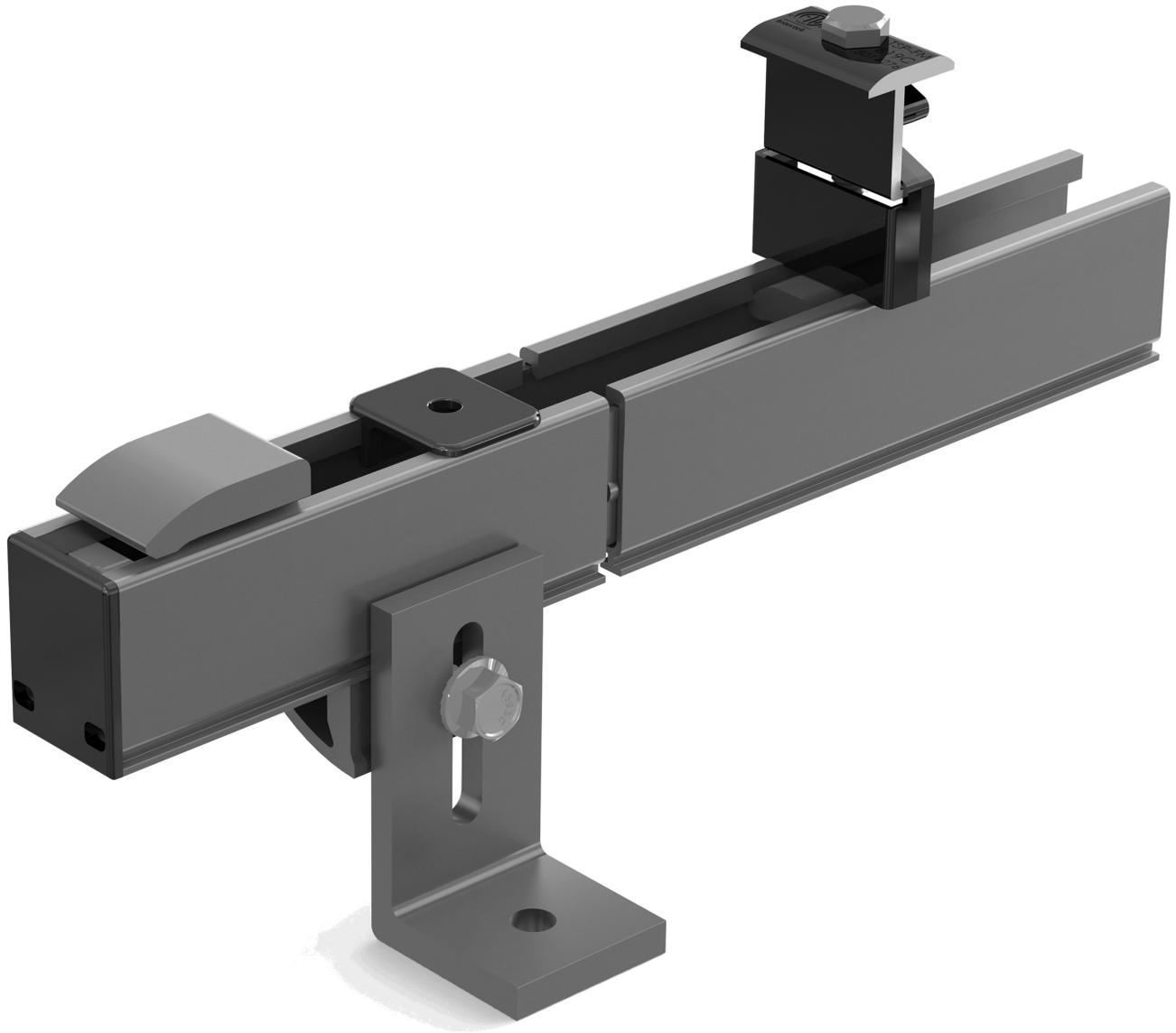


Tamarack Flush Mount Solar Roof Mount System



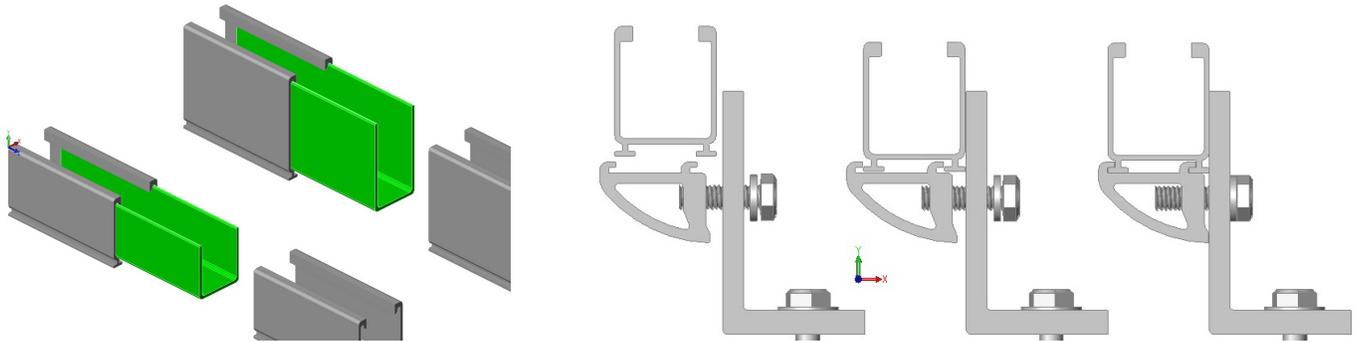
Installation Manual

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Tamarack Flush Mount System Features

- Designed for mounting on most residential roofs
- Can be installed with most available roof attachments for composition shingle, tile and metal roofs
- Only 4 tools required for installation
- Top clamps and rail attachments require the use of a single standard 1/2-inch socket
- One part for both mid-clamp and end-clamp use simplifies ordering and stocking parts
- Module clamps are spring loaded to ease module placement
- Two rail heights and one rail length
- Bonding splice installs easily without tools
- Built-in wire management for module and microinverter cables
- Sleak low-profile design eliminates the need for an array skirt



Tamarack Product Summary

Flush mount is a visually appealing, low profile, photovoltaic (PV) module installation system that significantly lowers PV module installation cost by allowing the installation professional to stock fewer parts and to complete the installation in less time.

