



SnapNrack™

Solar Mounting Solutions

Series 200

Residential Ground Mount System
Installation Manual

snapnrack.com



2703 Listed — PV Mounting System

SnapNrack Series 200 PV Mounting System offers a straightforward, 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.

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Certification Details

SnapNrack Series 200 system has been evaluated by Underwriters Laboratories (UL) and Listed to UL /ANSI Standard 2703 for Grounding/Bonding and Mechanical Loading.

Grounding/Bonding

The Series 200 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. The UL Listing covers bonding for a load rating up to 45 psf. 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 Series 200 system for integrated grounding.

Ground Lug has been evaluated to both UL 467 and UL 2703 Listing requirements.

Series 200 has been listed with a number of Module Level Power Electronic (MLPE) devices. A complete list can be found in the [Grounding Specifications](#) section.

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 Series 200 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.

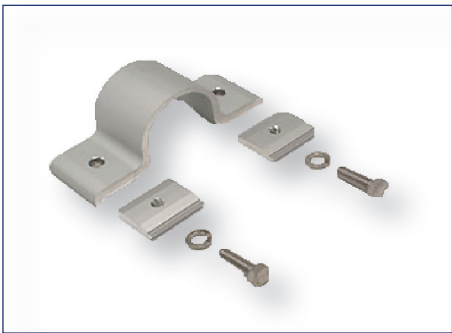
The UL Listing covers mechanical load ratings for the various module orientations and positive, negative, and down-slope ratings. These values can be found in the [Mechanical Loading Specifications](#) section.

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.

Structural Components



SnapNrack Ground Rail



SnapNrack Pipe Clamp Assembly



SnapNrack Adjustable End Clamp Assembly



SnapNrack Universal End Clamp



SnapNrack Mid Clamp



Hollaender Single Adjustable Socket Tee



Hollaender Double Adjustable Socket Tee



Hollaender Single Socket Tee

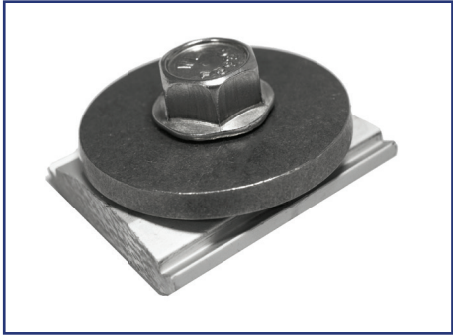
Wire Management/Grounding Components



SnapNrack Wire Clamp



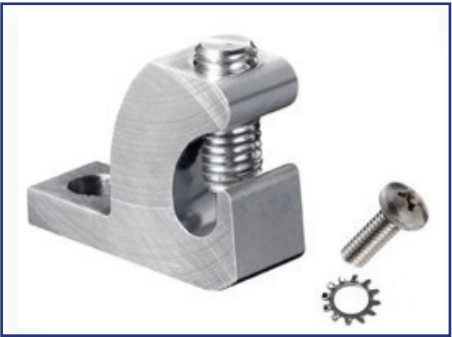
SnapNrack Wire Retention Clip



SnapNrack MLPE Attachment Kit

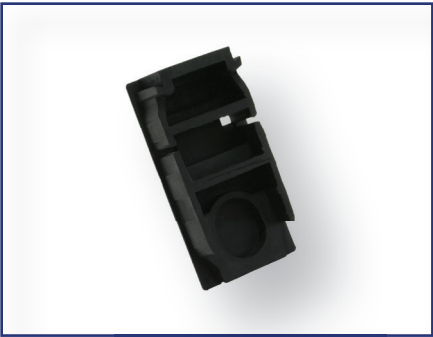


SnapNrack Ground Lug



IlSCO Lay-In Lug - GBL-4DBT

Aesthetic Components



SnapNrack Ground Rail End Cap



Hollaender Plastic Plug End



Hollaender Aluminum Plug End

Hardware Torque Specifications

| Hardware Description | Torque Specification |
|--|--------------------------|
| Grounding Electrode Conductor to SnapNrack Ground Lug (6-12 AWG Solid Copper) | 16 ft-lbs (192 in-lbs) |
| IlSCO Lay-in Lug GBL-4DBT to Rail | 5 ft-lbs (60 in-lbs) |
| Grounding Electrode Conductor to IlSCO Lay-in Lug GBL-4DBT (10-14 AWG Solid Copper) | 1.67 ft-lbs (20 in-lbs) |
| Grounding Electrode Conductor to IlSCO Lay-in Lug GBL-4DBT (8 AWG Stranded Copper) | 1.04 ft-lbs (25 in-lbs) |
| Grounding Electrode Conductor to IlSCO Lay-in Lug GBL-4DBT (4-6 AWG Stranded Copper) | 1.46 ft-lbs (35 in-lbs) |
| Adjustable End Clamp, Mid Clamp (Standard Stainless Steel Fasteners) | 10+ ft-lbs (120+ in-lbs) |
| Adjustable End Clamp, Mid Clamp (Black Stainless Steel Fasteners) | 8 ft-lbs (96 in-lbs) |
| Universal End Clamp | 10 ft-lbs (120 in-lbs) |
| Hollaender Single Socket Tee, Single Adjustable Socket Tee, Double Adjustable Socket Tee | 16 ft-lbs (192 in-lbs) |
| Pipe Clamp Assembly | 12 ft-lbs (144 in-lbs) |
| SolarEdge Frame Mounted Bracket to Module Frame | 7 ft-lbs (84 in-lbs) |
| MLPE Attachment Kit (Rail Mounted Bracket to Rail) | 10 ft-lbs (120 in-lbs) |
| Enphase Frame Mounted Bracket to Module Frame | 13 ft-lbs (156 in-lbs) |

Site Survey

- Measure the installation area and develop an accurate drawing identifying any obstacles such as buildings, ditches, and trees.
- Identify any access areas or keep-out areas as required by the local AHJ (i.e. easements).
- If terrain and/or soils conditions do not meet the minimum requirements set in the Series 200 Structural Engineering Report, consult a structural engineer.

Design Guidance

1) Layout the array in the available installation area. Adjacent modules in the same column are spaced 1/2" apart. Adjustable End Clamps require an additional 1" of rail extending past module frame, while Universal End Clamps require no extra rail. When installing multiple columns of modules, a minimum spacing gap of 1/8" should be used between columns.

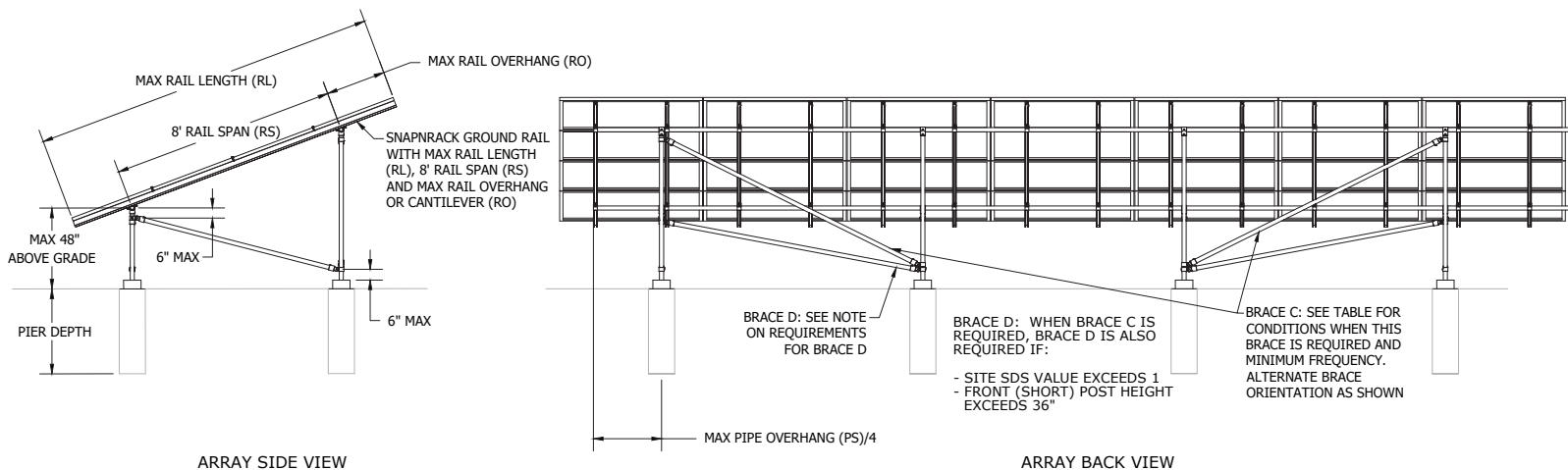
2) Review the shading pattern across the installation area from nearby structures, trees, etc.

 **Design Note:**
A shade analysis prior to the design as a part of the standard site analysis is recommended.

3) Determine site conditions for calculating the engineering values.

 **Design Note:**
Always confirm that site conditions and code versions comply with local AHJ requirements.

4) Reference site conditions and system specifications in Series 200 Structural Engineering Report to determine maximum pipe span and foundation requirements.



5) Confirm design complies with UL 2703 Listing for Mechanical Loading. For more details on the mechanical loading details see the [Mechanical Loading Specifications](#) section.

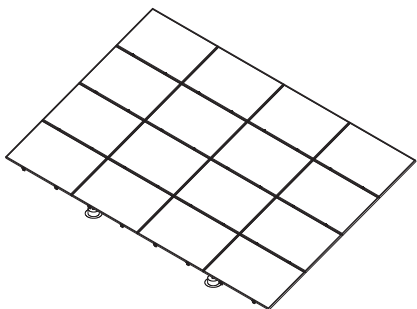
6) To simplify the design process and automatically generate a bill of materials for the mounting system, use the Series 200 Configuration Tool located on the SnapNrack website. Always refer to Approved Module Lists in Installation Manuals to ensure installation complies with UL 2703 Listing.

7) Insert SnapNrack installation details in to design set specific to the project requirements.

