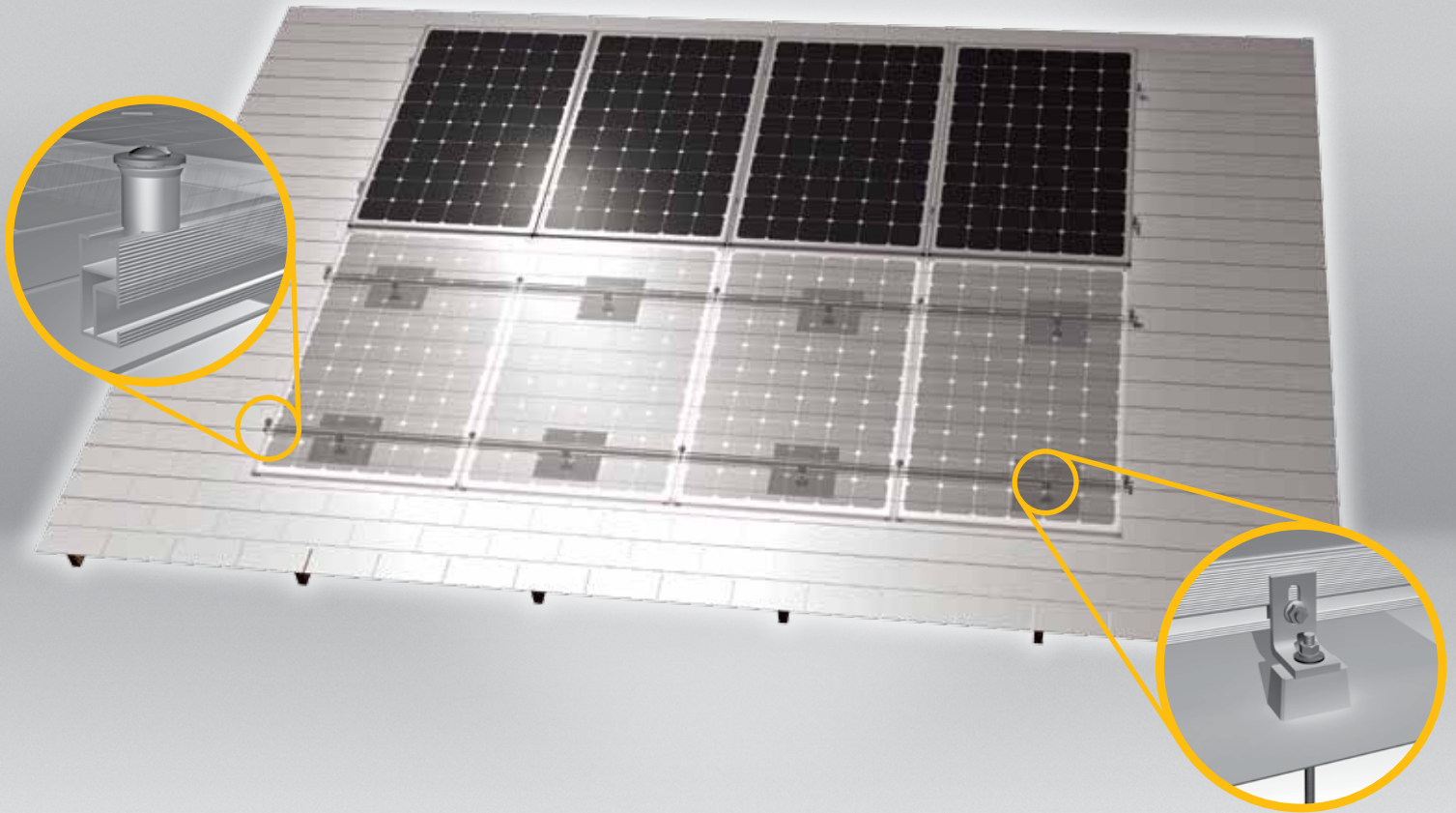


## Pitched roof mounting system planning and installation guide



# Proven quality – simply clever – obvious advantage

---

Congratulations, we are pleased you have chosen one of our high quality Sunfix plus® roof mounting systems from SolarWorld. All Sunfix plus mounting systems offer a value-added engineered design for ease of installation and safety, ensuring trouble free assembly and operation of the photovoltaic (PV) system. All components selected are quality inspected and held to the highest standards.

The instructions and contents of this manual are designed to assist you in planning and installing your Sunfix plus roof mounting system. Building and structural integrity of the installation is ultimately the responsibility of the installing party. Be aware of questionable roof construction conditions and regional wind and snow load exposure effects. Approval by a locally licensed professional engineer may be required.

# Table of contents

---

<b>Safety information</b>	<b>4</b>
<b>Installer responsibility</b>	<b>5</b>
<b>Installer considerations</b>	<b>6</b>
Suitable installation conditions	6
<b>Technical overview of system</b>	<b>8</b>
Component overview	9
Hardware overview	10
<b>System planning</b>	<b>13</b>
Design basics	13
Access, pathways and smoke ventilation	14
Identify roof type	16
Product selection	17
System layout	18
Rail span tables	21
<b>System installation</b>	<b>22</b>
Quick Mount PV composition shingle instructions	23
Quick Mount PV universal tile instructions	26
Installing Sunfix plus racking system	29
PV string wire pull box	31
Wire management	32
Equipment ground-bonding	32
Module installation	38
Top clamp hardware selector guide for other modules	40
Standing seam metal roofing installation	42
Micro-inverter installation	43
<b>Maintenance and cleaning</b>	<b>44</b>
<b>Warranty</b>	<b>45</b>
<b>Appendix</b>	<b>46</b>
Sunfix plus racking system – sample layouts	46

# Safety information

---

In-depth specialist knowledge is necessary to install and service a photovoltaic (PV) system. All work installing the PV system must be carried out by suitably qualified personnel. Carefully read through this manual before installing, operating or servicing the PV system. Store these instructions in an easily accessible place. Failure to follow the safety instructions may result in personal injury and/or damages.

## \*\*\* WARNING \*\*\*

***Danger of electrocution!*** Solar modules generate electricity when exposed to sunlight or other light sources and may constitute a danger of electric shock or burn.

Typically an individual module generates voltage less than 50 Vdc. A voltage of 30 Vdc is considered a shock hazard. When multiple modules are series connected the module-string voltage increases; lethal high voltages in excess of 500 Vdc are possible in grid connected PV systems. Although the fully insulated module-plug connectors provide protection against accidental contact, the following points should be observed when handling solar modules in order to avoid damages or arcing, risk of fire, serious injury or a potentially fatal electric shock.

- Do not insert electrically conductive objects into module-cable plugs or sockets.
- Do not touch the ends of module cables with bare hands when the module is illuminated.
- Ensure module cable connections are in good condition-no visible damage.
- Do not wear jewelry during mechanical and electrical installation work.
- Keep moisture away from tools and the working environment.
- Do not dismantle modules or remove parts or labels fitted by the manufacturer.
- Do not use or install broken modules.
- Be careful not to drop modules, especially onto hard surfaces.
- Keep children and unauthorized persons away during installation.
- Do not scratch or puncture the PV module back sheet; may void warranty.
- Do not drop objects onto module back sheet, or use as a work surface.
- Do not stand or walk on modules, avoid bending or twisting the modules.
- Never leave a module unsupported or unsecured while on roof top.
- Pay attention to the warning notices on the product packaging!

# Installer responsibility

---

- Ensure the roofing materials are in good condition not requiring repairs within the warranty life of the PV system.
- Ensure roof construction is suitable with regard to loading capacity (rafters, connections, other structural support members) determined by the appropriate building codes.
- Ensure debris shedding and water drainage is not impeded by the solar installation.
- Ensure adequate ventilation below array to avoid the build-up of heat which may reduce system performance.
- Ensure the waterproofing integrity of the roof is maintained. Include the use of roof flashing attachments that are appropriate for the roof-covering materials.
- It is highly recommended to consult a licensed professional engineer if in doubt when performing work in areas subject to high wind and/or snow loads, atypical exposures or seismic conditions.
- Protect exposed PV cables against atmospheric influences, such as UV light and mechanical damage by suitable measures.
- Incorporate appropriate wire management methods restricting module interconnect cables from touching the roof and tangling with debris.
- Sufficient distance should be kept to roof edges, allowing access for emergency response personnel. Solar modules must never extend beyond the edge of a roof.
- All applicable local and national code requirements shall be observed and followed, and shall take precedence over information provided in this installation guide.
- Ensure personal fall protection devices when buildings are greater than 10 ft tall.
- Protect persons on the ground against falling objects with appropriate barriers.
- Observe the manufacturer's safety instructions provided with other system components.
- Ensure all bolted connections are properly torqued to manufacturer recommended values.
- Record module serial numbers for system documentation and warranty purposes.

# Installation considerations

---

Provide adequate fall protection for yourself and others on roof. Do not perform installation during strong winds or adverse weather conditions. Always work in a team of minimum 2 or more people. Ensure that objects cannot fall down from the work area. Carefully secure the working area to avoid risks of injury to people. Always wear protective head gear and protective shoes with rubber soles. Use insulated tools and wear gloves to prevent risk of shock or burn.

## \*\*\* CAUTION \*\*\*

*Solar modules can weigh in excess of 40lbs (18.2kg). Two persons and proper handling equipment should be employed to safely transport the modules.*

## Suitable installation conditions

---

### **Install the modules in an unshaded location**

Even slight shading causes a reduced yield from the system. Hence it is particularly important that the modules be installed in a location with the least possible shading. For best performance - there should not be any shading of the PV array surface at any time of the year. The PV array should be exposed to several hours of unobstructed sunlight even during the winter months when sun is lowest in the sky.

### **Before installation**

Electric code (NEC), local utility, health and safety standards and accident prevention regulations should be complied with during installation. Ensure that the relevant safety instructions for the installation and operation of the other system components are also followed.

### **Installation**

The module must not be installed either as overhead glazing or as vertical glazing (e.g., on a façade). As well as the module itself, the mounting system must also be able to reliably withstand the expected load resulting from the conditions at the installation site (snowfall, wind).

### **Maximizing yield with optimum orientation and pitch**

Before installation, research the appropriate orientation for the modules to enable the system to generate the optimum yields. Ideal conditions for power generation occur when the sun's rays hit the generator surface at a perpendicular angle. When the modules are series connected, make sure all modules are installed with the same orientation and pitch to avoid output losses.

### **Tilt angle selection**

Installing at tilt angles between 9° and 45° is recommended. The tilt angle of the PV module is measured between the surface of the PV module and horizontal. The minimum recommended roof tilt angle is not less than 9 degrees when installed with Quick Mount PV™ roof flashing systems.

### **Ensure sufficient ventilation**

To ensure sufficient ventilation below a solar array mounted parallel to a roof surface, a clearance from 3" to 6" to the solar modules is recommended.

### **Do not exceed the maximum mechanical load**

Ensure solar mounting system is installed with consideration for local load conditions like wind and snow. The combined wind and snow loads shall not exceed the maximum load rating of the solar module.

### Ensure comprehensive fire protection

The installation of roof-mounted PV systems can affect a building's fire safety in some cases. Poorly executed installations in particular pose a hazard in the event of a fire. Ensure the system is mounted over a fire resistant roof covering rated for the application. Refer to your local building department for guidelines and requirements for building fire safety. The solar array must not be installed in proximity to highly flammable gases and vapors (e.g., close to gas canisters, paint spraying systems, fuel stations, near naked flames or combustible materials).

### Site considerations

Make certain installation site is not exposed to artificially concentrated sunlight or submerged in water or continually exposed to water splashes. If the solar array is exposed to high concentrations of salt or sulphur laden air or any unusual chemical exposure there is a risk of long term corrosion.

### Water Drainage

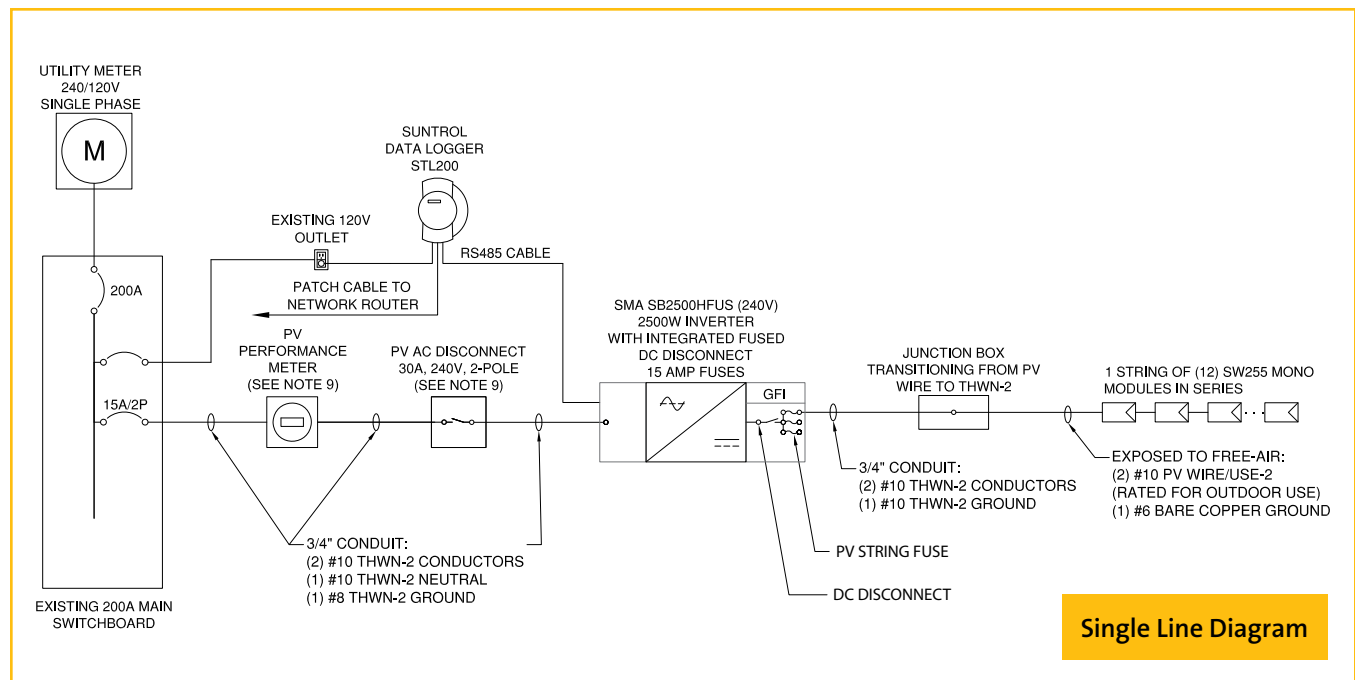
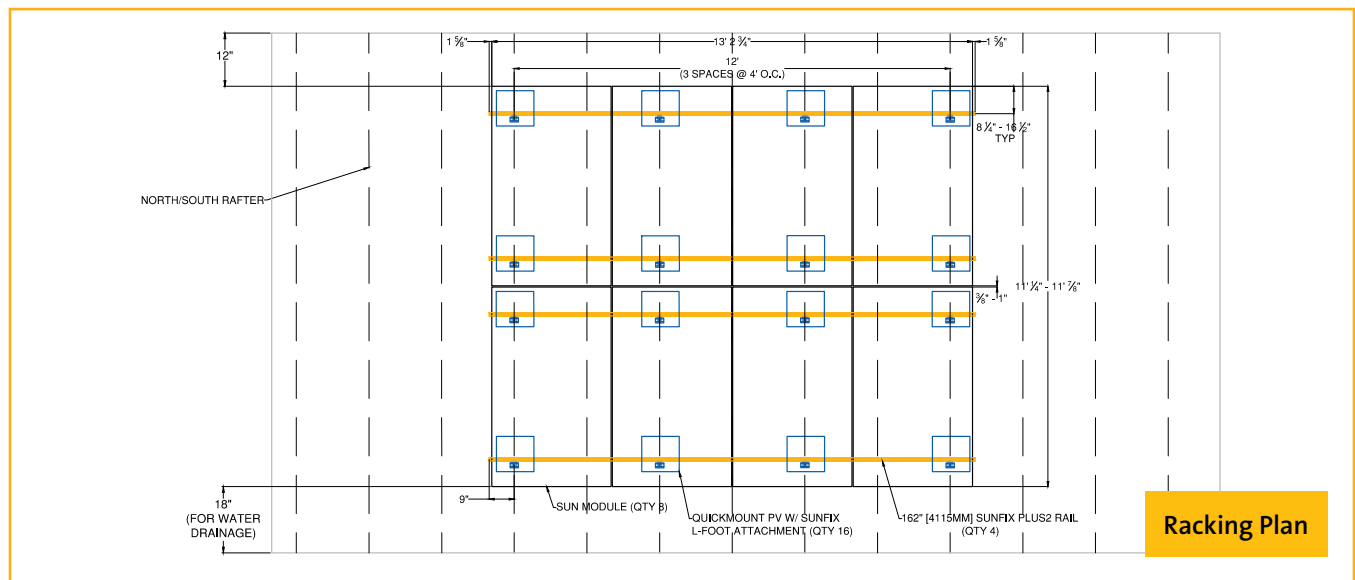
PV modules are typically elevated between 3" to 6" above roof, as such, a potential for rain water shedding down the PV array, overshooting the rain gutter exists if installed too close to the eave. A recommended distance from the rain gutter to the lower edge of the PV array is:

Distance	Roof Pitch
12"	27 degrees or less
18"	28 to 45 degrees

# Technical overview of system

The Sunfix plus pitched roof mounting system is a versatile support structure for the installation of solar modules onto pitched roofs. The Sunfix plus mounting system has been designed specifically for SolarWorld Sunmodules (2.0 & 2.5 frames). The Sunfix plus mounting system is not approved for use with any other PV module. When Supplied with SolarWorld Sunkits®, the Sunfix plus system is assembled as a complete kit, including all hardware, equipment grounding components and roofing attachments based on the existing roof structure and the site specific load requirements (tilt angle, snow, wind loads, etc.).