Certified to meet local and International Building Codes when installed in accordance with this manual. The design load rating meets the minimum requirements of 10 PSF downward pressure, 5 PSF upward pressure and 5 PSF down-slope load. Module orientation may be portrait or landscape. Designed for use with most third-party roof attachments including Solar Roof Hooks, Quick Mount PV, Ironridge Flashfoot, S-5 Clamps, etc.

Class A Fire Rating per UL 1703 for steep roof slope applications when using Type 1 or Type 2 Listed Photovoltaic Modules. This is per Middleton fire test report 103427989MID-004.

ETL Listed to UL 2307 for bonding and grounding when installed in accordance with this manual.

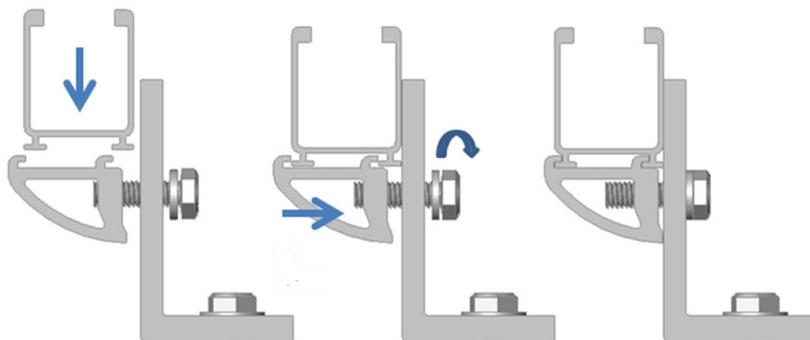
Rails, clamps, splices and mounting devices are UL2703 Listed for mounting flat-plate Photovoltaic Modules and Panels



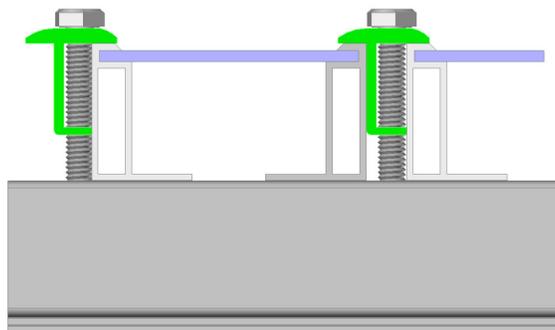
Tamarack Flush Mount System Components



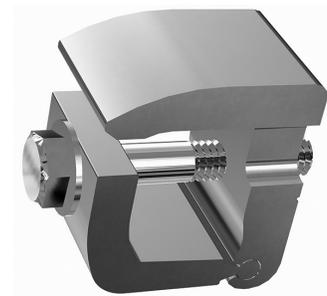
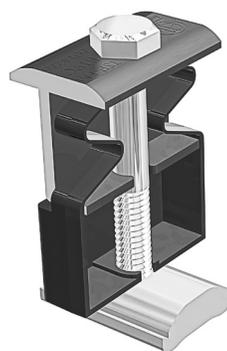
2.3 inch and 1.6 inch Rail



