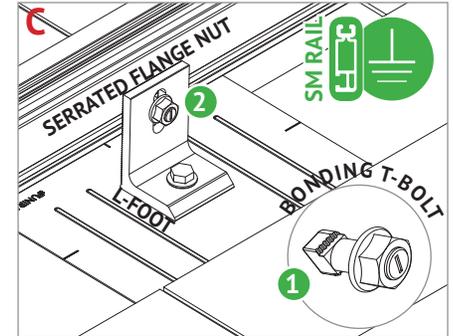
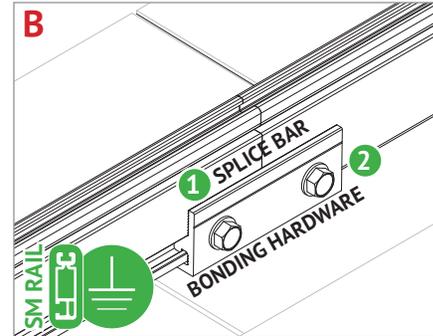
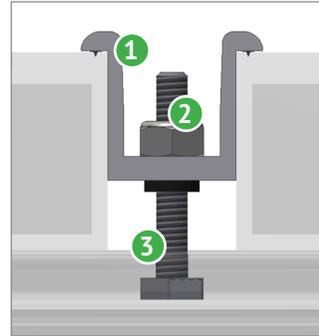
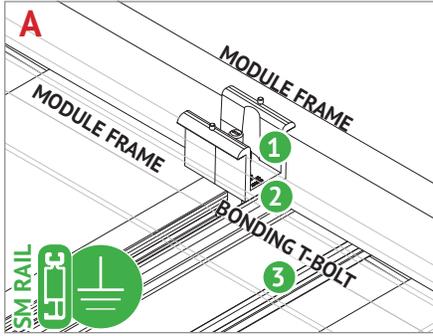
TORQUE VALUE (See table and notes on PG. 1)
11 ft-lbs. No anti-seize.



INSTALL END CAPS: End caps install as supplied on SM standard rail and SM light rail. If desired for SM light rail, the end cap may be modified as shown by hand, or by using a cutting tool.



FINISH TRIM INSTALLATION. CUT EXCESS TRIM AND INSTALL TRIM CLIPS:
 Attach trim to modules with at least one trim clip at each end of array and at locations where additional support is needed. Each section of trim must be attached to modules with at least one mid clamp.



BONDING MIDCLAMP ASSEMBLY

BONDING MIDCLAMP ASSEMBLY

BONDING RAIL SPLICE BAR

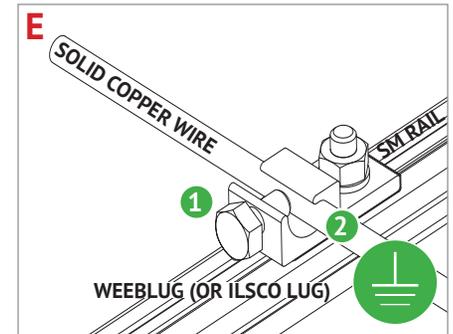
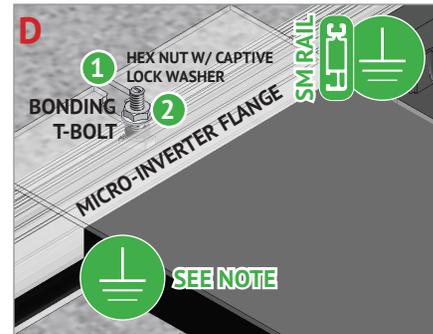
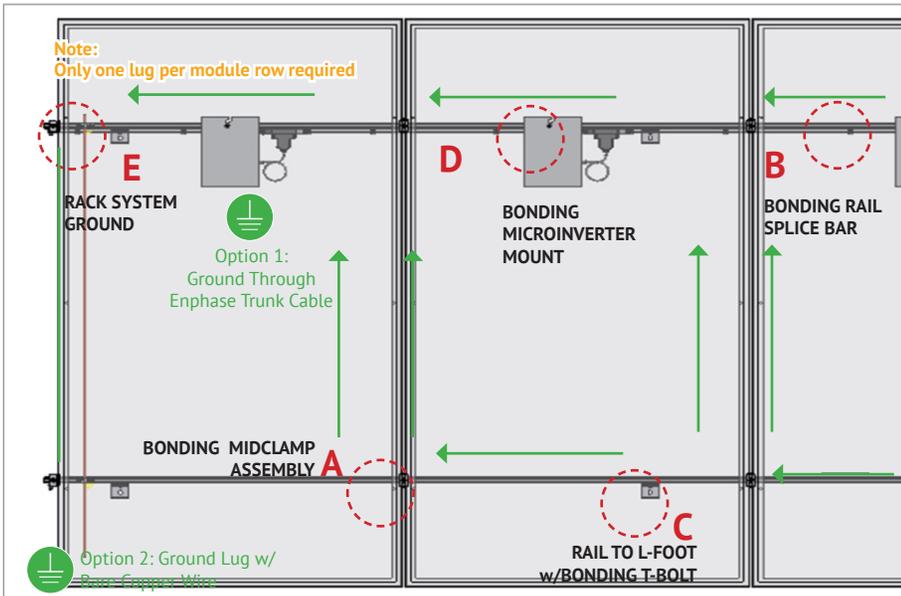
RAIL TO L-FOOT w/BONDING T-BOLT