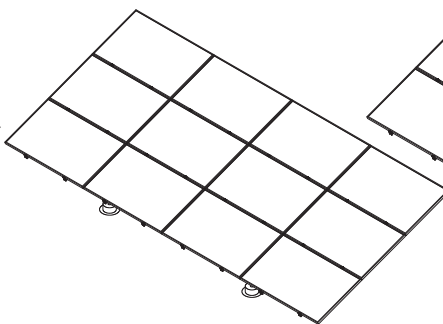
Design Note:

Series 200 allows for multiple mounting configurations. Modules can be mounted in landscape (long side of module perpendicular to slope) or portrait (long side of module parallel to slope) orientations. Landscape orientation is recommended for maximum material efficiency. Standard Series 200 configurations include:

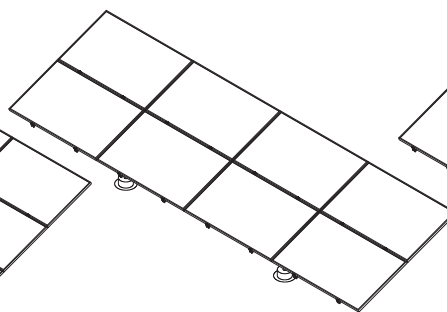
- Four modules in landscape
- Three modules in landscape
- Two modules in landscape
- Two modules in portrait



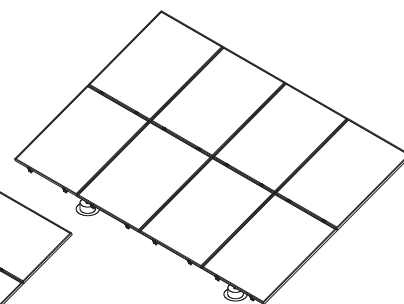
Four Modules in
Landscape



Three Modules in
Landscape



Two Modules in
Landscape



Two Modules in
Portrait

Safety Guidance

- Before you dig any holes, contact all utilities in the area to locate any underground lines, pipes, and wiring.
- 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) Stake corners of the array according to the plan layout.
- 2) Stake and mark locations of foundations based on design.

Layout Note:

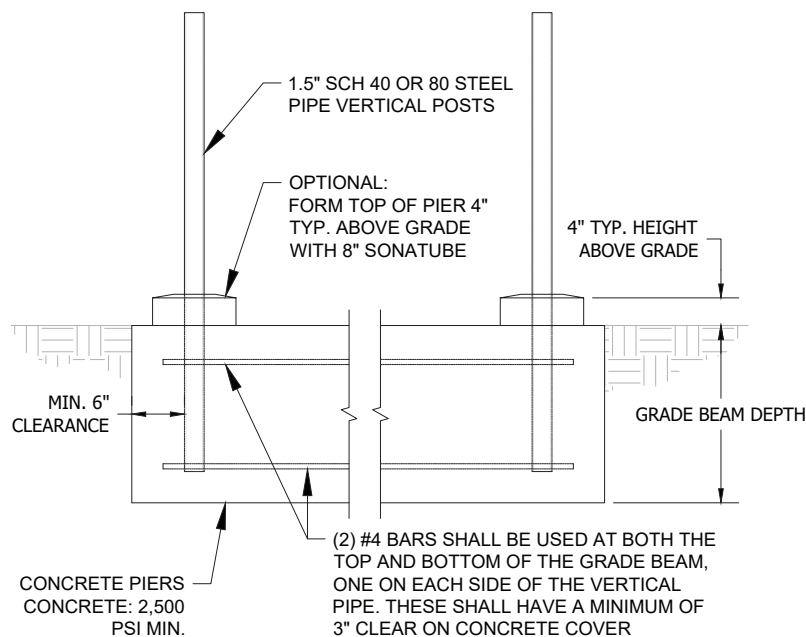
Ensure final foundation locations do not exceed the maximum pipe span and cantilever specified in the design.

Required Tools

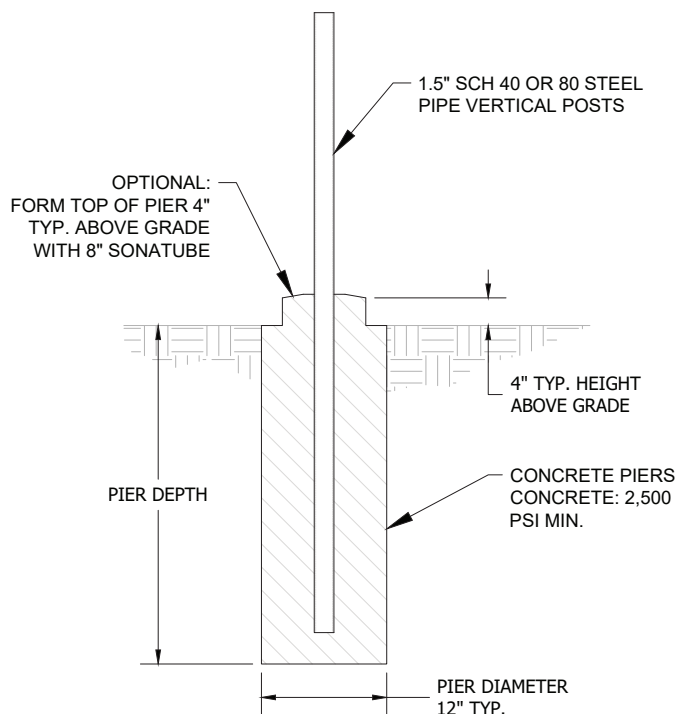
- 12" Diameter Excavation Drill Auger (Pier)
- Backhoe or Excavator with 12" Bucket (Grade Beam)
- Portable Band Saw (18 tpi)
- Concrete Mixer
- String Line
- Surveying Marker Pen or Paint
- Basic Concrete Tools

Materials Needed

- Sched 40 or 80 1-1/2" Pipe w/ 1.9" Outside Diameter (Local Supplier)
- Rebar #4 (Grade Beam Only)
- Concrete/Concrete Mix
- Wood 2x4 for Bracing Pipes



Grade Beam Foundation Detail



Standard Pier Detail

Conversion Chart for Pier to Grade Beam Footings

| 12" diameter Pier Depth | 12" wide Grade Beams Depth (in) | 18" wide Grade Beams Depth (in) | 24" wide Grade Beams Depth (in) |
|-------------------------|---------------------------------|---------------------------------|---------------------------------|
| 3 ft | 12 | 12 | 12 |
| 4 ft | 17 | 15 | 13 |
| 5 ft | 20 | 18 | 17 |
| 6 ft | 24 | 22 | 20 |
| 7 ft | 29 | 26 | 23 |

INSTALLATION INSTRUCTIONS



1A) **12" Pier Option** - Using a 12-in diameter auger, excavate footings at marked locations to the depth required by the structural engineering.



Install Note:

In areas subject to freezing, pier depths may increase to resist freeze heave. Always consult a structural engineer to confirm.



1B) **Grade Beam Option** - Using a backhoe or excavator, excavate footings at marked locations to the depth required by the structural engineering. Build rebar support structure in excavation, as specified in the Structural Engineering Report.



Install Note:

Jigs can be used to locate and support vertical posts.



2) Pour mixed concrete (minimum 2500 psi) into excavated holes.



Install Note:

Never use a sonotube in the footing and ensure concrete is in contact with soil.



3) Insert posts into wet concrete, ensuring that bottom of posts are not in contact with dirt. Set sonotubes at ground level centered around post and fill with concrete to create a pedestal above pier. Smooth concrete.



4) Use string line grid and post level to place verticals square and plumb. Support vertical posts while concrete cures.



5) Once concrete is cured, determine the proper angle for the module array and calculate the length of the vertical posts, then cut posts to length.



Install Note:

Move posts up and down to ensure concrete fills inside of posts.

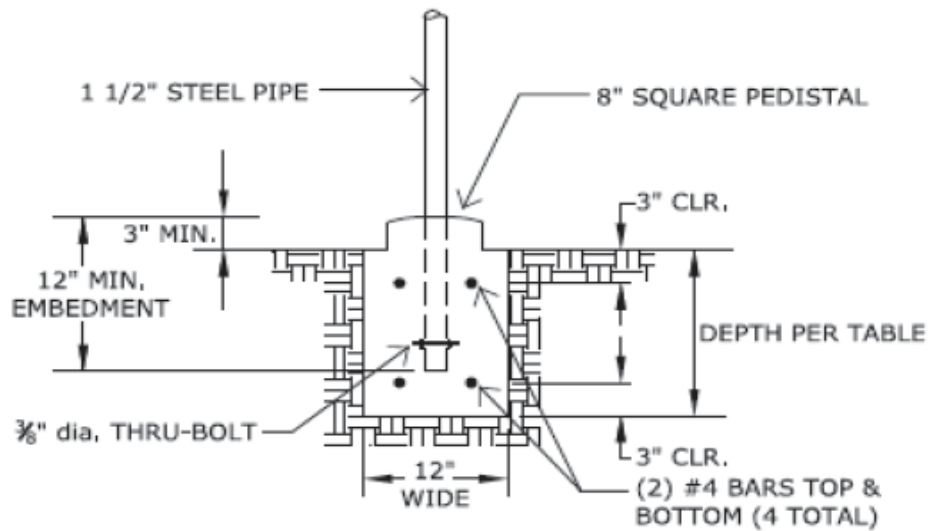


Install Note:

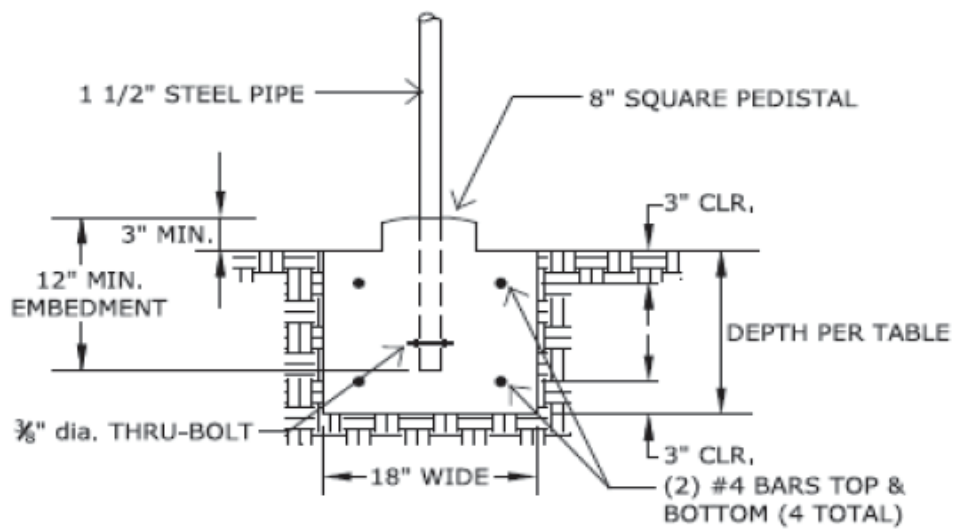
Maximum front post height is limited to 48" and maximum tilt angle is 45 degrees, measured from horizontal.

