



SnapNrack™

Solar Mounting Solutions

Ultra Rail

Residential Roof Mount System
Installation Manual

snapnrack.com

SnapNrack Ultra Rail Solar Mounting System offers a low profile, visually appealing, photovoltaic (PV) module installation system. This innovative system simplifies the process of installing solar PV modules, shortens installation times, and lowers installation costs..

SnapNrack systems, when installed in accordance with this manual, will be structurally adequate for the specific installation site and will meet the local and International Building Code. Systems will also be bonded to ground, under SnapNrack's UL 2703 Listing.

The SnapNrack installation system is a set of engineered components that can be assembled into a wide variety of solar mounting structures. It is designed to be installed by qualified solar installation technicians. With SnapNrack you will be able to solve virtually any PV module mounting challenge.

Benefits of Installing the SnapNrack Ultra Rail System

Install With Existing Roof Attachments

Compatible with existing SnapNrack roof attachments

Install With Very Few Tools

All Ultra Rail hardware is attached using a standard 1/2" socket

Built in Wire Management and Aesthetics

Extensive wire management solutions have been designed specifically for the system that adapts to multiple possible mounting positions.

The system is designed to be aesthetically pleasing on its own, so it does not require an aesthetic skirt. SnapNrack does offer an optional skirt for those looking for a high end look to the system.

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Certification Details

SnapNrack Ultra Rail system has been evaluated by Underwriters Laboratories (UL) and Listed to UL/ANSI Standard 2703 for Grounding/Bonding, Mechanical Loading, and Fire Classification.

Grounding/Bonding

The Ultra Rail system has been designed in compliance with UL Standard 2703 Section 9.1 Exception, which permits accessible components that **are not part** of the fault current ground path to **not be electrically bonded** to the mounting system (e.g. roof attachments, array skirt, etc.). For more details on the integrated grounding functionality see the [Grounding Specifications](#) section.

This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions. See the [Grounding Specifications](#) for the list of modules tested with the Ultra Rail system for integrated grounding.

Ground Lugs have been evaluated to both UL 467 and UL 2703 Listing requirements.

Ultra Rail has been listed with the following Enphase microinverter models for grounding/bonding: M215, M250, and C250. The Enphase microinverters are certified to be mounted to SnapNrack rail with the MLPE Attachment or to the module frame with the Enphase Frame Mount. When installing the Enphase microinverters per the specifications in the MLPE Installation section of this manual, the total roof-mounted PV system is bonded (modules, racking and microinverters) and grounded through the Enphase ground circuit when the Enphase units are properly grounded through to the service entrance. Therefore, no ground lugs or equipment grounding conductor (EGC) are required on the SnapNrack systems.

Ultra Rail has been Listed with the following SolarEdge optimizer models for grounding/bonding: P300-5NC4ARS, P320-5NC4ARS, P370-5NC4AFS, and P400-5NC4AFS. The SolarEdge optimizers are certified to be mounted to SnapNrack rail with the MLPE Attachment or to the module frame with the SolarEdge Power Optimizer Frame-Mounted Module Add-On. When installing the SolarEdge optimizers per the specifications in the MLPE Installation section of this manual, the total roof-mounted PV system is bonded to the optimizer backing plate (modules, racking and optimizers) and grounded through the ground lugs installed on the SnapNrack rail. Therefore, it is not necessary to run an EGC to each SolarEdge optimizer.

Note: Frame-Mounted Module Add-On has been evaluated for all modules except Suniva modules.

Ultra Rail has been Listed with the following Ginlong Rapid Shutdown Units for grounding/bonding: Solis-RSD-1G 1:1 and Solis-RSD-1G 2:2. The Ginlong Rapid Shutdown Units are certified to be mounted to SnapNrack rail with the MLPE Attachment.

The mounting system Bonding Listing is only valid when installed with a Non-Separately Derived PV system. The PV system is required to have a direct electrical connection to another source, such as connecting to the grid via a grid interactive inverter.

SnapNrack recommends that bare copper never come into contact with aluminum.

Mechanical Loading

The Ultra Rail system is Listed for mechanical loading for different load ratings depending on the mounting configuration and PV module installed. For more details on the mechanical loading details see the [Mechanical Loading Specifications](#) section.

SnapNrack engineered systems should only be used with SnapNrack components and hardware. Any application outside of those specified in this Installation Manual and the Structural Engineering Report may void the warranty and structural certification could become invalid.

If the module clamps have been engaged and need to be loosened and reengaged, SnapNrack recommends moving the module frame 3mm to engage the bonding pin in a new location *if required by the AHJ*.

The UL Listing covers mechanical load ratings for the various span lengths, module orientations and positive, negative, and side load ratings. These values can be found in the [Mechanical Loading Specifications](#) section.

SnapNrack recommends a periodic re-inspection of the completed installation for loose components, loose fasteners, and any corrosion, such that if found, the affected components are to be immediately replaced.

Fire

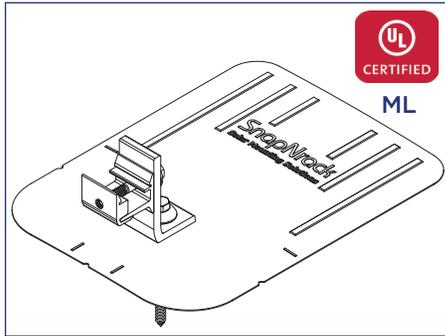
The Ultra Rail system has been evaluated for a Class A System Fire Classification for a Steep-Sloped Roof using Type 1 and Type 2 modules. In order to maintain the System Classification, modules are clamped to the mounting rails between 0 and 12 inches from the top and bottom edges of the module.

The Ultra Rail system has been evaluated for a Class A System Fire Classification for a Low-Sloped Roof using Type 1 and Type 2 modules. In order to maintain the System Classification, modules are clamped to the mounting rails between 0 and 16.3 inches from the top and bottom edges of the module.

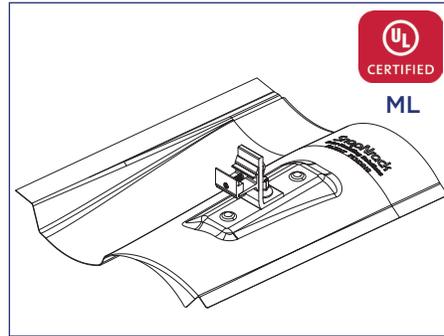
The optional Array Skirt accessory has also been evaluated and the Ultra Rail system will maintain the Class A System Fire Classification detailed above if installed with the Skirt.

Because the system was tested at 5 inches above the test roof fixture Ultra Rail can be installed without any height restrictions and will maintain the Class A System Fire Classification. See [Rail Installation](#) section for potential module-specific height restrictions due to module temperature.

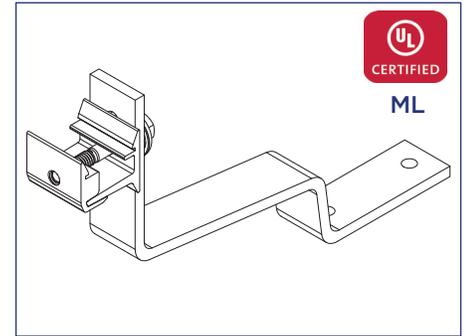
Structural Components



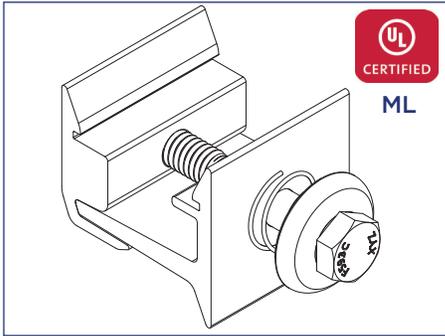
Composition Roof Attachment
Roof attachment kit for composition shingle roofs including L foot, umbrella lag screw, flashing, and hardware



Tile Replacement Roof Attachment
Roof attachment kit for flat, S, and W tile roofs including base, riser, tile replacement flashing, L foot, and hardware



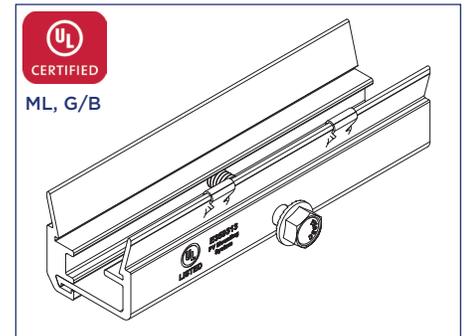
Flat Tile Roof Attachment
Roof attachment kit for flat tile roofs including tile hook and hardware



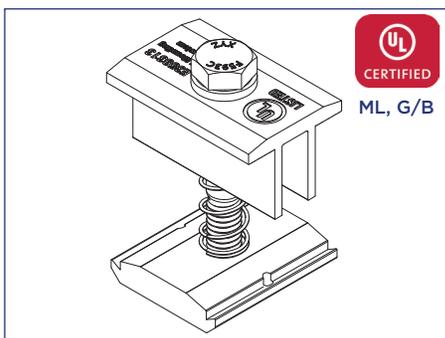
Ultra Rail Mounting Hardware
Hardware kit for attaching Ultra Rail to any roof attachment that uses an L foot or other slotted mount that accepts 5/16" hardware



UR-40 Rail
UR-40 rail for Ultra Rail roof mount racking system



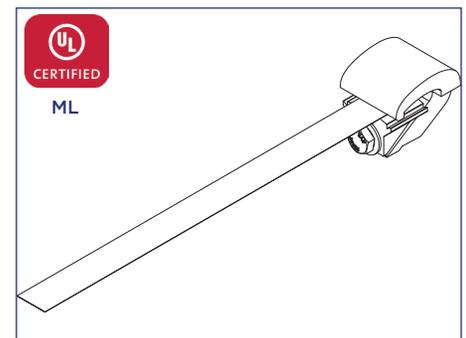
Ultra Rail Splice
Rail splice component including two splice halves and hardware



Mid Clamp
Top-down module mid clamp including clamp and hardware



Adjustable End Clamp
Top-down module end clamp including clamp and hardware

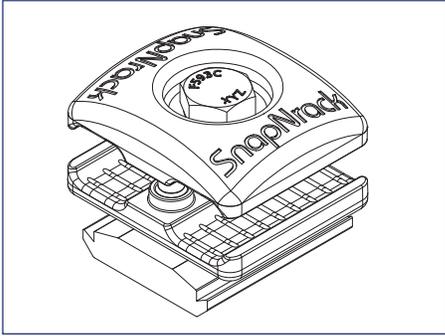


Universal End Clamp
Bottom-mount module end clamp including clamp and hardware

UL Listing Legend:

- ML - Evaluated for Mechanical Loading
- G/B - Evaluated for Grounding/Bonding

Wire Management/Grounding Component



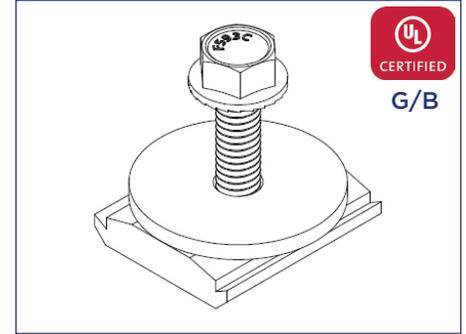
Universal Wire Clamp

Wire management component used to secure conductors between rails



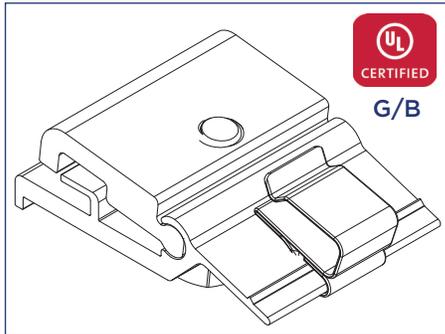
Wire Retention Clip

Wire management component used to secure conductors in rails



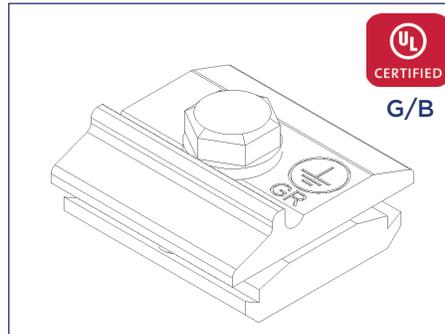
MLPE Rail Attachment Kit

Rail attachment for module level power electronics like microinverters and optimizers



MLPE Frame Attachment Kit

Module frame attachment for module level power electronics like microinverters and optimizers



SnapNrack Ground Lug



IlSCO Lay-In Lug - GBL-4DBT

Aesthetic Components



UR-40 Rail End Cap

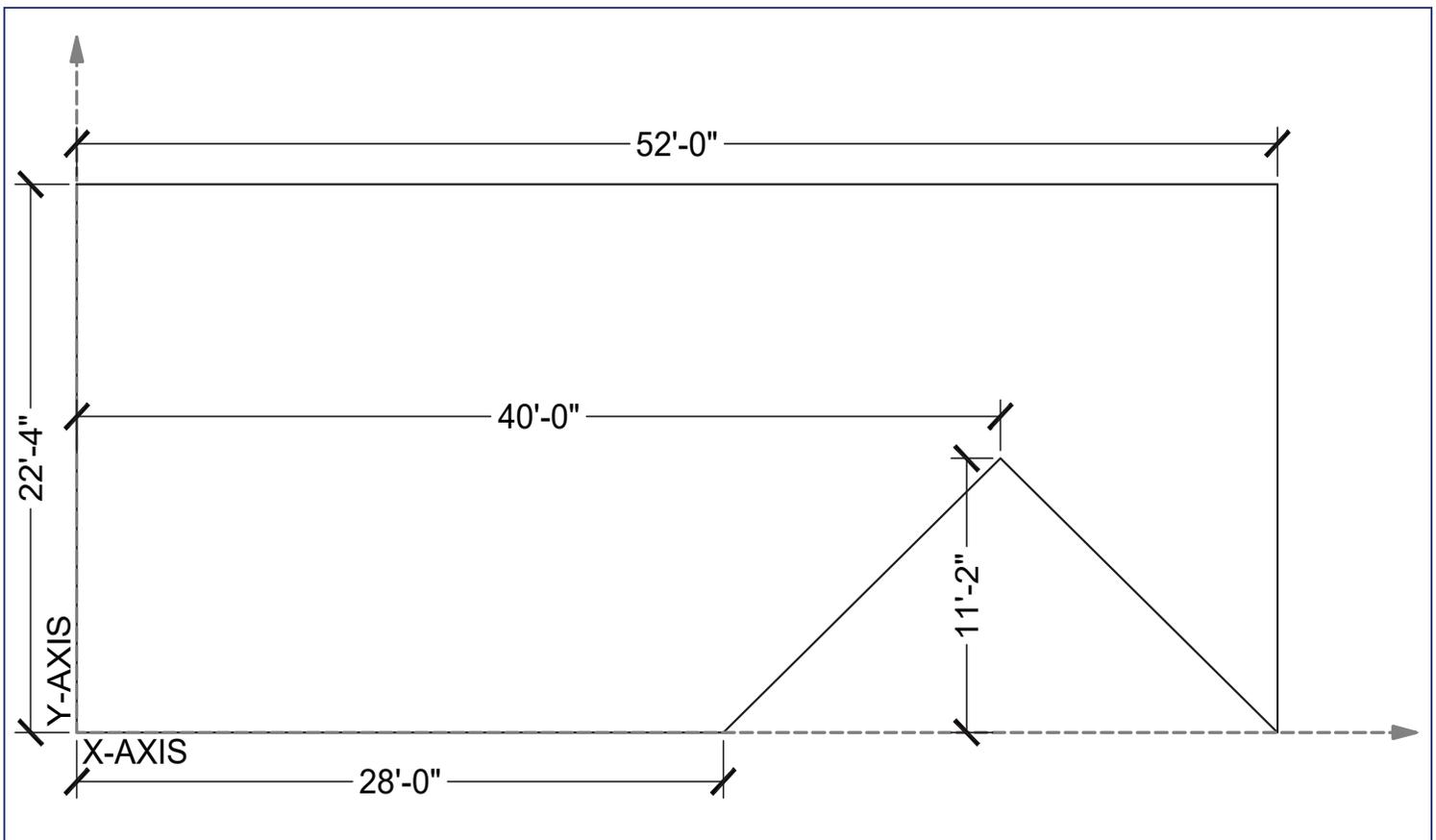
Plastic end cap for UR-40 Rail

Hardware Torque Specifications

Hardware Description	Torque Specification
SnapNrack Ground Lug model 242-02101 to Grounding Electrode Conductor (6-12 AWG Solid Copper)	16 ft-lbs (192 in-lbs)
SnapNrack Ground Lug model 242-92202 to Grounding Electrode Conductor and Module Frame	8 ft-lbs (96 in-lbs)
Ilsco Lay-in Lug GBL-4DBT to Rail or Module Frame	2.92 ft-lbs (35 in-lbs)
Ilsco Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (10-14 AWG Solid Copper)	1.67 ft-lbs (20 in-lbs)
Ilsco Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (8 AWG Stranded Copper)	1.04 ft-lbs (25 in-lbs)
Ilsco Lay-in Lug GBL-4DBT to Grounding Electrode Conductor (4-6 AWG Stranded Copper); Ground Lug SGB-4 to Grounding Electrode Conductor (4-14 AWG Solid or Stranded Copper)	1.46 ft-lbs (35 in-lbs)
Ilsco Ground Lug SGB-4 to Module Frame	6.25 ft-lbs (75 in-lbs)
Adjustable End Clamp, Mid Clamp, Universal End Clamp, Umbrella Nut for Tile Replacement Kits	10 ft-lbs (120 in-lbs)
Rail Splice, Flashed L-Foot to Rail, Flat Tile Roof Hook to Rail	12 ft-lbs (144 in-lbs)
SolarEdge Frame Mounted Bracket to Module Frame	7 ft-lbs (84 in-lbs)
MLPE Rail Attachment Kit, MLPE Frame Attachment Kit	10 ft-lbs (120 in-lbs)
Enphase Frame Mounted Bracket to Module Frame	13 ft-lbs (156 in-lbs)

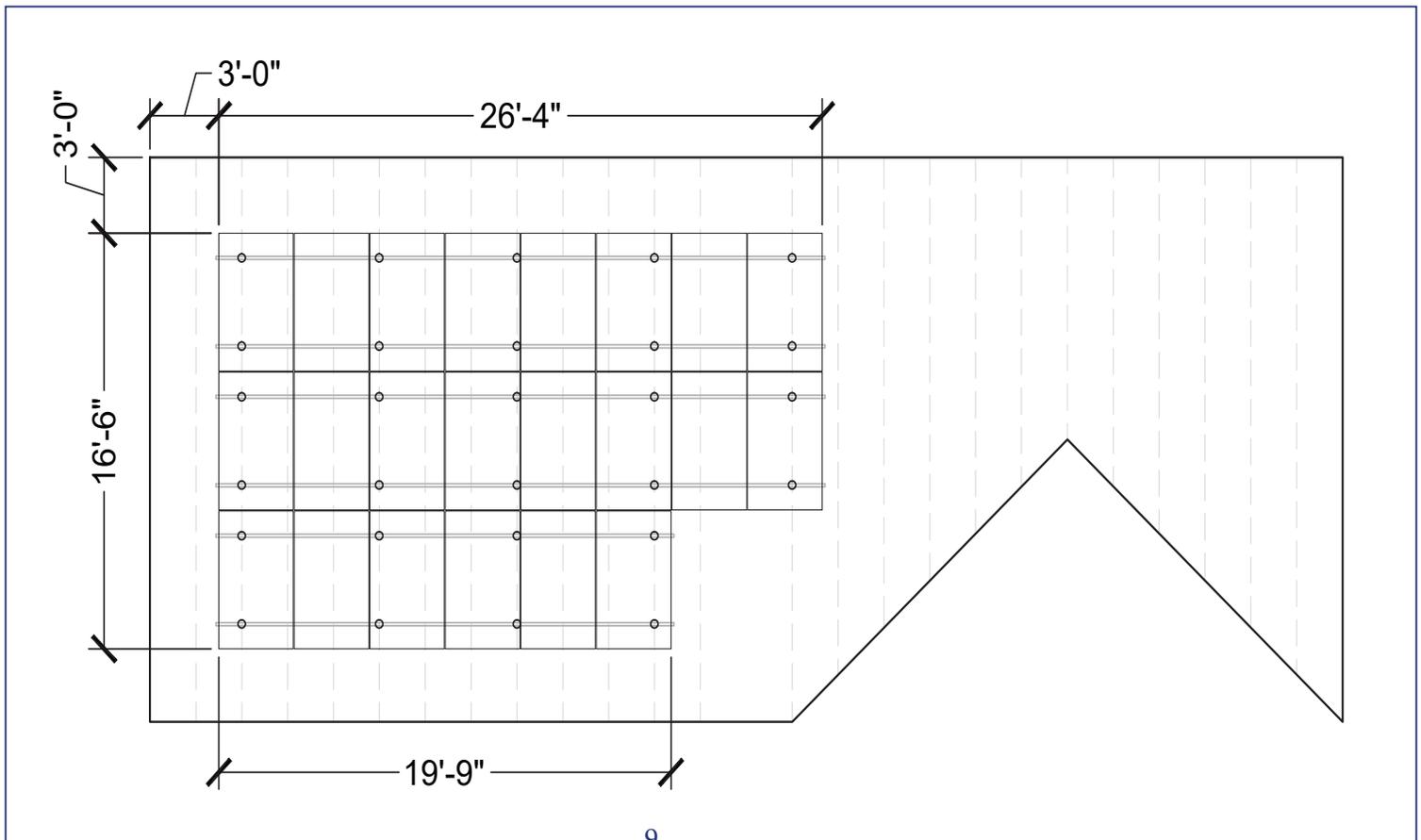
Site Survey

- Measure the roof surfaces and develop an accurate drawing, including any obstacles such as chimneys and roof vents.
- If plans are available, check to make sure that the plans match the final structure.
- Identify any roof access areas or keep-out areas as required by the local AHJ (i.e. fire lanes).
- Identify any construction issues that may complicate the process of locating roof framing members from the roof surface.
- If you find structural problems such as termite damage or cracked roof framing members that may compromise the structure's integrity, consult a structural engineer.