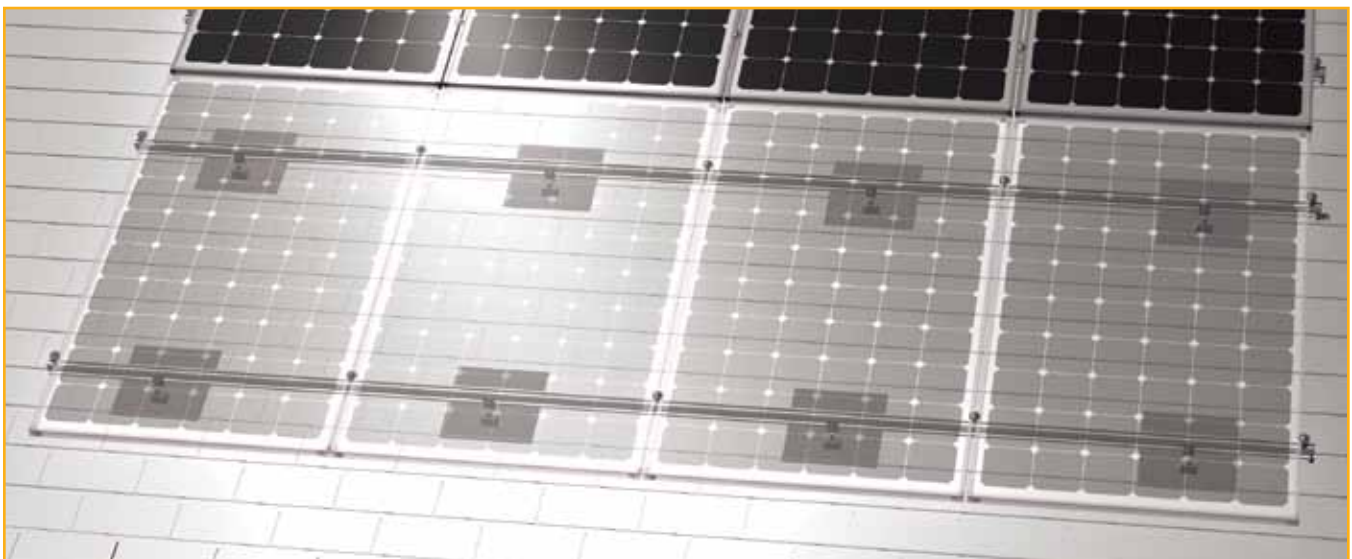
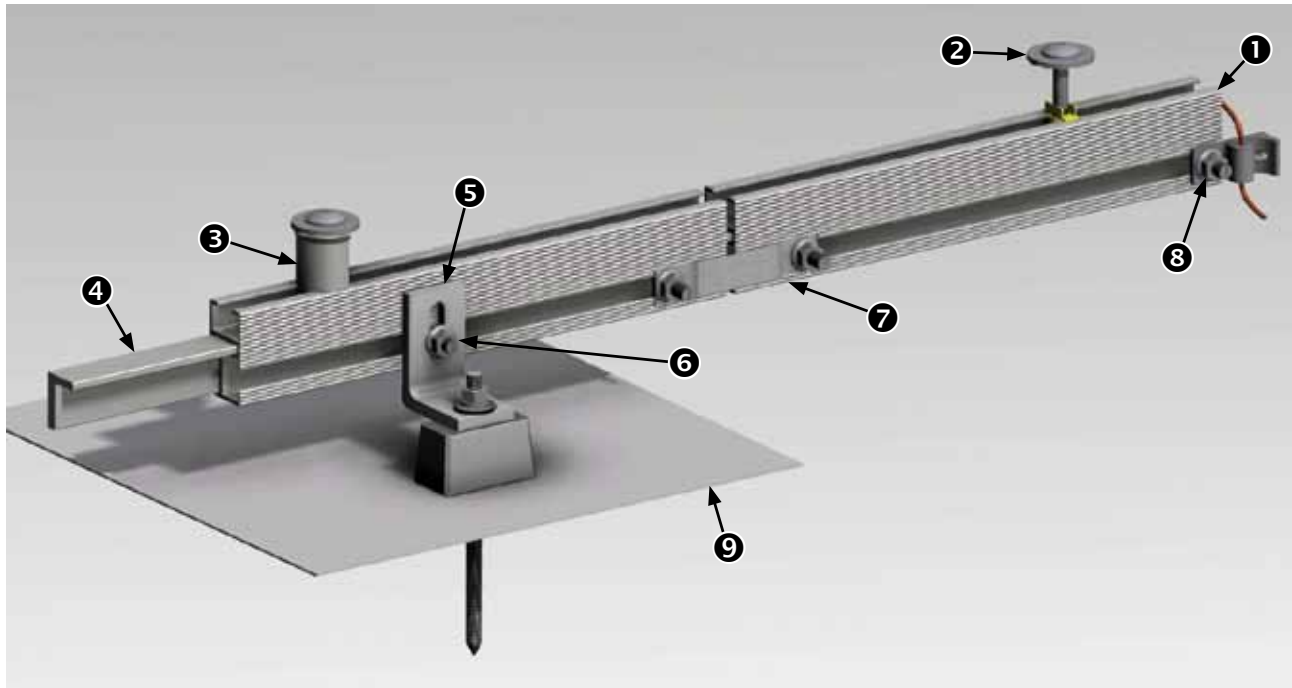
Every 'Sunkits' system is provided with a general racking plan and electrical wiring diagram. These define the arrangement of the attachment points and the supporting rail as well as the recommended wiring scheme from the array to the power inverter, all matched to suit your roof construction and PV array layout needs.





## Component overview

- ❶ Sunfix plus rail 2 modules = 82", 3 modules = 122", 4 modules = 162"
- ❷ Top-clamp assembly for 31 mm frame - M8 bolt with channel nut with bolt positioning retainer
- ❸ End clamp aluminum spacer - 31 mm
- ❹ Rail splice bar; joins rails together
- ❺ L-bracket with dual adjustment slots & mating serrations
- ❻ T-bolt M8 x 20 stainless steel with serrated flange hex nut
- ❼ Rail splice ground jumper WEEB 8.0 pre-assembled with T-bolts
- ❽ Rail-equipment ground WEEB-lug 8.0 with T-bolt assembly
- ❾ Roof attachment/flashing - Quick Mount PV®

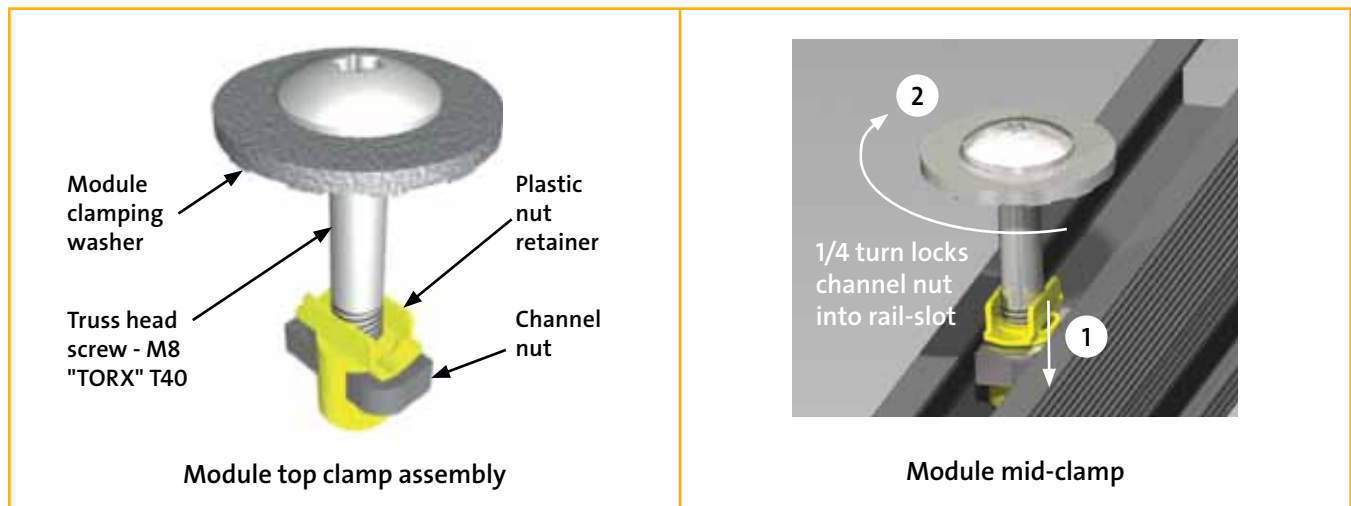


Portrait module orientation (single layer) shown with two parallel support rails per row.

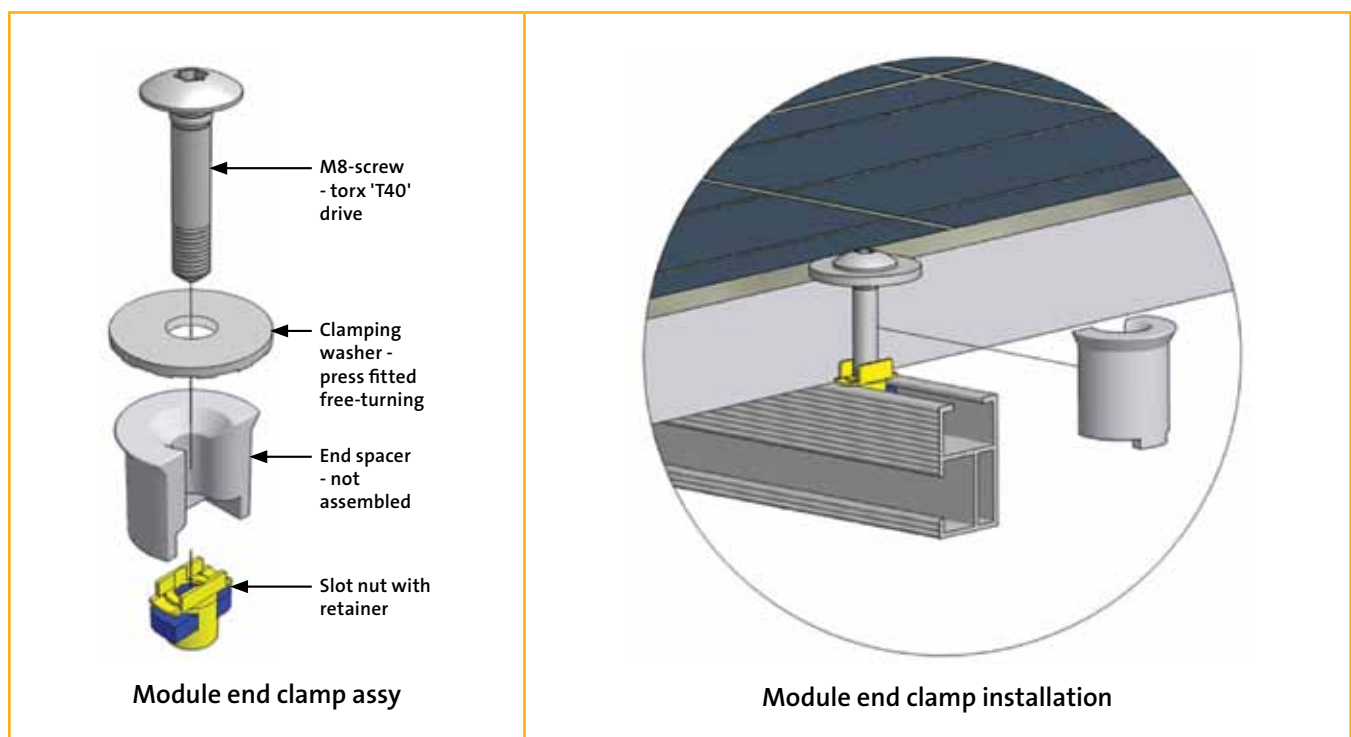
## Hardware overview

The Sunfix plus mounting system provides a fast, simple and cost effective flush mounting solution for PV modules on pitched roofs. The fasteners are of high quality, corrosion resistant stainless steel for long life. Top clamps insert easily into the Sunfix plus rails. Installation time is reduced by pre-assembled "Top-Clamp" hardware. Top clamps are silver colored, also available in black.

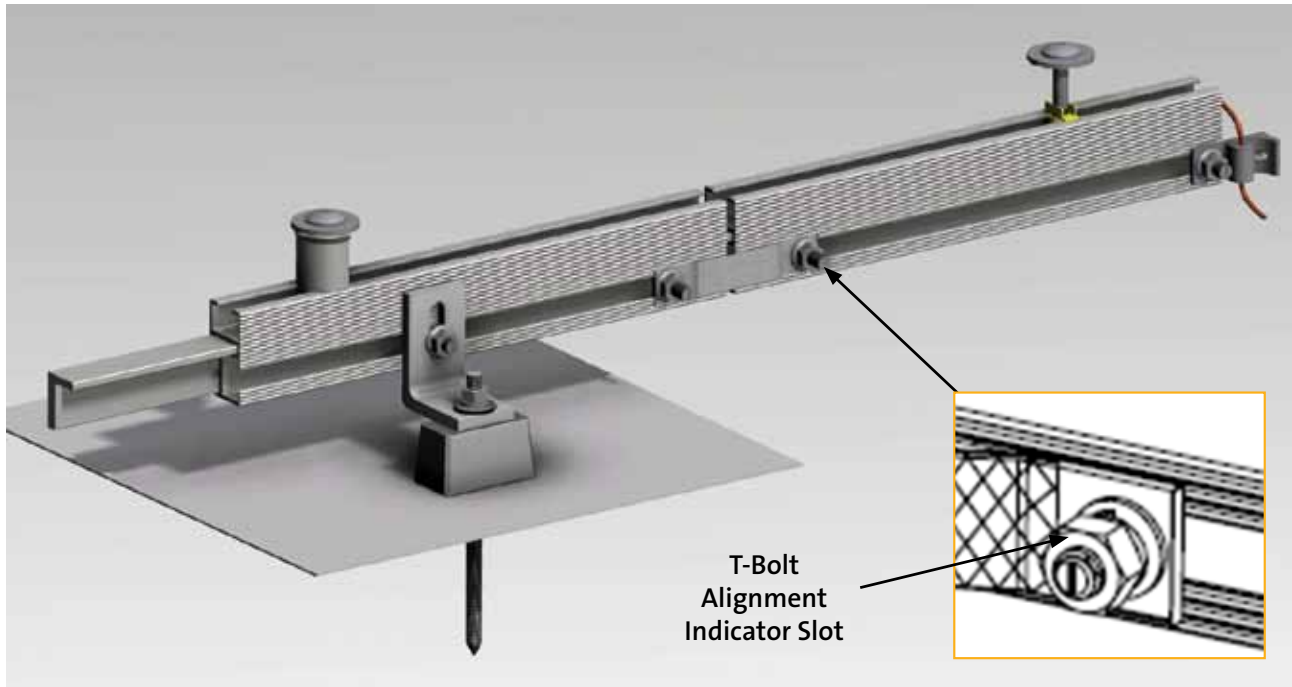
- Pre-assembled, as shown, Module top clamps are for a Sunmodule frame thickness of 31mm. For attachment of other PV modules other than Sunmodules see page 40. Top clamp bolt assemblies include a channel nut with a plastic retainer which simply inserts into the Sunfix plus rail-slot. This retainer allows the top clamp bolt to stay in place during installation of the modules. The top clamp sets the spacing between modules.