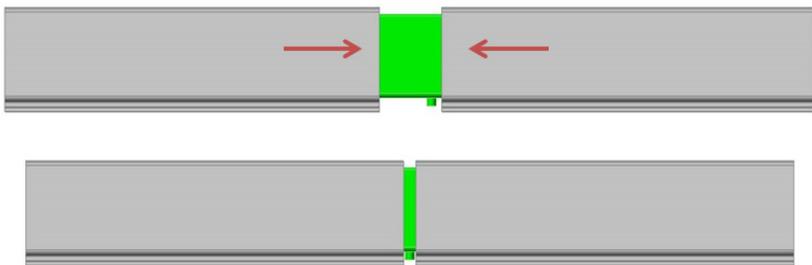
Rail Mount and L-Foot



50-50 Clamp



Channel End Clamp



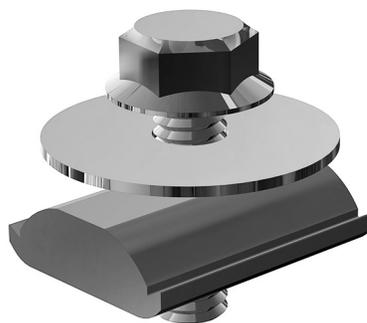
Bonding Splice



Wire Management Clip



Rail Ground Lug



MLPE Adapter



Rail End Cap

Tools Required

- Cordless Drill
- Torque Wrench
- Ratchet and 1/2" Socket
- Level

Torque Specifications

| | |
|--|------------------|
| Rail Support | 12 ft-lbs |
| MLPE Rail Attachment | 12 ft-lbs |
| Ground Lug | 12 ft-lbs |
| 50-50 clamp | 12 ft-lbs |
| Rail Ground Lug | 12 ft-lbs |
| IlSCO SGB-4 Module Frame Ground lug | 12 ft-lbs |

Prepare for Installation

Plan the PV module layout that fits the roof and confirm that plans comply with local AHJ requirements.

The rails can be installed parallel or perpendicular to the roof rafters. Center the rails over the structural members as much as possible.

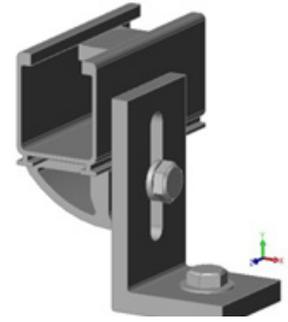
Leave enough room to work safely around the array during the installation process. Some building and fire codes require minimum clearances around PV module installations.

The length of the rails for each row in the installation will be equal to the total width of the modules plus 1/2-inch for each 50-50 clamp used between modules plus 2-inches total for end clamping. When using the channel end clamp, rails can be cut to the edge of the array.

Install proper roof mount flashings per the manufacturer's instructions. The maximum allowable spans between roof supports is 6 feet.

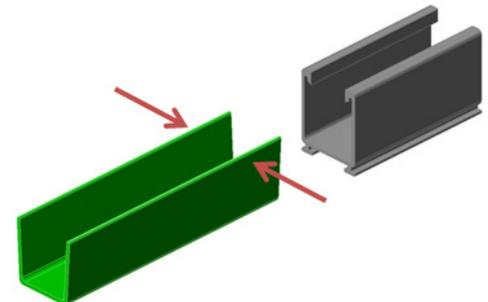
Attach Rail Mounts

Each Rail-Mount consists of two parts, a 5/16 inch bolt and a clamp extrusion. The rail adapters have been designed to interface with off-the-shelf mounting products that have vertical leveling slots. Our Rail Mounts work with most products that have 5/16 inch or 3/8 inch bolt slots. We also offer our own L foot for mounting to products that have a flat mounting surface, such as seam clamps, exposed beams or Quick Mount Q Blocks.



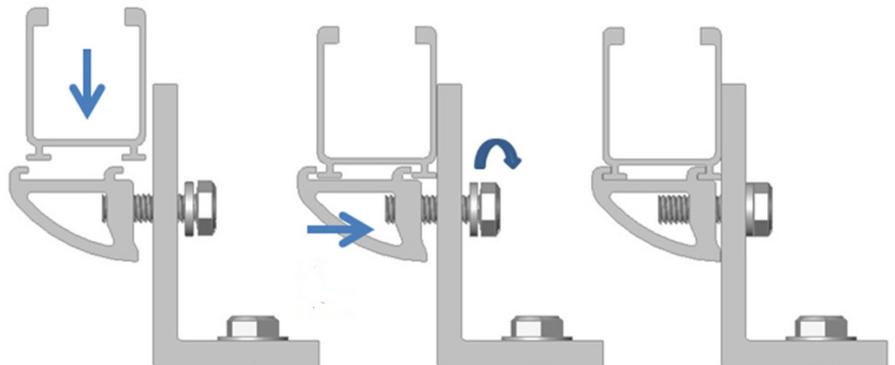
Install Rails

Rails are sold in convenient 126 inch lengths. This length is enough for three 60 cell or 72 cell modules with a width of up to 40.5 inches. Use a Tamarack bonding splice to connect each section of rail in a row.