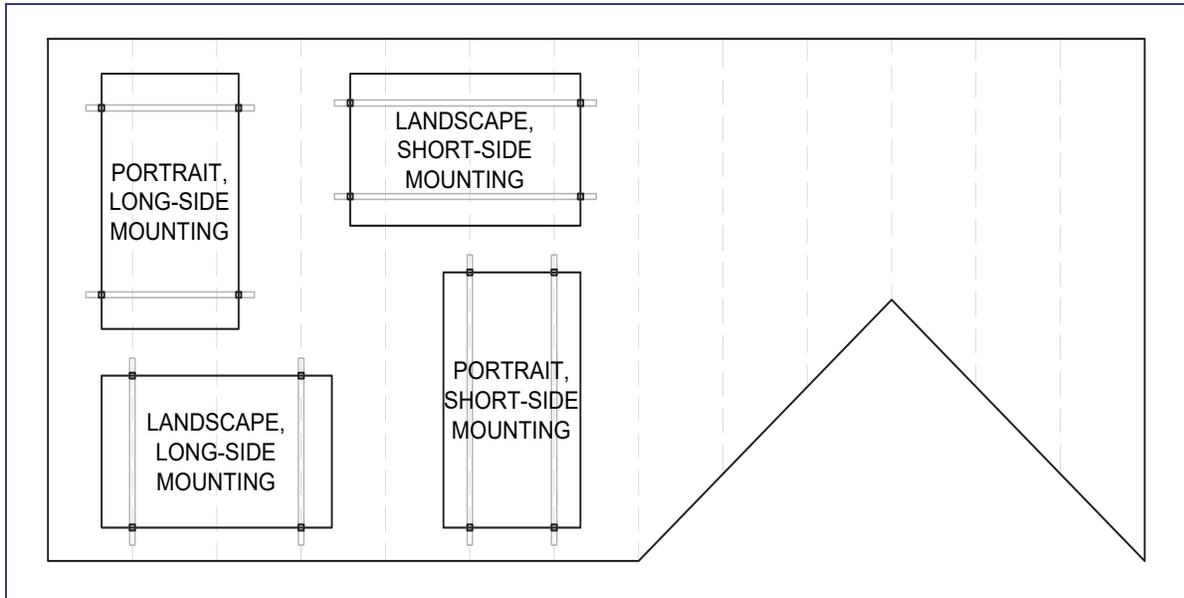
Design Guidance

- 1) Layout the modules in the available roof area. Adjacent modules in the same row are spaced 1/2" apart by Mid Clamps. Adjustable End Clamps require an additional 1" of rail extending past module frame, while Universal End Clamps require no extra rail. When installing multiple rows of modules, a minimum spacing gap of 1/8" should be used between rows.
- 2) Draw the roof framing member location on the layout to identify where roof attachments can be installed.
- 3) Determine site conditions for calculating the engineering values, confirm site conditions and code versions comply with local AHJ requirements.
- 4) Reference site conditions and system specifications in Ultra Rail Structural Engineering Report to determine maximum attachment spacing and cantilever values.
- 5) Draw roof attachment locations on layout based on maximum attachment spacing and cantilever values.
- 6) Confirm design complies with UL 2703 Listing for Mechanical Loading. For more details on the mechanical loading details see the [Mechanical Loading Specifications](#) section.
- 7) To simplify the design process and automatically generate a bill of materials (BOM) for the mounting system, use the Ultra Rail Configuration Tool located on the SnapNrack website. Always refer to Approved Module Lists in Installation Manuals to ensure installation complies with UL 2703 Listing.
- 8) Mark distance from array edge to identifiable roof features in x and y axes.
- 9) Insert SnapNrack installation details in to design set specific to the project requirements.



Design Note:

Ultra Rail allows for multiple mounting configurations. Modules can be mounted in portrait (long side of module perpendicular to ridge) or landscape (long side of module parallel to ridge) orientations. In addition, modules can also be short side-mounted (module clamps on short side) or long side-mounted (module clamps on long side). Long-side mounting is recommended for maximum material efficiency. Most residential structures utilize roof framing members that run in-slope with the roof, so a portrait orientation with long-side mounting is typically the most efficient use of materials.



Installation Note:

- Ensure the lag screws will be installed in a solid portion of the roof framing member.
- If the roof framing member is not found then seal the pilot hole immediately with roofing sealant.

Safety Guidance

- Always wear appropriate OSHA approved safety equipment when at active construction site
- Appropriate fall protection or prevention gear should be used. Always use extreme caution when near the edge of a roof
- Use appropriate ladder safety equipment when accessing the roof from ground level
- Safety equipment should be checked periodically for wear and quality issues
- Always wear proper eye protection

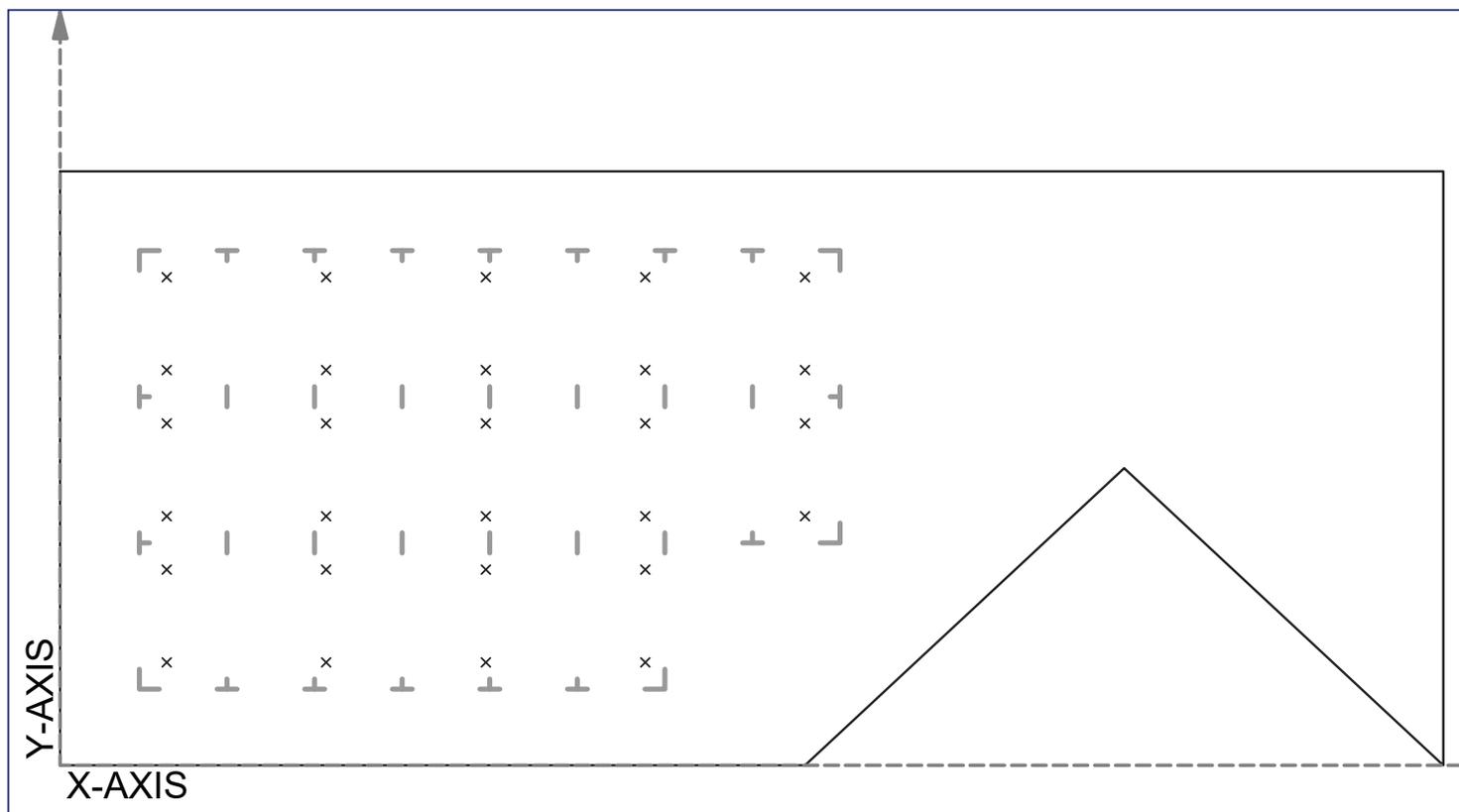
System Layout

- 1) Transfer the array layout to the roof using a roof marking crayon to mark the inside and outside corners of the array.
- 2) Locate the estimated roof framing member positions and mark them in the array area with a roof marking crayon.
- 3) Transfer rail locations using a chalk line.
- 4) Mark roof attachment locations on the roof, noting that attachments will be located at intersections of rails and roof framing members. Layout rails such that module frames do not overhang mounting rails more than specified by module manufacturer, more than 30% of total module length, or more than required by the Class A Fire Certification (see Certification Details section).



Layout Note:

Ensure final roof attachment locations do not exceed the maximum attachment spacing and cantilever specified in the design.

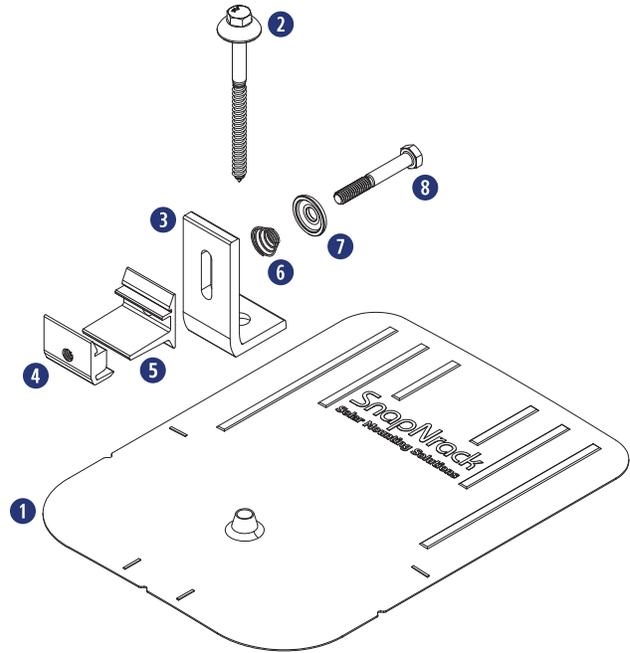


Required Tools

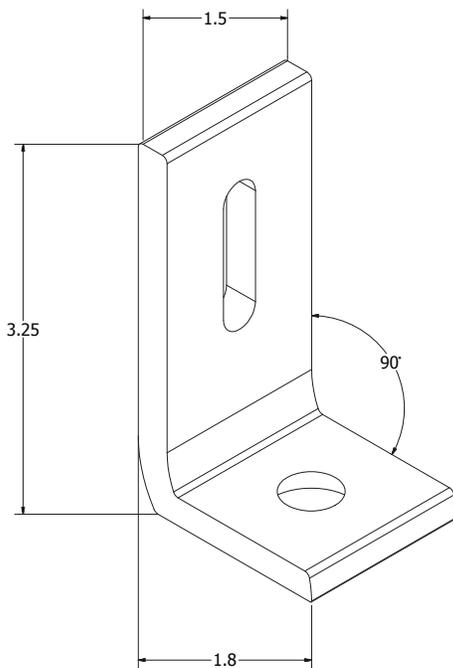
- Hammer or Stud Finder
- Roof Marking Crayon
- Drill with 3/16" Pilot Drill Bit
- Roof Sealant
- Torque Wrench
- Socket Wrench
- 1/2" Socket

Materials Included - L Foot Mount

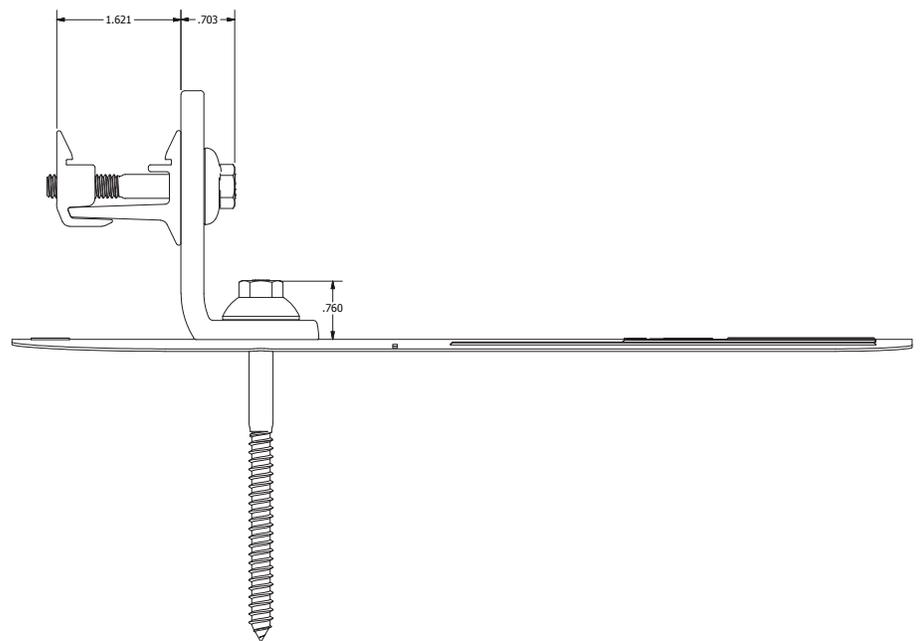
- (1) SnapNrack Comp Umbrella Flashing
- (1) SnapNrack Umbrella Lag Screw
- (1) SnapNrack Umbrella L Foot
- (1) SnapNrack Ultra Mount (Tapped)
- (1) SnapNrack Ultra Mount (Thru-Hole)
- (1) SnapNrack Ultra Mount Spring
- (1) SnapNrack Ultra Mount Spring Cage
- (1) 5/16"-18 X 2-1/4" SS HCS Bolt



Application Note:
Install on composition shingle roofs.

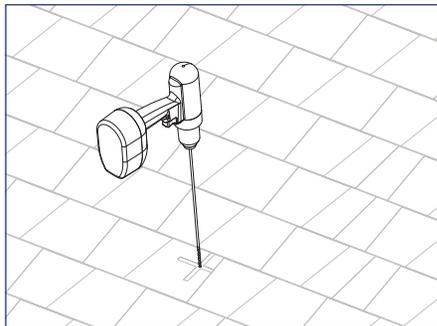


Dimensioned L Foot

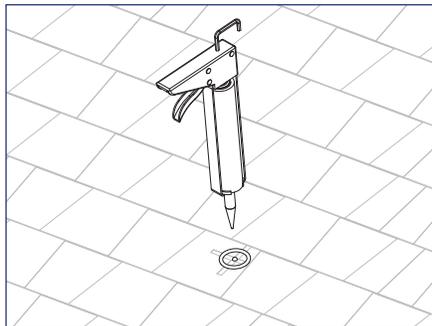


Dimensioned L Foot Assembly

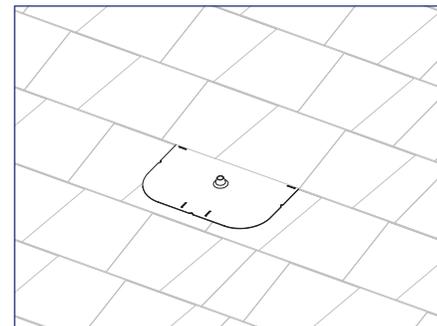
INSTALLATION INSTRUCTIONS



1) Using roof attachment locations drawn during system layout, drill a pilot hole through the roofing material into the roof framing member.



2) Apply roofing sealant in and around the pilot hole, and directly onto the lag screw to ensure a water tight seal.



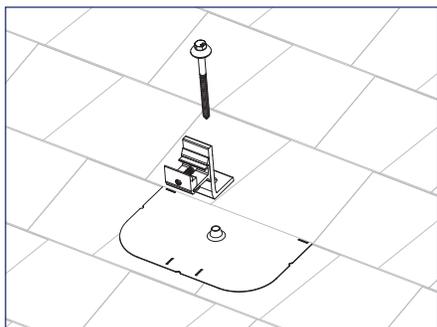
3) Pry up shingles with a breaker bar and install flashing underneath shingle course above pilot hole and, position flashing so cone is in line with pilot hole.



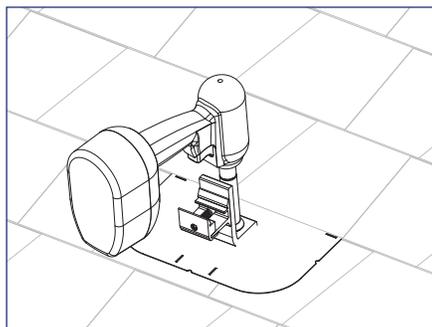
Install Note:

Ensure flashing extends minimum (2) courses above pilot hole, and does not overhang bottom edge of shingle course.

Apply a horseshoe of sealant under flashing to direct water away from penetration.



4) Insert Umbrella Lag Screw through Umbrella L Foot and cone in flashing, then drive lag screw for minimum 2.5" embedment into the roof framing member.



Install Note:

The L Foot can be attached in any orientation.



Best Practice:

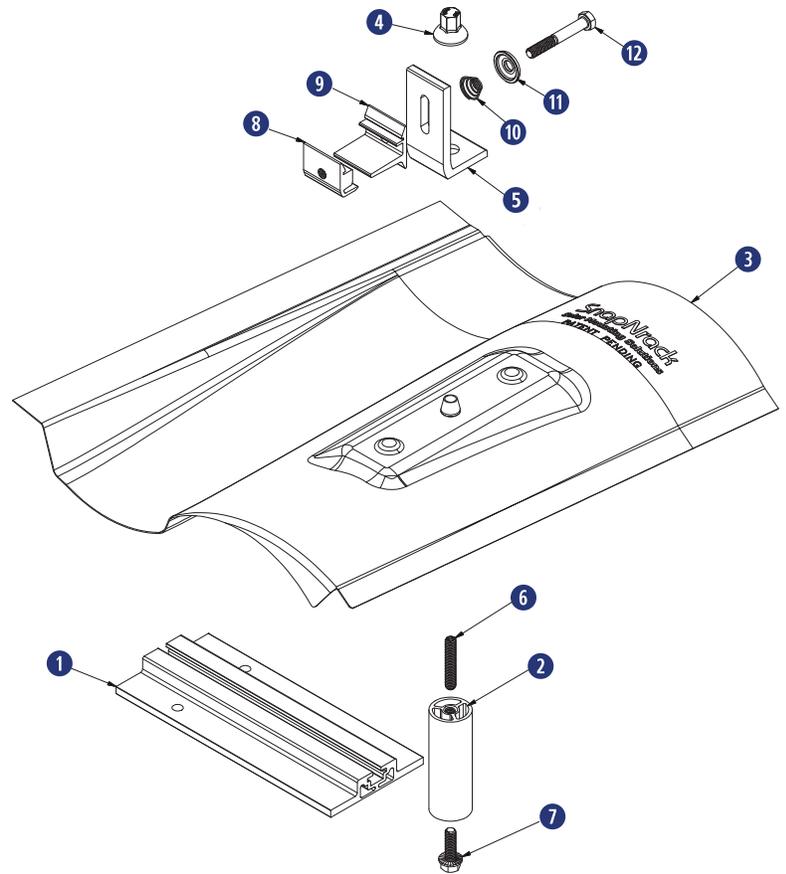
If using an impact driver, finish tightening lag screw with a hand wrench to prevent L Foot from rotating.