GRADE BEAM FOOTING OPTIONS

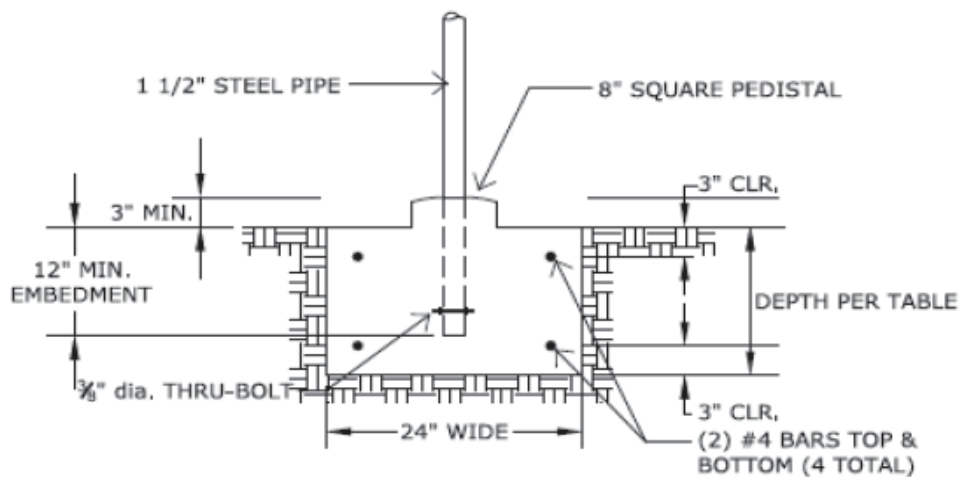
12" Wide Grade Beam Footing Option



18" Wide Grade Beam Footing Option



24" Wide Grade Beam Footing Option

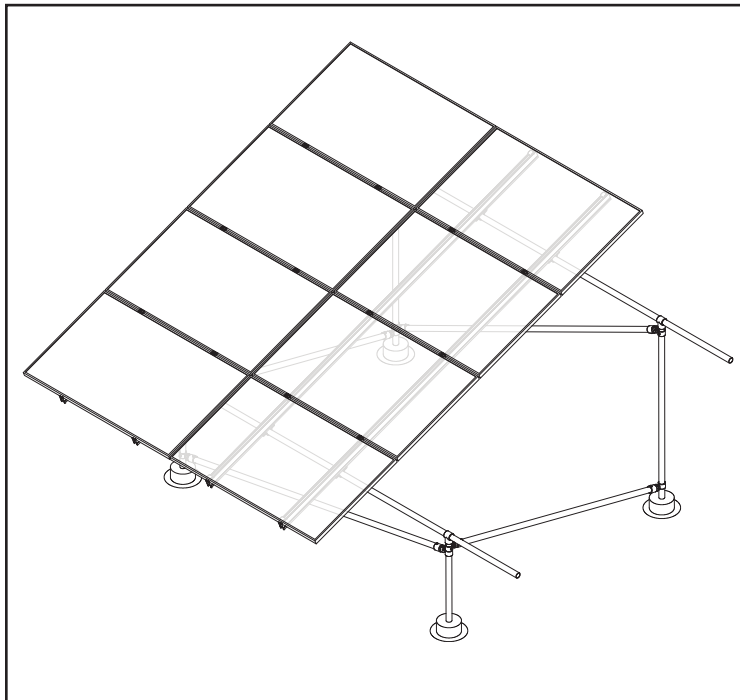


Required Tools

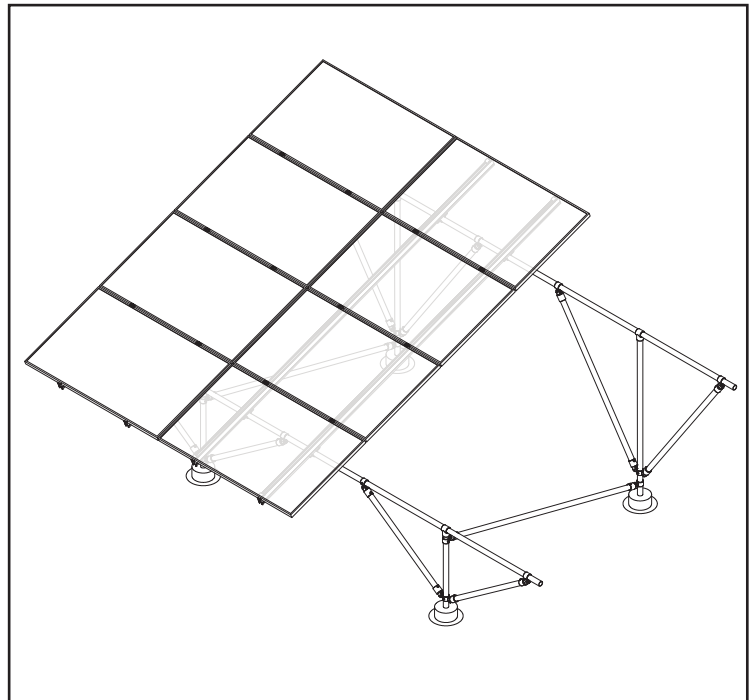
- 3/16" Allen Wrench
- Portable Band Saw
- Measuring Tape
- Cold Galvanizing Spray

Materials Needed

- Sched 40 or 80 1-1/2" Pipe w/ 1.9" Outside Diameter (Local Supplier)
- Single Socket Tee
- Single Adjustable Socket Tee
- Double Adjustable Socket Tee
- Plug Ends



Standard Option



Braced Option

INSTALLATION INSTRUCTIONS



1) Determine the bracing requirements for the racking design and slide all necessary adjustable socket tee fittings onto vertical pipes.



Install Note:

Bracing requirements can be found on Series 200 Configuration Tool output.



2) Slide the required number of single and any adjustable socket tee fittings onto horizontal pipes before installing onto verticals.



Install Note:

Install plug ends in top of vertical pipes to prevent entry of water.

Use existing rigid threaded couplers to connect long sections of pipe together.



3) Install horizontal pipes onto verticals, and then check for array tilt consistency using a section of rail along the entire length of array.



Best Practice:

Leave extra material on each end of horizontal pipes in case of errors.



4) Measure the distances between bracing fittings and cut braces to length, then install and tighten hardware on fittings.



Install Note:

Braces E and F are to be attached to the horizontal pipes at $\frac{1}{3}$ the distance between the two verticals.

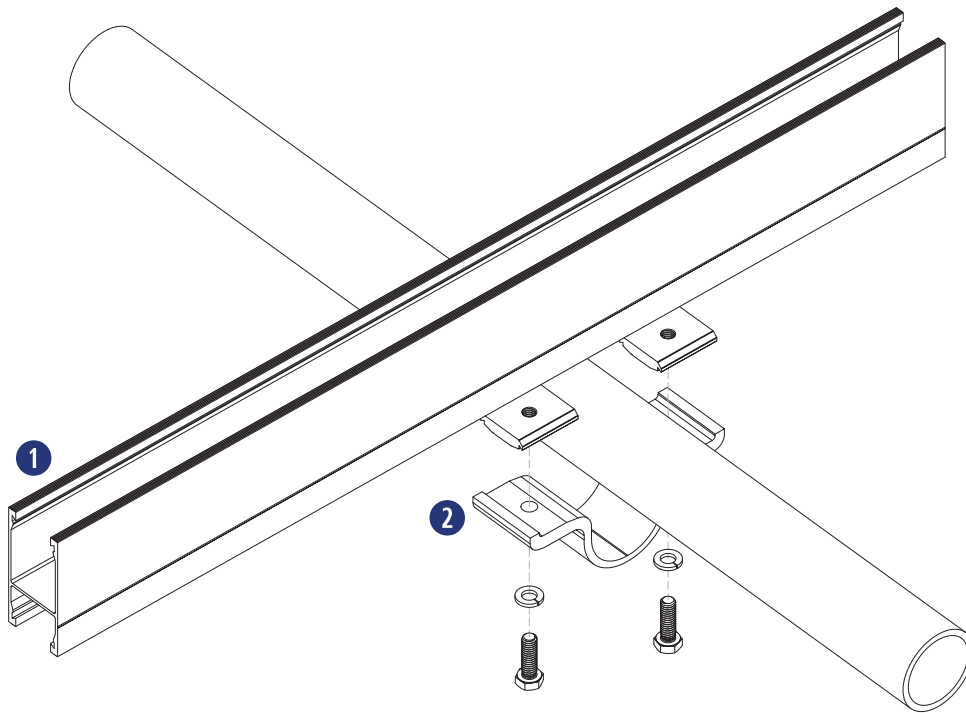
Online Configuration Tool conservatively estimates the brace lengths to ensure you purchase enough pipe, but actual field measurements should be taken and used.

Required Tools

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

Materials Needed - Rail Installation

- ① Ground Rail
- ② Pipe Clamp Assemblies



Pipe Clamp to Rail Assembly

INSTALLATION INSTRUCTIONS



1) Mark rail locations on lower horizontal pipe, using module dimensions as a guideline.



2) Place pipe clamps on horizontal pipes where markings were made for rails.



3) Attach rails with pipe clamps by snapping channel nuts in to bottom rail channel.



Install Note:

Be sure to account for a small gap between module columns when marking rail locations.



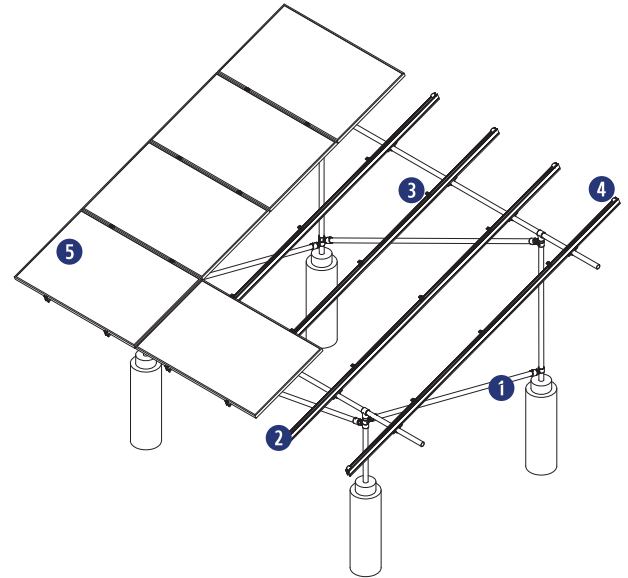
4) Square and center end rails to horizontal pipes and tighten hardware to 12 ft-lbs, then run a string line to align and install remaining rails.