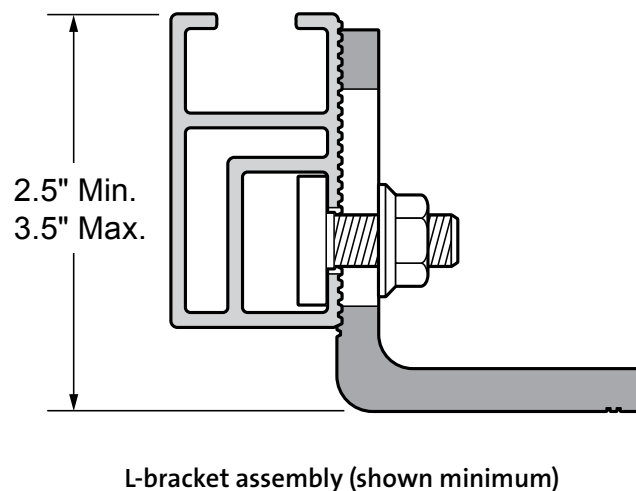
- The same top clamp bolt for module 'End-Clamp' adds a spacer for 31 mm module frame height. Top clamp bolts are with a 'Torx-T40' drive head. All fasteners are M8 thread end. Clamp spacer is aluminum.



- The side slot of Sunfix plus2 rail is designed for insertion of (M8) T-bolts. This slot is used for fastening "L-bracket" brackets and "WEEB" grounding devices with T- bolts. Added confidence in assembly includes alignment indicators on end of T-bolts. When the alignment indicator slot is oriented vertically, the bolt is secured in place.



The Sunfix plus2 rail and L-foot bracket have mating serrations to improve alignment and stability of the connection. The L-foot bracket has 1" slots, providing a range of adjustment from 2.5" to 3.5" (as shown). The Quickmount PV flashing for composition shingle roofing will add 1.25" below the L-foot bracket.



Item No.	Description	8 Modules	12 Modules	24 Modules
Parts		Qty	Qty	Qty
EC0589*	Rail, Sunfix plus2, 2 Module - 82" , Clear Anodize	0	0	0
EC0591*	Rail, Sunfix plus2, 3 Module-122", Clear Anodize	0	8	0
EC0592*	Rail, Sunfix plus2, 4 Module-162", Clear Anodize	4	0	12
EC0421	Plus Connect 2, Splice Bar, Clear Anodize	0	4	8
EC0427*	L-Bracket, Clear Anodize	16	20	40
SA0192*	Module Top Clamp Assy M8 -silver	20	28	52
SA0177*	End Spacer - 31 mm silver	8	8	8
SH0001	T-Bolt M8 x 20 S/S	16	20	40
EC0496	Hex-nut, M8 serrated flange S/S	16	20	40
Grounding				
EC0602	Equip. GND Lug Assy - WEEBLug 8.0	4	4	4
EC0603	Rail Splice GND Assy - WEEB8.0 Bond Jumper	0	4	8
Required Tools				
EC0604	Drive Bit 'Torx' T40, 1/4" hex 2" Lg.	1	2	2
Sunfix plus2 Wire Management				
EC0595	Wire Clip #10AWG S/S-50 Pk	1	1	2
Black Top Clamp Option				
SA0179	Module Top Clamp Assy M8 - Black	20	28	52
SA0181	End Spacer - 31mm Black, Anodize	8	8	8
Roof Attachment Choices				
EC0596	QMSC A, Composition mount, Mill Aluminum	16	20	40
EC0217	QMSC B, Composition mount, Bronze Anodize	16	20	40
EC0218	QMSC C, Composition mount, Clear Anodize	16	20	40
EC0597	QMUTM A, S Tile Mount - Mill alum. 6.5" post	16	20	40
EC0598	QMUTM B, S Tile Mount - Bronze ano. 6.5" post	16	20	40
EC0034	QMUFTM B, Flat Tile Mount - Mill alum. 4.5" post	16	20	40
EC0035	QMUFTM B, Flat Tile Mount - Bronze ano. 4.5" post	16	20	40

This parts list identifies the standard components and hardware items for Sunfix plus2, along with option and accessory items. Examples of typical quantities are shown based on the Sunmodule quantity.

The quantity of items listed are based on modules mounted in portrait, two-rail design, with the total number of modules divided into two equal rows.

Item No's Denoted '\*' are available in 'Black' as well.

When ordering Sunkits systems that are supplied with SolarWorld Sunmodules in black frames, all racking components will automatically default to 'Black' to match.

# System planning

## Design Basics

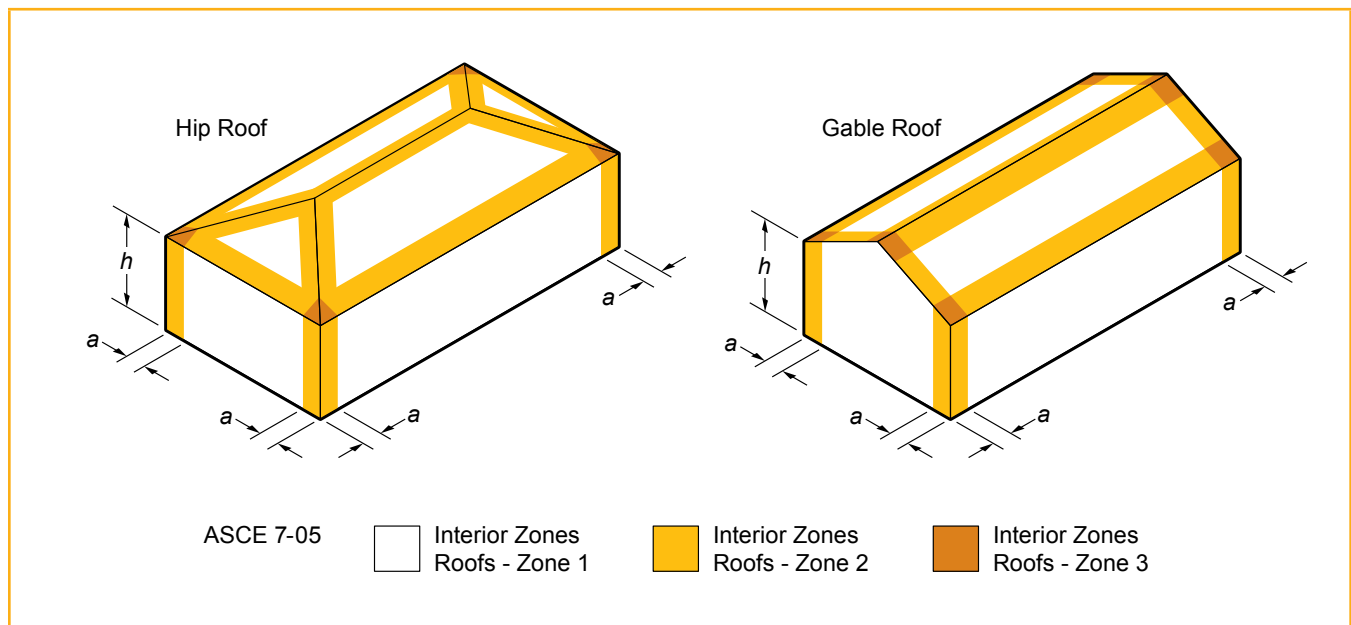
The Sunfix plus roof mounting system is intended only for flush mounting to sloped roofs, and is not to be used with tilt legs. Flush is defined as parallel to the roof surface. The recommended clearance between solar modules and the roof is 3 to 6 inches. Less than 3" to the roof increases heat build-up which affects power production.

The installer is responsible for ensuring appropriate design parameters were used in determining the design loading considerations for the specific installation. Parameters such as snow ground load, wind speed, exposure category and topographic factors should be confirmed with local building officials or a professional engineer.

### Roof zone

According to the width and height of the building for the PV system installation, the design wind load will vary based on where the installation is located on a roof. PV arrays may be located in more than one roof zone. The Sunfix plus mounting system is intended for roof types shown herein for roof zone 1; zones 2 and 3 should be avoided. Maintain appropriate distances around the solar array, and pathways for emergency or service personnel. The local building department should be consulted to determine any municipal or county or fire department clearance restrictions.

- The building construction must be enclosed, not an open or partially enclosed structure.
- The building is regular shaped with no unusual geometrical irregularity (geodesic dome).
- The building is not in an extreme geographic location such as a narrow canyon or steep cliff.
- The building has a gable roof with a pitch not greater than 45 degrees or a hip roof with a pitch less than 27 degrees.



$a$  = 10 percent of least horizontal dimension or  $0.4 h$ , which ever is smaller, but not less than either 4% of least horizontal dimension or 3 ft. (0.9 meters).

$h$  = Mean roof height, in feet (meters), except that eave height shall be used for roof angles  $< 10^\circ$ .

## Access, pathways and smoke ventilation

Access and spacing recommendations should be observed in order to:

- Ensure access to the roof
- Provide pathways to specific areas of the roof
- Provide for smoke ventilation opportunities area
- Provide emergency egress from the roof

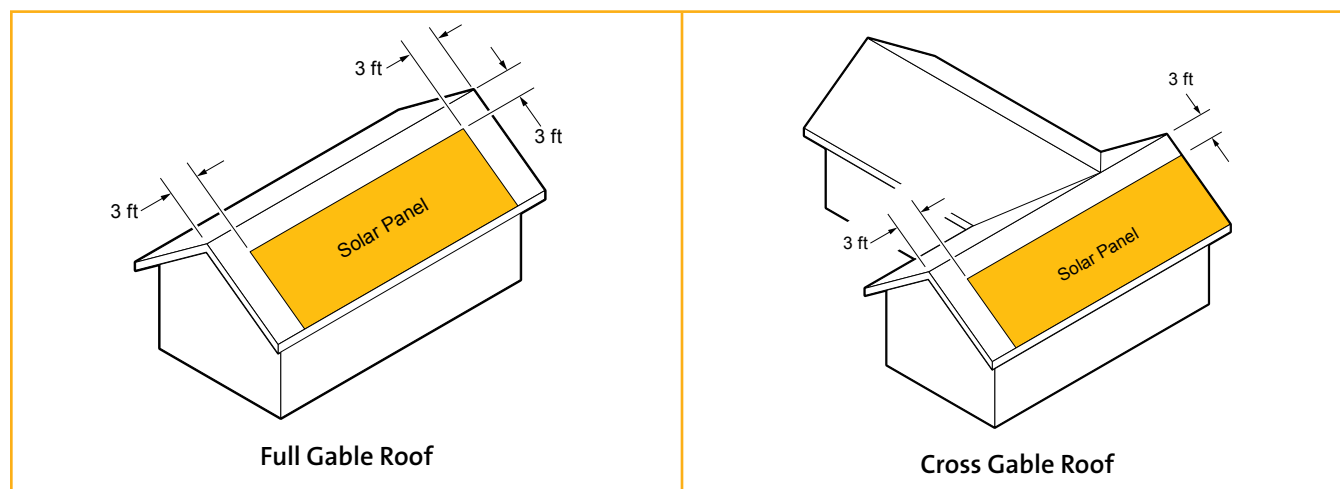
Contact the local AHJ for proper roof setback requirements.

Local jurisdictions may create exceptions to this requirement where access, pathway or ventilation requirements are reduced due to:

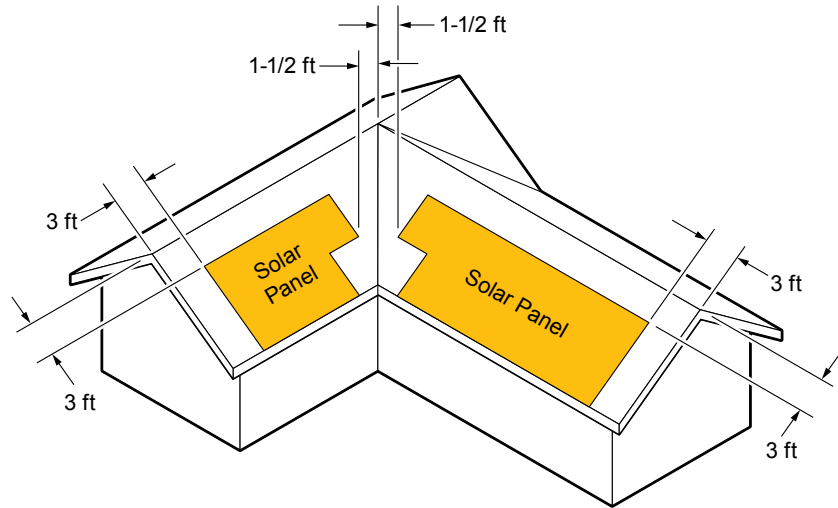
- Proximity and type of adjacent exposures
- Alternative access opportunities (as from adjoining roofs)
- Ground level access to the roof area in question
- Adequate ventilation opportunities beneath solar array (as with significantly elevated or widely-spaced arrays)
- Adequate ventilation opportunities afforded by module set back from other rooftop equipment (example: shading or structural constraints may leave significant areas open for ventilation near HVAC equipment)
- Automatic ventilation device
- New technology, methods, or other innovations that ensure adequate fire department access, pathways and ventilation opportunities

Designation of ridge, hip, and valley does not apply to roofs with 2-in-12 or less pitch. All roof dimensions are measured to center lines. Roof access points should be defined as areas where ladders are not placed over openings (i.e., windows or doors) and are located at strong points of building construction and in locations where they will not conflict with overhead obstructions (i.e., tree limbs, wires, or signs).

Residential Buildings with a single ridge: Modules should be located in a manner that provides two (2) three-foot (3') wide access pathways from the eave to the ridge on each roof slope where modules are located.

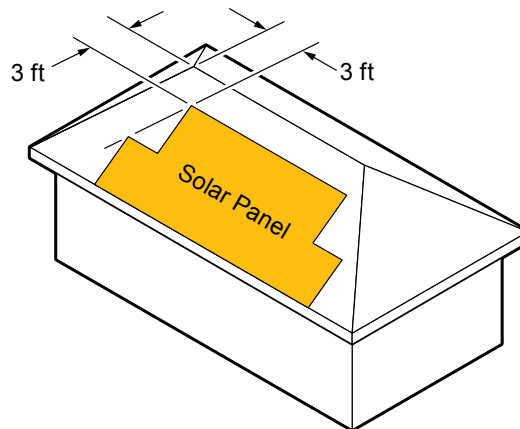


Hips and Valleys: Modules should be located no closer than one and one half (1.5) feet to a hip or valley if modules are to be placed on both sides of a hip or valley. If the modules are to be located on only one side of a hip or valley that is of equal length then the modules may be placed directly adjacent to the hip or valley.



**Cross Gable Roof with Valley**

Residential buildings with hip roof layouts: Modules should be located in a manner that provides one (1) three-foot (3') wide clear access pathway from the eave to the ridge on each roof slope where modules are located. The access pathway should be located at a structurally strong location on the building (such as a bearing wall).



**Full Hip Roof**

### **Location of direct current (DC) conductors**

Conduit, wiring systems, and raceways for photovoltaic circuits should be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities.

Conduit runs between sub arrays and to any DC combiner/pull boxes should use design guidelines that minimize the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes are to be located such that conduit runs are minimized in the pathways between arrays.

To limit the hazard of cutting live conduit in venting operations, DC wiring should be run in metallic conduit or raceways when located within enclosed specs in a building and should be run, to the maximum extent possible, along the bottom of load-bearing members.



## Identify roof type

### Know Your Roof

It is a good idea to do a thorough roof evaluation prior to your project installation. At this time you should do a layout on the roof confirming everything on the drawing will fit as it is intended. Any irregularities should be noted in advance, so that you can deal with them simply on install day. The quality of the roofing should be determined, so that any repairs or replacement can happen before or in conjunction with the installation. Remove a tile and see what is underneath. On a tile roof it is important to know as much as possible about the manufacturer of the tile, the size of the tile, age of tile, type of substrate (plywood or oriented strand board [OSB]), the rafter size and spacing, age of roof structure, who built it, who roofed it, etc.