Required Tools

- Hammer or Stud Finder
- Roof Marking Crayon
- Drill with 3/16" Pilot Drill Bit
- Roof Sealant
- Torque Wrench
- Socket Wrench
- 1/2" Socket
- Flat Pry Bar
- Tape Measure
- SnapNrack Tile Replacement Installation Template (optional)

Materials Included - Tile Replacement

- ① (1) SnapNrack Tile Replacement Base
- ② (1) SnapNrack Tile Replacement Riser
- ③ (1) SnapNrack Tile Replacement Flashing
- ④ (1) SnapNrack Umbrella Nut
- ⑤ (1) SnapNrack Umbrella L Foot
- ⑥ (1) 5/16"-18 X 1-3/4" SS Set Screw
- ⑦ (1) 5/16"-18 X 1" SS Flange Bolt
- ⑧ (1) SnapNrack Ultra Mount (Tapped)
- ⑨ (1) SnapNrack Ultra Mount (Thru-Hole)
- ⑩ (1) SnapNrack Ultra Mount Spring
- ⑪ (1) SnapNrack Ultra Mount Spring Cage
- ⑫ (1) 5/16"-18 X 2-1/4" SS HCS Bolt



Other Materials Required - NOT SHOWN

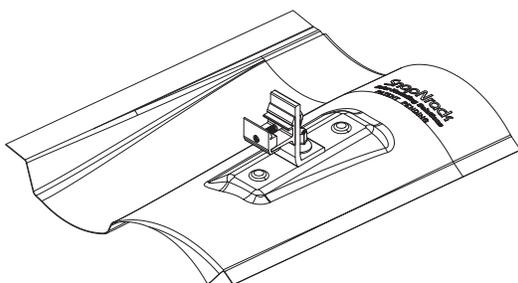
- ① (2) 5/16" Lag Screw
- ② (2) 5/16" Washer
- ③ Flexible Flashing (when required for deck level flashing)



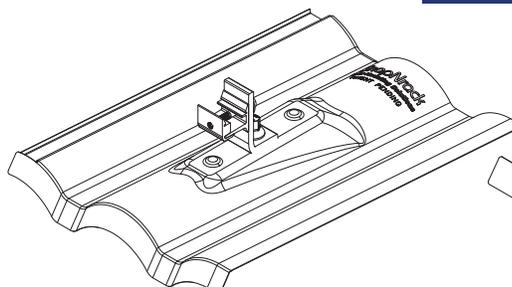
Application Note:

Install on flat, W and S style concrete tile roofs.

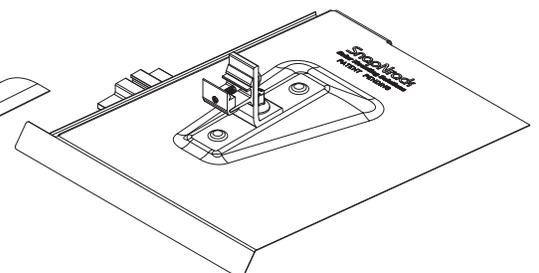
- Tile Course Spacing: 13"-16"
- Tile Thickness: 1-1/4" ±1/8"



S Tile Replacement



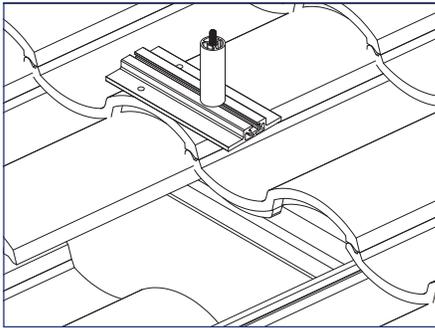
W Tile Replacement



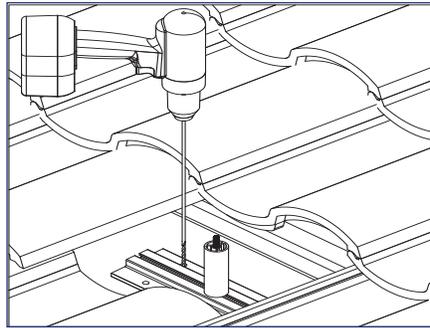
Flat Tile Replacement

Tile Replacement

INSTALLATION INSTRUCTIONS



1) Using roof attachment locations drawn during system layout, remove roof tile where the roof attachment will be installed. Slide riser assembly into base channel and snug by hand.



2) Locate base over rafter using riser position and Diagram 1 with measurements found in Table 1, then drill two pilot holes through the roofing material into the roof framing member.

Tile Profile	Riser Center to Tile Front Edge (A)	Riser Center Side - Side (B)
S	8.25"	Center of peak
W	8"	Center of peak
Flat	8"	5"

Table 1

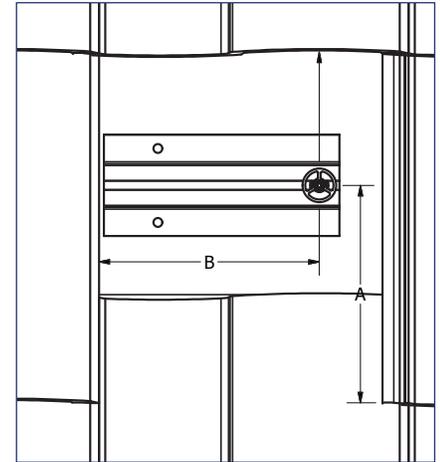


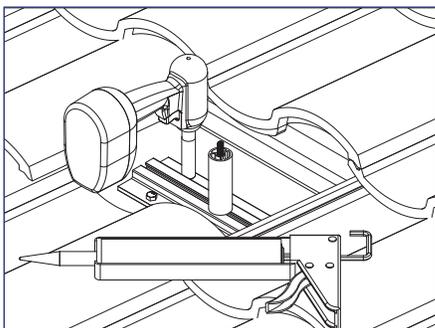
Diagram 1



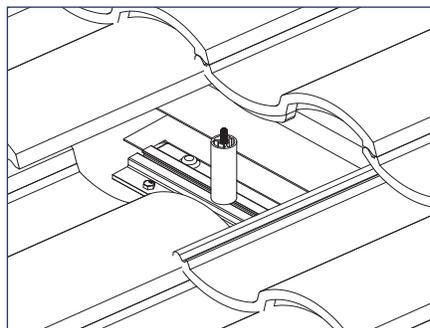
Install Note:

Base can be flipped and neighboring tile may need to be removed to attach to the roof framing member and line up riser with flashing.

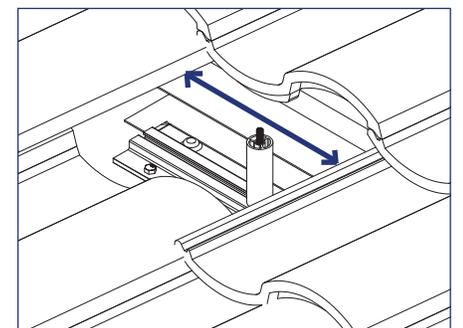
Working from RIGHT TO LEFT and UP THE ROOF will prevent neighboring tiles from lifting flashings.



3) Apply roofing sealant and attach the base with (2) 5/16" lag screws, drive lag screws for minimum 2.5" embedment into the roof framing member.



4) If deck level flashing is required, install flexible flashing per the Deck Level Flashing for Tile Replacement Installation Manual.



5) Align the riser with the hole in the flashing and tighten riser.

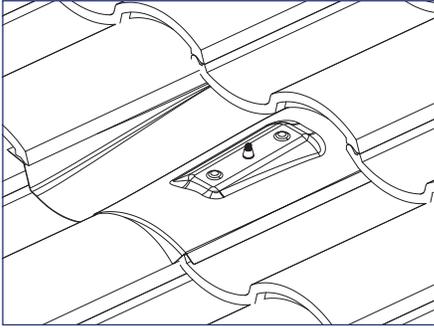


Best Practice:

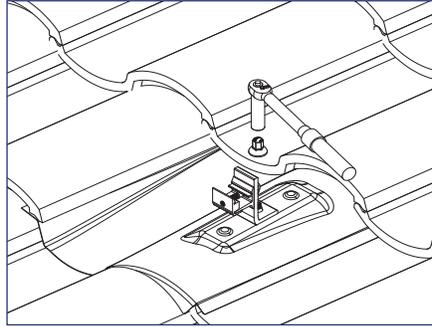
Flashing can be used as a template for locating riser.

Tile Replacement

INSTALLATION INSTRUCTIONS



6) Install flashing into place on top of riser, allowing stud to come through hole in Tile Replacement flashing.



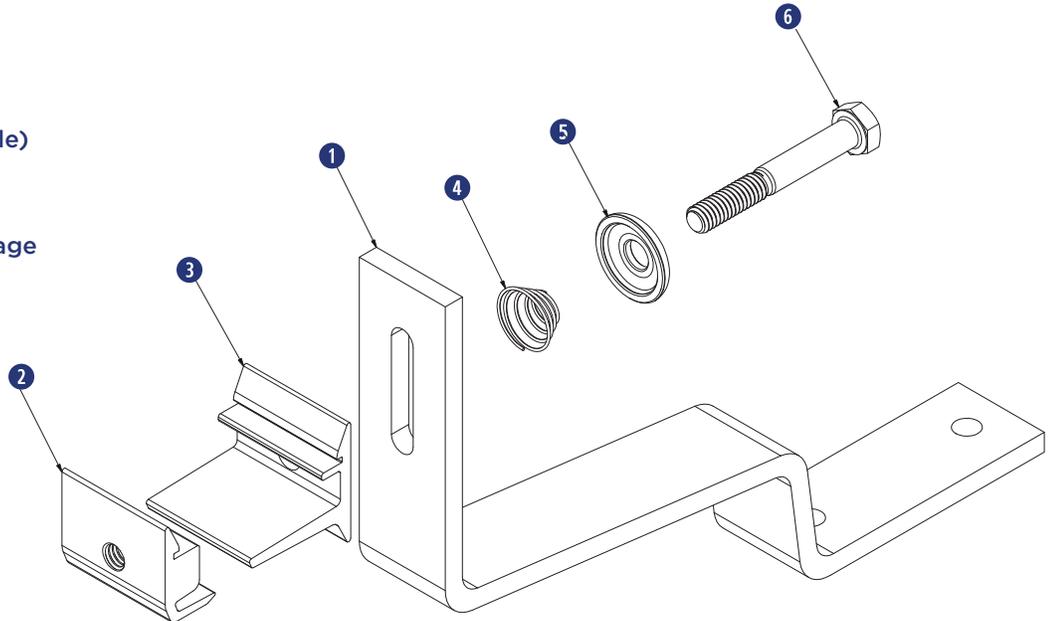
7) Install L Foot onto stud with Umbrella Nut, and tighten hardware.

Required Tools

- Hammer or Stud Finder
- Roof Marking Crayon
- Drill with 3/16" Pilot Drill Bit
- Roof Sealant
- Torque Wrench
- Socket Wrench
- 1/2" Socket
- Flat Pry Bar

Materials Included - Flat Tile Hook

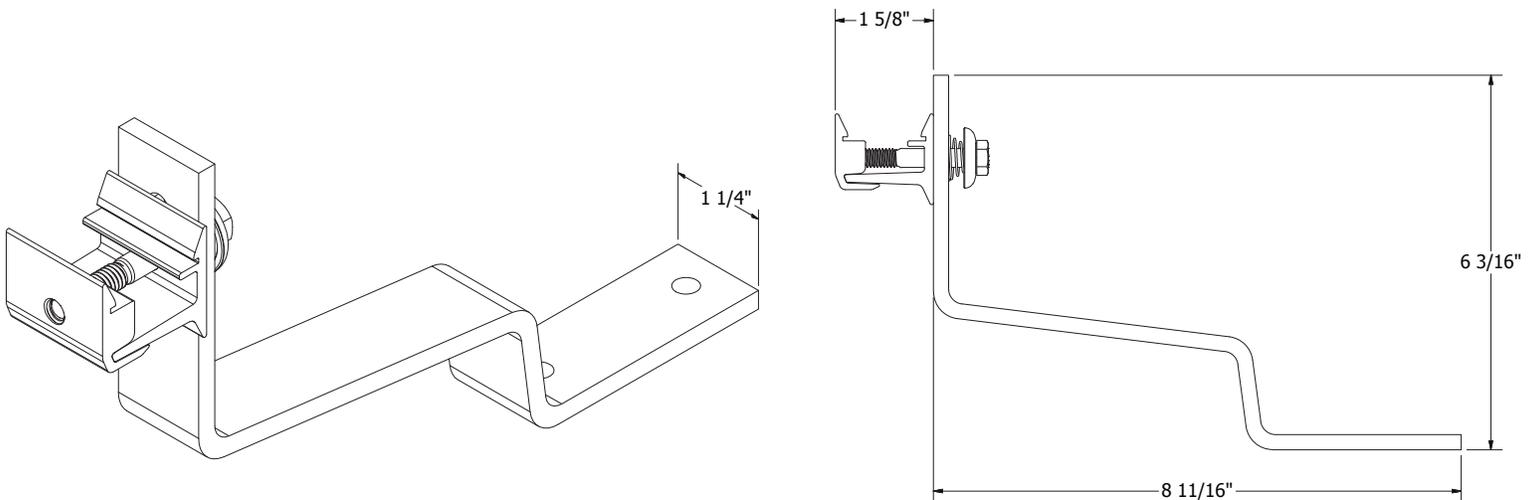
- ① (1) SnapNrack Flat Tile Hook
- ② (1) SnapNrack Ultra Mount (Tapped)
- ③ (1) SnapNrack Ultra Mount (Thru-Hole)
- ④ (1) SnapNrack Ultra Mount Spring
- ⑤ (1) SnapNrack Ultra Mount Spring Cage
- ⑥ (1) 5/16"-18 X 2-1/4" SS HCS Bolt



Other Materials Required - NOT SHOWN

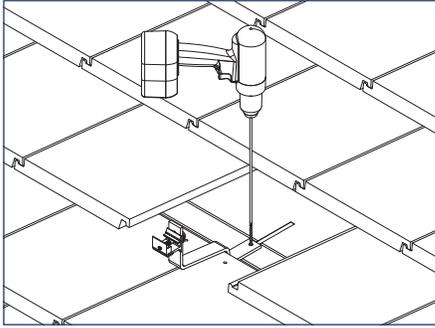
- ① (2) 5/16" Lag Screw
- ② (2) 5/16" Washer
- ③ Flexible Flashing (when required for deck level flashing)

Application Note:
Install on flat concrete tile roofs

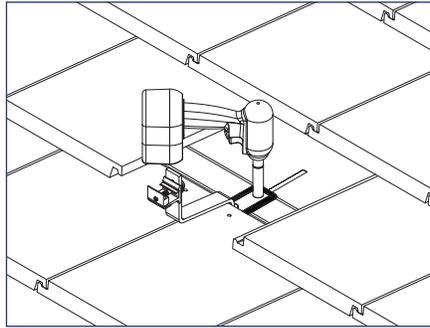


Dimensioned Flat Tile Hook Assembly

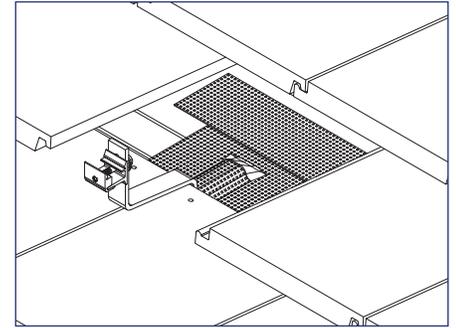
INSTALLATION INSTRUCTIONS



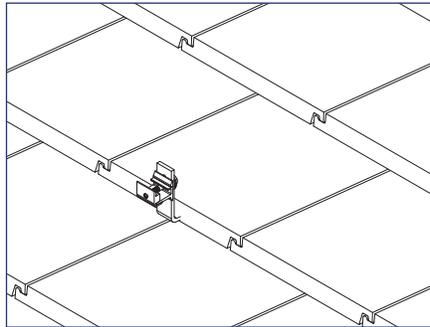
1) Using roof attachment locations drawn during system layout, remove roof tile where the roof attachment will be installed and drill two pilot holes through the roofing material into the roof framing member.



2) Apply roofing sealant and attach the Tile Hook with (2) 5/16" lag screws, drive lag screws for minimum 2.5" embedment into the roof framing member.



3) If deck level flashing is required, integrate roof felt or a flexible flashing with the existing underlayment and over the Tile Hook.



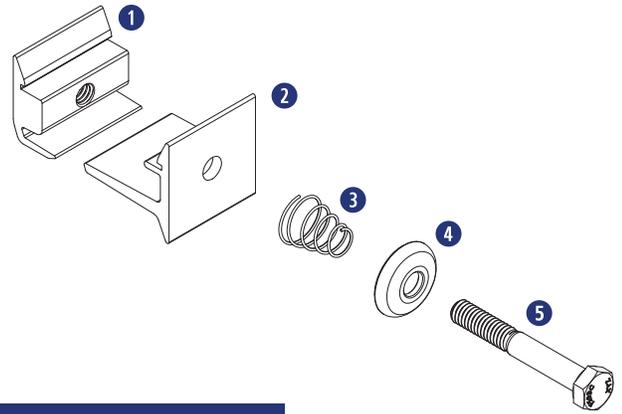
4) Replace the roof tiles.

Required Tools

- Torque Wrench
- Socket Wrench
- 1/2" Socket

Materials Included - Ultra Rail Mounting Hardware

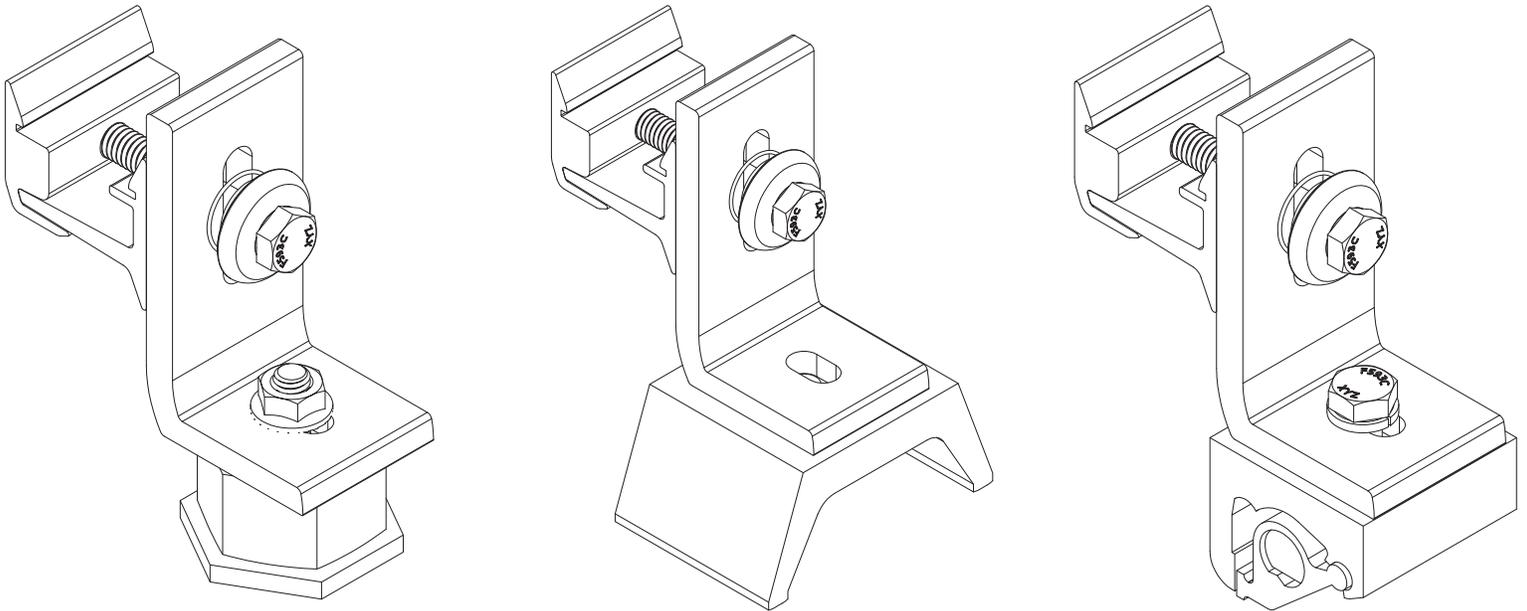
- ① (1) SnapNrack Ultra Mount (Tapped)
- ② (1) SnapNrack Ultra Mount (Thru-Hole)
- ③ (1) SnapNrack Ultra Mount Spring
- ④ (1) SnapNrack Ultra Mount Spring Cage
- ⑤ (1) 5/16"-18 X 2-1/4" SS HCS Bolt



Other Materials Required - Not Shown

- ① Roof Attachment

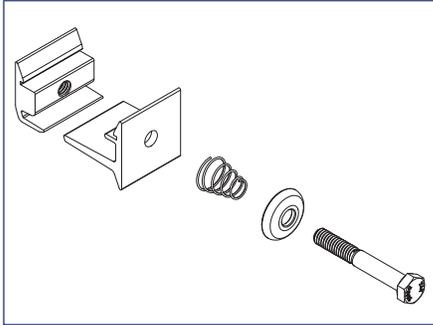
Application Note:
Install Ultra Rail onto any roof attachment that uses an L foot or other slotted mount that accepts 5/16" hardware.