Required Tools

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

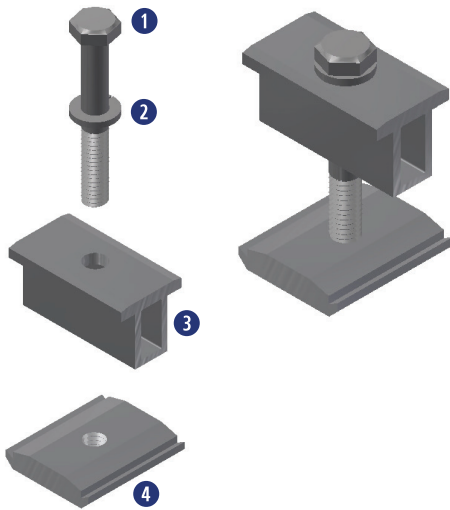
Materials Needed - Module Installation

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



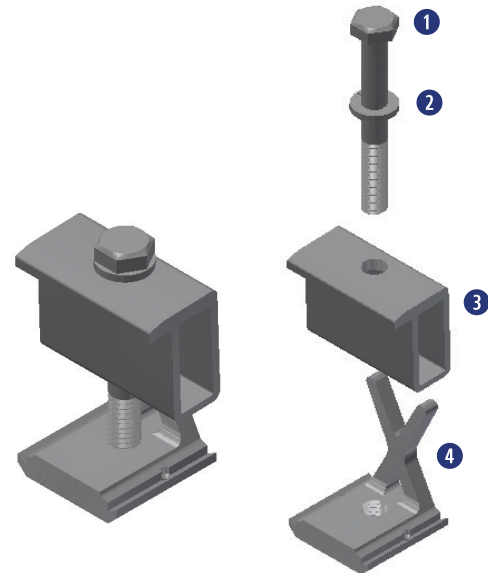
Mid Clamp Assembly

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



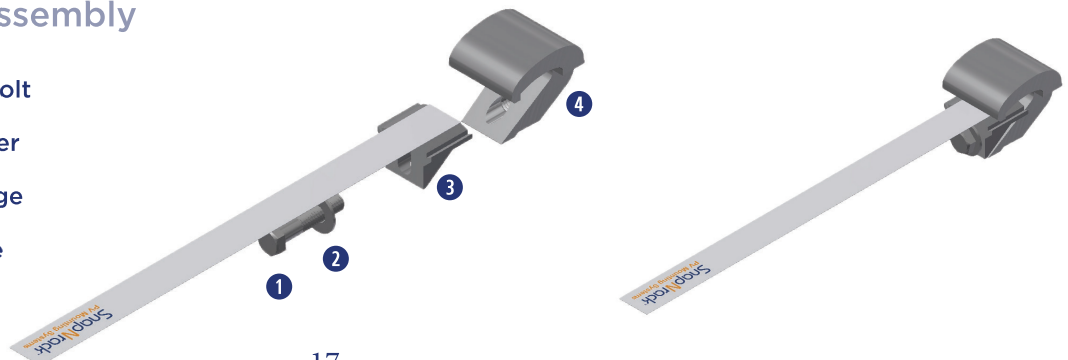
Adjustable End Clamp Assembly

- 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

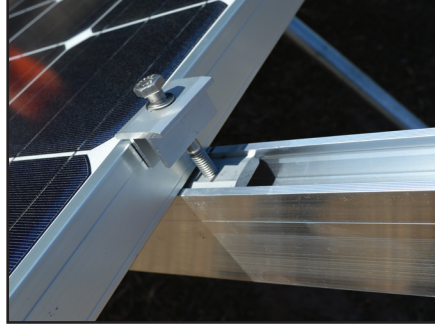


INSTALLATION INSTRUCTIONS

SnapNrack Mid Clamp



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



2) Slide the mid clamp flush to the module with the top lip of the mid clamp over the top edge of the module frame, then place the next module flush to the other side of the mid clamp.



3) Tighten hardware, torque silver hardware to 10+ ft-lbs and black hardware to 8 ft-lbs.



Install Note:

Mid clamps are Listed with and without springs.



Install Note:

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

Mid clamps create 1/2" gap between modules.

SnapNrack Adjustable End Clamp



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



Install Note:

Adjustable End Clamps require 1" of extra rail to extend past the end of the module frame.



2) Slide the clamp flush to the module with the top lip of the end 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) Tighten hardware, torque silver hardware to 10+ ft-lbs and black hardware to 8 ft-lbs.

INSTALLATION INSTRUCTIONS

SnapNrack Universal End Clamp



1) Slide the 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.



3) Use the pull tab to hold the UEC taut towards the end of the rail and tighten hardware to 10 ft-lbs.



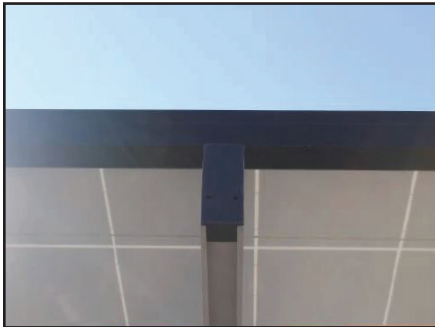
Install Note:

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



Install Note:

Rail can be cut flush to the module using the UEC Rail Cutting Tool.



4) Install rubber end cap to finish.



Install Note:

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

Required Tools

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

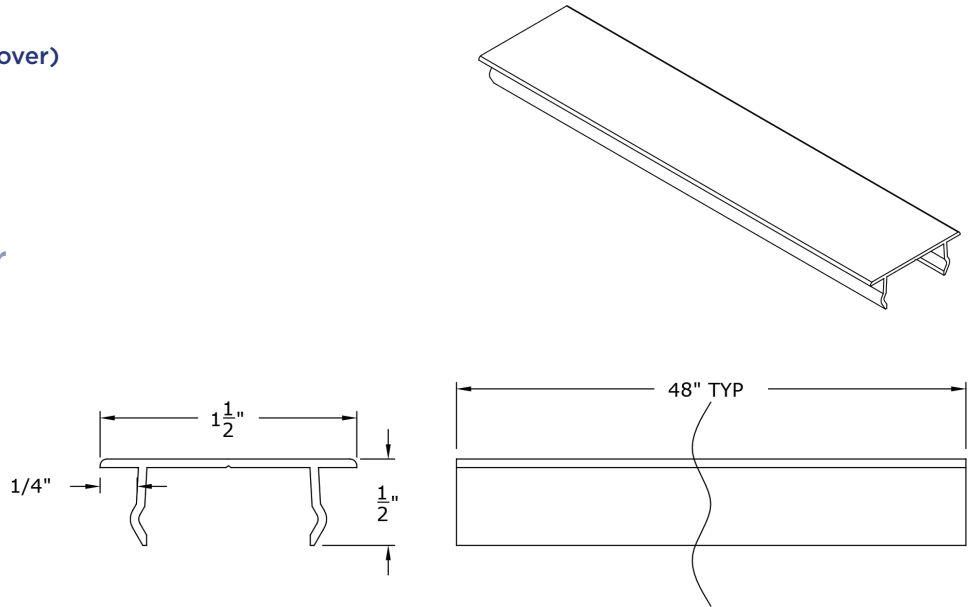
Materials Included - Rail Cover

- 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.



Dimensioned 48" Rail Cover

Materials Included - Wire Retention Clip

- 1 SnapNrack Wire Retention Clip



Dimensioned Wire Retention Clip



Application Note:

Install as necessary to manage and safely retain conductors within SnapNrack rails.

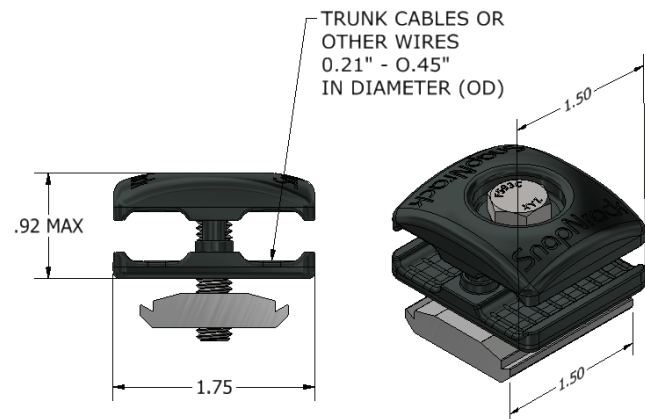
Materials Included - Wire Clamp

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



Application Note:

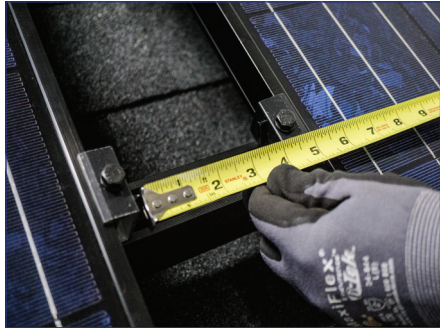
Install as necessary to secure cables and conductors running from rail to rail, or transitioning out/in from a rail channel



Dimensioned Universal Wire Clamp Assembly

INSTALLATION INSTRUCTIONS

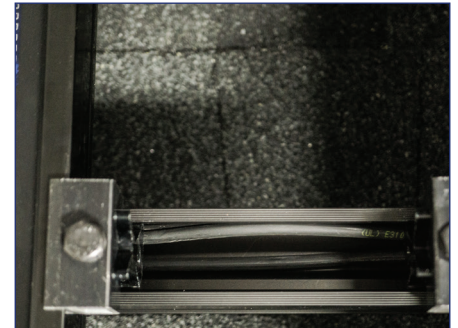
SnapNrack 48" Rail Cover



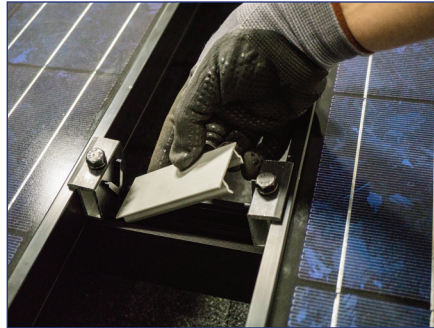
1) Measure the length of the SnapNrack 48" Rail Cover that is needed.



2) Cut the rail cover to length, then remove any sharp edges.



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.



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.



Install Note:

Wire Clamps can be rotated and oriented in any direction.