If a cut section of rail is required for the installation, it must not be installed at the end of a row. Each section of rail at the end of a row must be supported by two mounts before being spliced. If a rail section has a splice and 3 roof mounts, the splice should be located within 1/3 rail span of the middle mount.

Rail mounting is simple and easy. The Rail Adapter clamps to the two feet on the bottom of the rail. There is never any drilling, and parts can be brought on the roof fully assembled and ready to be installed. Rail Adapters may be installed anywhere on the rails, including at splices and they will not interfere with module mounting clamps.



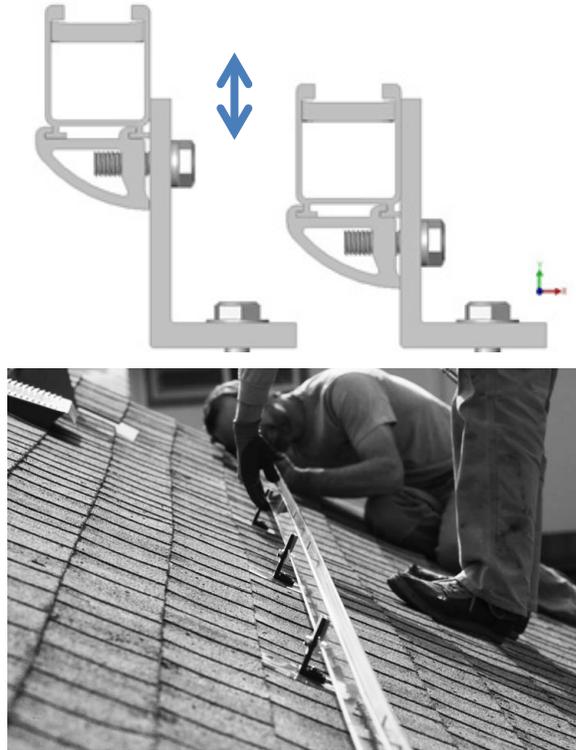
Simply position the adapter into the two feet on the bottom of the rail, and tighten the bolt slightly. Leave the bolt slightly loose to allow leveling of the rails in the next step.

Leveling Rails

Start by leveling the bottom rail of the array first. Set the Rail Adapters near the middle of the leveling range and adjust as necessary to have visually level rails. Tighten the attachment bolts to the specified torque when they are aligned. Level the top rail of the array in the same manner.

If there are multiple rows of rails in the array, use a string level or straight edge to help adjust the remaining rows to be level with the top and bottom rails. It is also possible to visually align rails in the middle of the array.

Tighten all hardware to the specified torque.



Grounding

Tamarack rails and PV modules are bonded by 50-50 Module Clamps and bonding splices. The 50-50 clamps achieve bonding to the module frames by stainless-steel pins in the clamping surface of the clamp tops, which penetrate module frame coating. The rails and channel nuts are bonded because of the conductive surface of the mill finish aluminum used in the rail construction.

SolarEdge Optimizers and Enphase Microinverters are bonded to the rail with the Tamarack MPLE adapters.

Bonding Method 1: Rail Lug

Use a Ground Clamp to bond a ground conductor to a rail.