- 1 Aluminum mid clamp with stainless steel bonding pins that pierce module frame anodization to bond module to module through clamp
- 2 Stainless steel nut bonds aluminum clamp to stainless steel T-bolt
- 3 Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, clamp, and modules to SM rail

- 1 Bonding Hardware creates bond between splice bar and each rail section
- 2 Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

Note: Splice bar and bolted connection are non-structural. The splice bar function is rail alignment and bonding.

- 1 Serrated flange nut removes L-foot anodization to bond L-Foot to stainless steel T-bolt
- 2 Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail

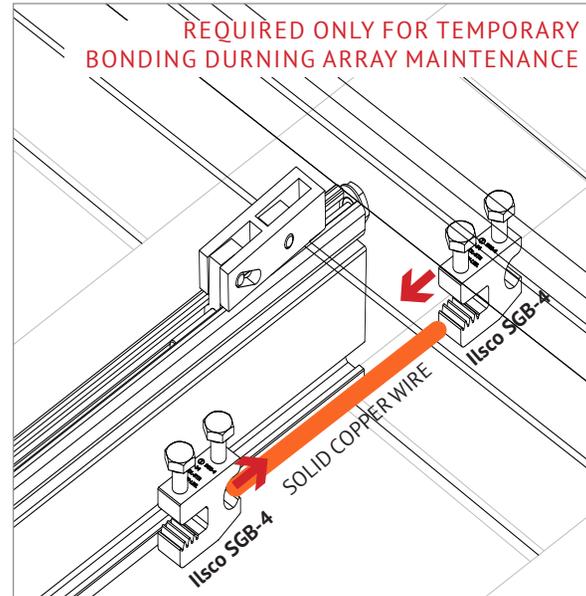
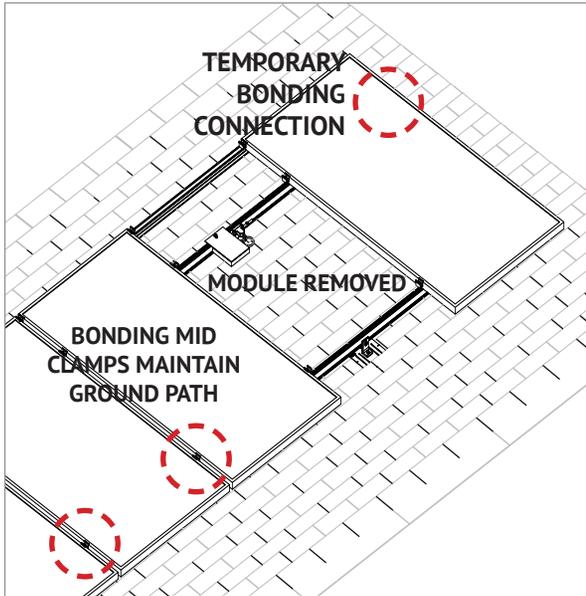