Ultra Rail Mounting Hardware Installed on Different Roof Attachments

Install Note:
Roof attachments used must always meet minimum structural requirements. Consult licensed structural engineer if necessary.

INSTALLATION INSTRUCTIONS

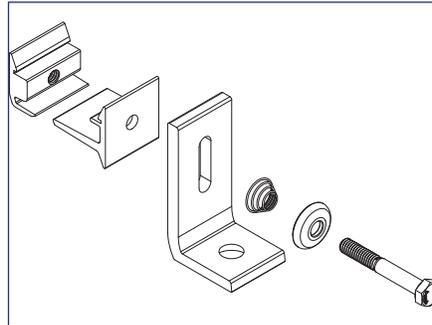


1) Disassemble Ultra Rail Mounting Hardware components, taking note of their installation order and orientation.



Install Note:

See exploded view on previous page for clarification.



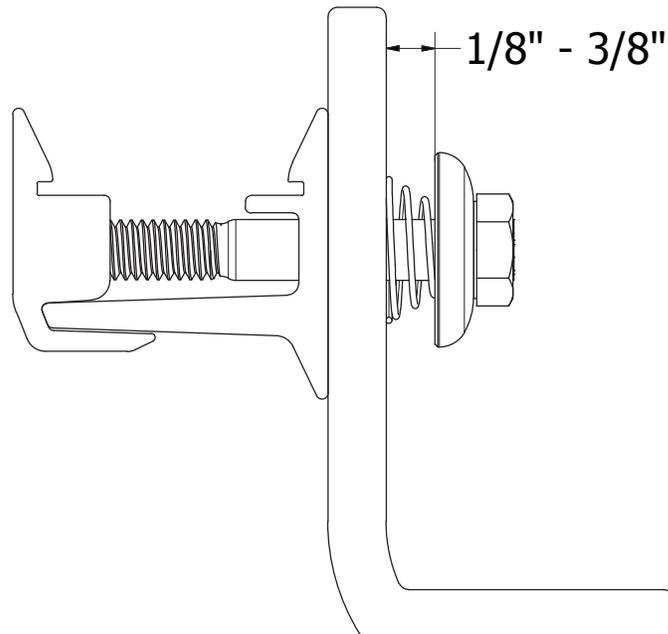
2) Re-assemble Ultra Rail Mounting Hardware components onto roof attachment in the following order:

Ultra Mount (tapped) - Ultra Mount (thru-hole) - roof attachment - spring - spring cage - bolt



Best Practice:

Ensure bolt is threaded into mount, but leave assembly loose for rail installation.



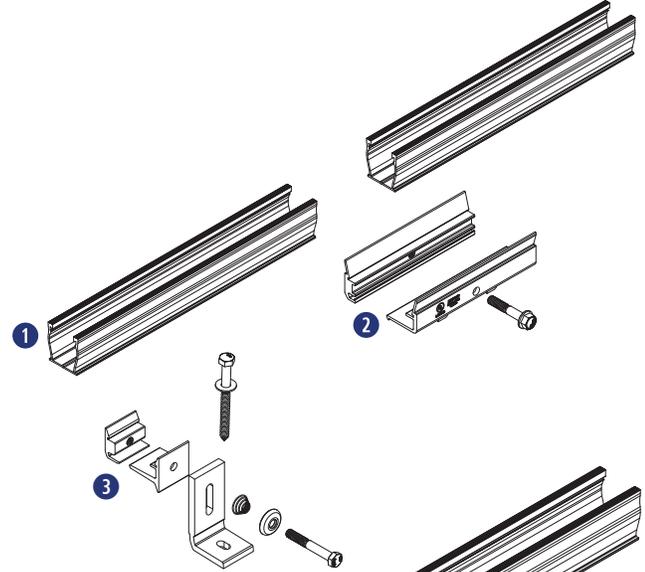
Recommended Ultra Rail Mounting Hardware Installation

Required Tools

- Level
- String Line or Spare Rail
- Pitch Meter
- Torque Wrench
- Socket Wrench
- 1/2" Socket

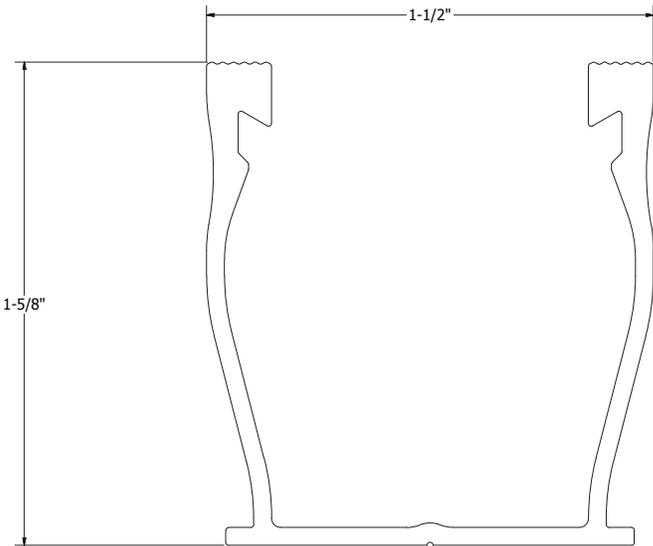
Materials Included - Installing and Leveling Rails

- ① SnapNrack Ultra Rail
- ② SnapNrack Ultra Rail Splice
- ③ Pre-Installed SnapNrack Roof Attachments
(L Foot Mount, Tile Replacement, etc.)

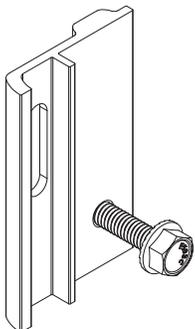


Other Materials Required - Not Shown

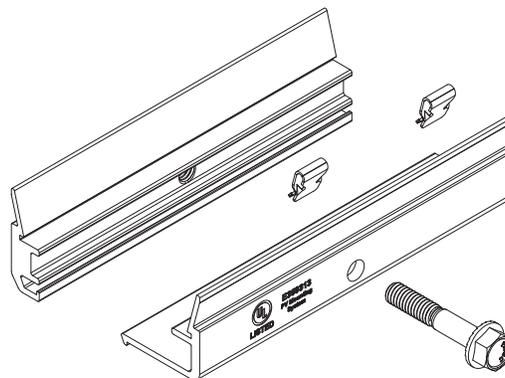
- ① SnapNrack L Foot Extension



UR-40 Rail Profile

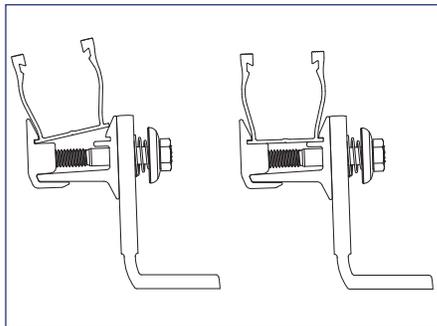


L Foot Extension

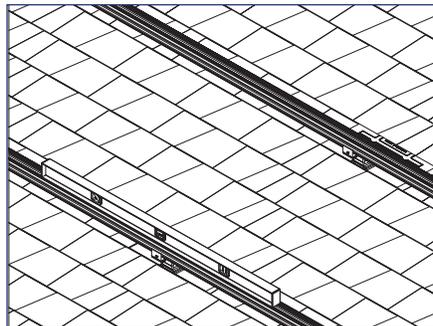


Ultra Rail Splice

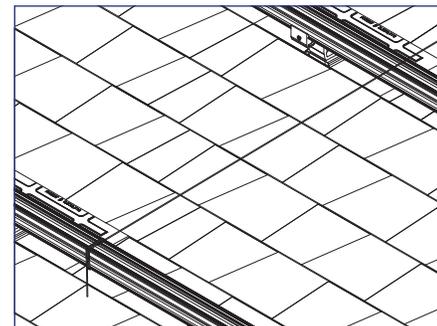
INSTALLATION INSTRUCTIONS



1) Set rails into the attachments by dropping and snapping into the mounts. Connect multiple lengths of rail end to end using the SnapNrack Ultra Rail Splice (see “Ultra Rail Splice” section).



2) Level the bottom rail of the array to the roof and tighten attachment points.



3) Run a string line or spare rail from the bottom rail to the top rail and set desired pitch of the array by adjusting the top rail, add L Foot Extension if needed.



Best Practice:

Set attachments in the middle of available leveling range to start.



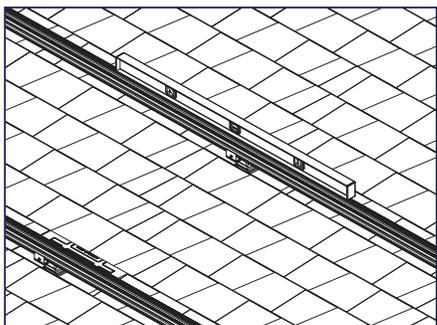
Install Note:

See “Leveling Components” section for installation instruction and restrictions.

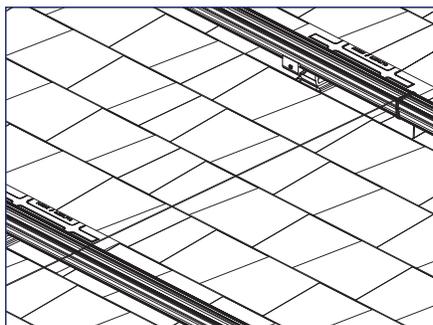


Install Note:

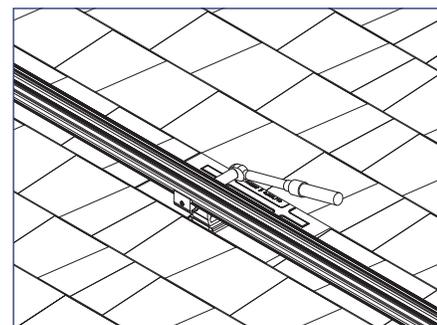
Slightly rocking rail into mounts can ease installation, leading first with side of rail furthest from mount.



4) Level the top rail by moving the string line down the length of the rail, matching pitch over the entire length of the array.



5) Level the remaining rails to the string line by working out from the middle rail, add L Foot Extensions or spacers if needed.



6) Tighten all racking hardware.



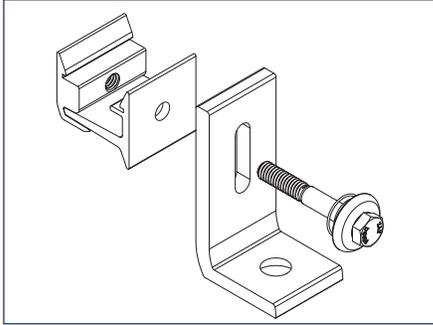
Note:

The minimum standoff height between the modules and roof is as follows:

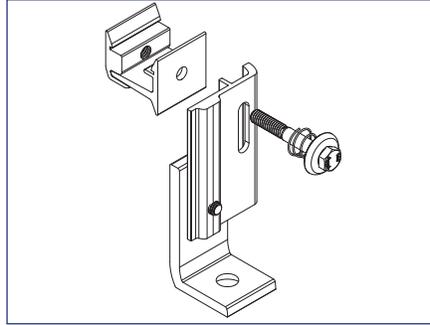
- REC Solar, Yingli, and Suniva modules: 4.00"
- ReneSola modules: 3.93" (100 mm)
- Trina Solar modules: 4.53" (115 mm)

INSTALLATION INSTRUCTIONS

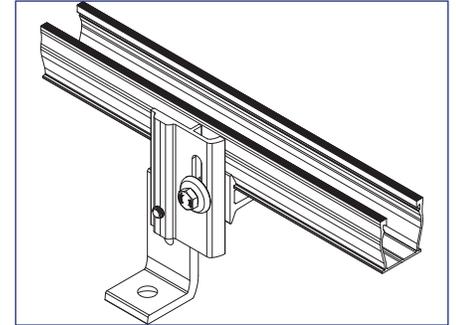
SnapNrack L Foot Extension



1) Remove Ultra Mount components from roof attachment, taking note of their installation order and orientation.



2) Remove bolt from L Foot Extension and install onto pre-installed roof attachment, then set desired height and tighten hardware.



3) Re-install Ultra Rail Mounting Hardware components onto L Foot Extension in the following order:

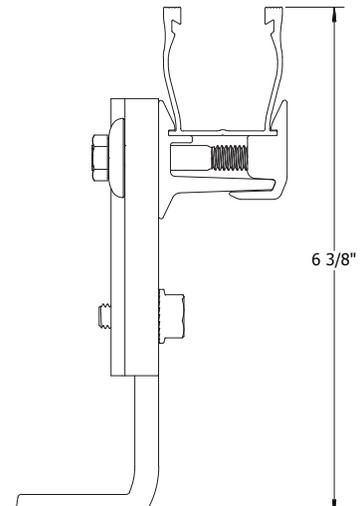
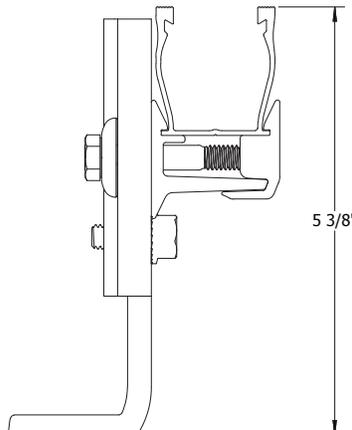
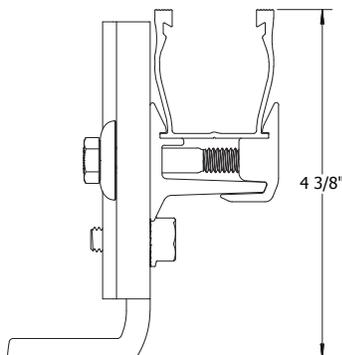
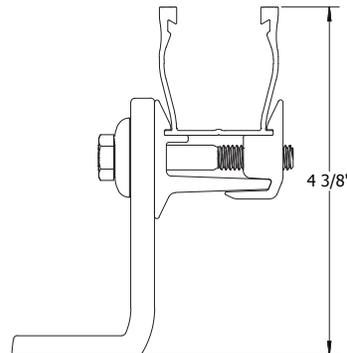
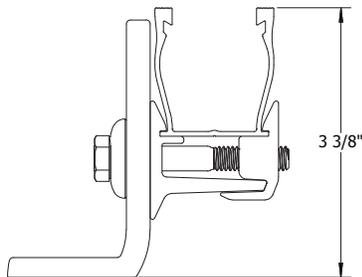
Ultra Mount (tapped) - Ultra Mount (thru-hole) - L Foot Extension - spring - washer - bolt

Install Note:

See exploded view in "Ultra Rail Mounting Hardware" section for clarification.

Best Practice:

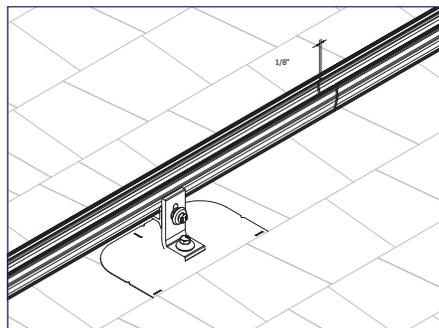
Ensure bolt is threaded into mount, but leave assembly loose for rail installation.



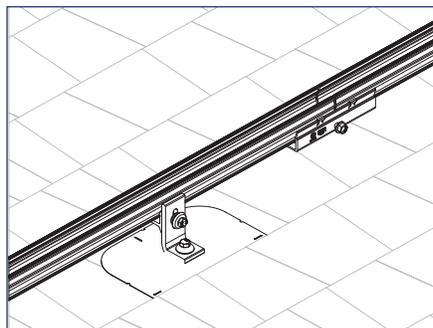
Use a single L Foot Extension on no more than 30% of attachment points.

L Foot Extension Provides Up To 3" of Height Adjustment

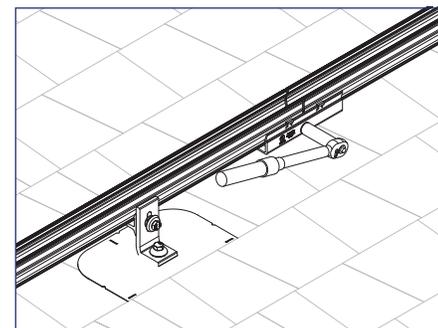
INSTALLATION INSTRUCTIONS



1) Align sections of rail so that ends butt up to each other.



2) Install rail splice assembly onto bottom of rail, making sure both rails are seated in grooves of splice and that the splice is centered.



3) Tighten splice hardware.

Install Note:

Leave approximately 1/8" gap between rails to allow for thermal expansion of rail.

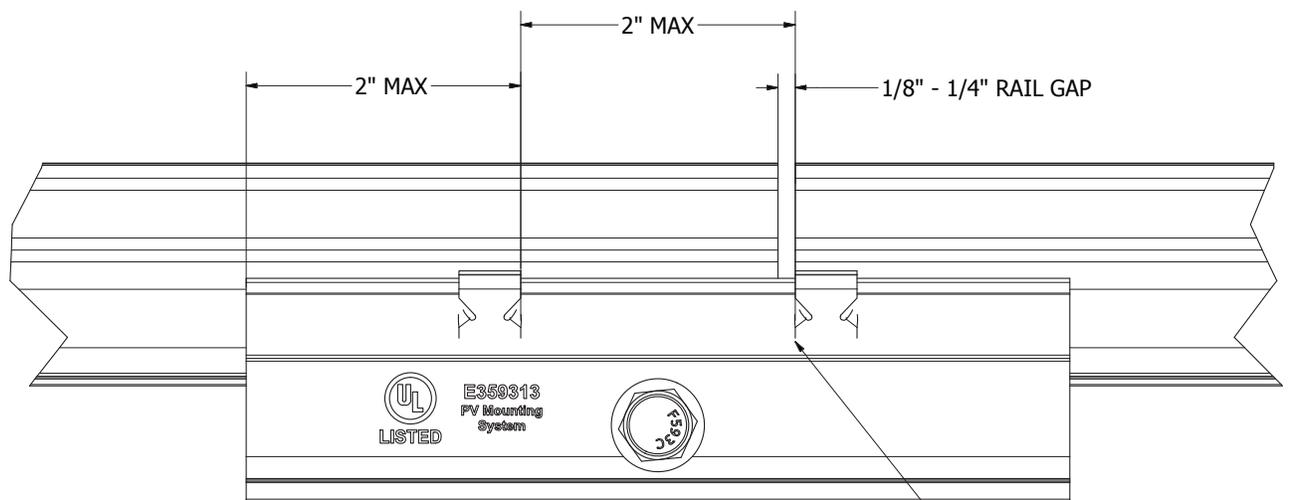
Any section of rail that is spliced will need to be supported by a roof attachment on both sides. Splices are not allowed to be installed on rail cantilevers.

Install Note:

Gap between rails must land between bonding clips on splice.

Best Practice:

Hold sides of splice together on rails with one hand and tighten with the other.