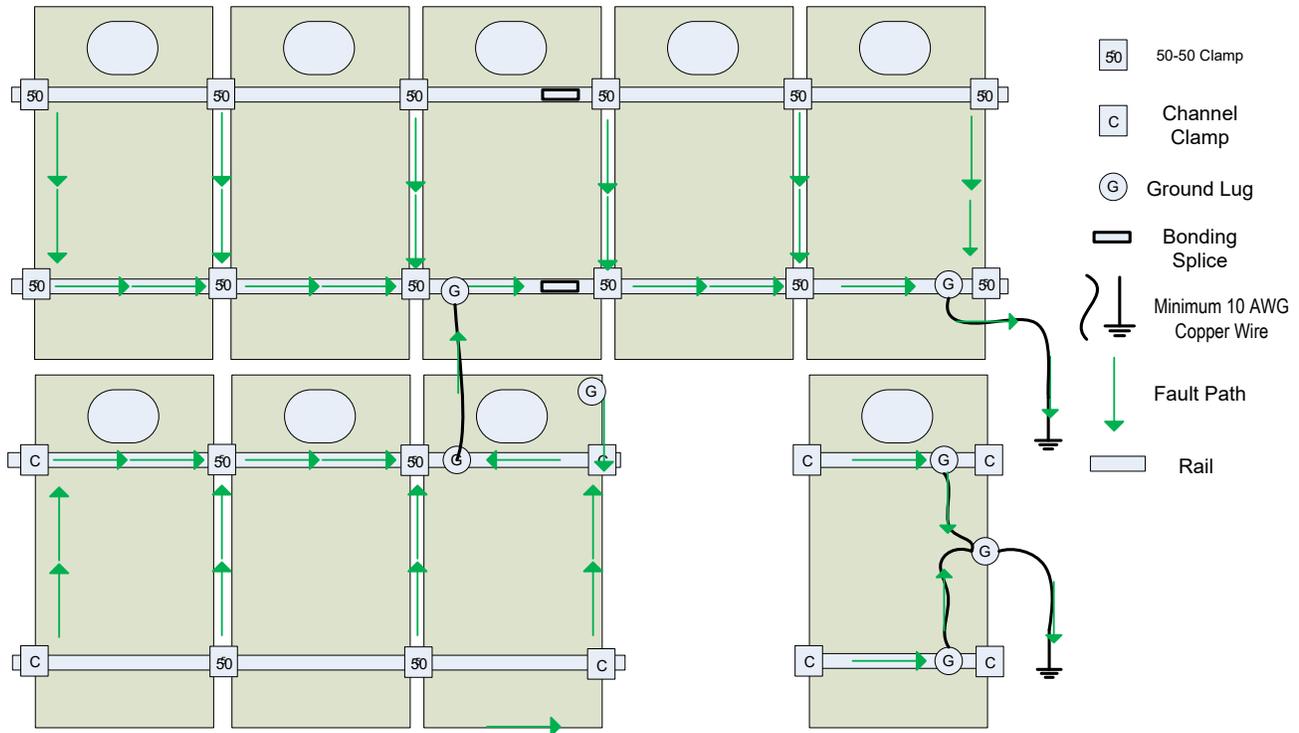
Bonding Method 2: Frame Lug

Use a module ground lug to bond a module frame to a ground conductor. The resulting system is bonded primarily through the module frames.

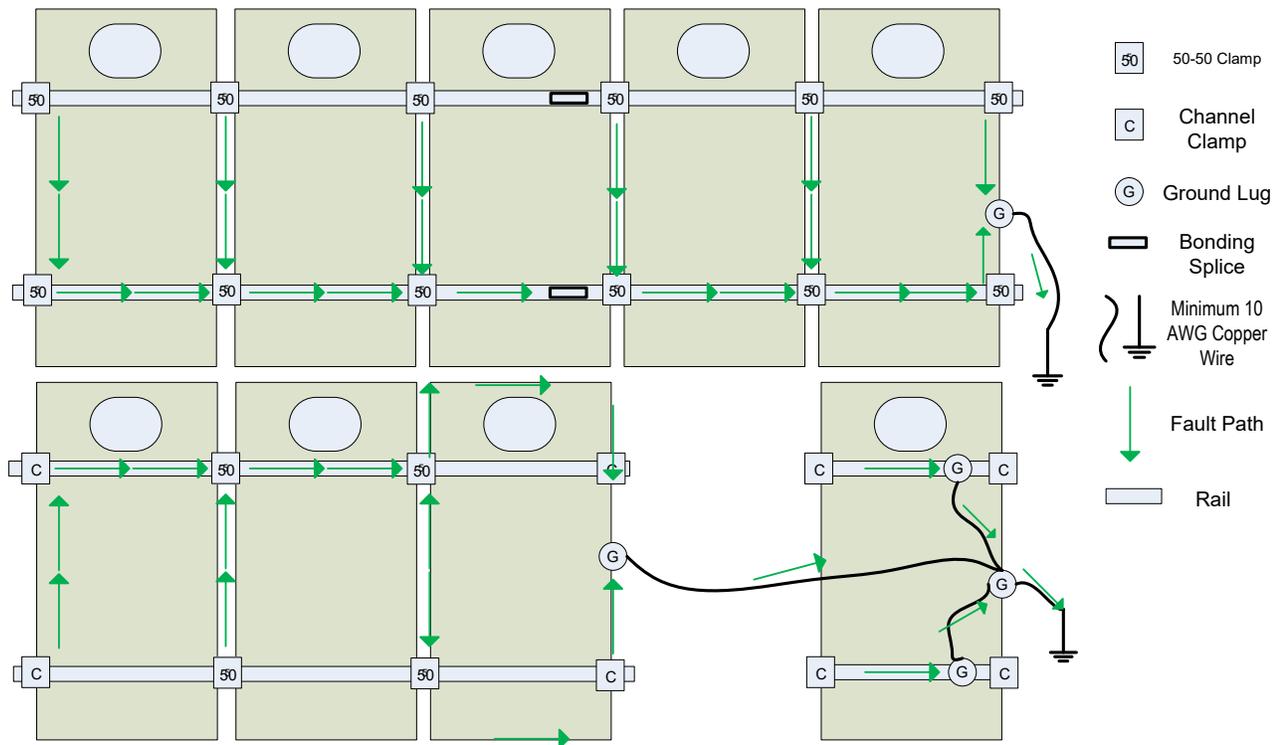


Grounding Diagrams

Rail Grounding method



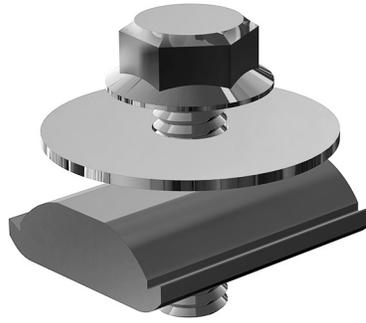
Frame Grounding Method



Module Level Power Electronics

Use the Tamarack MLPE Rail Adapter to attach Enphase microinverters or SolarEdge Optimizers to the rails.