Required Tools

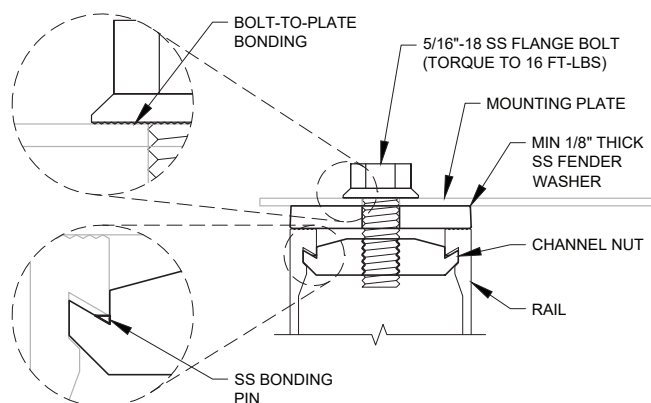
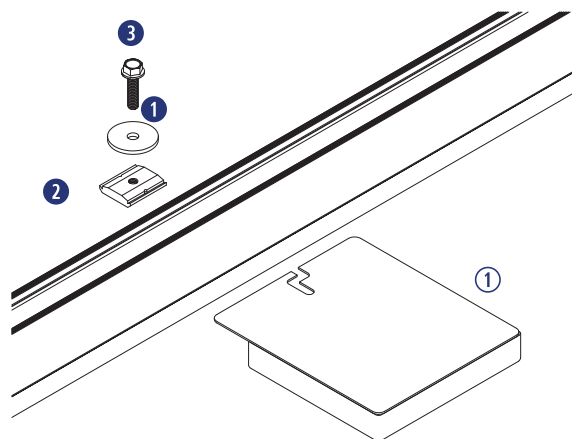
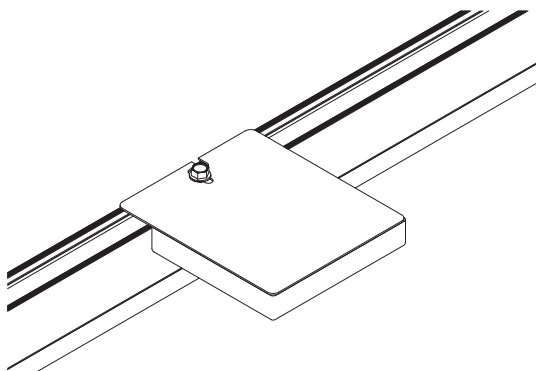
- Torque Wrench
- Socket Wrench
- 1/2" Socket

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

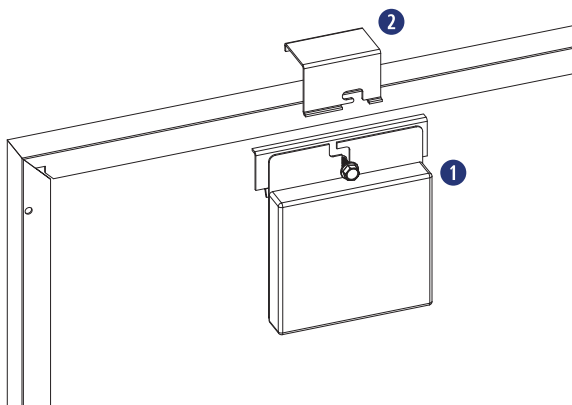
Other Materials Required

- ① (1) MLPE Unit



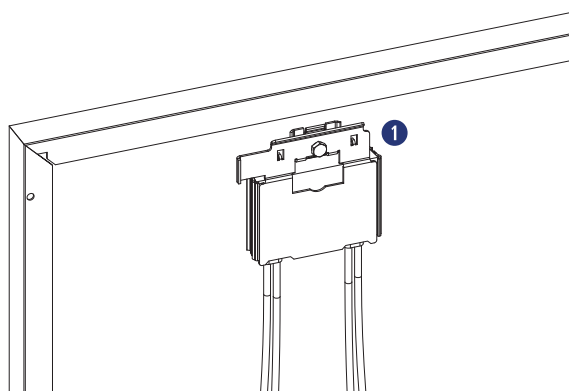
Materials Needed - Enphase Frame Mount

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



Materials Needed - SolarEdge Frame Mount

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



INSTALLATION INSTRUCTIONS - MLPE RAIL ATTACHMENT



1) Snap the SnapNrack 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, torque silver hardware to 10 ft-lbs.

Install Note:

MLPE Attachment Kits are approved for bolt lengths between 1" and 1.5" long.

INSTALLATION INSTRUCTIONS - SOLAREEDGE 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 to 7 ft-lbs.



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.



Install Note:

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



3) Tighten hardware to 13 ft-lbs



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

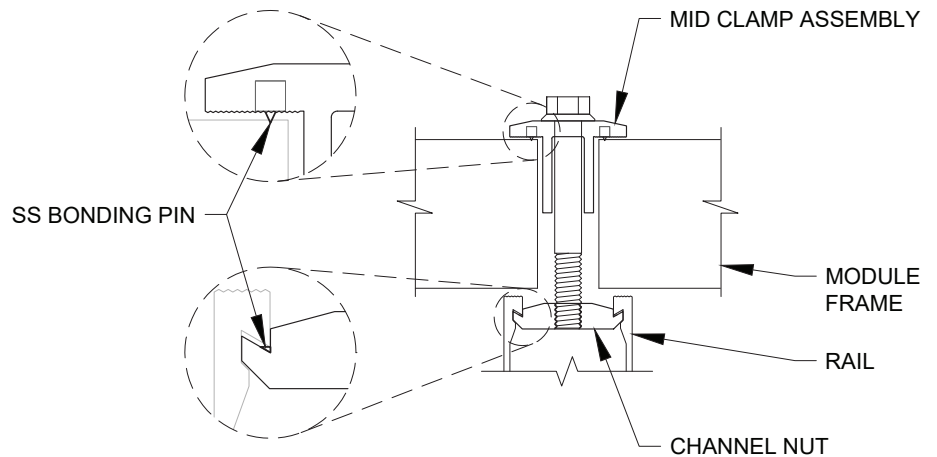


Install Note:

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

System Bonding Methods

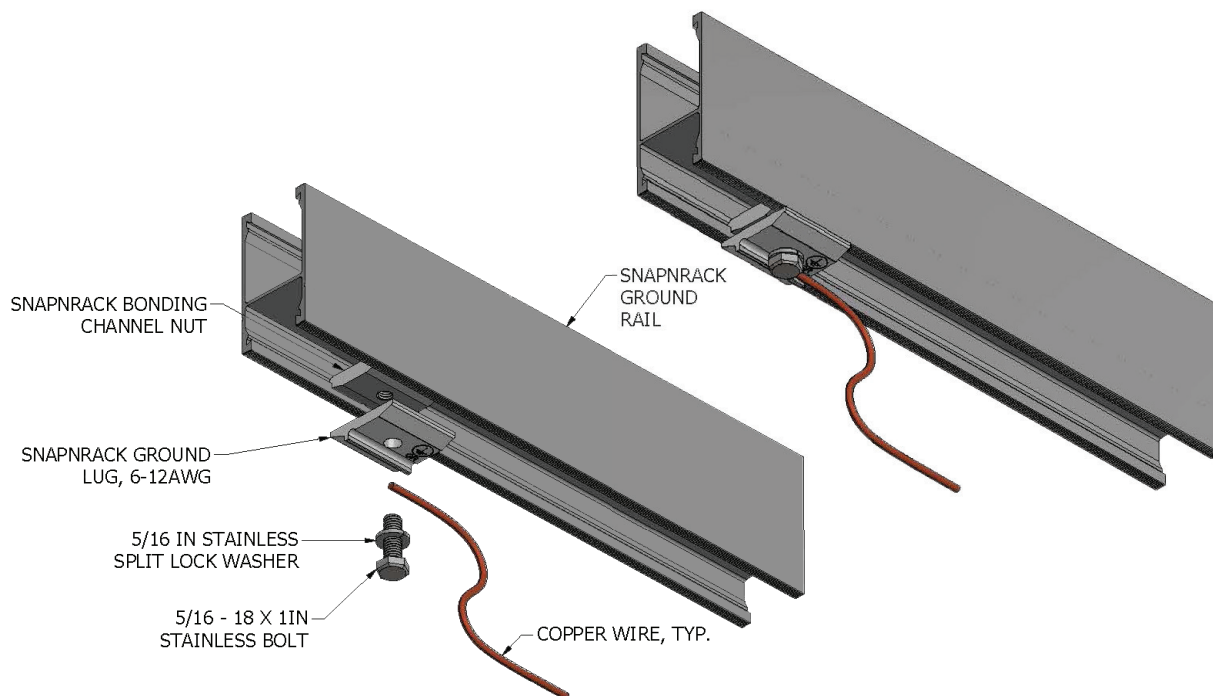
- 1 SnapNrack Mid Clamp
- 2 SnapNrack Adjustable End Clamp
- 3 SnapNrack Pipe Clamp
- 4 Hollaendar Pipe Fittings



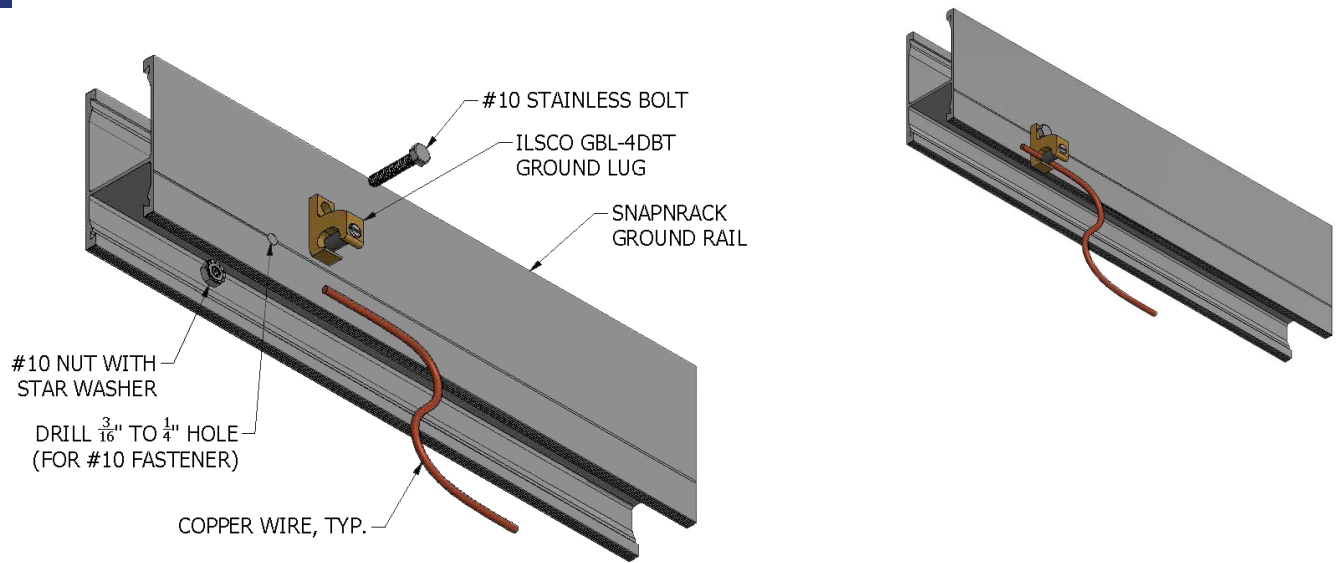
Note:

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

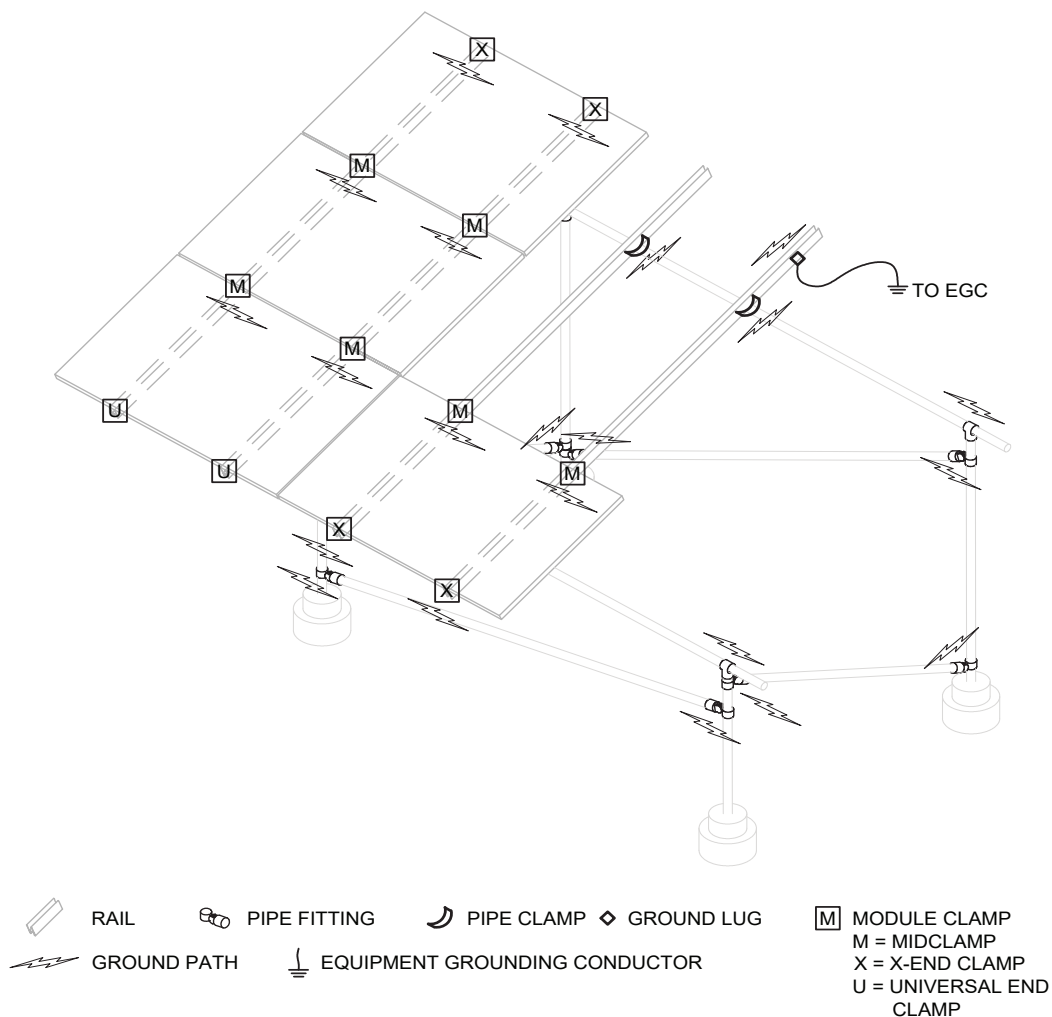
SnapNrack Ground Lug Assembly



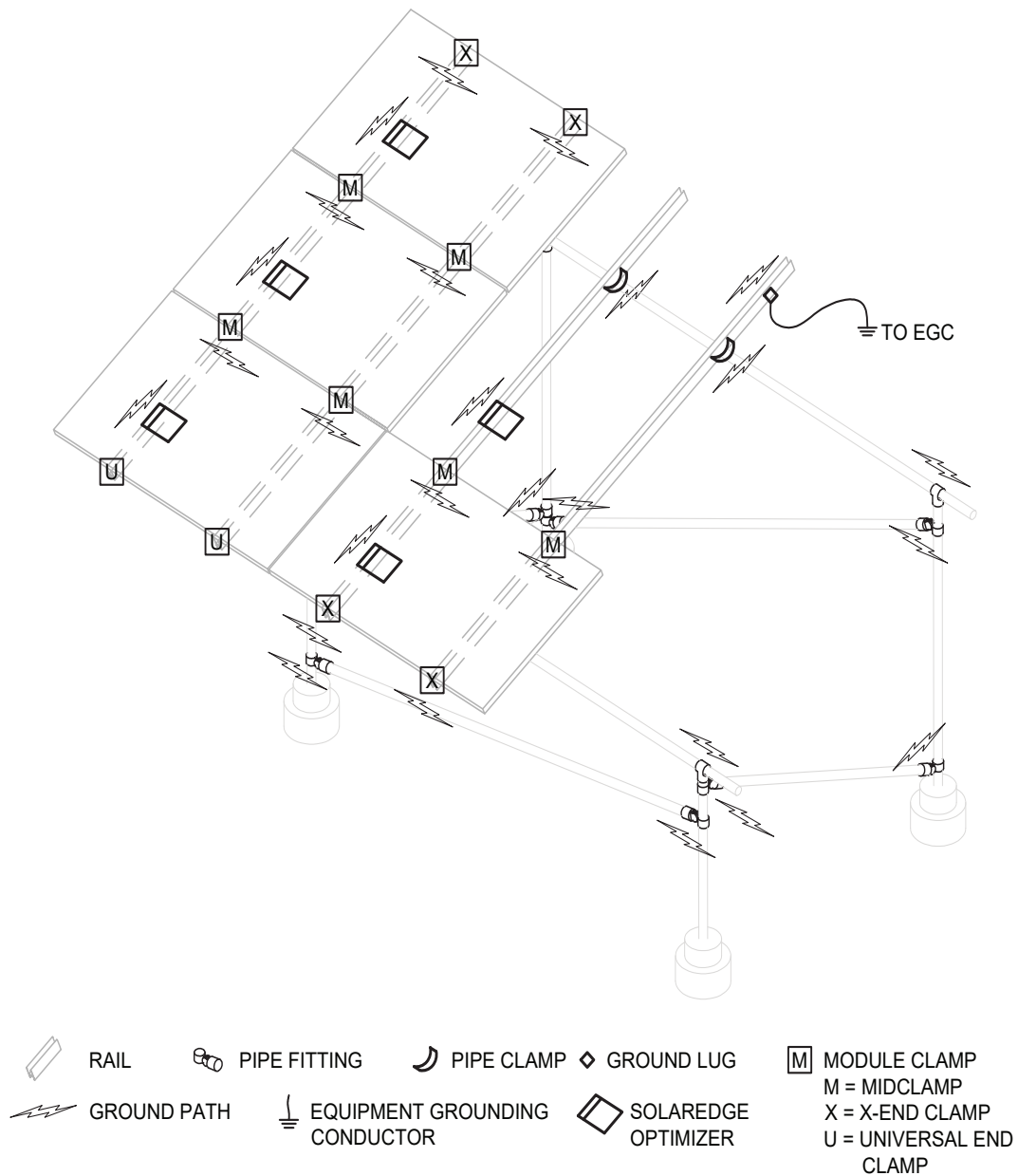
IlSCO Lay-in Lug Assembly



Ground Path Details



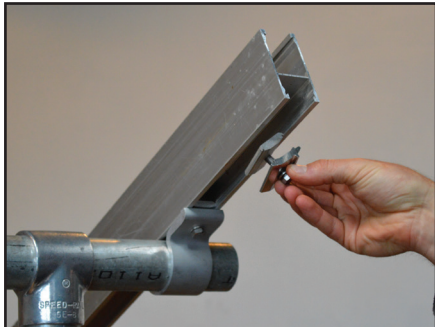
Ground Path Details - SolarEdge



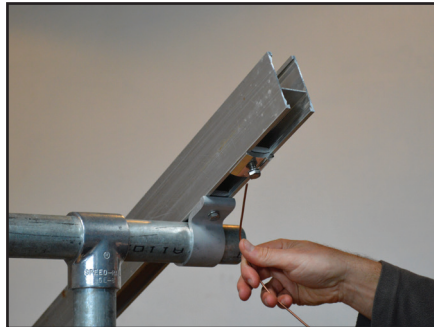


INSTALLATION INSTRUCTIONS

SnapNrack Ground Lug



1) Snap the SnapNrack Ground Lug into the rail channel on **one rail per array**.



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



3) Tighten hardware to a minimum of 16 ft-lbs.



Install Note:

SnapNrack Ground Lug may be used in top or bottom 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

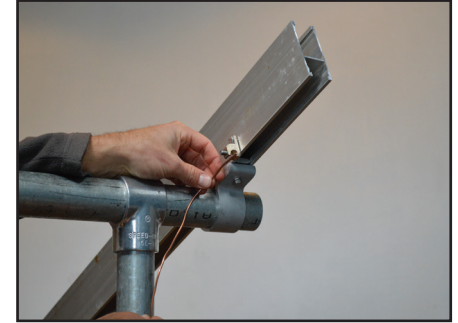
IlSCO Lay-In Lug



1) Drill and deburr a 3/8" hole in either 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 array**.



2) Place grounding conductor into slot.



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



Install Note:

Torque rail connection to 5 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 Ground Lug: torque bolt to 16 ft-lbs. The Ground Lug may be used in top or bottom 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.

DynoBond

R/C (QIMS2), DynoRaxx (E357716) photovoltaic bonding jumper cat. no. DynoBond is an optional component that may be used with this system. The DynoBond jumper has been evaluated to provide module to module bonding. The DynoBond device attaches to the frame flange of adjacent modules.