BONDING MICROINVERTER MOUNT

RACK SYSTEM GROUND

- 1 Hex nut with captive lock washer bonds metal microinverter flange to stainless steel T-bolt
- 2 Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail **System ground including racking and modules may be achieved through the trunk cable of approved microinverter systems. See page 1 for details**

- 1 WEEB washer dimples pierce anodized rail to create bond between rail and lug
- 2 Solid copper wire connected to lug is routed to provide final system ground connection. **NOTE: IlSCO lug can also be used when secured to the side of the rail. See page I-3 for details**



TEMPORARY BONDING CONNECTION DURING ARRAY MAINTENANCE

When removing modules for replacement or system maintenance, any module left in place that is secured with a bonding Midclamp will be properly grounded. If a module adjacent to the end module of a row is removed or if any other maintenance condition leaves a module without a bonding mid clamp, a temporary bonding connection must be installed as shown

- Attach Ilsco SGB4 to wall of rail
- Attach Ilsco SGB4 to module frame
- Install solid copper wire jumper to Ilsco lugs

ELECTRICAL CONSIDERATIONS

SOLARMOUNT is intended to be used with PV modules that have a system voltage less than or equal to that allowable by NEC. For standard system grounding a minimum 10AWG, 105°C copper grounding conductor should be used to ground a system, according to the National Electric Code (NEC). It is the installer's responsibility to check local codes, which may vary. See below for interconnection information.

INTERCONNECTION INFORMATION

There is no size limit on how many SOLARMOUNT & PV modules can be mechanically interconnected for any given configuration, provided that the installation meets the requirements of applicable building and fire codes.

GROUNDING NOTES

The installation must be conducted in accordance with the National Electric Code (NEC) and the authority having jurisdiction. Please refer to these resources in your location for required grounding lug quantities specific to your project.

The grounding / bonding components may overhang parts of the array so care must be made when walking around the array to avoid damage.

Conductor fastener torque values depend on conductor size. See product data sheets for correct torque values.

PERIODIC INSPECTION: Conduct periodic inspections for loose components, loose fasteners or any corrosion, immediately replace any affected components.

The SOLARMOUNT system has been certified and listed to the UL 2703 standard (Rack Mounting Systems and Clamping Devices for Flat-Plate Photovoltaic Modules and Panels). This standard included electrical grounding, electrical bonding, mechanical load and fire resistance testing.

In conducting these tests, specific modules are selected for their physical properties so that the certifications can be broadly applied. The following lists the specific modules that were tested and the applicability of those certifications to other modules that might come onto the market.

In addition to UL 2703 certification, Unirac performs internal testing beyond the requirements of certification tests in order to establish system functional limits, allowable loads, and factors of safety. These tests include functional system tests, and destructive load testing.