RAIL- EDGE MUST NOT PASS CLIP EDGE, AS SHOWN

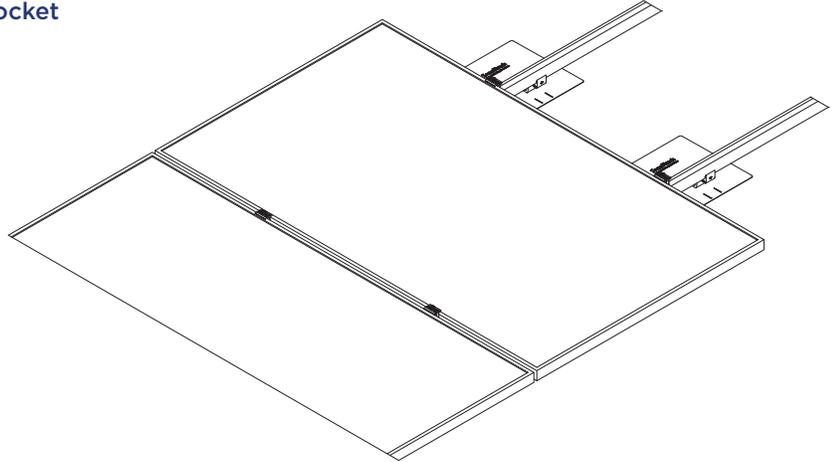
Splice Installation Limitations

Required Tools

- Torque Wrench
- Socket Wrench
- 1/2" Socket

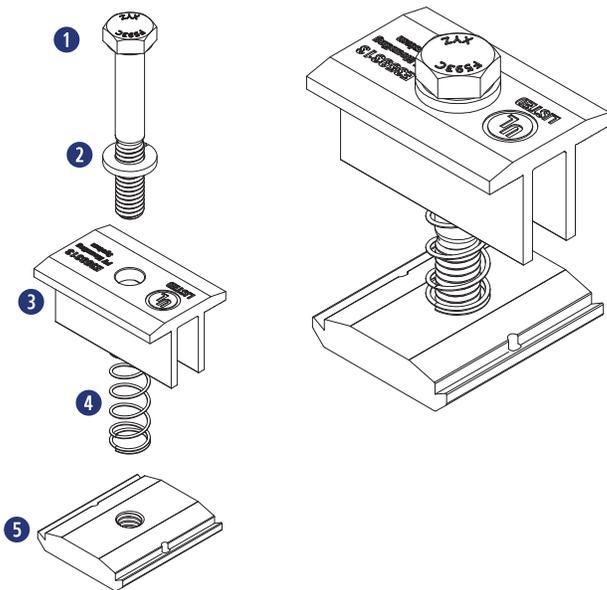
Materials Needed - Module Installation

- 1 Pre-Installed SnapNrack Roof Attachments
- 2 Pre-Installed SnapNrack Rails
- 3 SnapNrack Mid Clamp Assemblies
- 4 SnapNrack End Clamp Assemblies
- 5 PV Modules



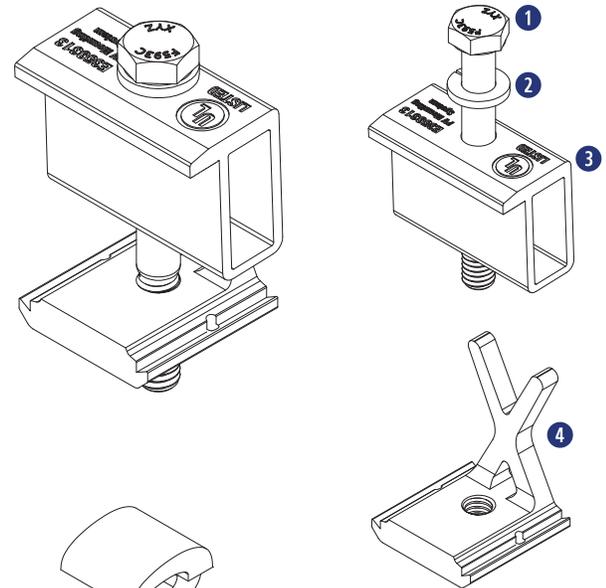
Mid Clamp Assembly

- 1 (1) 5/16"-18 SS HCS Bolt
- 2 (1) 5/16" SS Split Lock Washer
- 3 (1) SnapNrack Mid Clamp
- 4 (1) SnapNrack SS Mid Clamp Spring
- 5 (1) 5/16"-18 SnapNrack Channel Nut



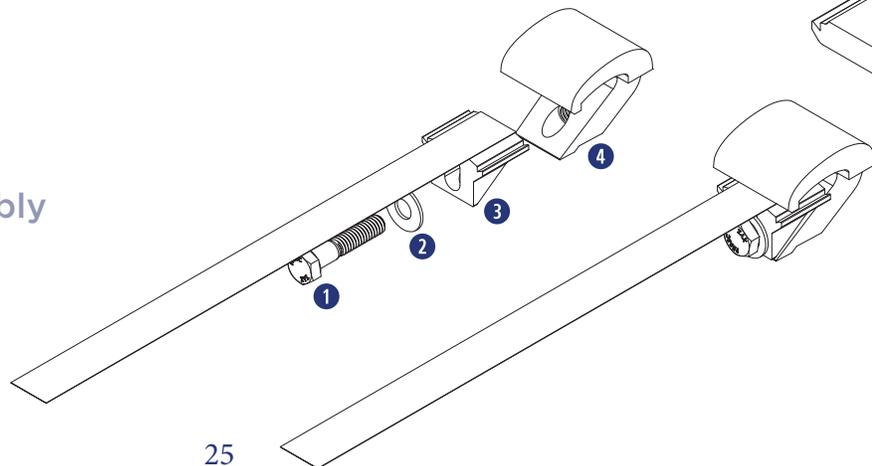
Adjustable End Clamp Assembly

- 1 (1) 5/16"-18 SS HCS Bolt
- 2 (1) 5/16" SS Split Lock Washer
- 3 (1) SnapNrack Adjustable End Clamp Top
- 4 (1) SnapNrack Adjustable End Clamp Bottom



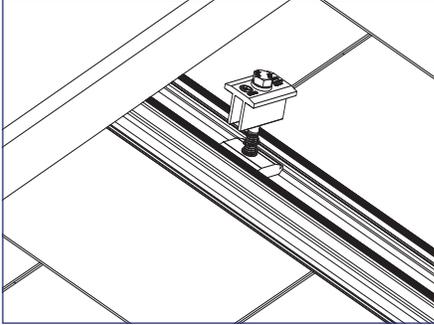
Universal End Clamp Assembly

- 1 (1) 5/16"-18 X 1-1/2" SS HCS Bolt
- 2 (1) 5/16" X 3/4" SS Flat Washer
- 3 (1) SnapNrack Universal Wedge
- 4 (1) SnapNrack Universal Wave



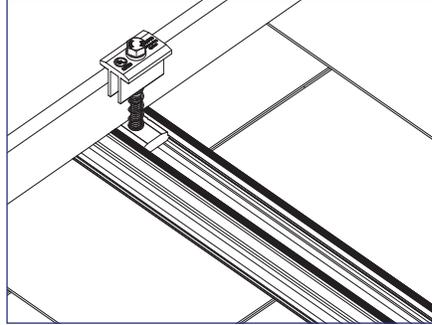
INSTALLATION INSTRUCTIONS

SnapNrack Mid Clamp



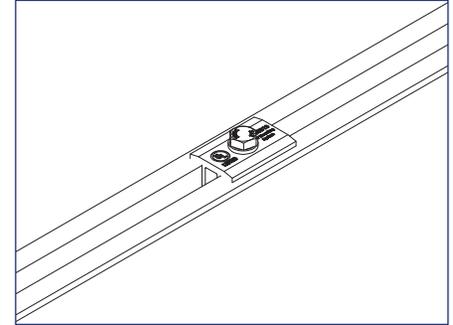
1) Snap the channel nut into the top channel of the rail.

Best Practice:
Backing channel nut off bolt will ease installation into rail channel.



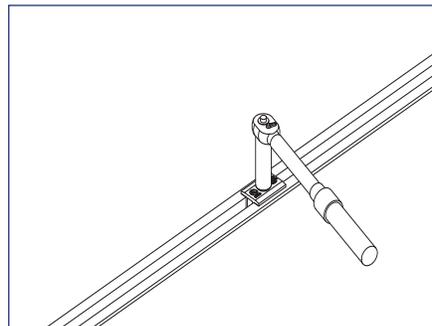
2) Slide the clamp flush to the module with the top lip of the mid clamp over the top edge of the module frame.

Install Note:
Take care to avoid having wires pinched between modules and rails, as this can lead to system failure and be dangerous.



3) Place the next module flush to the other side of the mid clamp.

Install Note:
Mid clamps create 1/2" gap between modules.

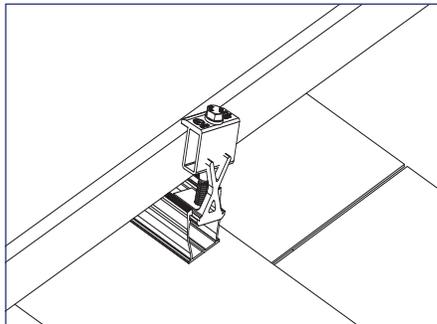


4) Tighten hardware.

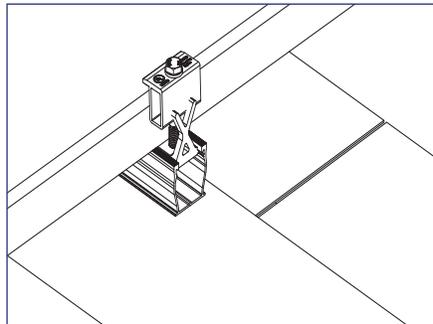
Install Note:
Mid clamps are Listed with and without springs.

INSTALLATION INSTRUCTIONS

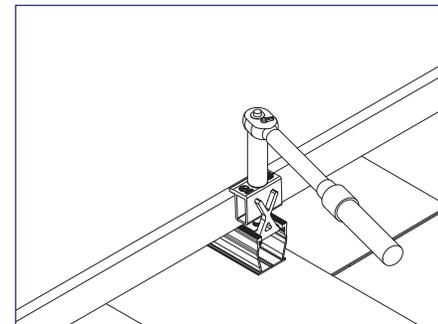
SnapNrack Adjustable End Clamp



1) Snap the channel nut into the top channel of the rail.



2) Slide the clamp flush to the module with the top lip of the end clamp over the top edge of the module frame.



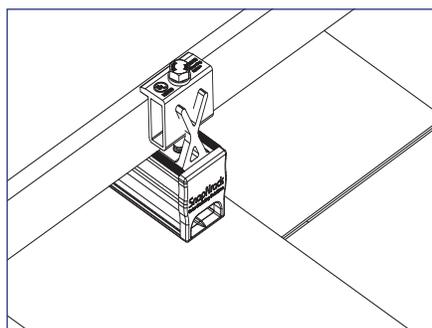
3) Tighten hardware.

Install Note:

Adjustable End Clamps require extra rail to ensure that channel nut is fully engaged.

Install Note:

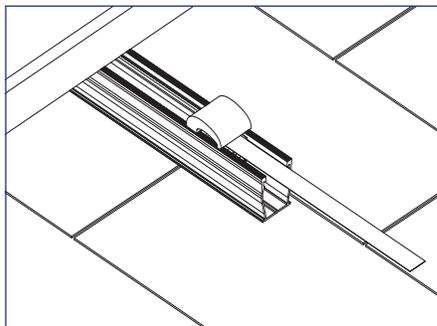
Take care to avoid having wires pinched between modules and rails, as this can lead to system failure and be dangerous.



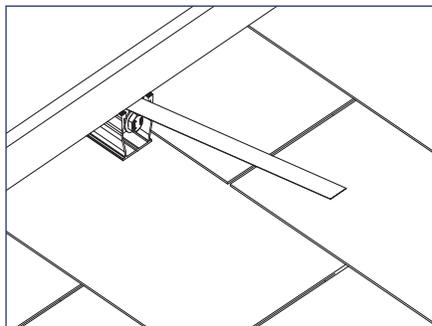
4) Install end cap to finish.

INSTALLATION INSTRUCTIONS

SnapNrack Universal End Clamp



1) Slide the preassembled Universal End Clamp (UEC) into the end of the rail.

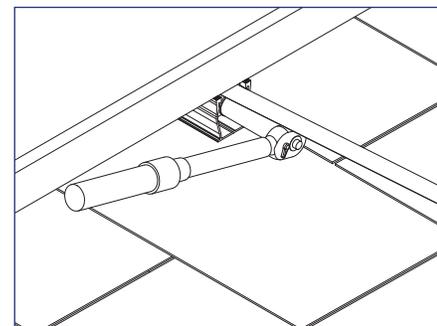


2) Lift the module and slide the clamp far enough under the module to pass the lip of the bottom edge of the module frame.



Install Note:

Take care to avoid having wires pinched between modules and rails, as this can lead to system failure and be dangerous.

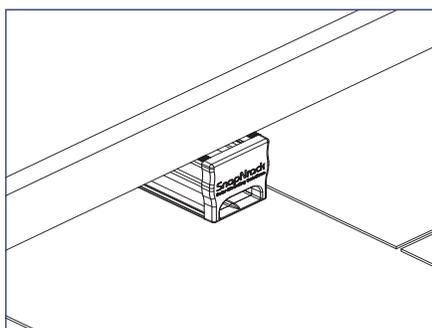


3) Use the pull tab to hold the UEC taut towards the end of the rail and tighten hardware.



Install Note:

Rail can be cut flush to the module when using UEC.



4) Install end cap to finish.



Install Note:

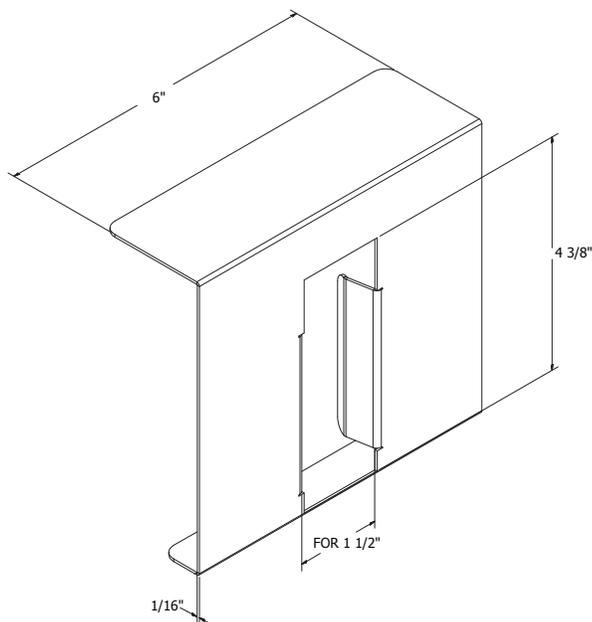
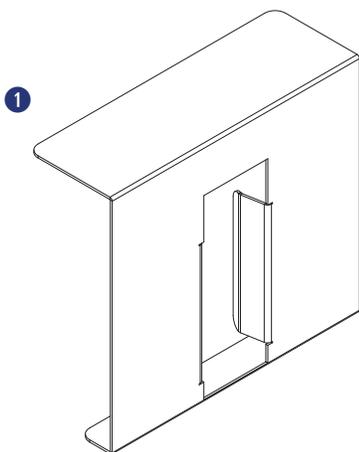
Modules need to be grounded separately when Universal End Clamps are the only type of clamp attaching a module.

Required Tools

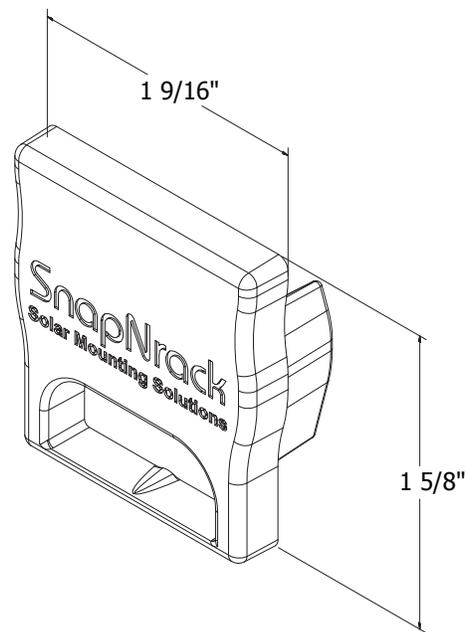
- Reciprocating Saw or Portable Band Saw

Materials Included - Rail Cutting Tool and Rail End Cap

- ① (1) SnapNrack Rail Cutting Tool
- ② (1) SnapNrack Ultra Rail End Cap



Dimensioned Rail Cutting Tool



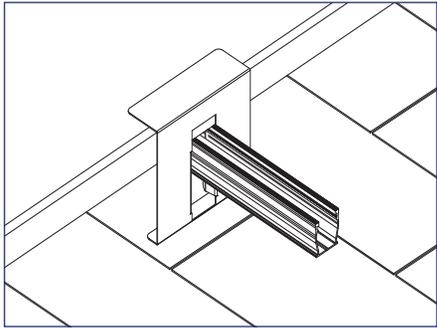
Dimensioned Ultra Rail End Cap



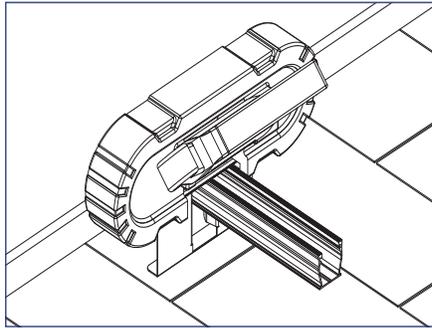
Application Note:

Use to cut rail flush to module frame when using Universal End Clamps (UEC).

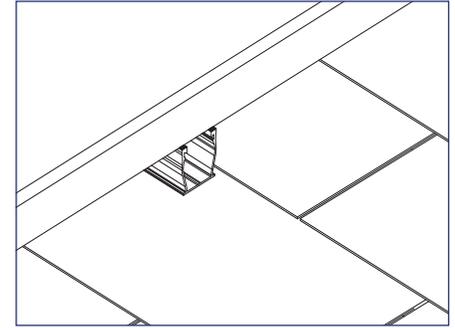
INSTALLATION INSTRUCTIONS



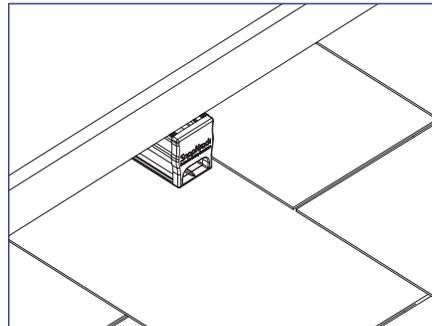
1) Slide the Rail Cutting Tool over the end of the rail and place it so that the upper lip is safely covering the edge of the module (*optional*).



2) Use the reciprocating saw or band saw to cut off the end of the rail (*optional*).



3) Remove the Cutting Tool from the rail (*optional*).



4) Insert SnapNrack Ultra Rail End Cap into the cut end of the rail to create a flush finish to the array.

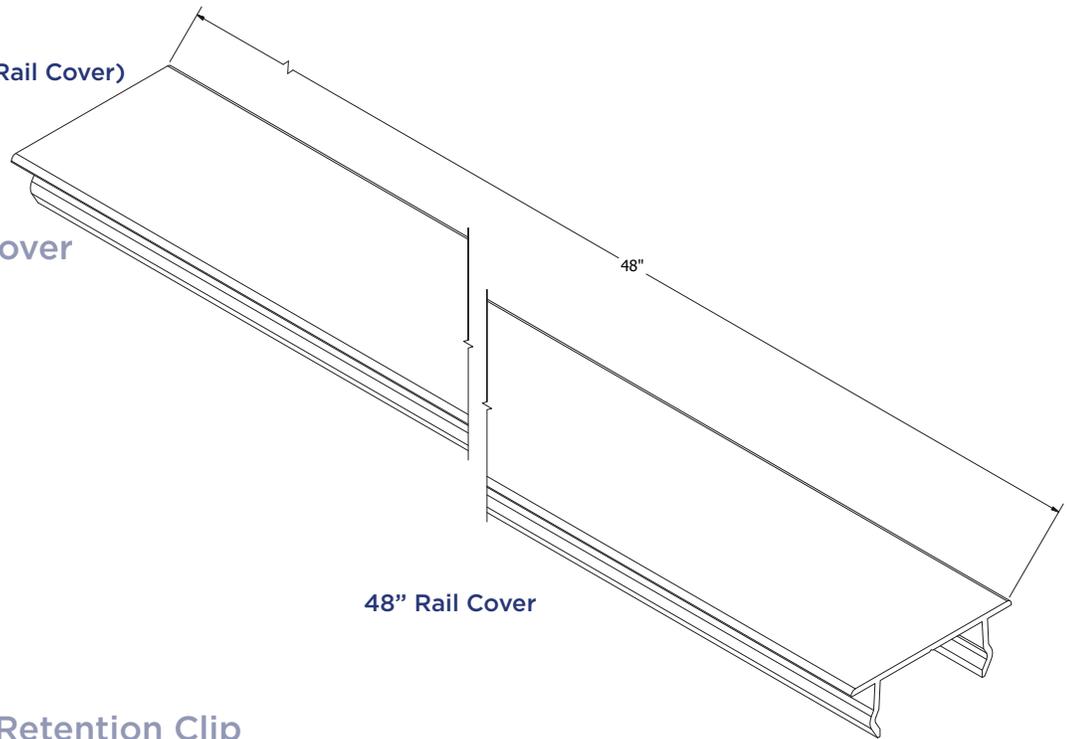
Required Tools

- Reciprocating Saw or Chop Saw (Rail Cover)
- Socket Wrench (Wire Clamp)
- 1/2" Socket (Wire Clamp)

Materials Included - Rail Cover

- ① (1) SnapNrack 48" Rail Cover

? Application Note:
Install to protect any conductors that are exposed to sunlight that are not approved for use in UV light.