The roof covering will dictate the appropriate type of flashing to be incorporated. Installations on composition roof surfaces with flashed components offer the quickest solution. For concrete tile or shake roofs or roofs with cladding that exceeds thickness of 1/8-inch, use taller, female threaded standoffs with approved flashings. Residential building roofs are primarily constructed of three types of coverings:

- Composition (asphalt) shingles
- Curved (S) or flat (slate) concrete tile
- Shake (wood) shingles



Composition (asphalt) shingles



Curved (S) concrete tiles



Composition shingle flashing



Universal flat tile flashing

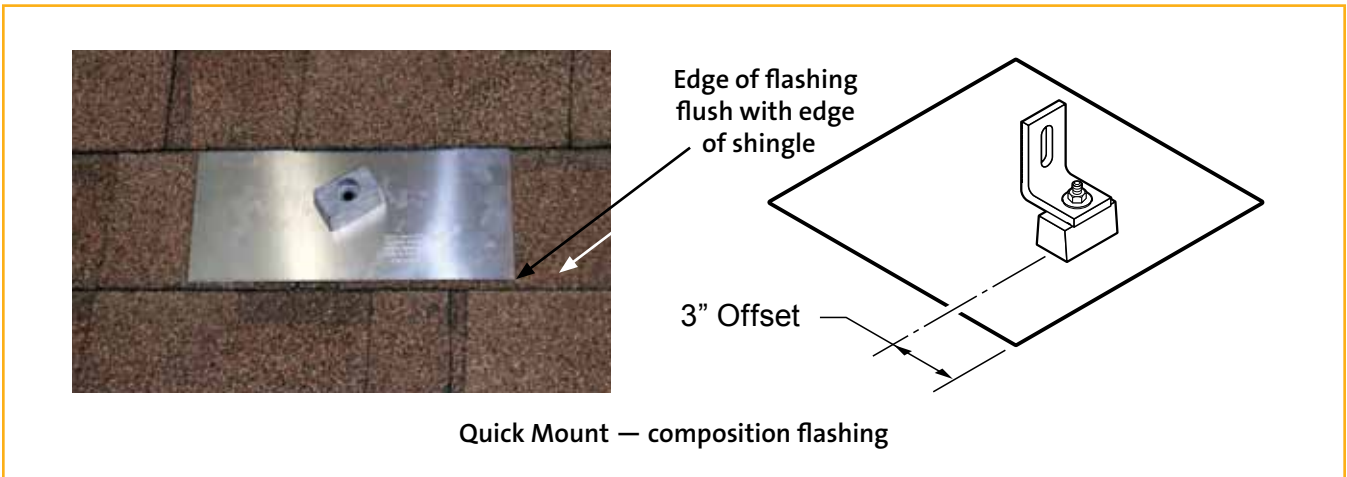


(Universal) S-tile flashing



# Product selection

Quick Mount PV® is an all-in-one waterproof flashing and mount to anchor photovoltaic racking systems to most roofing constructions. The composition flashing fits most asphalt and wood shake roof systems, but not all. Specifically it is sized to fit within a standard 5" to 5-1/2" row or course. To confirm that the composition flashing will match your roof, measure the course exposure of your roof. The "exposed" surface course height should measure no more than 5-3/4". If it turns out the roof tiles are a non-standard size greater than 5-3/4", the alternative method is to use a Quick Mount PV® Shake Mount.



The Quick Mount PV® **Composition Flashing** is to be installed on composition shingle roofing with the flashing's lower edge aligned flush with front edge of shingle course, resulting in a 3" offset from this location to where the provided fastener will penetrate the rafter and provide an attachment point for L-foot.

The composition flashing or mount is intended to be attached into a lumber rafter. Mounts are usually laid out based on the location of the rafters. In some cases it is desired to place a mount where there is no rafter. In this case it is possible to install wood blocking between rafters, then lag screw into the block.

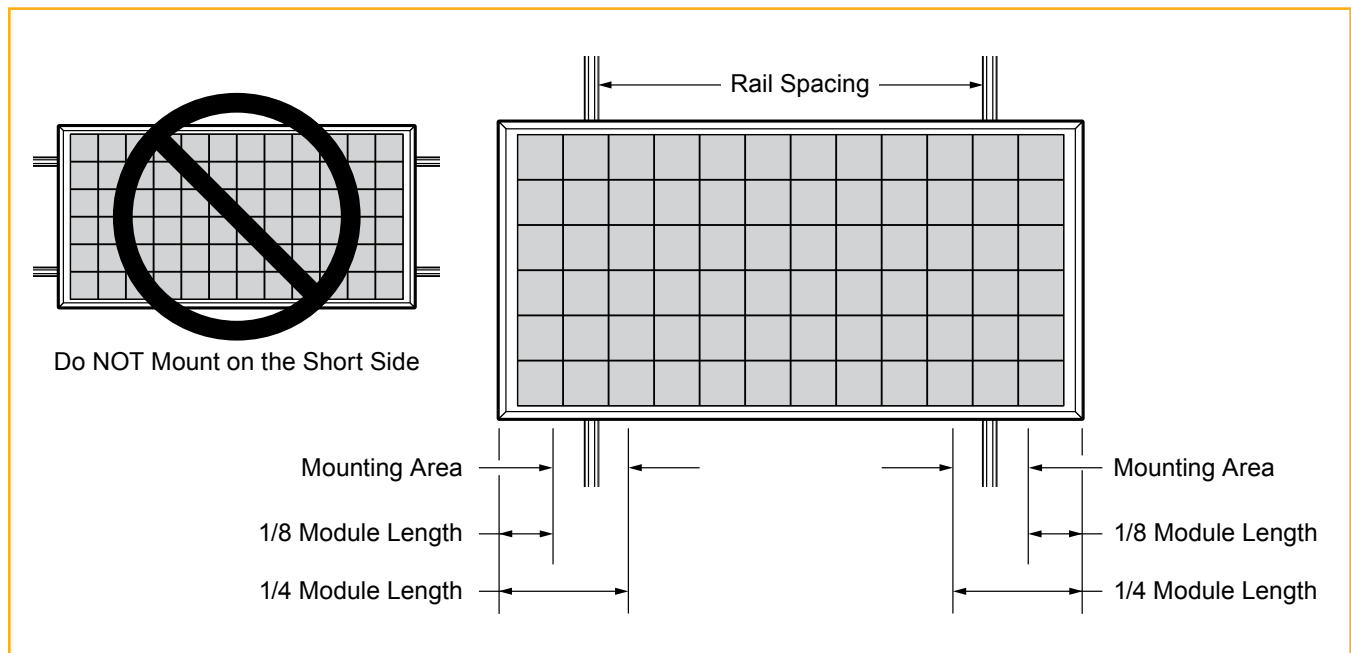
The Quick Mount PV® **Universal Tile Flashing** is intended to fit within most curved tile roof systems, as well as most flat tile systems. Specifically it is sized to fit within a standard 12" wide x 17" tall concrete tile space, flat or curved. It is used on most any flat and curved tile roof and rafter mounted as a standard. Height extensions are not for use with this product. Custom lengths can be ordered.

Pitched Roof Solutions	Composition	Flat Tile	S-Tile	Standing Seam
Sunfix Plus w/quick mount	X	X	X	
Sunfix S-5! (see page 40)				X

## System layout

Proper layout will reduce the risk of drilling extra holes in the wrong location and possibly having to reposition an installed array. Prior to getting on the roof, the system layout should be defined on paper in the form of a drawing or sketch. This will minimize the number of chalk lines on the roof and speed up the layout process. The drawing should define the overall dimensions of the array as well as the roof plane on which the array is to be installed.

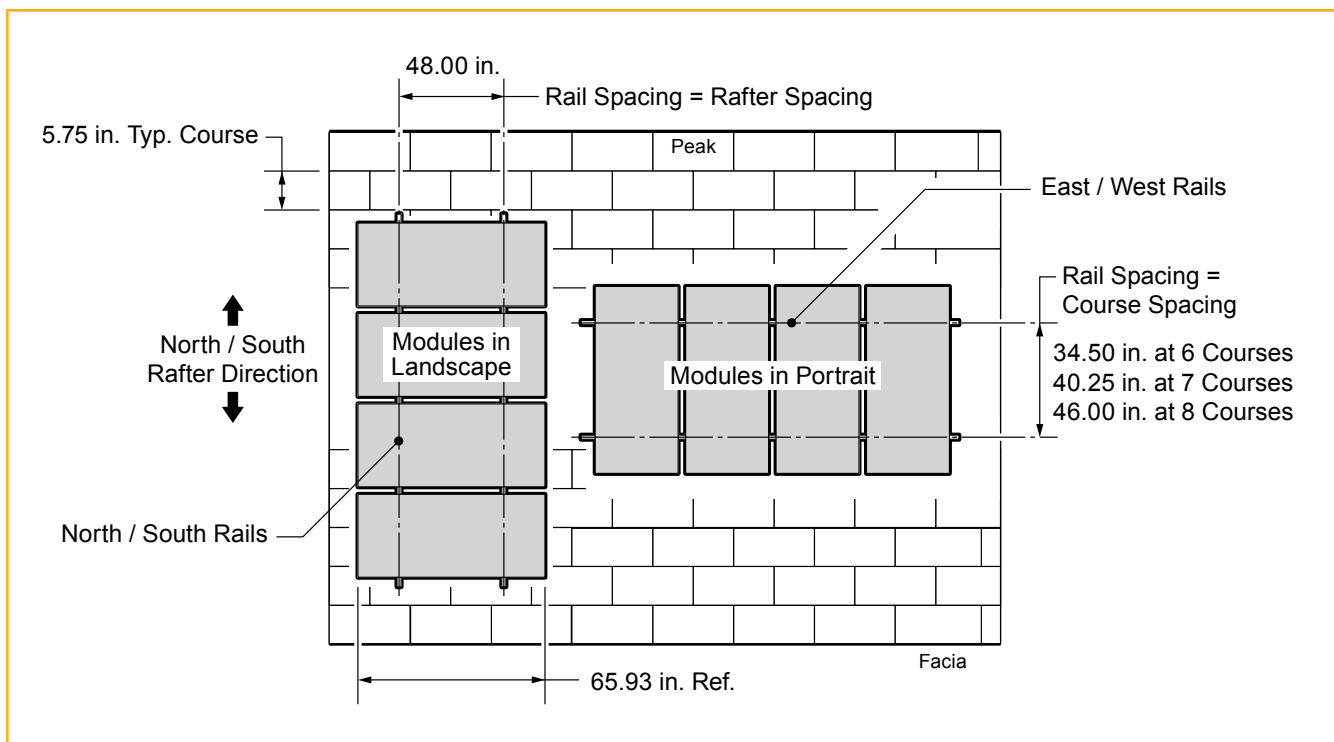
- Confirm roof rafter size, material, and span to verify that the roof structure is sound and capable of supporting the additional load of the PV array within local climatic conditions (wind/snow loads).
- Measure roof surfaces and develop an accurate drawing locating any obstacles such as chimneys, parapets, skylights or roof vents. Look for signs of weak or low-laying roof surfaces which may need repair or additional leveling adjustment of racking.
- Identify any roof areas requiring access, municipal set-back distances or keep-out areas as required by the local Jurisdiction.



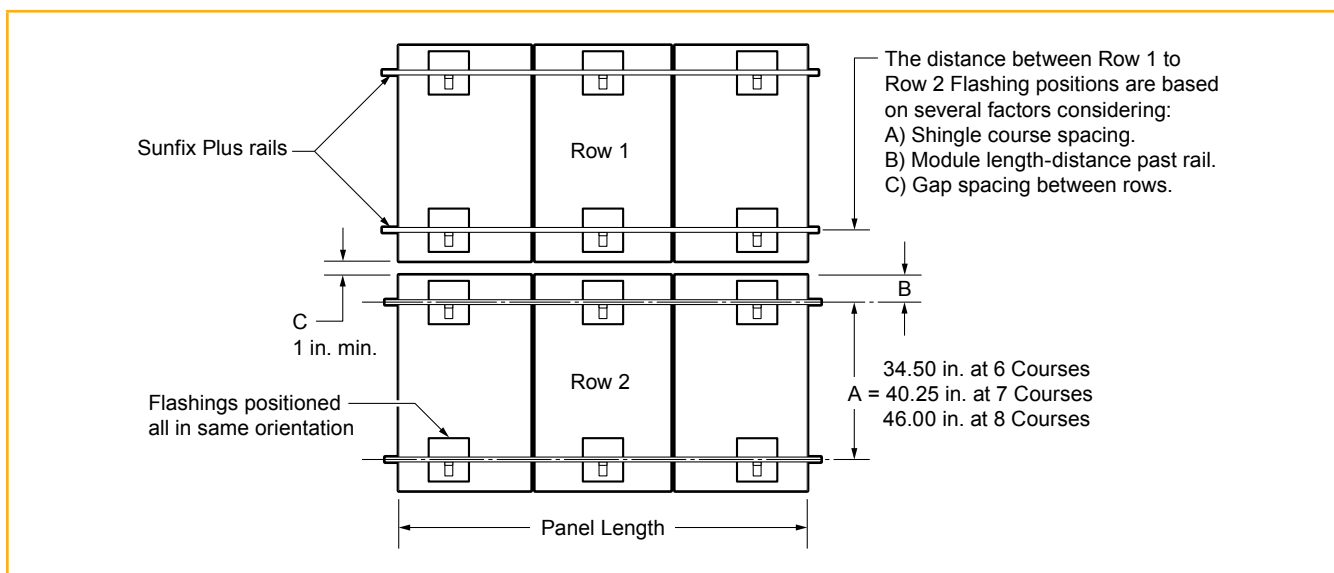
SolarWorld modules must be securely fastened at a minimum of 4 points on the long-sides between an 1/8 and 1/4 of the module length (from 8.25" to 16.5") from the edge. Defining overall dimensions of the array, SolarWorld Sun-modules are 39.41" wide x 65.94" long.

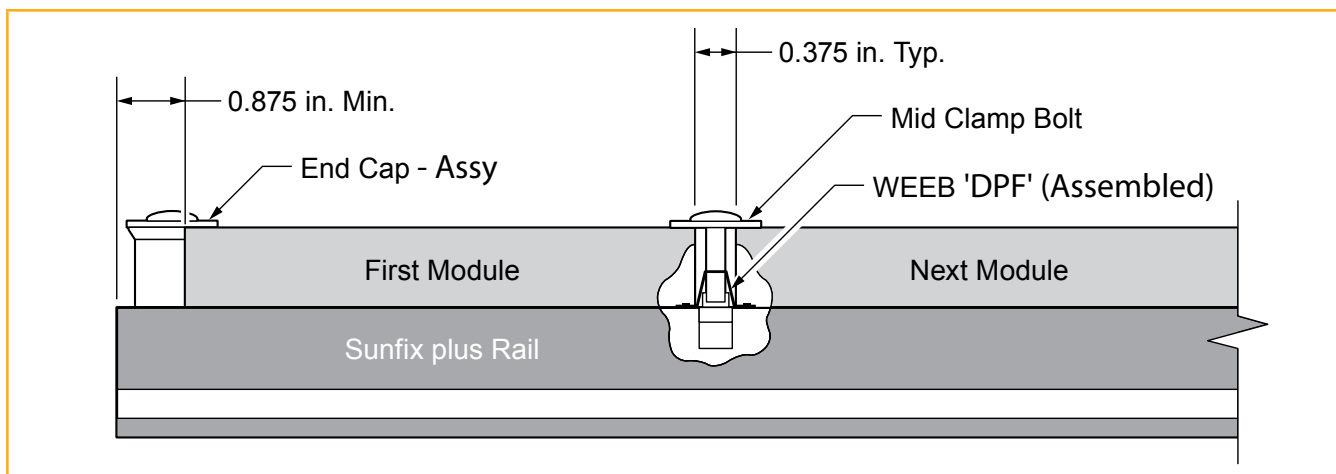
The rail spacing is governed by the attachment locations placed on the roof. Rail spacing must fall within the boundaries of the Sunmodule's recommended support rail attachment mounting area. Therefore, the minimum rail spacing is 33" and the maximum rail spacing is 49.5".

For a two-rail assembly, the Sunfix plus rails may be positioned either North/South for modules in landscape, or East/West for modules in portrait (preferred). Installing modules in portrait allows for better positioning of adjacent rows of panel assemblies with closer spacing, not so dependent on rafter locations.



The “shingled” surface course height should measure not more than 5-3/4”. For East / West rail direction, based on 5-3/4” typical ‘shingle-course’ spacing, attachment locations for composition shingle flashings would be between either 6, 7 or 8 courses.





To calculate the assembled Panel Length, the space between the modules needs to be accounted for as well as the rail distance extending beyond the first and last module in a row, allowing for the end-clamp. The minimum rail distance assumed beyond the modules for the end clamp spacer is 7/8". The assumed spacing between the modules is 3/8" when the top clamp bolt is combined with WEEB 'DPF' module bonding washer.