The large flat washer is installed between the mounting plate of the MLPE and the top of the rail. Tighten the bolt with a 1/2" socket to the proper torque.



Wire Management

Place electrical conductors and connectors at the bottom of the rail channels.

Install the wire protection clips where necessary to keep wires in the channels.

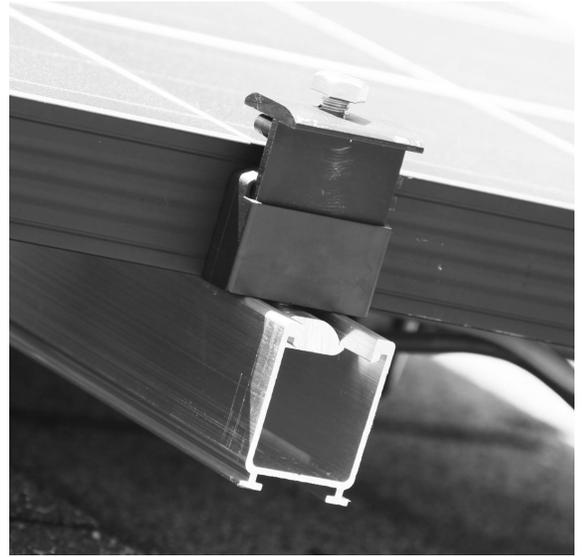
When using 1.6 inch rail, it is possible to damage connectors or large bundles of wire when 50-50 bolts are tightened. Position connectors and bundles appropriately to prevent risk of ground faults.



Module Installation

Start module installation at one end of the rails. If there are multiple rows, start on the bottom row.

Install a 50-50 clamp at the end of each rail with the side of the clamp with 2 bonding pins on the module frame. Push the channel nut into the rail. The integrated spring assembly will hold the clamp in place.



Place the first module onto the rails so that it is centered over the rails. Make sure the module is touching the inside edge of the clamps and tighten the clamps with a 1/2" socket.



Install 50-50 Clamps in each rail on the other side of the first module. The springs will hold the clamps in place prior to tightening. Place the second module on the rails, align it with the first module, and push in against the clamps. Tighten the clamps to fully secure the module.

Install the remaining modules and clamps on the rails in the same manner, aligning the corners of the modules.



On the outside edge of the last module, install the clamps so that the side with the two stainless-steel pins is on the module frame. Tighten all bolts to the specified torque.

Do a final check to be sure that all installation hardware on the array is properly tightened.

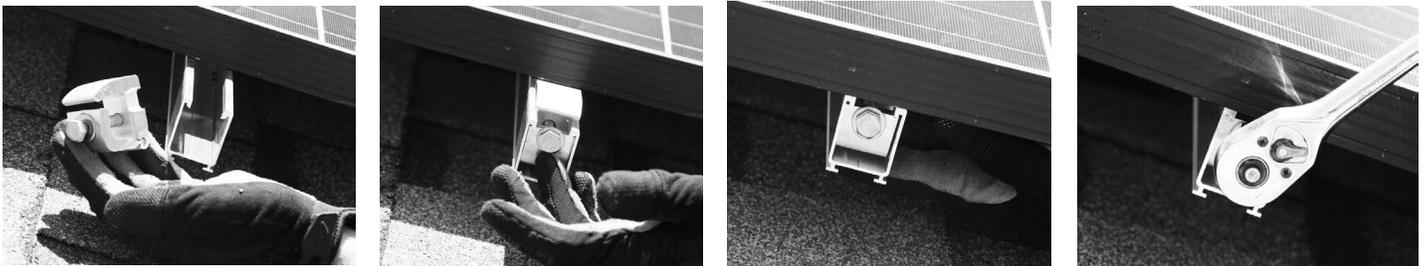


Channel End Clamps

Channel End Clamps may be used in place of the 50-50 clamps at the ends of rails. Channel Clamps secure the module frame from below and allow the rails to be cut flush to the edge of the array for a clean look.

Insert channel end clamp in the rail. The module must be lifted slightly to slide the clamp under the frame.

Allow the module to rest on the rail again and slide the clamp back toward the end of the module until it is flush with the outside end of the module frame and tighten lightly. Feel under the array to check that the clamp is clamping the module flange securely, then tighten to the specified torque.