Materials Included - Wire Retention Clip

- ① SnapNrack Wire Retention Clip



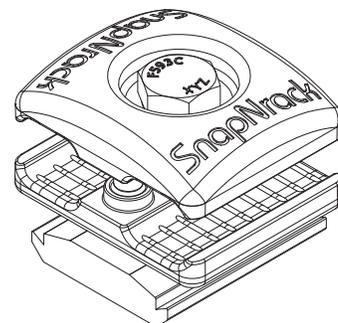
Wire Retention Clip

? Application Note:
Install as necessary to manage and safely retain conductors within SnapNrack rails.

Materials Included - Wire Clamp

- ① (1) SnapNrack 4-Wire Clamp, Trunk Cable Clamp, or Universal Wire Clamp

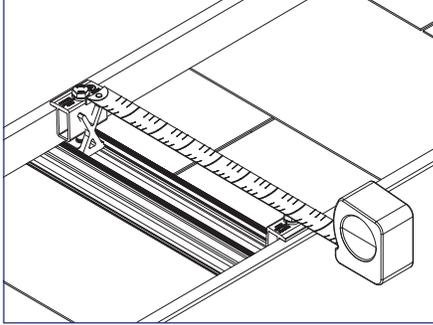
? Application Note:
Install as necessary to secure cables and conductors running from rail to rail, or transitioning out/in from a rail channel



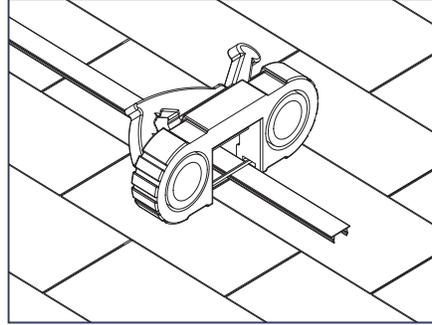
Universal Wire Clamp Assembly

INSTALLATION INSTRUCTIONS

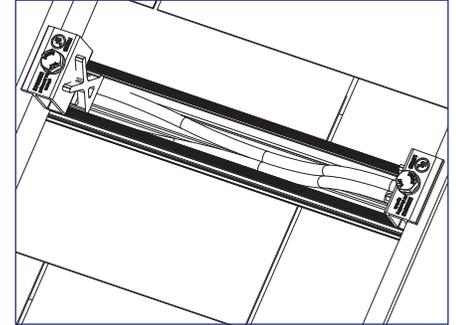
SnapNrack 48" Rail Cover



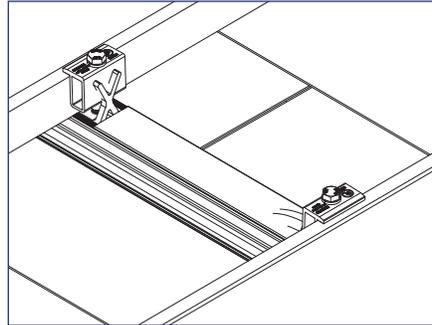
1) Measure the length of the SnapNrack 48" Rail Cover that is needed.



2) Cut the rail cover to length.



3) Place all electrical conductors in the bottom of the rail channel.



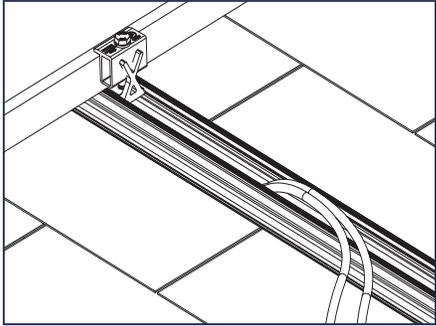
4) Snap Rail Cover into place, enclosing all conductors inside of rail channel.

Install Note:

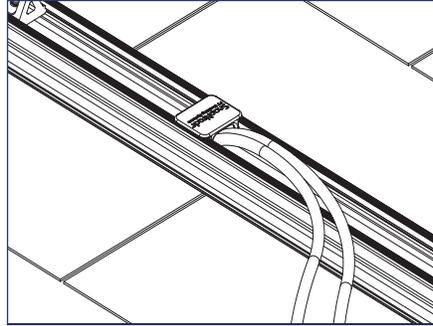
SnapNrack Rail Cover is designed to stay in place once installed, use a flat blade screw driver if it needs to be relocated or removed.

INSTALLATION INSTRUCTIONS

SnapNrack Wire Retention Clip

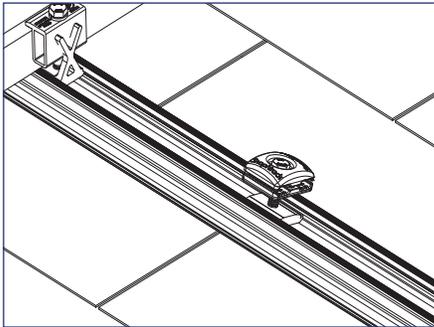


1) Place all electrical conductors in the bottom of the rail channel.

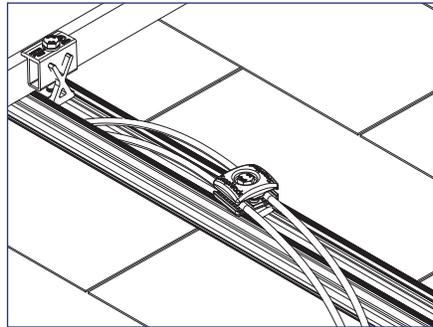


2) Install the Wire Retention Clip by snapping it into place on the rail.

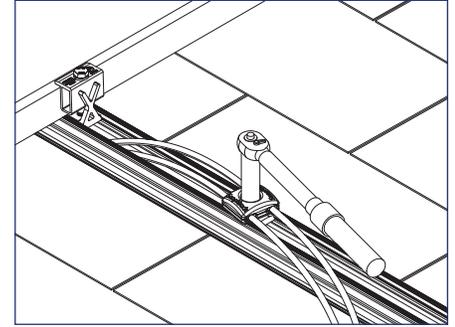
SnapNrack 4-Wire, Trunk Cable, or Universal Wire Clamp



1) Snap Wire Clamp into top or side rail channel.



2) With Wire Clamp loose, place conductors or cables in slots.

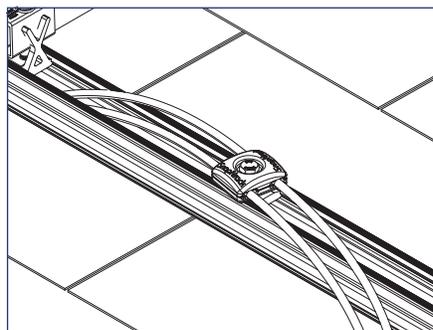


3) Tighten Wire Clamp with 1/2" socket, ensure cables and conductors are aligned in the clamp slots.



Install Note:

Wire Clamps can be rotated and oriented in any direction.



4) 4-Wire Clamp intended for PV Wire conductors, Trunk Cable Clamp intended for trunk cables, Universal Wire Clamp intended for both PV Wire conductors and AC trunk cables.



Install Note:

Conductors of different types should be placed under separate Universal Wire Clamps.

Required Tools

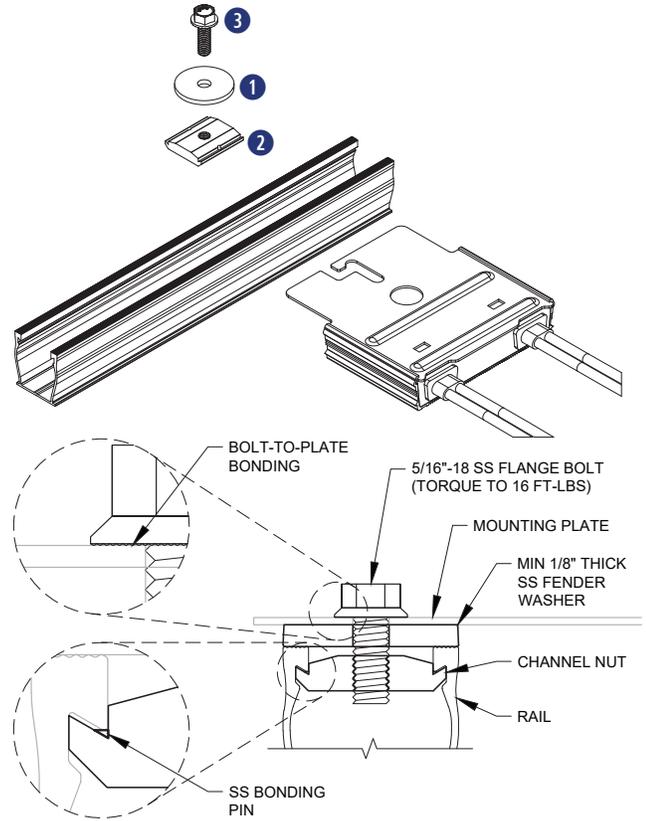
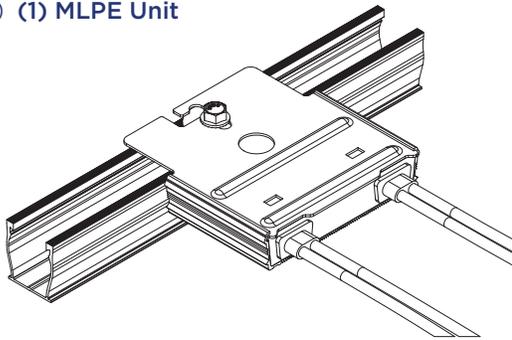
- Torque Wrench
- Socket Wrench
- 1/2" Socket

Materials Included - MLPE Rail Attachment Kit

- ① (1) 5/16" X 1-1/2" X 0.125" SS Fender Washer
- ② (1) SnapNrack Channel Nut
- ③ (1) 5/16"-18 X 1-1/4" SS Flange Bolt

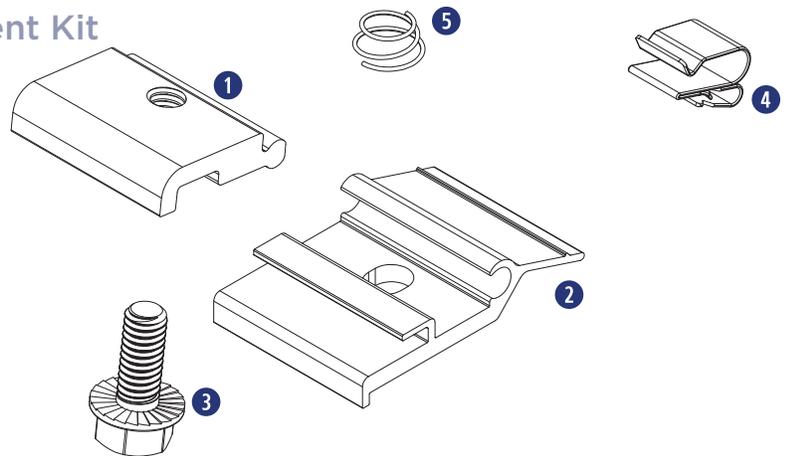
Other Materials Required

- ① (1) MLPE Unit



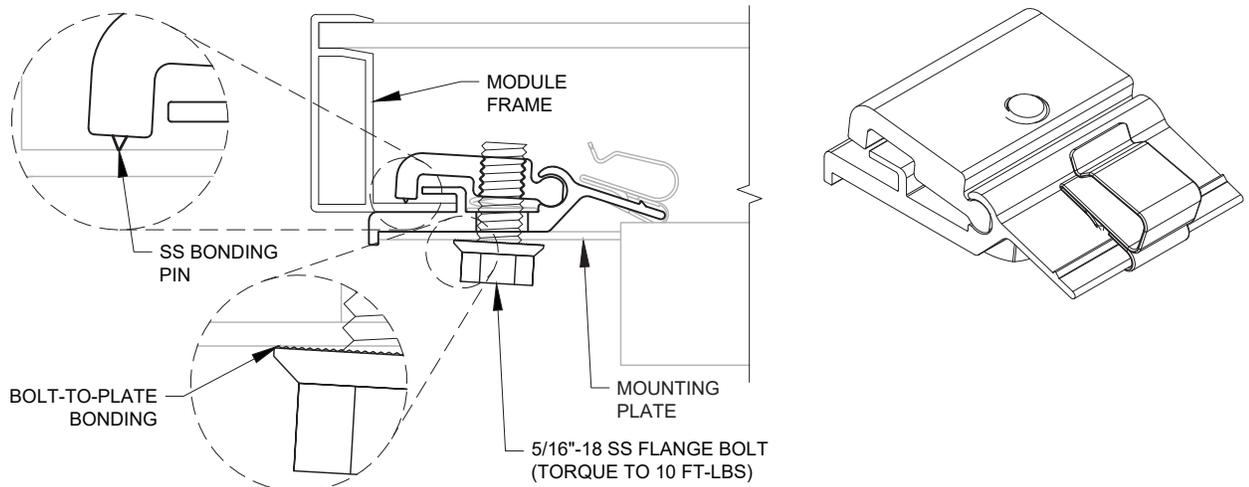
Materials Included - MLPE Frame Attachment Kit

- ① (1) SnapNrack MLPE Frame Attachment Top
- ② (1) SnapNrack MLPE Frame Attachment Bottom
- ③ (1) 5/16"-18 X 3/4" SS Flange Bolt
- ④ (1) SnapNrack Smart Clip II
- ⑤ (1) SnapNrack MLPE Frame Attachment SS Coil Spring



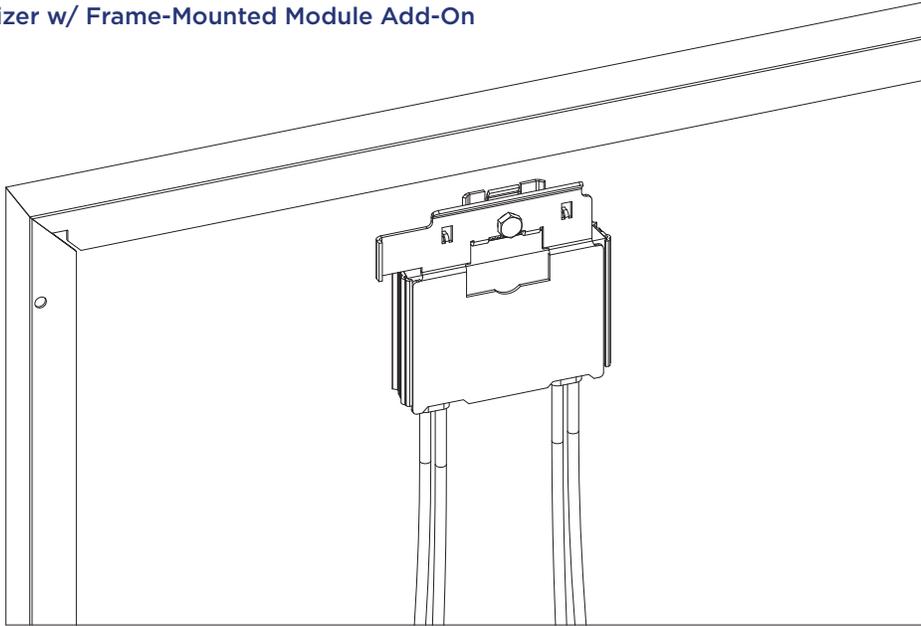
Other Materials Required

- ① (1) MLPE Unit



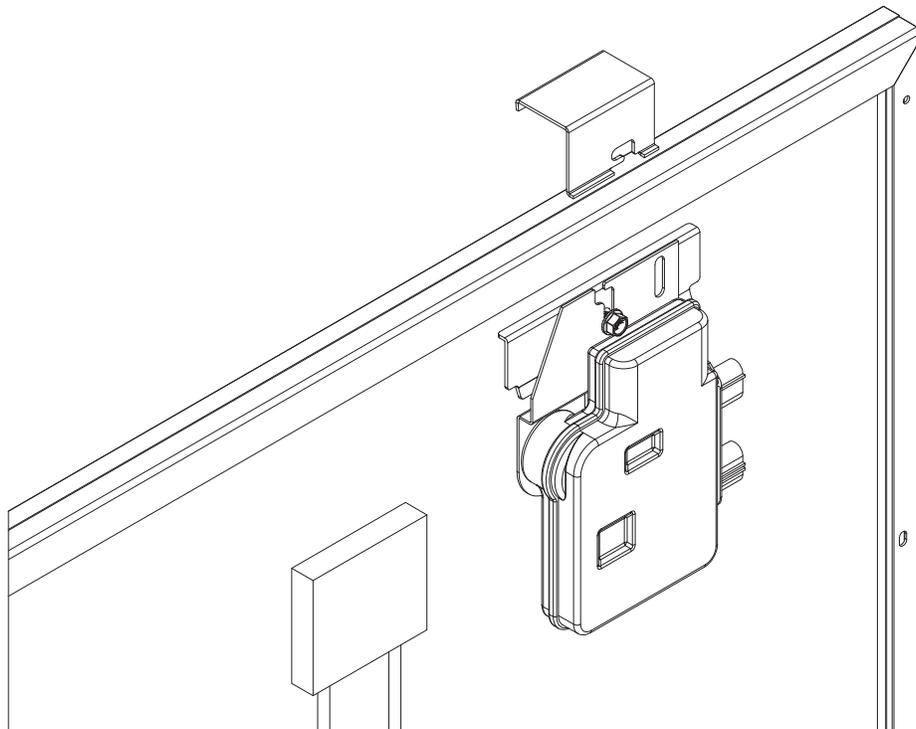
Materials Needed - SolarEdge Frame Mount

- ① (1) SolarEdge Optimizer w/ Frame-Mounted Module Add-On

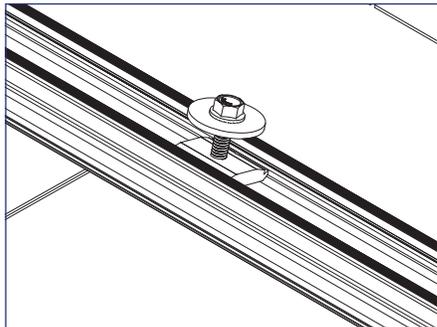


Materials Needed - Enphase Frame Mount

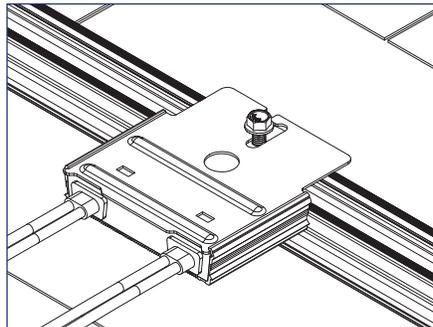
- ① (1) Enphase Microinverter
- ② (1) Enphase Frame Mount



INSTALLATION INSTRUCTIONS - MLPE RAIL ATTACHMENT

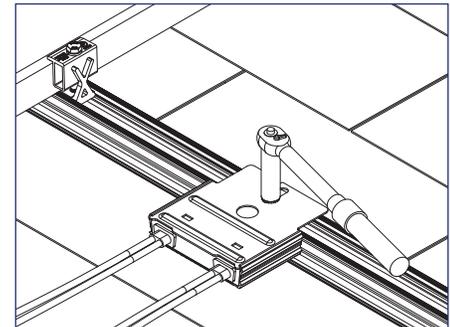


1) Snap the SnapRack MLPE Rail Attachment Kit channel nut into the desired location on the rail where the microinverter will be installed.



2) Install the microinverter mounting plate onto the bolt of the MLPE Rail Attachment Kit, ensuring that the large fender washer is between the rail and mounting plate.