Series 200 has been tested with the following UL Listed modules:

The Series 200 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.

| Manufacturer | Model | Wattage |
|----------------|---------------------|---------|
| Aptos Solar | DNA-120-MF23-XXX | 320-340 |
| | DNA-120-BF23-XXX | 320-345 |
| | DNA-144-MF23-XXX | 390-410 |
| | DNA-144-BF23-XXX | 390-415 |
| Boviet Solar | BVM6610P-XXX | 225-275 |
| | BVM6610M-XXX | 235-280 |
| | BVM6612P-XXX | 270-330 |
| | BVM6612M-XXX | 280-340 |
| Canadian Solar | CS6K-XXX-M | 240-335 |
| | CS6K-XXX-M-SD | 240-305 |
| | CS6K-XXX-P | 220-320 |
| | CS6K-XXX-P-SD | 240-300 |
| | CS6K-XXX-MS | 240-335 |
| | CS6P-XXX-M | 200-300 |
| | CS6P-XXX-P | 200-300 |
| | CS6P-XXX-P-SD | 240-300 |
| | CS6V-XXX-M | 215-225 |
| | CS6V-XXX-P | 250-255 |
| | CS6X-XXX-P | 250-360 |
| | CS3K-XXX-P | 250-350 |
| | CS3K-XXX-MS | 280-345 |
| | CS3U-XXX-MS | 350-420 |
| | CS3U-XXX-P | 295-420 |
| | CS1K-XXX-MS | 285-345 |
| | CS1H-XXX-MS | 310-350 |
| | CS1H-XXX-MS-AB | 310-350 |
| ET Solar | ET-P660XXXBB | 200-265 |
| | ET-P660XXXWB | 200-265 |
| | ET-P660XXXWW | 200-265 |
| | ET-P660XXXWWG | 235-265 |
| | P660XXXWB/WW | 200-265 |
| | P660XXXWWG | 240-250 |
| | M660XXXBB | 250-265 |
| | M660XXXWW | 200-270 |
| Hanwha Q Cells | Q.PEAK BLK-G3.1-XXX | 245-295 |
| | Q.PEAK G3.1-XXX | 270-325 |
| | Q.PLUS BFR-G3.1-XXX | 270-325 |

| Manufacturer | Model | Wattage |
|----------------|--------------------------|---------|
| Hanwha Q Cells | B.LINE PLUS BFR-G4.1-XXX | 245-295 |
| | B.LINE PRO BFR-G4.1-XXX | 245-295 |
| | Q.BASE GY-XXX | 245-295 |
| | Q.PEAK BFR-G4-XXX | 290-305 |
| | Q.PEAK BFR-G4.1-XXX | 285-295 |
| | Q.PEAK BLK-G4.1-XXX | 270-325 |
| | Q.PEAK BLK-G4.1/TAA-XXX | 270-325 |
| | Q.PEAK G4-XXX | 245-295 |
| | Q.PEAK G4.1-XXX | 270-325 |
| | Q.PEAK G4.1/MAX-XXX | 270-325 |
| | Q.PEAK G4.1/TAA-XXX | 270-325 |
| | Q.PLUS BFR-G4-XXX | 245-295 |
| | Q.PLUS BFR-G4.1-XXX | 245-295 |
| | Q.PLUS BFR-G4.1/TAA-XXX | 245-295 |
| | Q.PLUS G4-XXX | 245-295 |
| | Q.PLUS GY-XXX | 245-295 |
| | Q.PLUS BFR-GY-XXX | 245-295 |
| | Q.PRO BFR-G4-XXX | 245-295 |
| | Q.PRO BFR-G4.1-XXX | 245-295 |
| | Q.PRO BFR-G4.3-XXX | 245-295 |
| | Q.PRO BFR-GY-XXX | 245-295 |
| | Q.PRO BLK-GY-XXX | 245-295 |
| | Q.PRO G4-XXX | 245-295 |
| | Q.PRO GY-XXX | 245-295 |
| | Q.PRO GY/SC-XXX | 245-295 |
| | Q.PEAK DUO-G5-XXX | 290-360 |
| | Q.PEAK DUO-BLK-G5-XXX | 290-360 |
| | Q.PLUS DUO-G5-XXX | 290-360 |
| | Q.PEAK DUO-G7-XXX | 310-350 |
| | Q.PEAK DUO-BLK-G7-XXX | 290-350 |
| | Q.PEAK DUO-G7.2-XXX | 310-350 |
| | Q.PEAK DUO-G6+-XXX | 320-360 |
| | Q.PEAK DUO-BLK-G6+-XXX | 310-350 |
| | Q.PEAK DUO-G6-XXX | 320-360 |
| | Q.PEAK DUO-BLK-G6-XXX | 310-350 |
| | Q.PEAK DUO-G8+-XXX | 290-360 |
| | Q.PEAK DUO-BLK-G8+-XXX | 290-360 |
| | Q.PEAK DUO-G8-XXX | 290-360 |
| | Q.PEAK DUO-BLK-G8-XXX | 290-360 |
| | Q.PLUS L-G4-XXX | 280-355 |
| | Q.PLUS L-G4.1-XXX | 280-355 |

| Manufacturer | Model | Wattage |
|-----------------|---------------------------|---------|
| Hanwha Q Cells | Q.PLUS L-G4.2-XXX | 280-355 |
| | Q.PEAK L-G4.1-XXX | 330-390 |
| | Q.PEAK L-G4.2-XXX | 330-390 |
| | Q.PLUS DUO-L-G5-XXX | 340-425 |
| | Q.PLUS DUO-L-G5.1-XXX | 340-425 |
| | Q.PLUS DUO-L-G5.2-XXX | 340-425 |
| | Q.PLUS DUO-L-G5.3-XXX | 340-425 |
| | Q.PEAK DUO-L-G5.2-XXX | 360-425 |
| | Q.PEAK DUO-L-G5.3-XXX | 360-425 |
| | Q.PEAK DUO-L-G7-XXX | 360-415 |
| | Q.PEAK DUO-L-G7.1-XXX | 360-415 |
| | Q.PEAK DUO-L-G7.2-XXX | 360-415 |
| | Q.PEAK DUO-L-G7.3-XXX | 360-415 |
| | Q.PEAK DUO-L-G6-XXX | 375-425 |
| | Q.PEAK DUO-L-G6.2-XXX | 360-430 |
| | Q.PEAK DUO-L-G6.3-XXX | 360-430 |
| | Q.PEAK DUO-L-G8-XXX | 360-430 |
| | Q.PEAK DUO-L-G8.1-XXX | 360-430 |
| | Q.PEAK DUO-L-G8.2-XXX | 360-430 |
| | Q.PEAK DUO-L-G8.3-XXX | 360-430 |
| | Q.PEAK DUO-G5/SC-XXX | 290-360 |
| | Q.PEAK DUO-BLK-G5/SC-XXX | 290-360 |
| | Q.PEAK DUO-G6+/SC-XXX | 320-360 |
| | Q.PEAK DUO-BLK-G6+/SC-XXX | 310-350 |
| | Q.PEAK DUO BLK-G6+/AC-XXX | 340-350 |
| | Q.PEAK DUO-ML-G9-XXX | 370-390 |
| | Q.PEAK DUO-BLK-ML-G9-XXX | 365-385 |
| | Q.PEAK DUO-G5/TS-XXX | 290-360 |
| | Q.PEAK DUO BLK-G5/TS-XXX | 290-360 |
| | Q.PEAK DUO-G6/TS-XXX | 320-360 |
| | Q.PEAK DUO BLK-G6/TS-XXX | 310-350 |
| | Q.PEAK DUO-G6+/TS-XXX | 320-360 |
| | Q.PEAK DUO BLK-G6+/TS-XXX | 310-350 |
| Hanwha SolarOne | HSL60P6-PB-2-XXXQ | 230-270 |
| | HSL60P6-PB-4-XXXQ | 230-270 |
| Heliene | 60M-XXX | 225-325 |
| | 60P-XXX | 200-270 |
| | 72M-XXX | 275-390 |
| | 72P-XXX | 250-350 |

| Manufacturer | Model | Wattage |
|--------------|--------------------|---------|
| Hyundai | HiS-MXXXRG | 235-275 |
| | HiS-SXXXRG | 245-295 |
| | HiS-SXXXRW | 250-265 |
| | HiS-MXXXMG | 210-270 |
| | HiS-SXXXMG | 220-275 |
| JA Solar | JAM6-60-XXX/SI | 250-270 |
| | JAP6-60-XXX/3BB | 235-265 |
| | JAM60S09-XXX/PR | 310-325 |
| | JAM60S10-XXX/MR | 330-345 |
| | JAM60S10-XXX/PR | 320-335 |
| | JAM60S12-XXX/PR | 305-320 |
| | JAP72S01-XXX/SC | 315-335 |
| | JAM72S09-XXX/PR | 370-395 |
| | JAM72S10-XXX/MR | 395-415 |
| | JAM72S10-XXX/PR | 380-405 |
| | JAM72S12-XXX/PR | 365-385 |
| | JAP6(k)-72-XXX/4BB | 305-325 |
| | JAM60S17-XXX/MR | 320-330 |
| Jinko Solar | JKMXXXM-60 | 200-305 |
| | JKMXXXM-60L | 305-325 |
| | JKMXXXM-60HL | 315-335 |
| | JKMXXXM-60HBL | 310-330 |
| | JKMXXXP-60 | 200-290 |
| | JKMXXXP-60-J4 | 200-290 |
| | JKMXXXP-60-V | 200-290 |
| | JKMXXXP-60B-J4 | 200-290 |
| | JKMXXXPP-60 | 200-290 |
| | JKMXXXPP-60-V | 200-300 |
| | JKMXXXM-72 | 250-365 |
| | JKMXXXM-72L-V | 370-390 |
| | JKMXXXP-72 | 250-360 |
| | JKMXXXP-72-V | 250-360 |
| | JKMXXXPP-72 | 250-360 |
| | JKMXXXPP-72-V | 250-360 |
| | JKMSXXXP-72 | 250-330 |
| | JKMXXXM-72HL-V | 370-420 |
| | JKMXXXM-72HL-TV | 380-410 |
| Kyocera | KUXXX-6YYY | 250-280 |
| | KUXXX-8YYY | 315-355 |