Mechanical Load Test Modules	System Level Fire Classification																								
<p>The modules selected for UL 2703 mechanical load testing were selected to represent the broadest range possible for modules on the market. The tests performed cover the following basic module parameters:</p> <ul style="list-style-type: none"> Frame thicknesses greater than or equal to 1.0 mm Basic single and double wall frame profiles (some complex frame profiles could require further analysis to determine applicability) Clear and dark anodized aluminum frames UL2703 Certification Load Ratings: <ul style="list-style-type: none"> Down – 113.4 PSF , Up – 50.4 PSF , Down-Slope – 14.7 PSF Tested Loads: <ul style="list-style-type: none"> Down – 170.10 PSF , Up – 75.60 PSF, Down-Slope – 22.05 PSF Maximum Area of Module = 21.06 sqft <div style="text-align: center; margin-top: 20px;"> <table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Tested Modules</th> </tr> <tr> <th style="width: 50%;">Module Manufacturer</th> <th style="width: 50%;">Model/Series</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Hyundai</td> <td style="text-align: center;">HiS-S325TI</td> </tr> </tbody> </table> </div>	Tested Modules		Module Manufacturer	Model/Series	Hyundai	HiS-S325TI	<p>The system fire class rating requires installation in the manner specified in the SOLARMOUNT Installation Guide. SOLARMOUNT has been classified to the system level fire portion of UL 1703. This UL 1703 classification has been incorporated into our UL 2703 product certification. Class A system level fire performance is inherent in the SOLARMOUNT design, and no additional mitigation measures are required. The fire classification rating is only valid on roof pitches greater than 2:12 (slopes \geq 2 inches per foot, or 9.5 degrees). There is no required minimum or maximum height limitation above the roof deck to maintain the system fire rating for SOLARMOUNT. Module Types & System Level Fire Ratings are listed below:</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 20px;"> <thead> <tr> <th style="width: 12.5%;">Rail Type</th> <th style="width: 12.5%;">Module Type</th> <th style="width: 12.5%;">System Level Fire Rating</th> <th style="width: 12.5%;">Rail Direction</th> <th style="width: 12.5%;">Module Orientation</th> <th style="width: 12.5%;">Mitigation Required</th> </tr> </thead> <tbody> <tr> <td>Standard Rail</td> <td>Type 1, Type 2, Type 3, & Type 10</td> <td>Class A, B, & C</td> <td>East-West North-South</td> <td>Landscape OR Portrait</td> <td>None Required</td> </tr> <tr> <td>Light Rail</td> <td>Type 1 & Type 2</td> <td>Class A, B, & C</td> <td>East-West North-South</td> <td>Landscape OR Portrait</td> <td>None Required</td> </tr> </tbody> </table>	Rail Type	Module Type	System Level Fire Rating	Rail Direction	Module Orientation	Mitigation Required	Standard Rail	Type 1, Type 2, Type 3, & Type 10	Class A, B, & C	East-West North-South	Landscape OR Portrait	None Required	Light Rail	Type 1 & Type 2	Class A, B, & C	East-West North-South	Landscape OR Portrait	None Required
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Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the SOLARMOUNT system.

Manufacturer	Series/Model
Aleo	P18, P19
AU Optronics (BenQ Solar)	PM Series
Auxin	AXN6M610T, AXN6P610T, AXN6M612T & AXN6P612T
Axitec	AXIpower, AXIpremium, AXIblackpremium
Boviet	BVM6610 & BVM6612 Series
Canadian Solar	CS5A-M, CS6P-M, CS6P-P, CS6X-P, CSX-P, ELPS CS6P-MM, ELPS CS6A-MM, CS6U-P, CS6U-M, CS6K-MS, CS6K-M, CS6K-P, CS3U-P, CS3U-MS, CS3K-P, CS3K-MS, CS1K-MS, CS3W-P, CS3L-P, CS3K-MB, CS3K-PB, CS3U-MB, CS3U-PB, CS3U-MS, CS3U-P, CS3K-MS, CS3K-P, CS6U-P, CS6K-MS, CS6K-P
Centrosolar America	C-Series, E-Series
CertainTeed	CTxxxMxx-01, CTxxxP01, CTxxxMxx02, CTxxxMxx03
Eco Solargy	Orion 1000, Apollo 1000
ET Solar	ET AC Module, ET Module
Flextronics	FXS
GCL	GCL-P6 & GCL-M6 Series
Hansol	TD-AN3, TD-AN4, UB-AN1, UD-AN1
Hanwha SolarOne	HSL 60
Heliene	72M, 72P, 72M-BLK, 60M, 60P, 60M-BLK, 36M, 36P
Hyundai Heavy Industries	MG, RW, RG, KG, TG Series
Hyundai Heavy Industries	KI, TI, RI Series
ITEK	iT HE and iT SE
Japan Solar	JPS-60 & JPS-72 Series
JA Solar	"JAP6(k)-72-xxx/4BB; JAP72SYY-xxx/ZZ; JAP6(k)-60-xxx/4BB; JAP60SYY-xxx/ZZ; JAM6(k)-72-xxx/ZZ; JAM72SYY-xxx/ZZ; JAM6(k)-60-xxx/ZZ; JAM60SYY-xxx/ZZ YY = Backsheet, ZZ Cell technology"
Jinko 60 Cell	JKMxxxP-60, JKMxxxP-60B, JKMxxxM60, JKMxxxM60B JKMxxxPP-60, JKMxxxPP-60B JKMSxxxP-60, JKMSxxxPP-60, JKMxxxP-72, JKMxxxM-72 JKMSxxxP-72, JKMSxxx-72 JK07A, JK07B