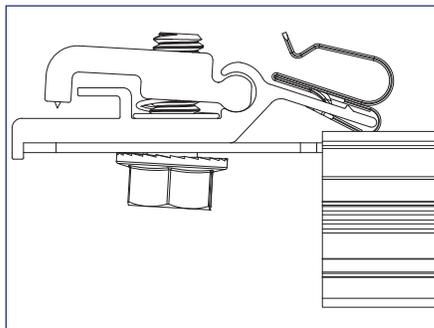
Install Note:
Bolt and washers may need to be removed and then replaced.



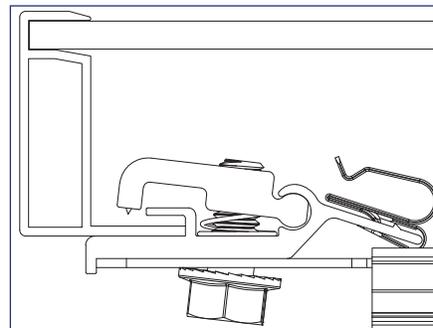
3) Tighten hardware.

Install Note:
MLPE Attachment Kits are approved for bolt lengths between 1" and 1-1/2" long.

INSTALLATION INSTRUCTIONS - MLPE FRAME ATTACHMENT

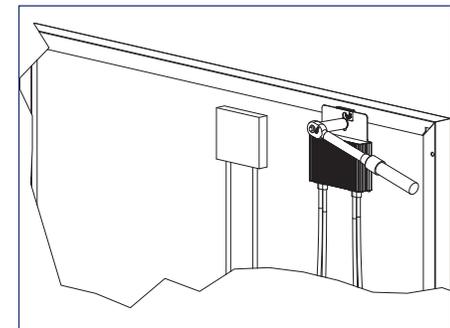


1) Slide the backplate channel of the MLPE device under the MLPE Frame Attachment Kit bolt. The MLPE mounting plate should rest against the MLPE mounting plate backstop on the MLPE Frame Attachment Kit.



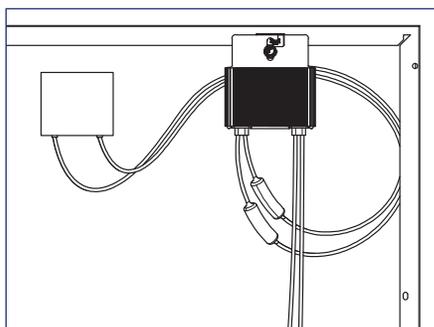
2) Position the MLPE Frame Attachment Kit on the module frame flange in a location that will not interfere with mounting system components. The module frame flange should rest against the module flange backstop on the MLPE Frame Attachment Kit.

Install Note:
Avoid blocking module frame drainage holes when installing the MLPE Frame Attachment Kit.



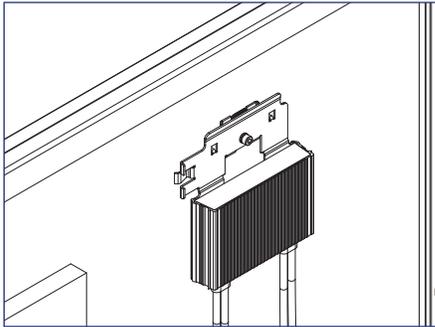
3) Tighten the mounting bolt on the MLPE Frame Attachment Kit.

Install Note:
The MLPE Frame Attachment Kit bonds the following components: Module Frame, MLPE backplate and Smart Clip.

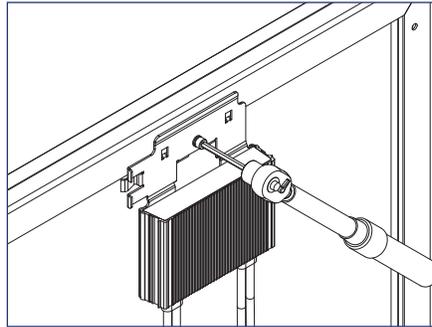


4) Connect the module leads to the input connectors on the MLPE device and manage conductors with the integrated Smart Clip.

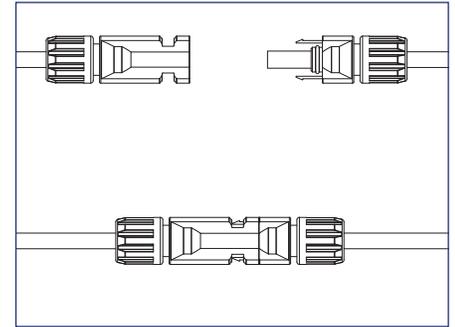
INSTALLATION INSTRUCTIONS - SOLAREGE FRAME MOUNT



1) Locate the SolarEdge optimizer with Frame-Mounted Module Add-On at a location on the module frame that will not interfere with the SnapNrack rail.



2) Install the optimizer mounting plate onto the module frame and tighten hardware.

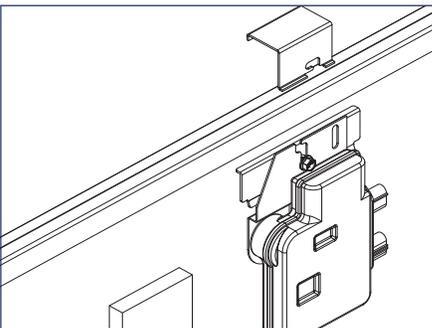


3) Connect the module leads to the input connectors on the optimizer.

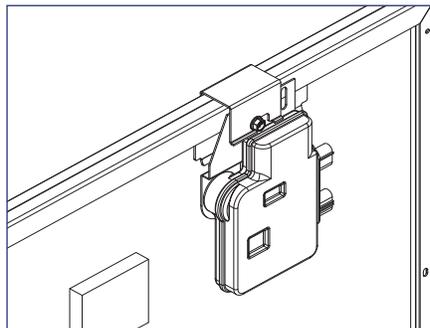
Install Note:

Refer to the SolarEdge optimizer Frame-Mounted Module Add-On installation guide for additional instructions.

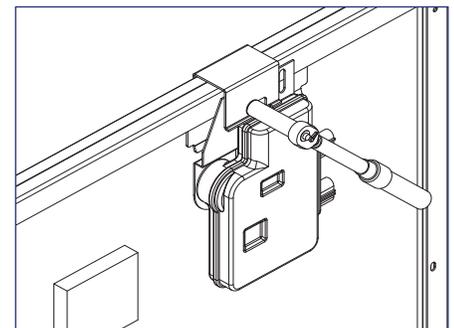
INSTALLATION INSTRUCTIONS - ENPHASE FRAME MOUNT



1) Locate the Enphase Frame Mount bracket clamp at a location on the module frame that will not interfere with the SnapNrack rail.



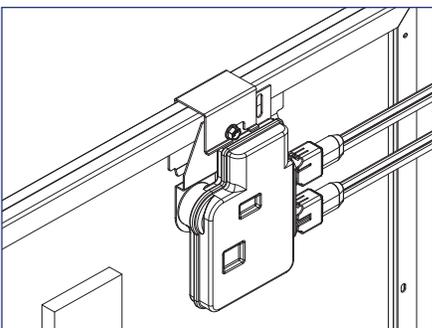
2) Slide the microinverter unit onto the bracket clamp, then move it slightly to the left.



3) Tighten hardware to 13 ft-lbs

Install Note:

The microinverter mounting flange should be on the outside of the module frame.



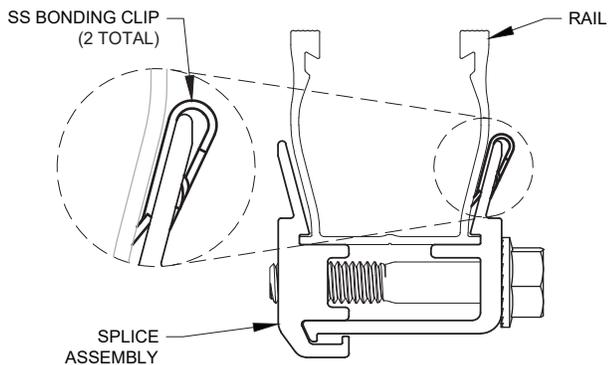
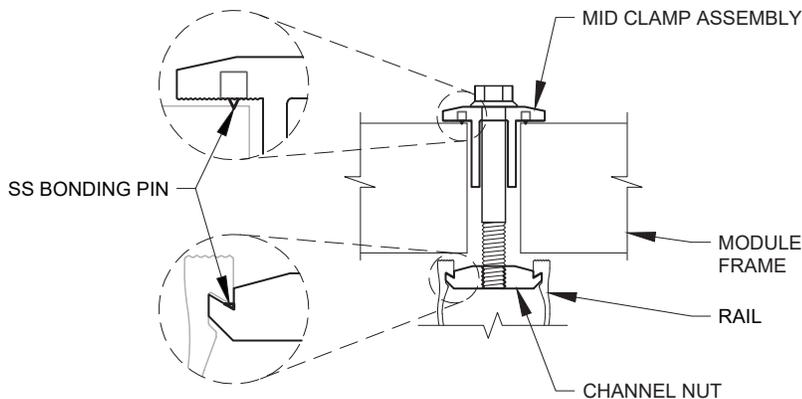
4) Connect the module leads to the microinverter DC connectors.

Install Note:

Refer to the Enphase Frame Mount installation guide for additional instructions.

System Bonding Methods

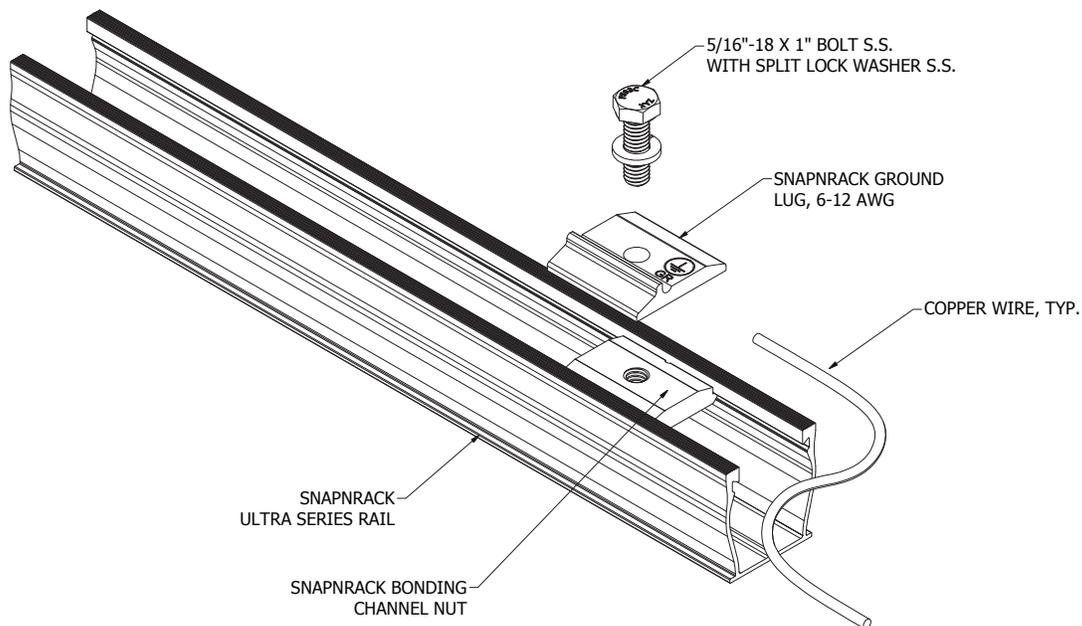
- 1 SnapNrack Mid Clamp
- 2 SnapNrack Adjustable End Clamp
- 3 SnapNrack Ultra Rail Splice



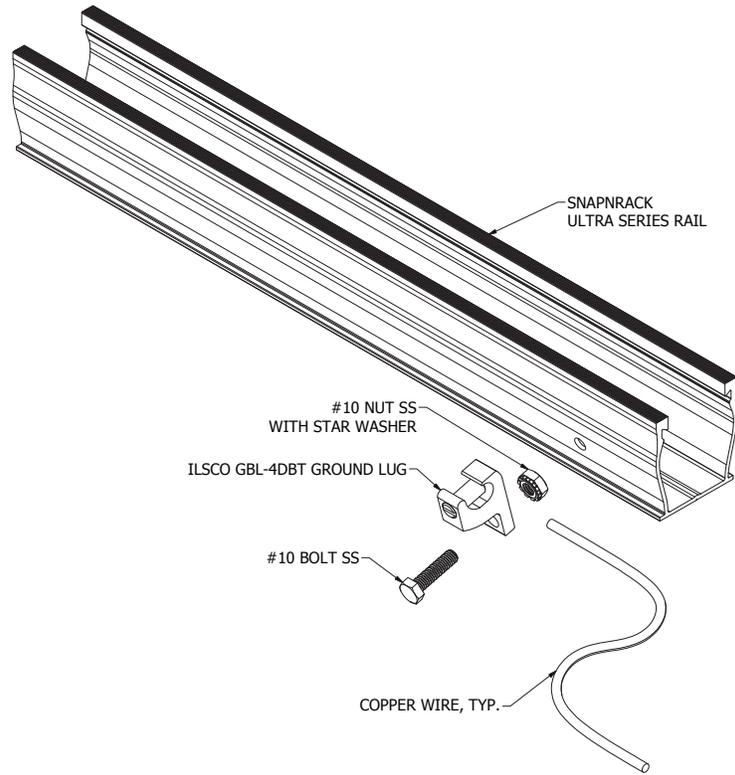
Note:
SnapNrack module clamps contain a SnapNrack Channel Nut with integral bonding pins in assembly to properly bond the system (except Universal End Clamps).

Note:
SnapNrack Ultra Rail Splices contain integral bonding clips in assembly to properly bond the system.

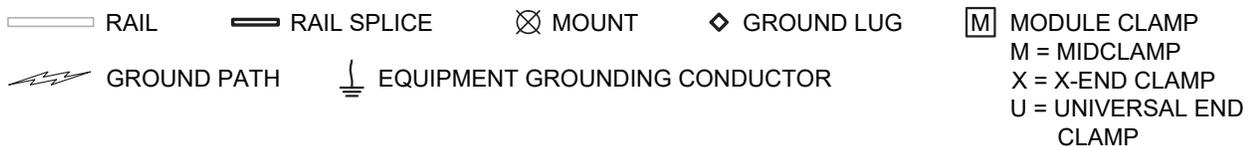
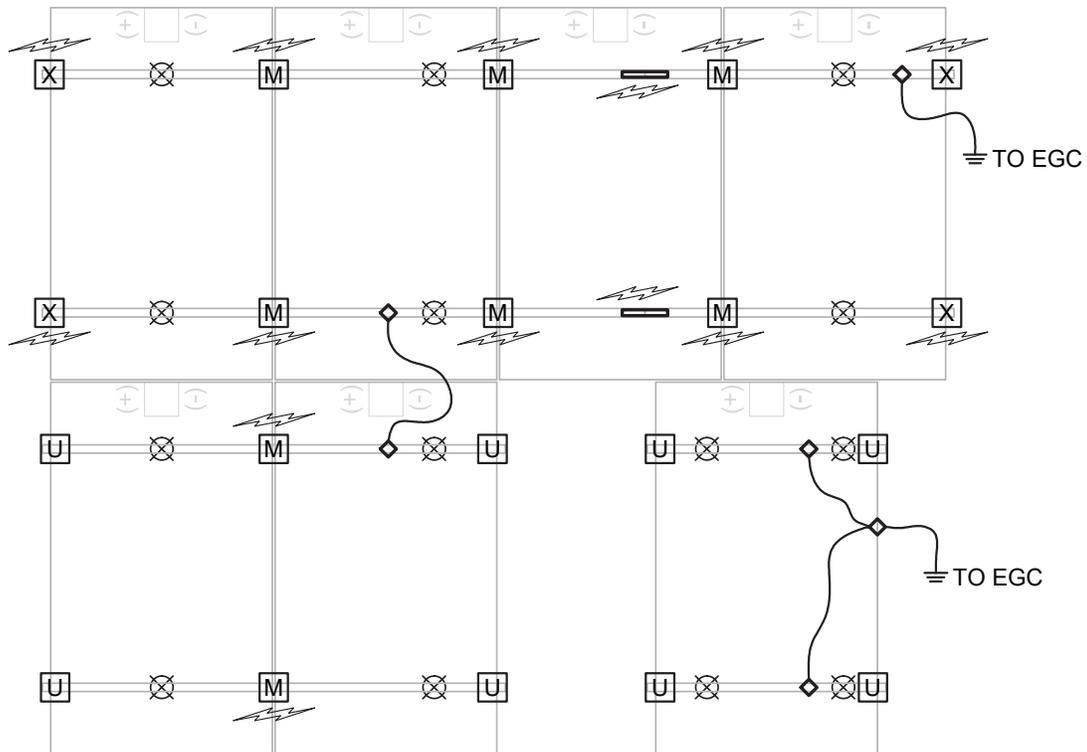
SnapNrack Ground Lug Assembly



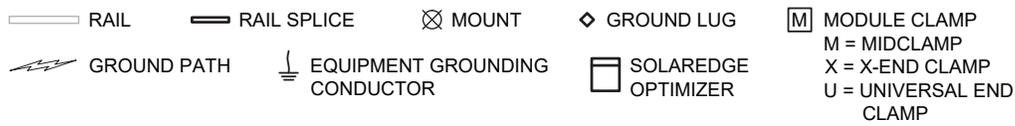
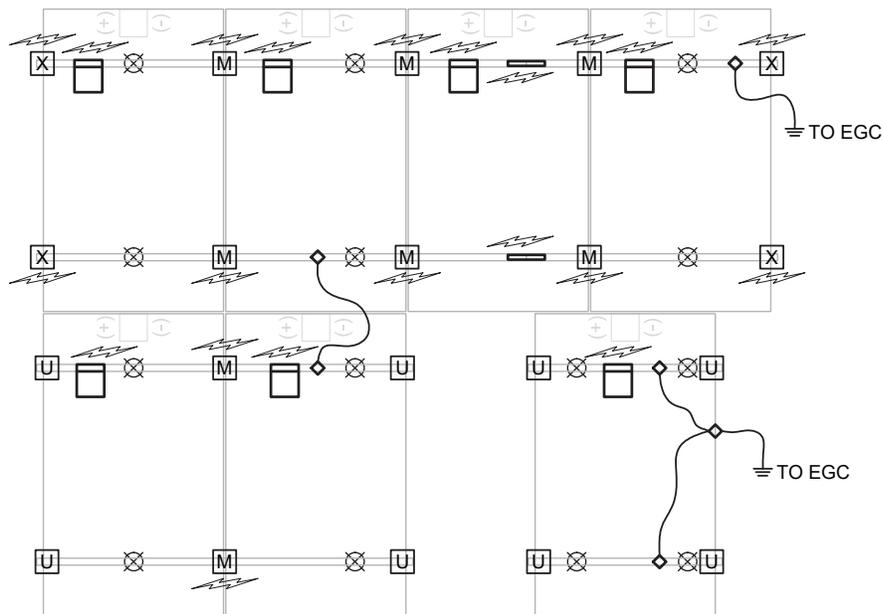
IlSCO Lay-in Lug Assembly



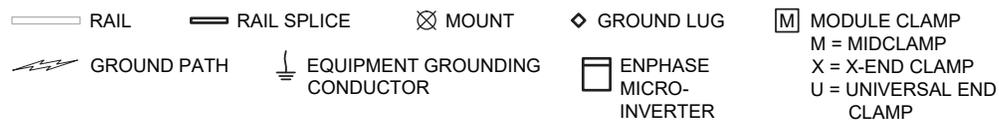
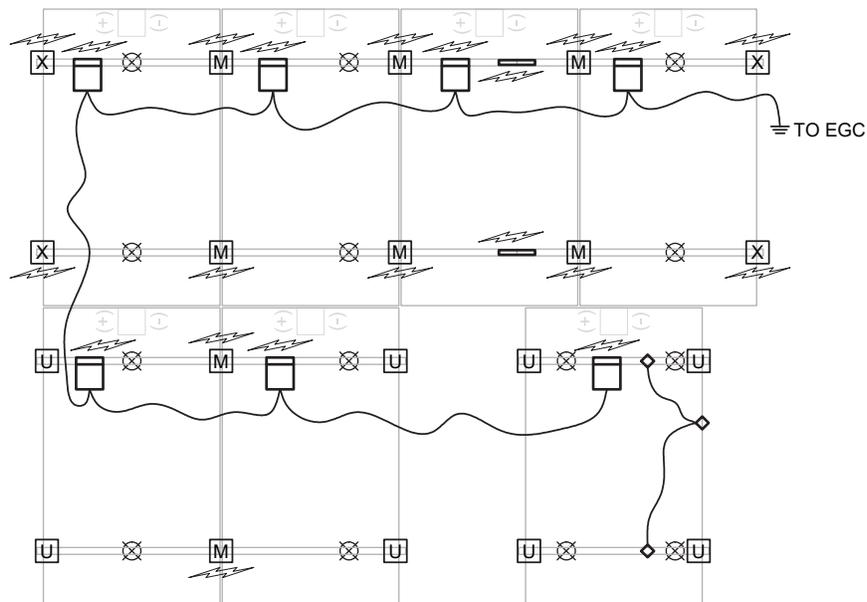
Ground Path Details



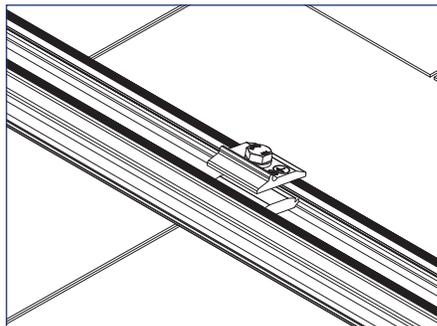
Ground Path Details - SolarEdge



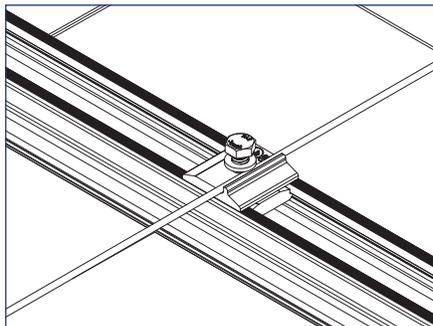
Ground Path Details - Enphase



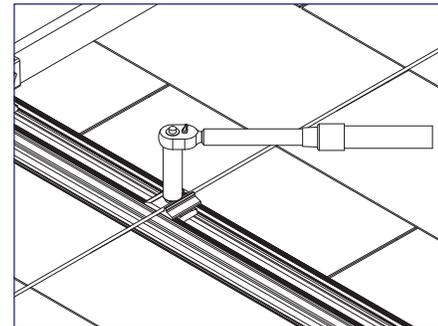
INSTALLATION INSTRUCTIONS - SNAPNRACK GROUND LUG



1) Snap the SnapNrack Ground Lug into the rail channel on one rail per module row.