**Example:** The minimum overall design length of a Sunfix Plus assembly of 4 Sunmodules in portrait would be:

$$39.41 * 4 \text{ (Modules)} + 0.375 * 3 \text{ (mid clamps)} + 2 * 0.875 = \boxed{160.5"} \text{ (end clamps)}$$

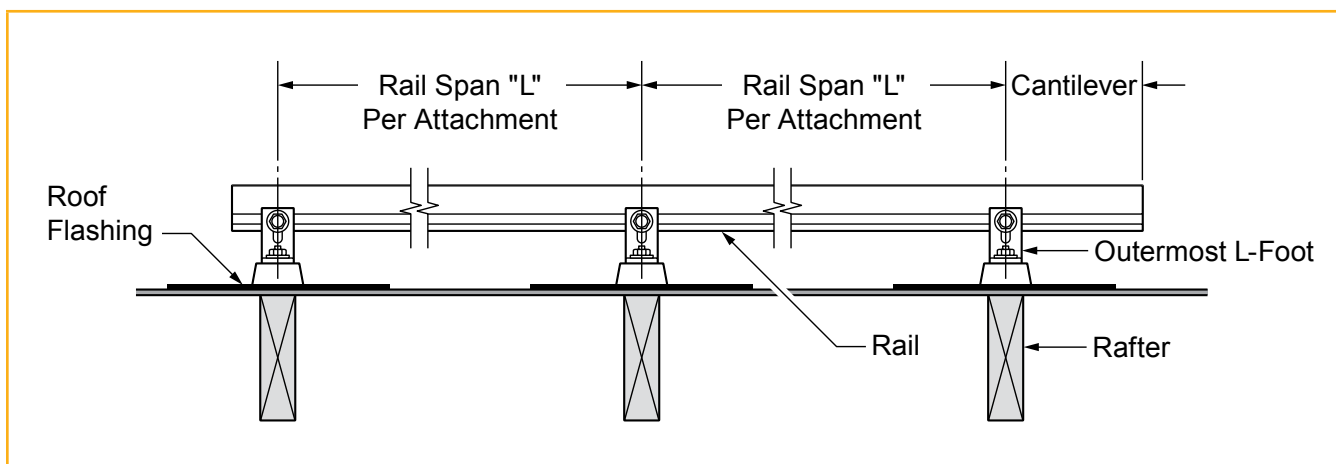
However, the Sunfix plus2 mounting rail lengths have been predetermined, allowing for installation tolerance and mismatch of positioning roof attachments, these lengths are:

Two (2) module rail = 82"	Three (3) module rail = 122"	Four (4) module rail = 162"
---------------------------	------------------------------	-----------------------------

Refer to Sunfix racking layout drawings for examples of typical combinations from 8 to 24 modules in the Appendix.

### Rail Attachment Locations

There are two key dimensional considerations for the positioning rail attachments, "span" (the center-to-center distance between rail supports (L-feet) and "cantilever" the over-hang distance from the outermost L-foot support to the end of the rail). Rail spans and cantilever distances should not exceed the values listed in the rail span tables on the next page.



For parallel two-rail systems, the installer should take precaution when setting the rail cantilever distance past the L-foot such that the ends of both rails are within +/- 1/4" respectively.

## Rail span tables

The following span tables have been engineered to provide the maximum rail attachment span distance (values in inches) for Sunfix plus2 rails. To effectively use the rail span tables, one should consider the wind and snow loads at the site by consulting the local building department. Span calculations utilized design methods or material data from the 2000 AA Specification, ASCE 7-05, 2009 IBC, and 6005-T5 aluminium alloy. The following assumptions were made:

- Wind exposure category C, zones 1, 2, and (not recommended\*) 3
- Adjustment factor = 1.0
- Importance factor (occupancy category II) = 1.0
- Topographic factor = 1.0
- Maximum deflection limit of L/180
- Single span condition, building height of 30 feet
- PV module area is 18 ft<sup>2</sup>. The dead load including support structure and PV module is 50 lbs

Roof pitch 9 - 27 degrees	Rail Attachment Span (in)			
	Rail Cantilever (in)			
	Snow Load (psf)			
Wind speed (mph)	0	20	40	50
85	66	66	54	48
	33	33	27	24
90	63	63	54	48
	30	30	27	24
100	57	57	54	48
	27	27	27	24
110*	51	51	51	48
	24	24	24	24

\* Roof zone 3 not recommended at 110 mph.

Roof pitch 28 - 45 degrees	Rail Attachment Span (in)			
	Rail Cantilever (in)			
	Snow Load (psf)			
Wind speed	0	20	40	50
85	78	66	54	51
	39	33	27	24
90	75	66	54	51
	36	30	27	24
100	66	60	51	48
	33	30	24	24
110	60	57	51	48
	30	27	24	21

**Wind Exposure Category:** ASCE 7-05 defines wind exposure categories as follows:

**Exposure B:** is an urban or suburban area, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single family dwellings upwind for at least a 1/2 mile.

**Exposure C:** has open terrain with scattered obstructions having heights generally less than 30 feet. This category includes flat open country, grasslands, and all water surfaces in hurricane prone regions.

# System installation

This manual primarily covers the installation of the Sunfix plus mounting system and does not address the necessary wiring, conduit, safety disconnects or balance of system components or location thereof conducive to a complete PV system installation.

Planning ahead, ensuring that all necessary plans, instructions, tools, safety equipment, materials and spare parts are gathered prior to arriving at the job site will save time.

## Installation Sequence

The following pages will illustrate the recommended sequence for racking installation.

- Install appropriate Quick Mount PV roof flashings per roof type and layout drawing.
- Attach L-foot brackets to roof flashings, assemble T-bolt and nut onto L-foot top slot.
- Loosely fasten Sunfix plus rails to L-foot brackets, following layout drawings.
- Insert rail splice connectors where necessary during rail installation.
- Adjust L-foot brackets for roof height and rail alignment inconsistencies.
- Check measurements and alignment of rails before applying torque to fasteners.
- Attach a roof mounted wiring pull box in a convenient location, preferably below the PV array.
- Connect PV string home-run cable(s) into wiring pull box.
- Mount the PV string home-run cables by attaching wire management ties to the rails.
- Install equipment bonding devices to each rail row-end and rail splice connections.
- Install a continuous copper ground conductor to all rail-end lugs and along every row (if the modules will also be grounded through this conductor) allowing extra length for the connection into the wiring pull box.
- Starting at one end of the racking, place the End Clamps and the first module with consideration for positioning/alignment of the module onto the parallel rails.
- Install adjacent modules with Mid-Clamp bolts, remembering to electrically interconnect the series cables together. Connect the ground conductor to each module 'lug', unless the WEEB "DPF" option is used.
- Check PV module alignments for aesthetic purposes before applying final torque to top clamps.



## Quick Mount PV installation instructions - composition shingle mount

Photos should be taken of all of the roof variables and placed with the job file for any future reference either short term or long. If the roofing manufacturer is known, it is then easy to obtain the written manufacturer's installation instructions for the roofing materials you are dealing with.

Quick Mount flashings are 100% IBC, UBC compliant, and meet or exceed roofing industry best practices, with the following specifications:

- 2554 lbs average pullout (Douglas fir)
- 2203 lbs average shear
- Stainless steel hardware (included)
- 10-year warranty
- 50-year expected life to not void roof manufacturer's warranty

There's no need for trimming shingles to force a fit. Drill one pilot hole into the rafter, backfill it with appropriate sealant, slide the Quick Mount flashing beneath the felt in the course above, drive the bolt home, and it's done. The 12 x 12-inch Composition Mount flashing is designed to fit within a standard 5 to 5.5" course and the exposed course should be no greater than 5.75".

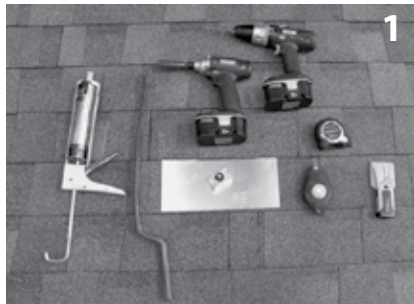
### Recommended tools/materials for Quick Mount PV - composition flashings



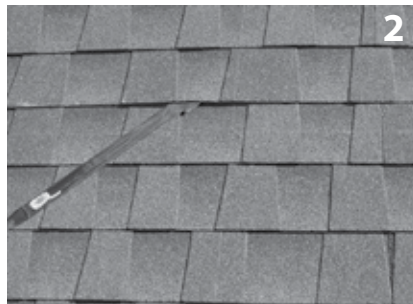
- Cordless impact driver (for hanger bolt)
- Socket wrench with 1/2" hex deep socket (for hanger bolt)
- Cutoff saw ( for excess rail)
- Nail pry-bar (enables roof flashing beneath shingle)
- Drill bit – 7/32" dia. (pilot hole for 5/16" lag screw)
- Caulk gun-dispenser
- Approved roof sealant for attachments
- Digital IR laser stud-finder
- Tape measure, Level
- Chalk - plumb line
- OSHA approved safety glasses and footwear
- OSHA approved safety harness and anchor



## Quick Mount PV installation instructions - composition shingle mount



1  
Locate, choose rafters to be mounted and mark centers of rafters with chalk line (N/S). Select each row course of roofing for mount placement of Quick Mounts.



2  
Lift composition roof shingle with roofing bar, just above placement of Quick Mount.



3  
Slide mount into desired position. Remove any nails that conflict with getting mount flush with front edge of shingle course. Mark center for drilling.



4  
Using drill with 7/32" diameter bit, drill pilot hole into roof and rafter, taking care to drill square to the roof. Do not use mount as a drill guide.



5  
Clean off any saw dust, and fill hole with sealant.



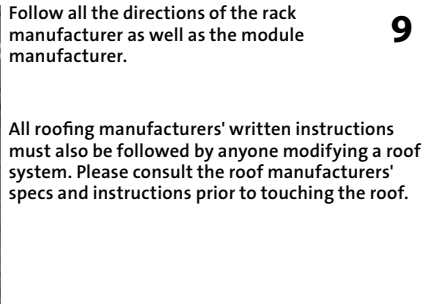
6  
Slide mount back into position. Prepare hanger bolt with (1) hex nut and (1) sealing washer; insert through block into hole and drive hanger bolt into rafter, tightening to a solid, snug fit.



7  
Insert EPDM rubber washer over hanger bolt into block.



8  
Fasten the L-foot onto hanger bolt, secure the Sunfix plus rails. Tighten to 13 foot pounds.

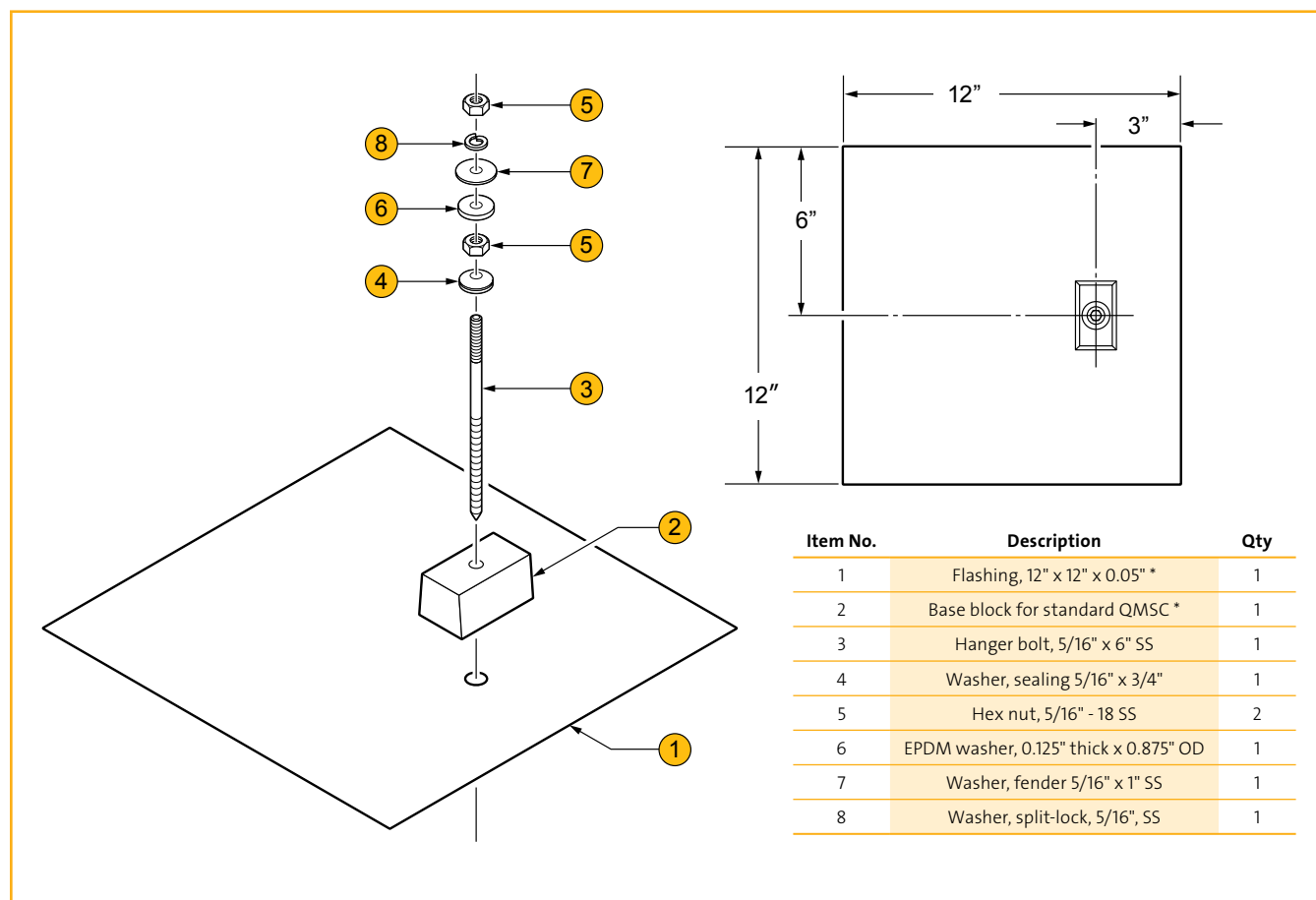


9  
Follow all the directions of the rack manufacturer as well as the module manufacturer.

All roofing manufacturers' written instructions must also be followed by anyone modifying a roof system. Please consult the roof manufacturers' specs and instructions prior to touching the roof.



## Quick Mount PV - Installation instructions, composition shingle mount



## Lag pull-out (withdrawal) capacities (lbs) in typical lumber

	Specific gravity	Lag Bolt Specifications	
		5/16" shaft per 3" thread depth	5/16" shaft per 1" thread depth
Douglas Fir, Larch	0.50	798	266
Douglas Fir, South	0.46	705	235
Engelmann Spruce, Lodgepole Pine (MSR 1650 1 & higher	0.46	705	235
Hem, Fir	0.43	636	212
Hem, Fir (North)	0.46	705	235
Southern Pine	0.55	921	307
Spruce, Pine, Fir	0.42	615	205
Spruce, Pine, Fir (E of 2 million psi and higher grades of MSR and WEL)	0.50	798	266

Sources: Uniform Building Code; American Wood Council.

Notes:

1) Thread must be embedded in a rafter or other structural roof member.

2) See IBC for required edge distances.

## Quick Mount PV installation instructions – universal flat tile and S-tile mount

The primary flashing at the roof deck forms a waterproof shield isolating all penetrating fasteners from corrosive water intrusion. The top flashing is malleable, so it works equally well for curved and flat tile roofs. Both flashings feature a spun aluminum cone, with no seams to fail in extreme climates. The reinforced QBase makes an extraordinarily strong foundation.

For concrete tile roofing, typically the tile roof manufacturer puts a stamp of some sort on the back of each tile. This stamp can be defined by the roofing yard, or by a little on-line surfing. The manufacturer's instructions will spell out exactly what does and does not void the warranty of their roofing product. Officially the roofing manufacturer's instructions supersede our instructions.