Jinko 72 Cell	Jinko 72: JKMxxxP-72, Jinko Eagle 72: JKMxxxPP-72, Jinko Eagle MX72: JKMxxxPP-72
Kyocera	KD-F Series, KU-60 Series, KU2XX-6MCA
LG Electronics	Mono Neon, Mono X, NeON 2 LGxxxN1C-G4, NeON 2 LGxxxN2W-G4, NeON LGxxxN2W-B3, NeON LGxxxS1C-G4, Mono X LGxxxS2W-G4, Mono X Plus LGxxxS1C-A5, NeON 2 LGxxxN1C-A5 NeON R LGxxxQ1C(Q1K)-A5 NeON 2 LGxxxN1C(N1K)-A5 Mono X Plus LGxxxS1C-A5 NeON 2 Bifacial LGxxxN2T-A5 NeON 2 LGxxxN2W-A5 Mono X Plus LGxxxS2W-A5 NeON 2 ACe LGxxxE1C-A5 NeON 2 LGxxxN1C(N1K)-G4
LONGi	LR6-60 & LR6-72 Series
Mission Solar	MSE Mono 60, MSE Mono 72 MSE PERC 60, MSE PERC 72
Mitsubishi	MJE, MLE
Neo Solar Power Corporation (NSP)	D6MXXXE4A, D6MXXXB4A, D6MXXXE4AME
Panasonic	VBHNxxxSA06, VBHNxxxSA06B, VBHNxxxSA11, VBHNxxxSA11B, VBHNxxxSA15, VBHNxxxSA15B, VBHNxxxSA16, VBHNxxxSA16B, VBHNxxxKA, VBHNxxx SA17/18/KA03/04
Peimar	SGxxxM, SGxxxM (BF), SGxxxM (FB)
Phono Solar Technology	All Standard Modules

The modules selected for UL 2703 bonding and grounding testing represent the broadest possible range of modules on the market. The tests were performed for each specific bonding location using representative module frame profile sections. The tests performed cover the following basic module parameters:

- Use with a maximum over current protection device OCPD of 30A
- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system

Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the SOLARMOUNT system.

Manufacturer	Series/Model
Q-Cells	Q.PEAK-G3.1 XXX, Q.PEAK BLK-G3.1 XXX, Q.PLUS BFR G3.1 XXX, Q.PLUS-G3 XXX, Q.PRO G3 XXX, Q.PRO BFR-G3 XXX, Q.PEAK-G3 XXX, Q.PEAK BLK-G3 XXX, Q.PLUS BFR G4.1 XXX, Q.PRO BFR G4 XXX, Q.PRO BFR G4.1 XXX, Q.PRO BFR G4.3 XXX, Q.PEAK-G4.1 XXX, Q.PEAK-G4.1/MAX XXX, Q.PEAK BLK G4.1 XXX, Q.PRO G4 XXX, Q.PLUS G4 XXX, Q.PEAK-G4.1/TAA XXX, Q.PEAK BLK G4.1/TAA XXX, Q.PLUS BFR G4.1/TAA XXX, Q.PLUS BFR G4.1/MAX XXX, B.LINE PLUS BFR G4.1 XXX, B.LINE PRO BFR G4.1 XXX, Q.PRO EC-G4.4 XXX, Q.PRO L-G2 XXX, Q.PEAK L G4.2 XXX, Q.PLUS L G4.2 XXX, Q.PLUS L G4.1 XXX, Q.PLUS L G4 XXX, Q.PRO L G4 XXX, Q.PRO L G4.1 XXX, Q.PRO L G4.2 XXX, B.LINE PLUS L G4.2 XXX, B.LINE PRO L G4.1 XXX, B.LINE PRO L G4.2 XXX, Q.PLUS L-G4.2/TAA
Q-Cells	Q.PEAK DUO-G5, DUO BLK-G5 Q.PEAK BLK G4.1 & Q.PEAK G4.1 Q.PLUS BFR G4.1/TAA, Q.PLUS BFR G4.1/MAX B.LINE PLUS BFR G4.1, B.LINE PRO BFR G4.1 Q.PRO EC-G4.4 Q.PEAK-G3.1, Q.PEAK BLK G3.1 Q.PLUS BFR G3.1 Q.PLUS G3, Q.PRO G3, Q.PRO BFR-G3, Q.PEAK-G3, Q.PEAK BLK-G3
REC	TwinPeak 72 45mm Peak Energy 72 45mm Peak Energy 38mm TwinPeak (2) (BLK2) - 38mm TwinPeak2S 72 Series - RECxxxTP2S 72 30mm
Renesola	All 60-cell modules
Seraphim	SEG-6PA, SEG-6PB, SEG-6MA, SEG-E01, SEG-E11, SRP-6QA, SRP-6QB (40mm only)
Sharp	ND240QCJ, ND240QCS, NDQ235F4 NU-SA & NU-SC
S-Energy	SN72 & SN60 Series
Silfab	SLA-M, SLA-P, SLG-P, SLG-M
Solaria	PowerXT