2) Place grounding conductor into slot underneath split ring washer.



3) Tighten all hardware.

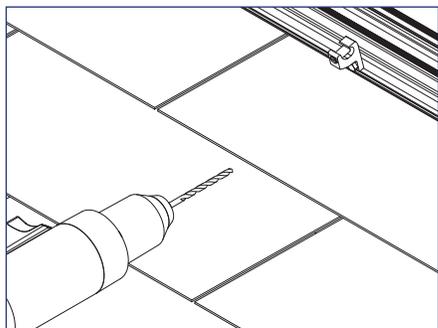
Install Note:

SnapNrack Ground Lug may be used in side or top channel, and may be rotated 90 degrees relative to slot to facilitate running copper across top of rails.

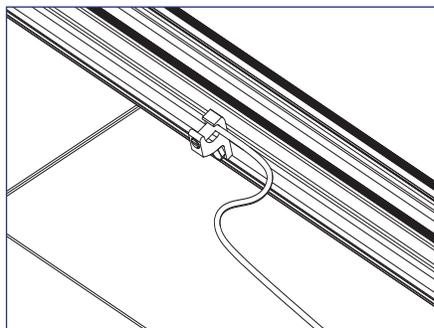
Install Note:

SnapNrack Ground Lug only Listed for use with 6-12 AWG solid copper conductor.

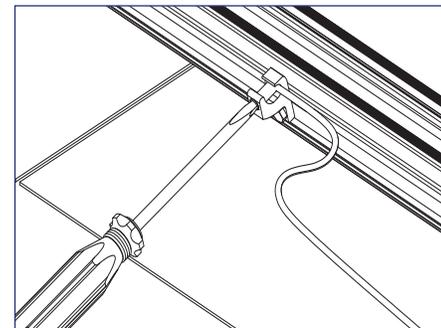
INSTALLATION INSTRUCTIONS - ILSCO LAY-IN LUG



1) Drill and deburr a 1/4" hole in the back side of the rail for the IlSCO lug to attach to, place the bolt through the hole, and attach the lug assembly on one rail per module row.



2) Place grounding conductor into slot.



3) Tighten set screw per IlSCO's recommendation (see below).

Install Note:

Torque rail connection to 35 ft-lbs.

Install Note:

Torque set screw to 20 in-lbs for #10-#14 solid and stranded copper, 25 in-lbs for #8 stranded copper, and 35 in-lbs for #4-#6 stranded copper.

Note:

- System has been evaluated to a maximum overcurrent device (OCD) protection level of 20 Amps.
- Universal End Clamp (UEC) does not bond module to rail. Be sure to separately ground any modules that are only secured by UECs, especially during servicing.
- SnapNrack recommends that bare copper never come into contact with aluminum.
- SnapNrack Ground Lug: torque bolt to 16 ft-lbs. The Ground Lug may be used in side or top channel. It may be rotated 90 degrees relative to slot to facilitate running copper across top of rails.
- Grounding with a standard IlSCO GBL-4DBT Lug is a listed alternate and requires drilling of a hole in the rail.
- IlSCO hardware connection to rail: 5 ft-lbs. Torque for lug set screw: #10-#14 solid and stranded copper- 20 in-lbs, #8 stranded copper- 25 in-lbs, #4-#6 stranded copper- 35 in-lbs.

Ultra Rail has been tested with the following UL Listed modules:

The Ultra Rail System employs top-down clamps which have been evaluated for frame-to-system bonding, at specific mounting torques and with the specific modules listed below. The system has been assessed to a maximum Over-Current Device (OCD) protection level of 20 amps. The UL file number is included in parentheses below.

Hyundai Heavy Industries Co Ltd (E325005): HiS-MXXXRG Series where XXX is 235 to 275; HiS-SXXXRG where XXX is 245 to 295; HiS-SXXXRW where XXX is 250 to 265; HiS-MXXXMG where XXX is 210 to 270; HiS-SXXXMG where XXX is 220 to 275. All may be followed by the suffix BK or blank.

Jinko Solar (E362479): Models JKMXXXP-60 where XXX is 200 to 290; JKMXXXP-72 where XXX is 250 to 360; JKMXXXM-60 where XXX is 200 to 305; JKMXXXM-72 where XXX is 250 to 360; JKMXXXPP-60 where XXX is 200 to 290; JKMXXXPP-72 where XXX is 250 to 360; JKMXXXP-60-V where XXX is 200 to 290; JKMXXXP-72-V where XXX is 250 to 360; JKMXXXPP-60-V where XXX is 200 to 300; JKMXXXPP-72-V where XXX is 250 to 360; JKMSXXXP-72 where XXX is 250 to 330; JKMXXXP-60-J4 where XXX is 200 to 290; JKMXXXP-60B-J4 where XXX is 200 to 290.

Kyocera (E467150): KU-60 1000 V Series - KUXXX, where XXX is 250 to 275, followed -6BCA, -6BFA, -6BPA, -6DCA, -6DFA, -6DPA, -6MCA, -6MPA, -6XCA, -6XPA, -6ZCA, -6ZPA, -6ZPB, -6ZCB, -6ZPC, -6ZCC, -6ZPD, -6ZCD, -6ZPE, 6ZCE, -6MPC, -6MCC, -6MPB or -6MCB; KU-80 1000 V Series - KUXXX, where XXX is 315 to 335, followed by -8BCA, -8BFA or -8BPA.

LG (E329725) - LGXXXQ1C-A5 where XXX is 340 to 385; LGXXXQ1K-A5 where XXX is 315 to 375.

Panasonic (E181540) - VBHNXXXSA16 where XXX is 320 to 335; VBHNXXXKA01 and VBHNXXXKA02 where XXX is 310 to 325; VBHNXXXKA03 and VBHNXXXKA04 where XXX is 310 to 325; VBHNXXXSA17 and VBHNXXXSA18 where XXX is 325 to 335.

REC Solar AS (E308147): RECXXX, where XXX is 214 to 270, all may be followed by PE, PE(BLK), PE-US, PE-US(BLK), PEQ2 or PEQ3.

Renesola Jiangsu Ltd (E312637): JCXXXM-24/Bb Series where XXX is 200 to 270; JCXXXM-24/BBh Series where XXX is 235 to 270.

Suniva Inc (E333709): MVX-XXX-60-5-YYY where XXX is 235 to 265 and YYY is 701 or 7B1; OPT-XXX-60-4-YYY where XXX is 250 to 275 and YYY is 800 or 8B0.

Sunpower (E246423): Gen 3 or Gen 5 frame models SPR-XY-### where YY represents numbers 18, 19, 20 or 21, and ### represents any number from 365 to 310 and 274 to 233; Gen 3 or Gen 5 frame models SPR-EYY-### where YY represents numbers 18, 19, 20 or 21, and ### represents any number from 345 to 285 and 250 to 225.

Talesun Solar (E359349) - TP660P-XXX where XXX is 235 to 285; TP660M-XXX where XXX is 240 to 300; TP672P-XXX where XXX is 280 to 345; TP672M-XXX where XXX is 290 to 360.

Trina Solar Ltd (E306515) - TSM-XXXPA05 where XXX is 215 to 260; TSM-XXXPA05.05 where XXX is 215 to 260; TSM-XXXPA05.08 where XXX is 215 to 260; TSM-XXXPD05 where XXX is 240 to 280; TSM-XXXPD05.05 where XXX is 240 to 280; TSM-XXXPD05.08 where XXX is 240 to 280; TSM-XXXPD05.08D where XXX is 245 to 275 TSM-XXXDD05A(II) where XXX is 260-300; TSM-XXXDD05A.08(II), TSM-XXXDD05A.05(II) Series where XXX is 260 to 300. All may be followed by Black or White.

Yingli Energy (China) Co Ltd (E320066) - YLXXXP-29b where XXX is 215 to 260; YLXXXA-29b where XXX is 220 to 255.

NRTL Listed PV Modules:

Boviet Solar: Models BVM6610P-XXX where XXX is 225 to 275; BVM6610M-XXX where XXX is 235 to 280; BVM6612P-XXX where XXX is 270 to 330; BVM6612M-XXX where XXX is 280 to 340.

Canadian Solar: Models CS6P-XXX-P where XXX is 200 to 285; CS6P-XXX-M where XXX is 200 to 290; CS6P-XXX-P-SD where XXX is 240 to 285; CS6K-XXX-M where XXX is 240 to 305; CS6K-XXX-M-SD where XXX is 240 to 305; CS6K-XXX-P where XXX is 220 to 285; CS6K-XXX-P-SD where 220 to 285; CS6X-XXX-P where XXX is 250 to 345; CS6V-XXX-M where XXX is 215 to 225; CS6V-XXX-P where XXX is 250 to 255; CS3K-XXX-P where XXX is 250 to 310; CS3K-XXX-MS where XXX is 280 to 330; CS1K-XXX-MS where XXX is 285 to 345.

ET Solar: ET-P660XXXBB where XXX is 200 to 265; ET-P660XXXWB where XXX is 200 to 265; ET-P660XXXWW where XXX is 200 to 265; ET-P660XXXWWG where XXX is 235 to 265; P660XXXWB/WW where XXX is 200 to 265 and may be followed by WB or WW; P660XXXWWG where XXX is 240 to 250; M660XXXBB where XXX is 250 to 265; M660XXXWW where XXX is 200 to 270.

Hanwha Q Cells: Q.Pro BFR-G4-XXX where XXX is 205 to 295. Q.Pro BFR-G4.1-XXX where XXX is 245 to 295. Q.Plus BFG-G4-XXX where XXX is 255 to 280. Q.Plus BFG-G4.1-XXX where XXX is 270-280. Models Q.BASE-GY XXX, Q.PRO-GY XXX, Q.PLUS-GY XXX, Q.PRO BFR-GY XXX, Q.PLUS BFR-GY XXX, Q.PRO BLK-GY XXX, Q.PRO-GY/SC XXX, where Y is the generation number between 1.x and 9.x, where XXX is 205 to 295; Q.PEAK-G3.1 XXX and Q.PEAK BLK-G3.1 XXX where XXX is 270 to 325; Q.PLUS BFR-G3.1 where XXX is 245 to 295.

Hanwha SolarOne: Models HSL60P6-PB-X-YYYQ where X is 2 or 4, and YYY is 230 to 270, may be followed by additional suffixes.

JA Solar: Models JAP6-60-XXX/3BB where XXX is 235 to 265; JAM6-60-XXX/SI where XXX is 250 to 270.

LG Electronics Inc.: Models LGXXS1C-G4 where XXX is 250 to 300; LGXXN1K-G4 where XXX is 280 to 300; LGxxxN1C-G4 where XXX is 280 to 340; LGXXN2C-G4, LGXXN2W-G4, where XXX is 360 to 395; LGXXN2K-G4, where XXX is 360 to 385; LGXXS2C-G4, LGXXS2W-G4, where XXX is 300 to 360; LGXXN2C-B3, LGXXN2W-B3, where XXX is 330 to 400; LGXXS1C-A5 where XXX is 280 to 320; LGXXN1C-A5 where XXX is 320 to 345; LGXXN1K-A5 where XXX is 310 to 335.

Longi Green Energy Technology Co., Ltd.: LR6-60-XXXM, LR6-60BK-XXXM, LR60-HV-XXXM, where XXX is 270 to 300; LR6-60PB-XXXM, LR6-60PE-XXXM, LR6-60PH-XXXM, where XXX is 280 to 310.

Mission Solar: Models MSEXXS05T where XXX is 260 to 290; MSEXXS05K where XXX is 270 to 290; MSEXXSQ5T where XXX is 280 to 300; MSEXXSQ5K where XXX is 285 to 305; MSEXXMM4J and MSEXXMM6J where XXX is 320 to 330; MSEXXS06W where XXX is 320 to 340; MSEXXS04J and MSEXXS06J where XXX is 320 to 350; MSEXXSQ4S and MSEXXSQ6S where XXX is 345 to 365.

REC Solar PTE. LTD.: Models RECXXXPE Series where the XXX is 214 to 280; RECXXTP Series where XXX is 260 to 300; RECXXTP2 Series where XXX is 260 to 300; RECXXTP IQ Series where XXX is 260 to 300; All may be followed by BLK; RECXXTP72, where XXX is 330 to 345; RECXXX, where XXX is 285 to 325, followed by PE72, PE72BLK, PE72 Q2 or PE72 Q3; RECXXXPE72XV, where XXX is 295 to 325, followed by PE72 XV, PE72 XV Q2 or PE72 XV Q3.

Silfab: SLAXXX-M, where XXX is 280 to 300; SLGXXX-M, where XXX is 335 to 360; SLAXXX-P, where XXX is 250 to 265; SLGXXX-P, where XXX is 300 to 315; SSAXXX-M, where XXX is 280 to 300; SSGXXX-M, where XXX is 335 to 360; SSAXXX-P, where XXX is 250 to 260; SSGXXX-P, where XXX is 300 to 315.

Solar World: Models SWXXX-Mono where XXX is 200 to 300; SWXXX-Mono XL where XXX is 320 to 350. All may be followed by Black.

Suniva Inc: OPTXXX-60-4-YYY where XXX is 240 to 300 and YYY is 100; OPTXXX-60-4-YYY where XXX is 235 to 300 and YYY is 1B0.

Trina Solar Ltd: Models TSM-XXXPD05.002 or TSM-XXXPD05.082 where XXX is 215 to 275; TSM-XXXDD05A.082(II) where XXX is 260 to 315; TSM-XXXPD05.08S and TSM-XXXPD05.05S where XXX is 215 to 275; all may be followed by Black.

The following components have been evaluated for mechanical loading:

Ultra Rail, Mid Clamp, X End Clamp, Universal End Clamp, Ultra Rail Splice, Ultra Rail Composition Mount Kits, Standard Standoff for Ultra Rail, Four Hole Standoff for Ultra Rail, Heavy Duty Standoff for Ultra Rail, Metal Roof Base Standoff for Ultra Rail, Ultra Rail Corrugated Block, Standard Base Seam Clamp for Ultra Rail, Wide Base Seam Clamp for Ultra Rail, Ultra Rail Universal Tile Hook, Ultra Rail Flat Tile Hook, Flat Tile Replacement Kit for Ultra Rail, S Tile Replacement Kit for Ultra Rail, W Tile Replacement Kit for Ultra Rail.

The UL Listing covers mechanical load ratings for the following span lengths, module orientations and downforce, uplift, and down-slope ratings:

Span	Orientation	Direction	Load Rating (lb/ft ²)
4 or 6 feet	Long Side or Short Side Mounting	Downforce	10
		Uplift	5
		Down-Slope	5

Ultra Rail has been tested with the following UL Listed modules:

The Ultra Rail System has been evaluated for mechanical loading for its top-down clamps with the specific modules listed below. The UL file number is included in parentheses below. *(The following modules were also evaluated for bonding. Please see Grounding Specifications section.)*

Hyundai Heavy Industries Co Ltd (E325005): HiS-MXXXRG Series where XXX is 235 to 275; HiS-SXXXRG where XXX is 245 to 295; HiS-SXXXRW where XXX is 250 to 265.

JA Solar (E328263): Models JAP6-60-XXX/3BB where XXX is 235 to 250.

Jinko Solar (E362479): Models JKMXXXP-60 where XXX is 200 to 290; JKMXXXM-60 where XXX is 200 to 290; JKMXXXPP-60 where XXX is 200 to 290; JKMXXXP-60-J4 where XXX is 200 to 290; JKMXXXP-60B-J4 where XXX is 200 to 290.

Panasonic (E181540) - VBHNXXXSA16 where XXX is 320 to 335; VBHNXXXKA01 and VBHNXXXKA02 where XXX is 310 to 325; VBHNXXXKA03 and VBHNXXXKA04 where XXX is 310 to 325; VBHNXXXSA17 and VBHNXXXSA18 where XXX is 325 to 335.

ReneSola (E312637): Models JCXXXM-24/Bbh where XXX is 235 to 270.

Trina Solar (E306515): Models TSM-XXXPD05, TSM-XXXPD05.05 and TSM-XXXPD05.08, where XXX 240 to 280; TSM-XXXPD05.08D where XXX is 245 to 275 TSM-XXXDD05A(II) where XXX is 260-300; TSM-XXXDD05A.08(II), TSM-XXXDD05A.05(II) Series where XXX is 260 to 300.

Yingli Solar (E357540): Models YLXXXP-29b where XXX is 215 to 265.

NRTL Listed PV Modules:

Boviet Solar: Models BVM6610P-XXX where XXX is 225 to 275; BVM6610M-XXX where XXX is 235 to 280.

Canadian Solar: Models CS6P-XXX-P where XXX is 200 to 285; CS6P-XXX-P-SD where XXX is 240 to 285; CS6P-XXX-M where XXX is 200 to 290; CS6K-XXX-M where XXX is 240 to 305; CS6K-XXX-M-SD where XXX is 240 to 305; CS6K-XXX-P where XXX is 220 to 285; CS6K-XXX-P-SD where 220 to 285.

ET Solar: Models ET-P660XXXBB where XXX is 200 to 265; ET-P660XXXWB where XXX is 200 to 265; ET-P660XXXWW where XXX is 200 to 265; ET-P660XXXWWG where XXX is 235 to 265.

Hanwah Q Cells: Q.Pro BFR-G4-XXX where XXX is 205 to 295. Q.Pro BFR-G4.1-XXX where XXX is 245 to 295. Q.Plus BFR-G4-XXX where XXX is 255 to 265. Q.Plus BFR-G4.1-XXX where XXX is 270 to 280; Q.PEAK-G3.1 XXX and Q.PEAK BLK-G3.1 XXX where XXX is 270 to 325; Q.PLUS BFR-G3.1 where XXX is 245 to 295.

LG Electronics: Models LGXXXN1C-G4 where xxx is 280 to 340; LGXXXS1C-G4 where XXX is 250 to 300; LGXXXN1K-G4 where XXX is 280 to 330; LGXXXN1K-A5 where XXX is 310 to 350.

REC Solar PTE, LTD: Models RECXXXPE or RECXXXPE-BLK Series, where XXX is 214 to 270; RECXXXTTP or RECXXXTTP-BLK Series, where the XXX is 260 to 300; RECXXXTTP2 or RECXXXTTP2-BLK Series, where XXX is 260 to 300.

SolarWorld: Models SW XXX mono where XXX is 200 to 300, may additionally be followed by “black”.

Talesun: Models TP660P-XXX where XXX is 215 to 285; TP660M-XXX where XXX is 210 to 300.