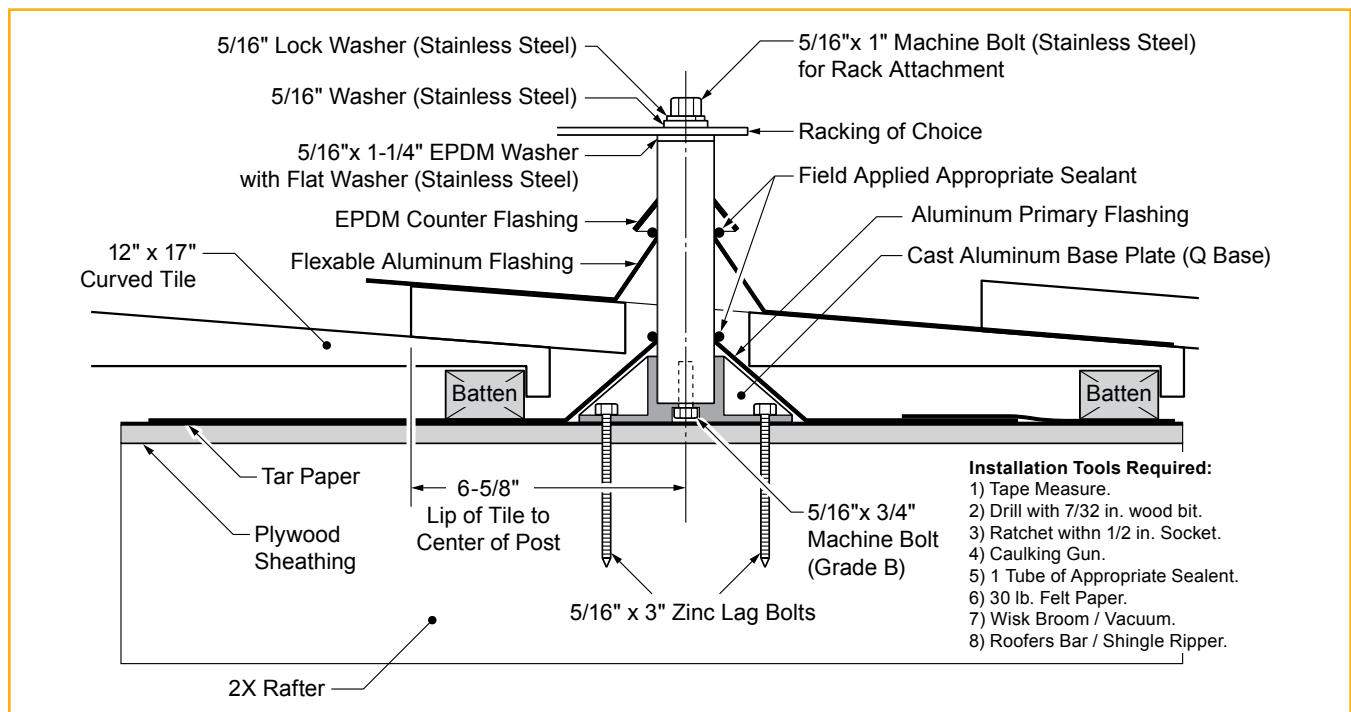
### Waterproofing

On a tile roof it is actually the building paper below the tiles that is waterproof. The tiles are considered water resistant. It is assumed that water will travel under the tiles. The tiles are there for aesthetics, thermal absorption, and to protect the building paper from U.V. and the elements. It is imperative to follow standard roofing practices with the paper. The Aluminum Primary Flashing that we provide needs to go over our Q Base Mounting Base Plate with the long side of the flashing up-slope, above the mount. On the up-slope side of the mount, the Aluminum Primary Flashing must extend under the existing lap in the paper course directly above the mount.

In the common occurrence that the paper is too far up the roof to reach, you must supply and install another piece of building paper (usually 30 lb.) under the row of paper above, and over the top 2 inches of Aluminum Primary Flashing. This paper should be wider than the Aluminum Primary Flashing, and either stapled down or nailed. If a batten board is in the way, pry it up and slip the paper under the batten. Alternatively, three coursing the flashing into the paper is also an acceptable method. Please consult the NRCA's best practices for material specifics, and methods within your geographic area.

### Sealants

It is important to put a compatible sealant into any and all holes drilled into a roof. Most roofing manufactures list a suggested, approved sealant in their specifications. In the freeze-thaw zones, it is important to follow the manufacturers' rules for freeze-thaw conditions. Use the properly rated sealant for each specific application and condition. Some that may be more appropriate for asphalt/composition roofs include Geocell 2300 and ChemLink M-1.



## Quick Mount PV installation instructions - universal tile mount\*



Remove Tile at selected location of Mount.



Locate center of rafter and Mark with a felt pen.



Use a straight edge and measure up 6 5/8" from bottom of tiles to center of the Mount, over the center of Rafter.



Align Q Base over rafter center and drill 2 each 7/32" pilot holes. Place grade 8 Machine Bolt under Q Base in hex slot, threads pointing up. Lag Q Base into Rafter on Marks.



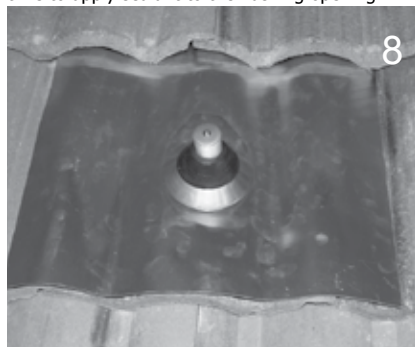
Carefully clean the building paper then install Primary Flashing in either a three course method, or properly lapped paper method. Now is a good time to apply sealant to the flashing opening.



Take care to do a quality installation – when using the paper method, cut a piece of paper 18" wide to slide under the course above, and over the Primary Flashing of the Mount.



Cut a hole in the tile removed, with room to get the post through. Replace tile in position, Insert post and tighten into place. Install the 18" x 18" flashing, and apply sealant around the opening.



If tile is curved, pre-bend the flashing to follow the contour of the tile. Install counter flashing collar.

You are now ready for the Sunfix plus rack. Follow all the directions of the Sunfix plus instructions as well as the Sunmodule instructions.

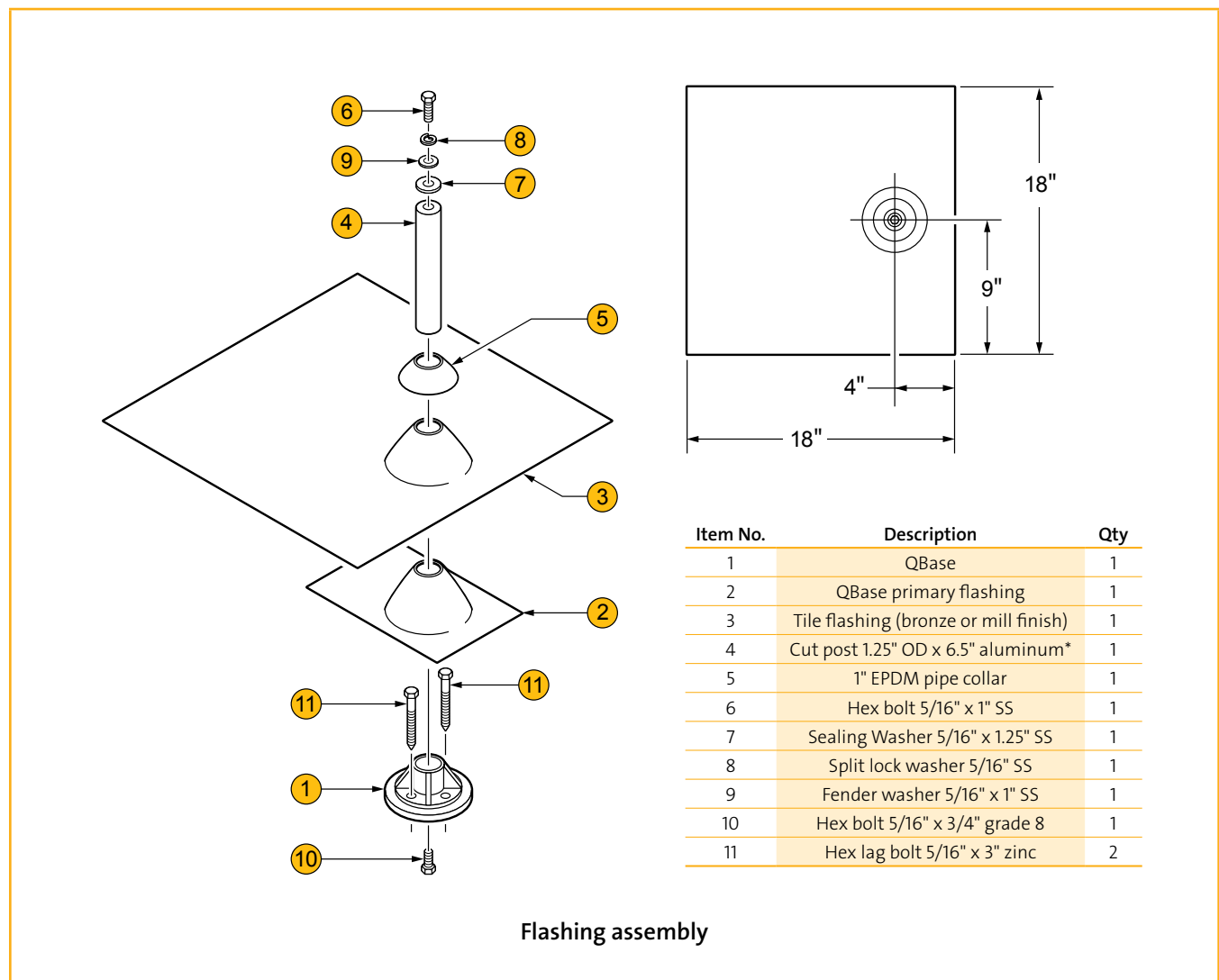
All roofing manufacturers' written instructions must also be followed by anyone modifying a roof system. Please consult the roof manufacturers' specs and instructions prior to touching the roof.

**\*Note:** SolarWorld offers a universal 'flat' tile mount (4.5" post) in addition to an "S"-curved tile mount (6.5" post). Both versions, show above, are otherwise identical.

## Quick Mount PV installation instructions - universal tile mount

	Specific gravity	Lag bolt specifications (lbs)	
		2 ea. 5/16" shaft 2.5" thread depth	5/16" shaft 1" thread depth
Douglas fir, larch	0.50	1330	266
Douglas fir, South	0.46	1175	235
Engelmann spruce (MSR 1650 f & higher)	0.46	1175	235
Hem, fir	0.43	1060	212
Hem, fir (North)	0.46	1175	235
Southern pine	0.55	1535	307
Spruce, pine, fir	0.42	1025	205
Spruce, pine, fir (E of 2 million psi and higher grades of MSR and MEL)	0.50	1330	266

Sources: Uniform Building Code; American Wood Council



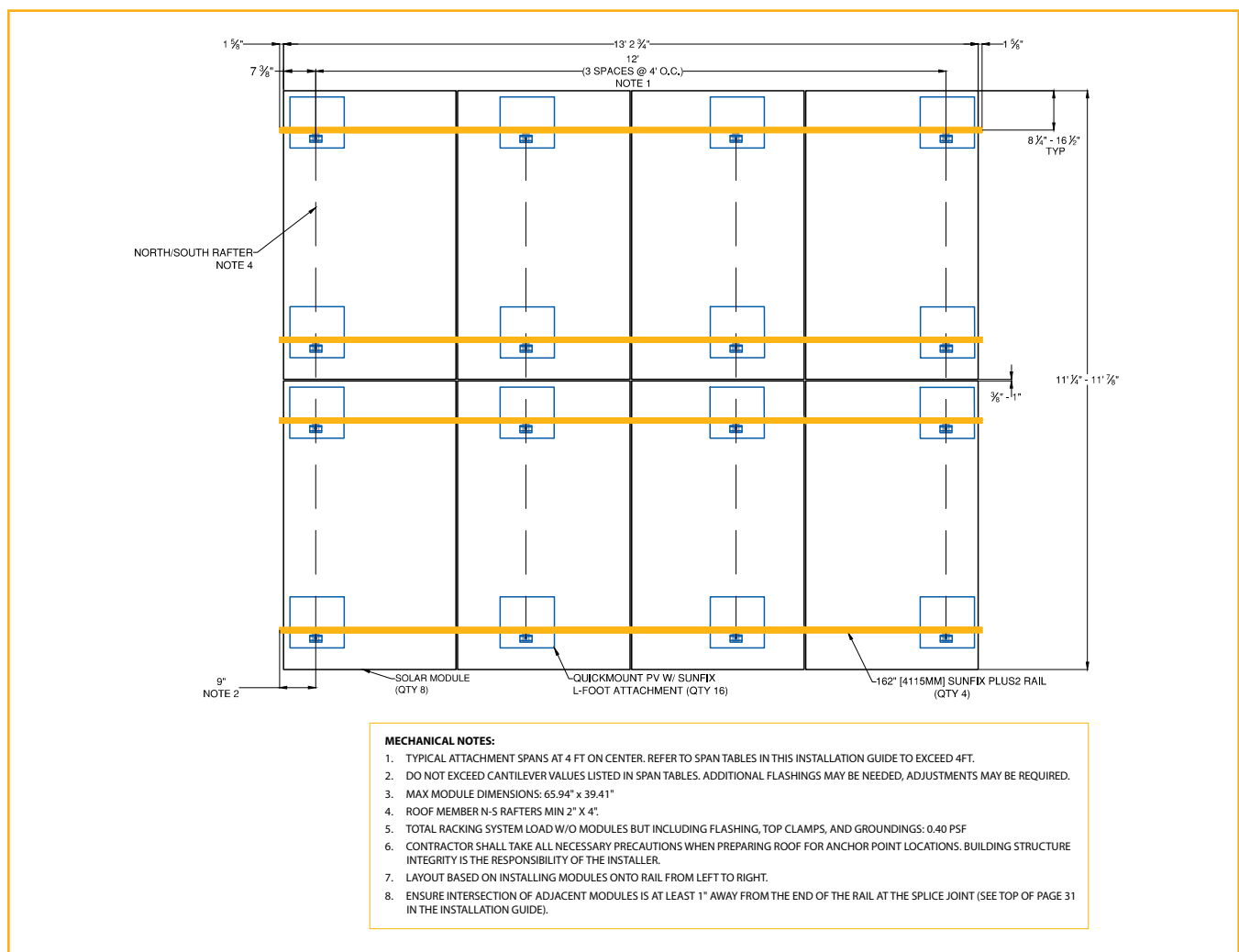
## Installing Sunfix plus racking system

### Tools for Sunfix plus Mounting System:

- 13 mm open end wrench
- Socket wrench - 3/8" drive
- 7/16" and 13 mm hex socket - 3/8" drive
- 'Torx' T40 drive bit (supplied with Sunkits)
- 'Torx' T40 socket x 3/8" drive (for torque wrench)
- Torque wrench 0-30 ft-lbs x 3/8" drive (for top clamp bolts)
- OSHA approved safety glasses and footwear
- OSHA approved safety harness and anchors

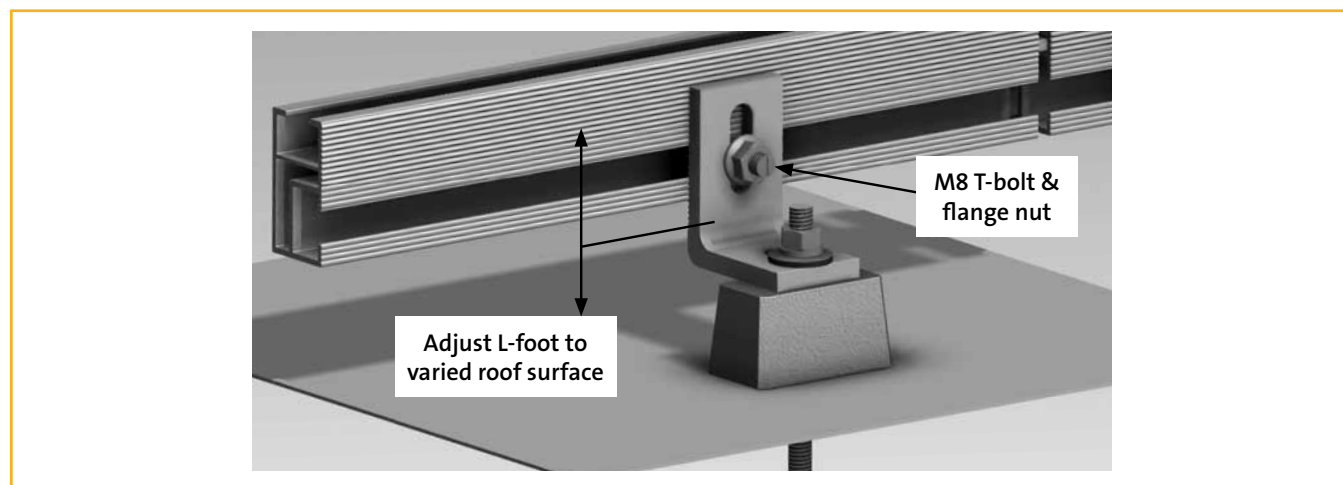
### Sunfix plus rail assembly

Once the roof attachments and L-foot brackets are in position as per the layout drawing, working from left to right, measure the distance of the first rail overhang to the center of the L-foot and secure the T-bolt(s) on the L-foot into the side of the rail profile (13 mm wrench). Refer to Appendix A for examples of typical rack layout drawings.