| Manufacturer | Model | Wattage |
|--------------|----------------|---------|
| LG | LGXXXN1C-A5 | 320-345 |
| | LGXXXN1K-A5 | 310-355 |
| | LGXXXQ1C-A5 | 340-385 |
| | LGXXXQ1K-A5 | 315-375 |
| | LGXXXS1C-A5 | 280-320 |
| | LGXXXN2C-B3 | 330-340 |
| | LGXXXN2W-B3 | 330-340 |
| | LGXXXN1C-G4 | 280-340 |
| | LGXXXN1K-G4 | 280-300 |
| | LGXXXS1C-G4 | 250-300 |
| | LGXXXN2C-G4 | 360-395 |
| | LGXXXN2K-G4 | 360-385 |
| | LGXXXN2W-G4 | 360-395 |
| | LGXXXS2C-G4 | 300-360 |
| | LGXXXS2W-G4 | 300-360 |
| | LGXXXN1C-V5 | 325-355 |
| | LGXXXN1W-V5 | 325-345 |
| | LGXXXN2T-V5 | 385-430 |
| | LGXXXN2T-J5 | 385-405 |
| | LGXXXN1T-V5 | 310-340 |
| | LGXXXA1C-V5 | 360-380 |
| | LGXXXM1C-L5 | 355-370 |
| | LGXXXM1K-L5 | 340-350 |
| | LGXXXN1C-N5 | 330-360 |
| | LGXXXN1K-L5 | 310-335 |
| Longi | LR6-60-XXXM | 270-300 |
| | LR6-60BK-XXXM | 270-300 |
| | LR6-60HV-XXXM | 270-300 |
| | LR6-60PB-XXXM | 280-320 |
| | LR6-60PE-XXXM | 280-320 |
| | LR6-60PH-XXXM | 280-320 |
| | LR6-60HPB-XXXM | 295-320 |
| | LR6-60HPH-XXXM | 300-320 |
| | LR4-60HPB-XXXM | 335-365 |
| | LR4-60HIB-XXXM | 335-365 |
| | LR4-60HPH-XXXM | 350-380 |
| | LR4-60HIH-XXXM | 350-380 |
| | LR6-60HIH-XXXM | 300-330 |
| | LR6-60HIB-XXXM | 295-320 |
| | LR4-72HPH-XXXM | 420-455 |

Grounding Specifications

| Manufacturer | Model | Wattage |
|---------------|-------------------|---------|
| Mission Solar | MSEXXXSO5T | 260-290 |
| | MSEXXXSO5K | 270-290 |
| | MSEXXXSQ5T | 280-300 |
| | MSEXXXSQ5K | 285-305 |
| | MSEXXXMM4J | 320-330 |
| | MSEXXXMM6J | 320-330 |
| | MSEXXXSO6W | 320-340 |
| | MSEXXXSO4J | 320-350 |
| | MSEXXXSO6J | 320-350 |
| | MSEXXXSQ6S | 345-365 |
| | MSEXXXSQ4S | 345-365 |
| | MSEXXXSR8K | 315-335 |
| | MSEXXXSR8T | 310-330 |
| | MSEXXXSR9S | 375-400 |
| | MSE60AXXX | 290-315 |
| | MSEXXXTS60 | 300-310 |
| Panasonic | VBHNXXXKA01 | 310-325 |
| | VBHNXXXKA02 | 310-325 |
| | VBHNXXXSA16 | 320-325 |
| | VBHNXXXKA03 | 310-325 |
| | VBHNXXXKA04 | 310-325 |
| | VBHNXXXSA17 | 325-335 |
| | VBHNXXXSA18 | 325-335 |
| | VBHN325SA17E | 325-330 |
| | VBHXXXRA18N | 325-340 |
| | VBHXXXRA03K | 320-335 |
| Phono Solar | PSXXXM-20/U | 270-320 |
| | PSXXXMH-20/U | 270-320 |
| REC | RECXXXPE | 214-280 |
| | RECXXXPE-BLK | 214-280 |
| | RECXXXTP | 260-300 |
| | RECXXXTP-BLK | 260-300 |
| | RECXXXTP IQ | 260-300 |
| | RECXXXTP2 | 260-300 |
| | RECXXXTP2-BLK | 260-300 |
| | RECXXXNP | 310-330 |
| | RECXXXTP2M | 300-315 |
| | RECXXXTP72 | 330-345 |
| | RECXXXPE72 | 295-325 |
| | RECXXXPE72XV | 295-325 |
| | RECXXXTP2M 72 | 350-400 |
| | RECXXXTP2M 72 BLK | 350-400 |

| Manufacturer | Model | Wattage |
|--------------|----------------------------|---------|
| REC | RECXXXT2M 72 BLK2 | 350-400 |
| | RECXXXT2SM 72 | 350-400 |
| | RECXXXT2SM 72 BLK | 350-400 |
| | RECXXXT2SM 72 BLK2 | 350-400 |
| | RECXXXAA | 340-380 |
| | RECXXXT3M | 295-340 |
| Renesola | JCXXXM-24/Bb | 200-270 |
| | JCXXXM-24/BBh | 235-370 |
| Silfab | SLAXXX-M | 225-320 |
| | SLAXXX-P | 225-275 |
| | SSAXXX-M | 225-300 |
| | SSAXXX-P | 225-270 |
| | SILXXXBL | 280-330 |
| | SILXXXML | 280-320 |
| | SILXXXNL | 280-320 |
| | SLGXXX-M | 265-380 |
| | SLGXXX-P | 265-320 |
| | SSGXXX-M | 265-360 |
| | SSGXXX-P | 265-320 |
| | SILXXXNT | 350-380 |
| | SILXXXHL | 265-320 |
| Solaria | Solaria PowerXT-XXXR-PX | 315-385 |
| | Solaria PowerXT-XXXR-BX | 315-385 |
| | Solaria PowerXT-XXXR-AC | 315-385 |
| | Solaria PowerXT-XXXR-PM | 360-440 |
| | Solaria PowerXT-XXXR-PM-AC | 360-440 |
| SolarWorld | SWXXX-Mono | 200-300 |
| | SWXXX-Mono XL | 320-350 |
| Suniva | MVX-XXX-60-5-701 | 235-265 |
| | MVX-XXX-60-5-7B1 | 235-265 |
| | OPT-XXX-60-4-100 | 240-300 |
| | OPT-XXX-60-4-1B0 | 235-300 |
| | OPT-XXX-60-4-800 | 250-275 |
| | OPT-XXX-60-4-8B0 | 250-275 |
| Sunpower | SPR-EYY-### | 225-250 |
| | SPR-XY-### | 233-274 |
| | SPR-EYY-### | 285-345 |
| | SPR-XY-### | 310-365 |
| Talesun | TP660M-XXX | 240-300 |
| | TP660P-XXX | 235-285 |
| | TP672M-XXX | 290-360 |
| | TP672P-XXX | 280-345 |

| Manufacturer | Model | Wattage |
|--------------|----------------------|---------|
| Trina | TSM-XXXDD05(II) | 260-300 |
| | TSM-XXXDD05A.05(II) | 260-300 |
| | TSM-XXXDD05A.08(II) | 260-300 |
| | TSM-XXXDD05A.082(II) | 260-315 |
| | TSM-XXXPA05 | 215-260 |
| | TSM-XXXPA05.05 | 215-260 |
| | TSM-XXXPA05.08 | 215-260 |
| | TSM-XXXPD05 | 240-280 |
| | TSM-XXXPD05.002 | 215-275 |
| | TSM-XXXPD05.05 | 240-280 |
| | TSM-XXXPD05.05S | 215-275 |
| | TSM-XXXPD05.08 | 240-280 |
| | TSM-XXXPD05.082 | 215-275 |
| | TSM-XXXPD05.08D | 245-275 |
| | TSM-XXXPD05.08S | 215-275 |
| | TSM-XXXDD06M.05(II) | 315-350 |
| | TSM-XXXDE15H(II) | 380-420 |
| | TSM-XXXDE15M(II) | 335-420 |
| | TSMXXXDD05H.05(II) | 275-340 |
| Yingli | YLXXXA-29b | 220-255 |
| | YLXXXP-29b | 215-260 |
| Znshine | ZM6-60-XXX/M | 295-330 |

Series 200 has been tested with the following Module Level Power Electronic (MLPE) devices:

The Series 200 System has been tested with the following UL/NRTL Listed Module Level Power Electronic (MLPE) Devices. The back plates of the MLPEs have been evaluated for bonding to Se-ries 200 Ground Rail through the MLPE Attachment Kit.

| | | |
|-------------------------|-------------------|-------------------|
| AP Smart | RSD-S-PLC | |
| Celestica International | DG-006-F001201x | DG-006-F001401x |
| Delta Electronics | GPIO0010105 | |
| Enphase | C250 | IQ7-60-2-US |
| | M215 | IQ7-60-B-US |
| | M250 | IQ7PLUS-72-2-US |
| | IQ6-60-2-US | IQ7PLUS-72-B-US |
| | IQ6PLUS-72-2-US | |
| Ginlong Technologies | Solis-RSD-1G | Solis-MLRSD-R2-1G |
| | Solis-MLRSD-R1-1G | |

| | | |
|-----------|--------------|-------------|
| SolarEdge | P300-5NC4ARS | P405 |
| | P320-5NC4ARS | P485 |
| | P370-5NC4AFS | P505 |
| | P400-5NC4AFS | P730 |
| | P320 | P800p |
| | P340 | P850 |
| | P370 | P860 |
| | P400 | P950 |
| | P401 | |
| SMA | RSB-2S-US-10 | |
| Tigo | TS4-R-F | TS4-R-S-DUO |
| | TS4-R-M | TS4-A-F |
| | TS4-R-O | TS4-A-2F |
| | TS4-R-S | TS4-A-O |
| | TS4-R-M-DUO | TS4-A-S |
| | TS4-R-O-DUO | |

Notes:

AP Smart RSD-S-PLC, Ginlong Solis-MLRSD-R1-1G and Solis-MLRSD-R2-1G, and all Tigo models have not been investigated for bonding since the enclosures are constructed entirely of polymeric materials.

The SolarEdge P320 and P370 models are both frame mount and rail mount. All other PXXX series models are rail mount.

Functionality of these devices was not evaluated.

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

| Span | Orientation | Direction | Load Rating (lb/ft ²) |
|--------|--------------------|------------|-----------------------------------|
| 8 feet | Long Side Mounting | Downforce | 46.7 |
| | | Uplift | 32.1 |
| | | Down-Slope | 52.4 |

Series 200 has been evaluated for Mechanical Loading with all UL/NRTL Listed Photovoltaic modules listed in this manual for the minimum mechanical load ratings per UL 2703.