Solartech	STU-XXX HJT, b. STU-XXX PERC, Quantum PERC
SolarWorld	SunModule Protect, SunModule Plus, SunModule Pro
Sun Edison / MEMC	F-Series, R-Series
Suniva	MV Series, OPTIMUS Series
SunPower	AC, E-Series, Sig Black, X-Series P-Series
Suntech	STP "XXX"
Talesun	TP672, TP660, TP572, TP596, Hipor M350, Smart
Trina	PD05, PA05, DD05, DD14, PE14, PD14, DE14
TSMC Solar	TS-150C2 CIGS
UpSolar	60 and 72 cell modules
Winaico	WST, WSP
Yingli	Panda 60, YGE 60, YGE-Z 60 YGE-U72 YLM60 & YLM 72

The modules selected for UL 2703 bonding and grounding testing represent the broadest possible range of modules on the market. The tests were performed for each specific bonding location using representative module frame profile sections. The tests performed cover the following basic module parameters:

- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A



STEP 1
INSTALL FLASHKIT PRO FLASHING



STEP 2
INSTALL L-FOOT



STEP 3
ATTACH L-FOOT TO RAIL

PRE-INSTALL

- Locate roof rafters and snap chalk lines to mark the installation point for each roof attachment.
- Drill a 7/32" pilot hole at each roof attachment. Fill each pilot hole with sealant.

STEP 1 INSTALL FLASHKIT PRO FLASHING

- Add a U-shaped bead of roof sealant to the underside of the flashing with the open side of the U pointing down the roof slope. Slide the aluminum flashing underneath the row of shingles directly up slope from the pilot hole as shown. Align the indicator marks on the lower end of the flashing with the chalk lines on the roof to center the raised hole in the flashing over the pilot hole in the roof. When installed correctly, the flashing will extend under the two courses of shingles above the pilot hole.

STEP 2 INSTALL L-FOOT

- Fasten L-foot and Flashing into place by passing the included lag bolt and pre-installed stainless steel-backed EPDM washer through the L-foot EPDM grommet, and the raised hole in the flashing, into the pilot hole in the roof rafter.

- Drive the lag bolt down until the L-foot is held firmly in place. It is normal for the EPDM on the underside of the stainless steel backed EPDM washer to compress and expand beyond the outside edge of the steel washer when the proper torque is applied.

TIP:

- Use caution to avoid over-torquing the lag bolt if using an impact driver.
- Repeat Steps 1 and 2 at each roof attachment point.

STEP 3 ATTACH L-FOOT TO RAIL

- Insert the included 3/8"-16 T-bolts into the lower slot on the Rail (sold separately), spacing the bolts to match the spacing between the roof attachments.
- Position the Rail against the L-Foot and insert the threaded end of the T-Bolt through the continuous slot in the L-Foot. Apply anti-seize to bolt threads to prevent galling of the T-bolt and included 3/8" serrated flange nut. Place the 3/8" flange nut on the T-bolt and finger tighten. Repeat STEP 3 until all L-Feet are secured to the Rail with a T-bolt. Adjust the level and height of the Rail and torque each bolt to 30ft-lbs.