End Caps

Place an end cap at the end of each rail to improve the look of the system. Drain holes on the bottom of the end caps ensure that water does not accumulate in the rails.



Certified Module List for UL2703 Listing Program

| Manufacturer | Modules/Series |
|----------------------|--|
| Auxin | AXN6M610Txxx, AXN6P610Txxx, AXN6M612Txxx, AXN6P612Txxx. |
| Axitec | AXIblackpremium 60 (35mm), AXIpower 60 (35mm), AXIpower 72 (40mm), AXIpremium 60 (35mm), AXIpremium 72 (40mm). |
| Canadian Solar | CS6V-xxxM, CS6P-xxxP, CS6K-xxxM, CS5A-xxxM, CS6K-xxxMS CS6U-P, CS6U-M, CS6X-P, CS6K-MS, CS6K-P, CS6P-P, CS6P-M, CS3U-P, CS3U-MS, CS3K-P, CS3K-MS, CS1K-MS, CS3K, CS3K, CS3U, CS3U-MB-AG, CS3K-MB-AG, CS3K-MB-AG, CS6K, CS6U, CS3L, CS3W, CS1H-MS, and CS1U-MS |
| Certainteed | CTxxxMxx-01, CTxxxPxx-01, CTxxxMxx-02 Where "xx" denotes frame and backsheet color. CT-03 Series G3, L-G4 and L-G2, Q.PLUS G4 xxx, Q.PLUS BFR G4.1/TAA xxx, Q.PLUS BFR, G4.1/MAX xxx, Q.PLUS BFR G4.1 xxx, Q.PRO-G4 xxx, Q.PRO [q.pro] EC-G4.4 xxx, Q.PRO [q.pro] BFR G4 xxx, Q.PRO [q.pro] BFR G4.1 xxx, Q.PRO [q.pro] BFR G4.3 xxx, Q.PEAK-G4.1 xxx Q.PEAK- G4.1/MAX xxx, Q.PEAK BLK G4.1 xxx, Q.PEAK-G4.1/TAA xxx Q.PEAK BLK G4.1/TAA xxx, B.LINE PRO BFR G4.1 xxx, B.LINE PLUS BFR G4.1 xxx, B.LINE PRO BFR G4.1 xxx, Q.PEAK DUO-G5-xxx, Q.PEAK DUO-G5.X-xxx and Q.PEAK DUO BLK-G5-xxx Q.PEAK L G4.2, Q.PLUS L G4.2, Q.PLUS L G4.1 -35mm, Q.PLUS L G4 - 35mm, Q.PRO [q.pro] L G4 -35mm, Q.PRO [q.pro] L G4.1 - 35mm, Q.PRO [q.pro] L G4.2 - 35mm, B.LINE PLUS L G4.2 - 35mm, B.LINE PRO L G4.1 - 35mm, B.LINE PRO L G4.2 - 35mm, Q.PLUS L-G4.2/TAA -35mm, Q.PEAK DUO L-G5.2, Q.PEAK DUO L-G5.3 (380-395), Q.Peak Duo L-G6 xxx, Q.Peak Duo L-G6.2 xxx, Q.Peak Duo L-G6.3 xxx, Q.Peak Duo G6 xxx, Q.Peak Duo BLK-G6 xxx |
| Heliene | 36M, 60M, 72M, 60P, and 72P |
| Hyundai | KG, MG, TG, RI, RG, TI and KI series (35mm and 40mm) |
| JA Solar | JAP6 60-xxx, JAM6-60-xxx/SI, JAM6(K)-60/xxx, 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, JAM 72S09, JAM72S10, JAP72S10, JAM60S10, JAP60S10 i. YY: 01 white backsheet, 02 black backsheet, 03 half-cell and white backsheet, 09 M4 cell, 10 M4 1/2 cell ii. ZZ: SC standard cell, PR = perc, BP = bifacial, HiT = HIT, IB = IBC, MW = MWT |
| Jinko | JKM xxx P-60, JKM xxx PP-60, JKM xxx M-60, JKM xxx M-60B, JKMS xxx PP-60 JKMS xxx P-60, JKMSxxx-72, JKMSxxxP-72, JKMSxxxP-72, JKMSxxxM-72, JK07A (JKMSxxxPP-60 & JKMSxxxPP-72), JK07B (JKMSxxxPP-60), JKM xxx PP-60(Plus), JKMSxxxM-60-EP, JKM xxx P-72B, JKMSxxxPP-72, JKMSxxxPP-72B, JKMSxxxPP-72(Plus), JKMSxxxPP-72, JKM xxx PP-60B, JKM xxx M-60B, JKMSxxxM-60, JKMSxxxM-72-V, JKMSxxxPP-72-V, JKMSxxx-72L-V, JKMSxxx-72HL-V, JKMSxxxM-60L, JKMSxxxM-60BL, JKMSxxxM-60HL, JKMSxxxM-72HL-V, JKMSxxxM-72L-V |
| LG | LG xxxN2W-B3/LGxxxN2W-B3 LGxxxS1C-G4 LGxxxN1C-G4, LGxxxS1C-L4, LGxxxS2W-G4 |
| Longi | LR6-72HV 330-350M, LR6-60PH 290-310M, LR6-72PH 360-380M |
| Mission | MSE series |
| NSP | NEO Solar Power D6M and D6P N240, N330, N320K, N315K, N310K |
| Panasonic | VBHNxxxSA16/VBHNxxxSA16B, VBHNxxxSA15/VBHNxxxSA15B, VBHNxxxKA01, VBHN SA17/18/KA03/04, VBHNxxxSA17G, VBHNxxxSA17E/18E, VBHNxxxZA01, VBHNxxxZA02, VBHNxxxZA03, VBHNxxxZA04. |
| Piemar | SGXXXM (FB), SGXXXM (BF), SGXXXM |
| Phono Solar | PS-xxx-60, PS-xxx-72 |
| REC | REC Alpha Series, REC Peak Energy BLK2 Series, REC Peak Energy Series, REC TwinPeak Series |
| Renesola | Virtus II with module ratings of 250-260 in increments of 5, 156 series with module ratings of 270-275. |
| Silfab | SLA-M and SLG-M |
| Sun Power | E20-xxx-COM, X21-xxx, X22-360-C-AC, Evaluated with both the G3 and G5 frame SPR-P17-xxx-COM, (xxx: module power rating) |
| Talisun | TP572, TP596, TP654, TP660 (35mm/40mm), TP672, Hipor M350+ (40mm) Talesun Smart (35mm) M = Mono, P = Poly, B = Black, T = Transparent (H) = 1500V, without (H) is 1000V |
| Tesla/Zep/Solar City | SCxxx, SCxxxB, SCxxxB1, SCxxxB2 |
| Trina Solar | TSM-PD05, TSM-PD05.05, TSM-PD05.08, TSM-PE05A, TSM-PE05A.08 TSM-DD05A.05(II), TSM-DD05A.08(II), TSM-DD05A.08S(II), TSM-DD05A.05S(II) TSM-PD05.08S, TSM-PD05.08C, TSM-PD05.08D, TSM-PD14, TSM-PE14A TSM-PE14A.08, TSM-DD14A(II), TSM-DD14A.05(II), TSM-DD14A.08(II), TSM-PD14.002 |
| URE | D7MxxxH8A, D7KxxxH8A, D7MxxxH7A |
| Vikram | Eldora Grand Ultima, Eldora Grand, Eldora Prime, Eldora Ultima, Solivo, Somera Grand, Ultima, Somera Grand, Somera Half (VSMH.72), Somera Prime, Somera Ultima |
| Yingli | YL xxx P-29b, YLM 60, YLM 72, YGE, YGE-VG, YLM, YL xxx P-35b, YL xxx D-30b, YL xxx D-36b |