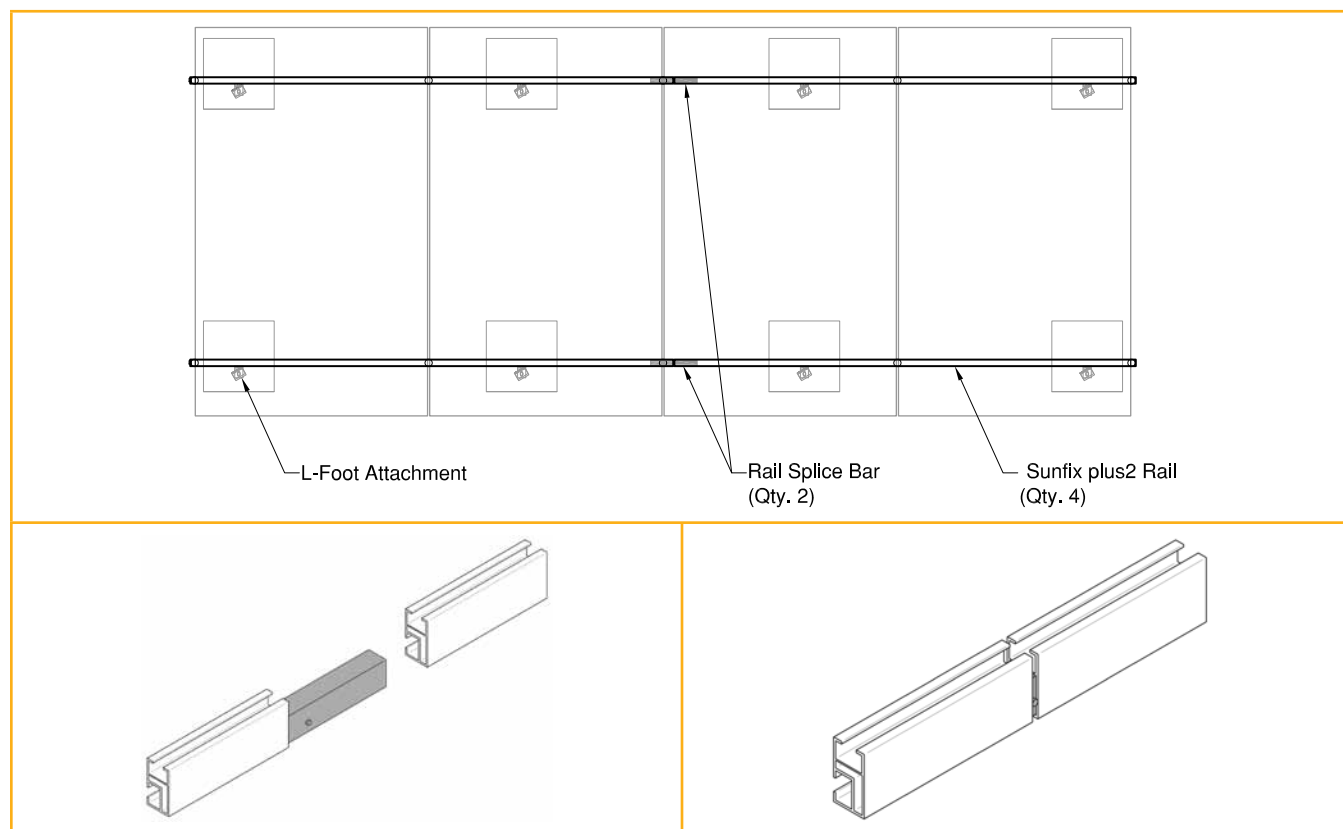


Typical racking layout drawing.

Place the other rows of parallel rails onto the roof attachments in the same manner. Do not torque the T-bolts connecting the L-brackets to the rails until all rails have been placed, aligned and spaced off the roof surface (if necessary). Torque all M8 T-bolts to 12 ft-lbs.

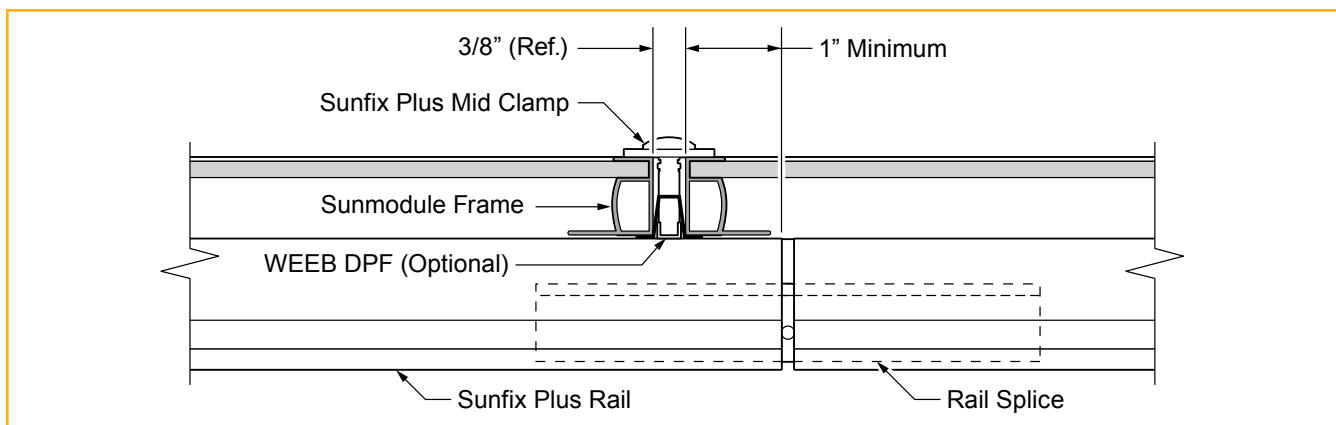


To join rails on a given row, attach rails together using the rail splice connector. Once all of the rails are connected together and fastened to L-foot brackets, check the flatness of the support rails along the length and correct any bowing by adjusting the upper L-foot slot.



The individual rail sections are connected to each other by a fastener-free rail splice connector. One rail splice connector is used at each rail connection.

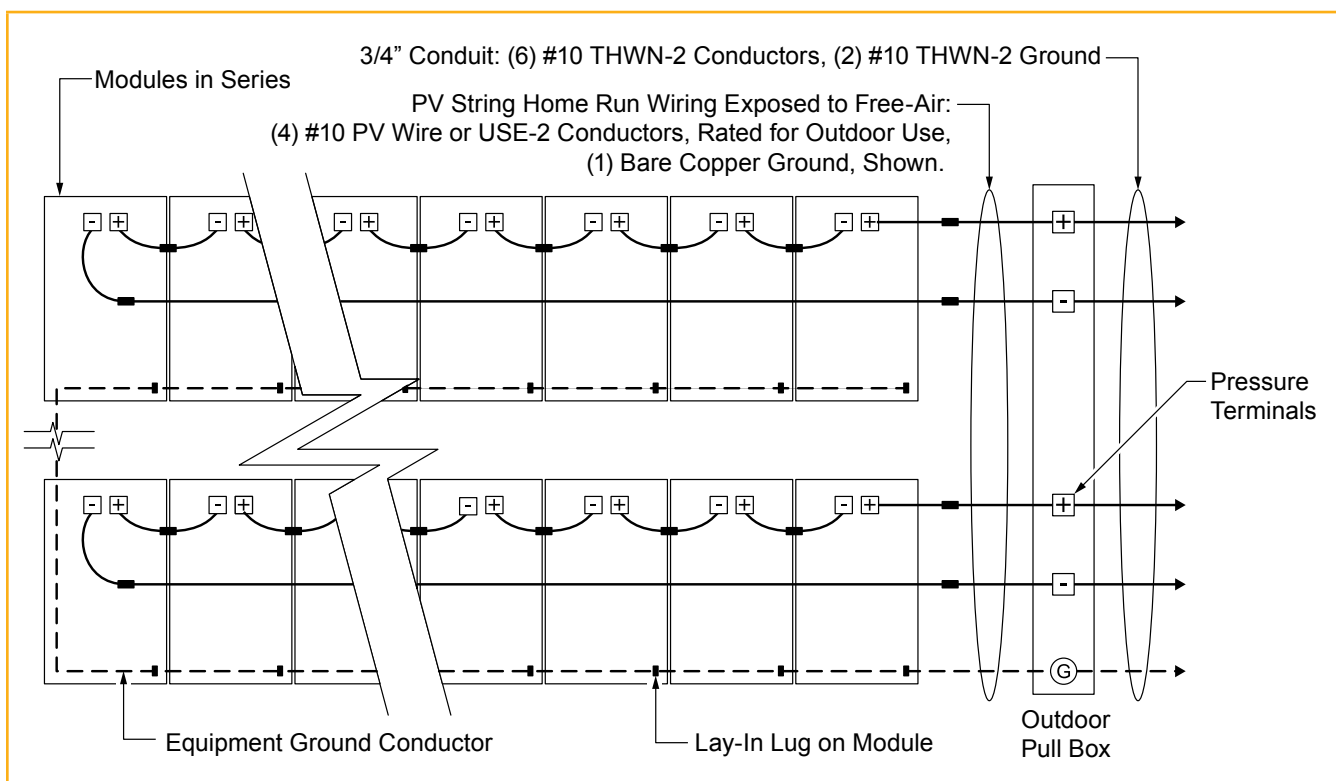
A pin on the center of the splice connector separates the rails leaving a gap of 1/4" inch between the rail sections to accommodate thermal expansion.



When placing solar modules onto Sunfix plus rails, it is important to keep the intersection of adjacent modules at least 1" away from the end of the rail at the splice joint, preventing the module frame from resting directly over the gap between spliced rails.

## PV string wire pull box

A PV-string wire transition pull box rated for the intended use is located either below the PV array (if space allows) or along side the PV array onto the roof surface with the appropriate sealing considered. The pull box facilitates transition for open PV array wiring to wiring in conduit and should not be attached to the support rail unless it is specifically designed to do so and may only be attached onto the side rail slot with M8 T-bolts.



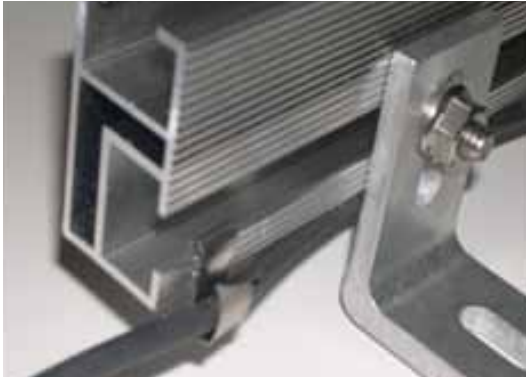
Install the PV-String Home Run cables and route cables to their respective locations at each end of the 'modules in series' string.



## Wire management

The PV string cables and module series interconnects should not be allowed to hang much below the support structure of the solar array. Sufficient wire management devices are to be incorporated to prevent any wiring from nearing the roof surface. PV array wiring can be neatly attached to the supporting rails by black cable ties (supplied with Sunkits)—outdoor rated for UV resistance and high-temperature services.

Wire clips/ties should be spaced approximately 12" apart - along the rail.



## Equipment ground-bonding

### Tools for Rail Grounding Devices (with Lay-in Lugs)

- Socket wrench - 3/8" drive
- 13 mm & 7/16" hex socket - 3/8" drive
- Torque wrench 0-30 ft-lbs x 3/8" drive
- Torque screwdriver 0-30 in-lbs

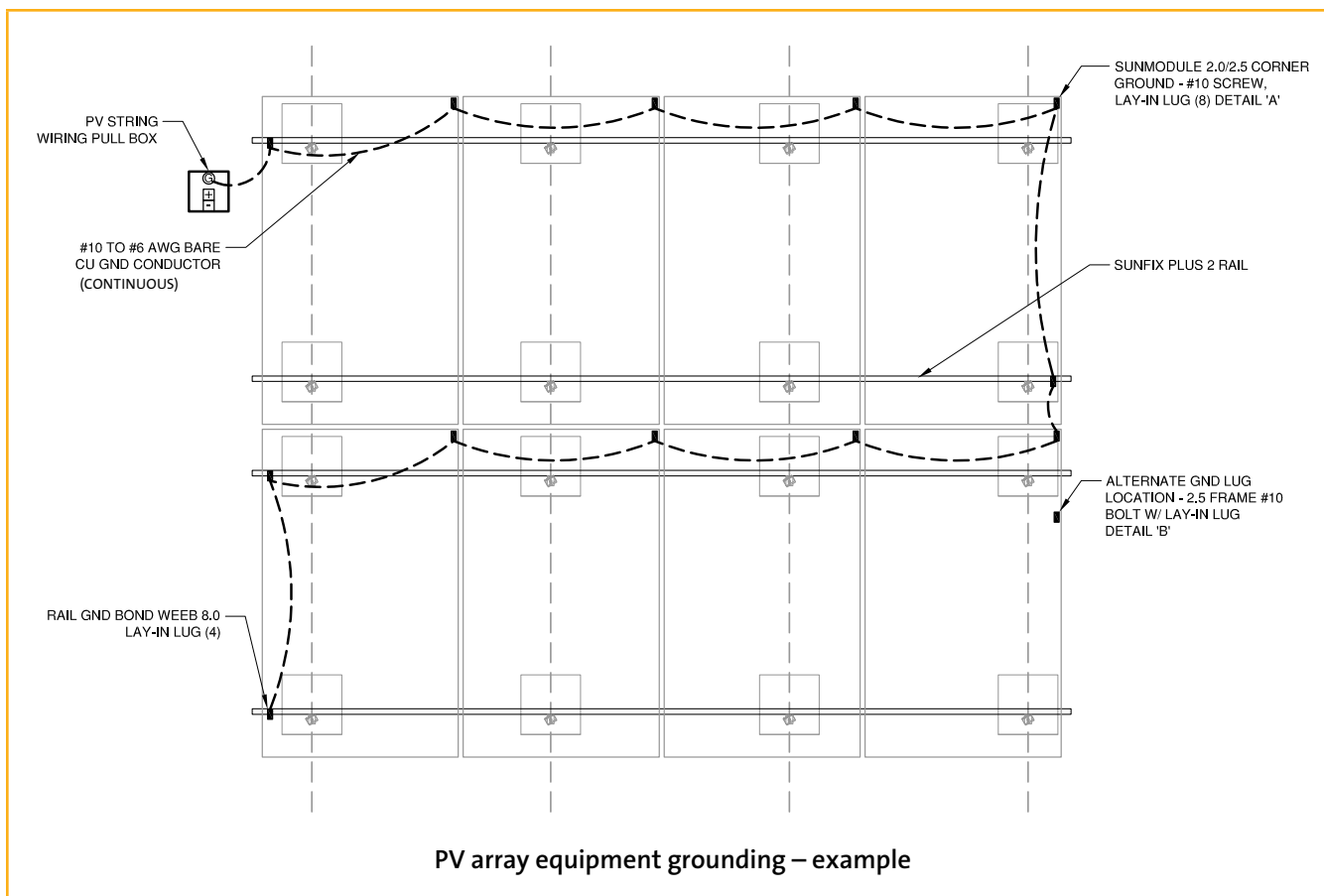
### Equipment Grounding

Grounding is required by the National Electric Code (NEC) for module frames and equipment racking (2008NEC 690.43). Therefore, it is necessary to use the provided grounding devices to connect all non-current carrying electrically conducting components to the Earth (ground) with wire sized per NEC 250.122. The contractor is responsible for ensuring professional grounding of the system and components.

Grounding method should result in an electrically continuous wire to each PV module and supporting metal structure. However, if WEEB-DPFs are used, then only rails need to be bonded. Requirement in the NEC is to make a grounding connection first and break it last (250.124(A)). Consider a module with an internal ground fault to the frame. If WEEBs are used and the circuit conductors are left connected, and the module is unbolted from the grounded rack—disconnecting the frame grounding first rather than last—the module frame may be energized with up to 600 volts to the grounded rack.