Certified Power Optimizer List for UL2703 Listing Program

| Manufacturer | Model Numbers |
|----------------------------|--|
| SolarEdge Technologies LTD | P400J, P600, P700, P730, P800p, P800s |
| Enphase | M250-72, 250-60, M215-60, C250-72, S230, S280, IQ 6, IQ 6+, IQ 7, IQ 7+, IQ 7X, Q Aggregator |

Disclaimer

This manual describes proper installation procedures and provides necessary standards required for product reliability. Warranty details are available on our website. www.tamaracksolar.com

All installers must thoroughly read this manual and have a clear understanding of the installation procedures prior to installation. Failure to follow these guidelines may result in property damage, bodily injury or even death.

Installers Responsibilities

- Follow all applicable local or national building and fire codes, including any that may supersede this manual.
- Electrical installation should be conducted by a licensed and bonded electrician or solar contractor.
- Module maintenance or removal must not break the bonding path of the system.
- Ensure all products used are appropriate for the installation and array under the site's loading conditions.
- Use only Tamarack parts or parts approved by Tamarack; substituting parts may void any applicable warranty.
- Comply with all applicable fire codes including, but not limited to, keeping walkways clear.
- Ensure bare copper grounding wire does not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion.
- If loose components or loose fasteners are found during periodic inspection, retighten immediately. If corrosion is found, replace affected components immediately.
- Provide an appropriate method of direct-to-earth grounding according to the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, NEC 690: Solar Photovoltaic Systems, and CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1
- Disconnect AC power before servicing or removing microinverters and power optimizers.
- Review module manufacturer's documentation to ensure compatibility and compliance with warranty terms and conditions.
- Maximum Series Fuse Rating of 20 Amps.