Devices identified and listed for bonding the metallic frames of PV modules shall be permitted to bond the exposed metallic frames of PV modules to the metallic frames of adjacent PV modules. The equipment grounding conductors shall be no smaller than #14AWG. Equipment grounding conductors for PV modules smaller than #6AWG shall comply with NEC art. 250.120C. If lay-in lugs are used for PV module grounding, it is recommended to attach these lugs onto each PV module prior to installation onto the racking system. Follow the SolarWorld Sunmodule installation instructions for module grounding device attachment.





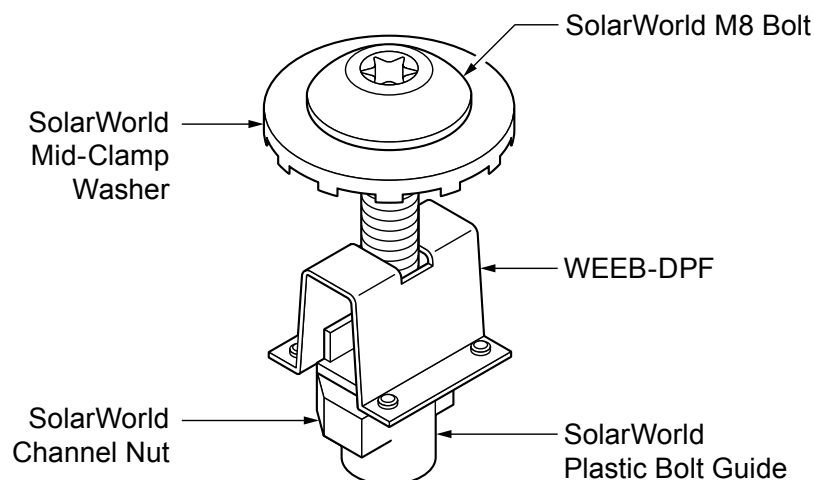
**Module corner ground (2.0/2.5 frame) detail "A"**

**Module frame (2.5) ground detail "B"**

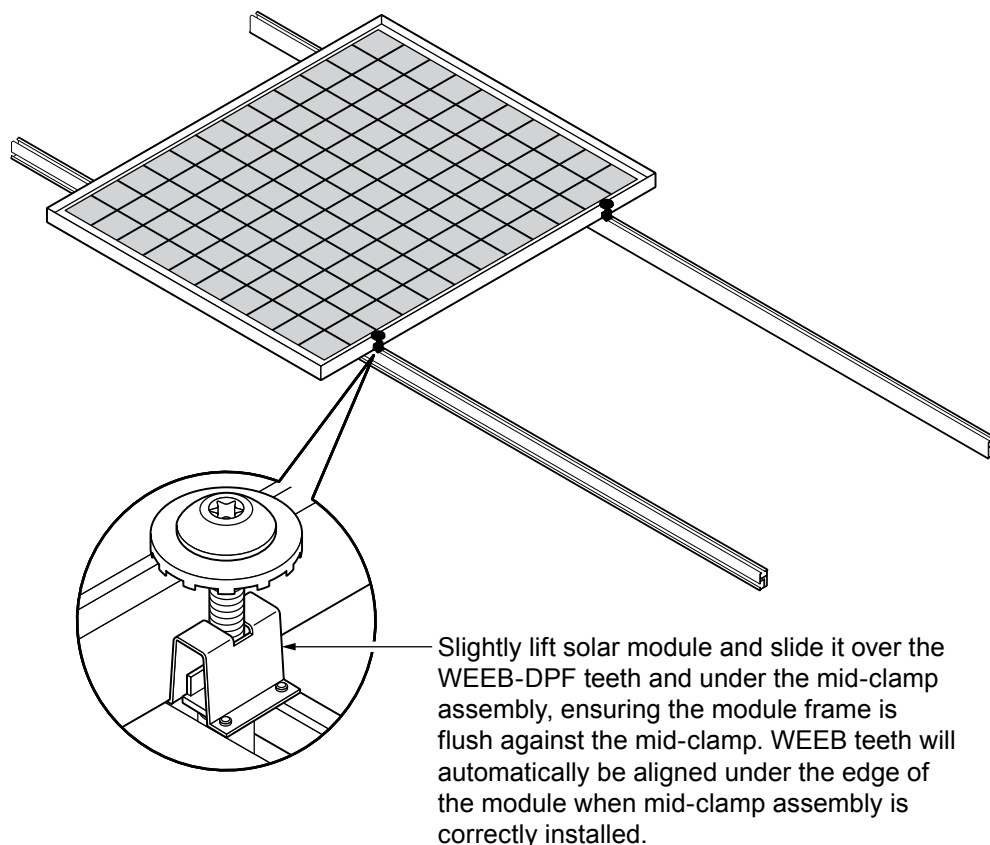
Item	Description
1) Grounding lay-in lug	GBL-4EDBT (or Equivalent)
2) Socket head cap screw	#10-24, 5/8", S/S
3) Serrated lock washer	#10, S/S
4) Flat washer	#10 S/S
5) Nut	#10-24, S/S

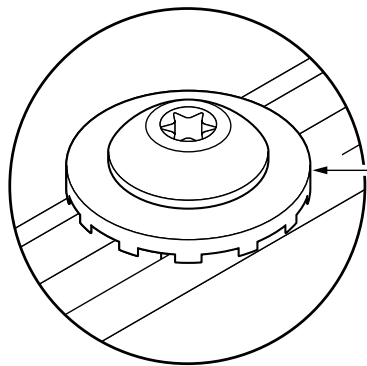
Sunkits are supplied with rail splice ground jumpers WEEB 8.0 and WEEB 8.0 lay-in lugs (Burndy LLC) for equipment

ground-bonding of all support rails. One WEEB lug 8.0 is needed at one end of each rail-row. Also, every rail splice connection will need the rail splice ground jumpers WEEB 8.0 attached as shown. WEEB "DPF" module grounding clips are supplied (as option with Sunkits) as an accessory item. Burndy LLC recommends that the sufficient details of the installation be submitted to the AHJ for approval before any work is started.

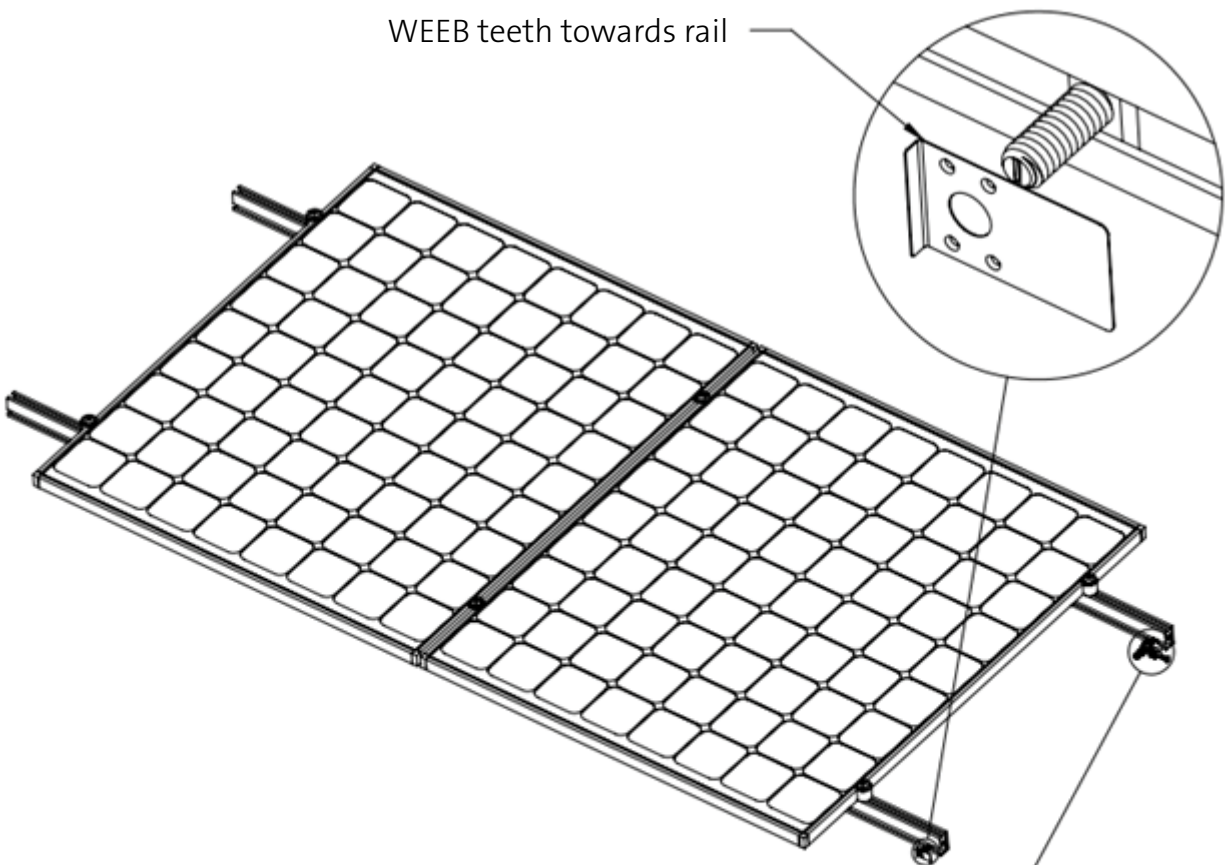


Pre-assemble WEEB-DPF to mid-clamp assembly as shown. Pre-assembling WEEB-DPF to mid-clamp assembly will contain the small individual parts, reducing the possibility of losing parts during installation.



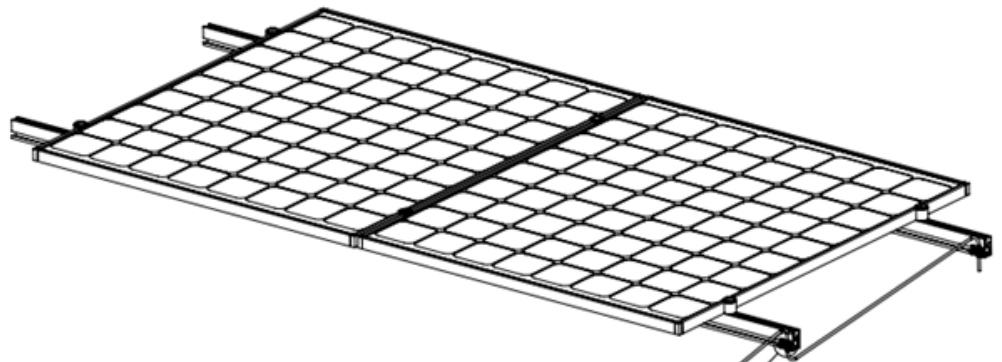


When position of solar modules are finalized, torque fasteners to 12ft-lb / 16.3 N-m using general purpose anti-seize compound on threads.

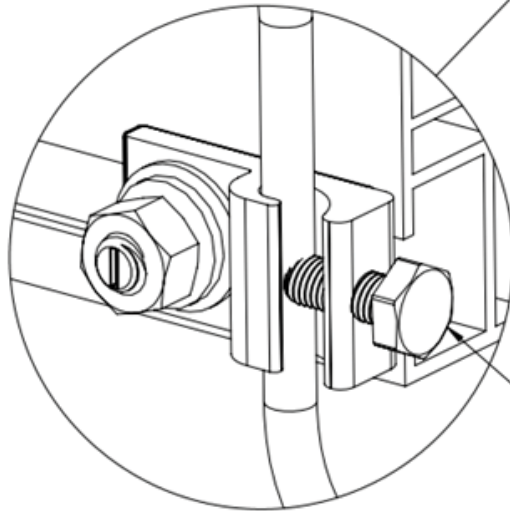


WEEB teeth towards rail

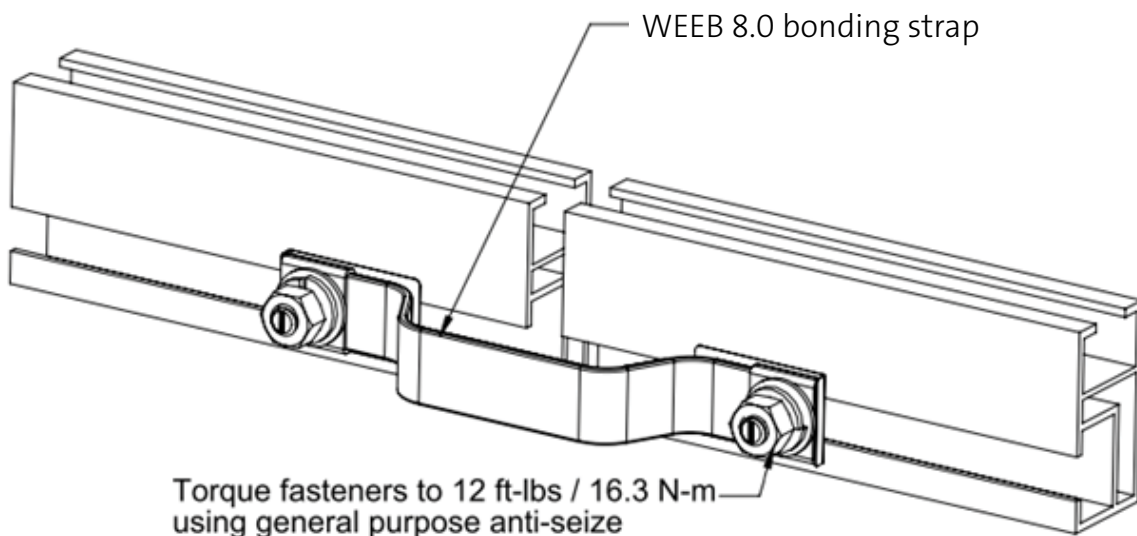
Assemble WEEB 8.0 lay-in lug assembly and torque fasteners to 12 ft-lb / 16.3 N-m using general purpose anti-seize compound on threads.



Equipment ground conductor



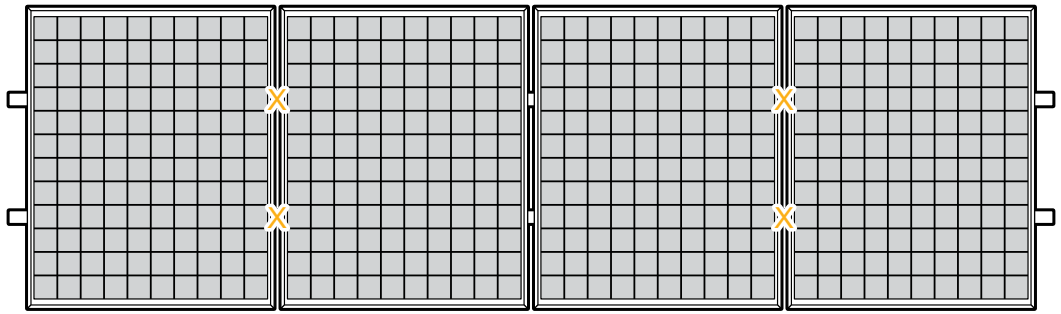
Lay in equipment ground conductor and torque bolt to 7ft-lb / 10 N-m.



WEEB 8.0 bonding strap

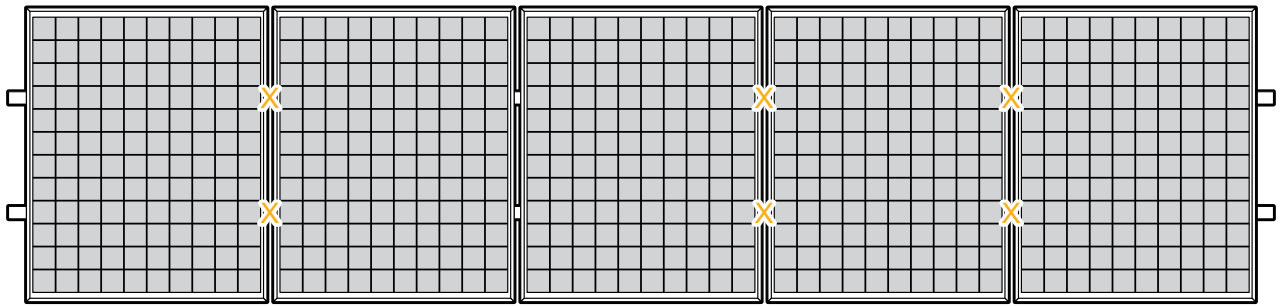
Torque fasteners to 12 ft-lbs / 16.3 N-m using general purpose anti-seize compound on threads.

Even number of modules in a row



X denotes places to install WEEB-DPF

Odd number of modules in a row



X denotes places to install WEEB-DPF

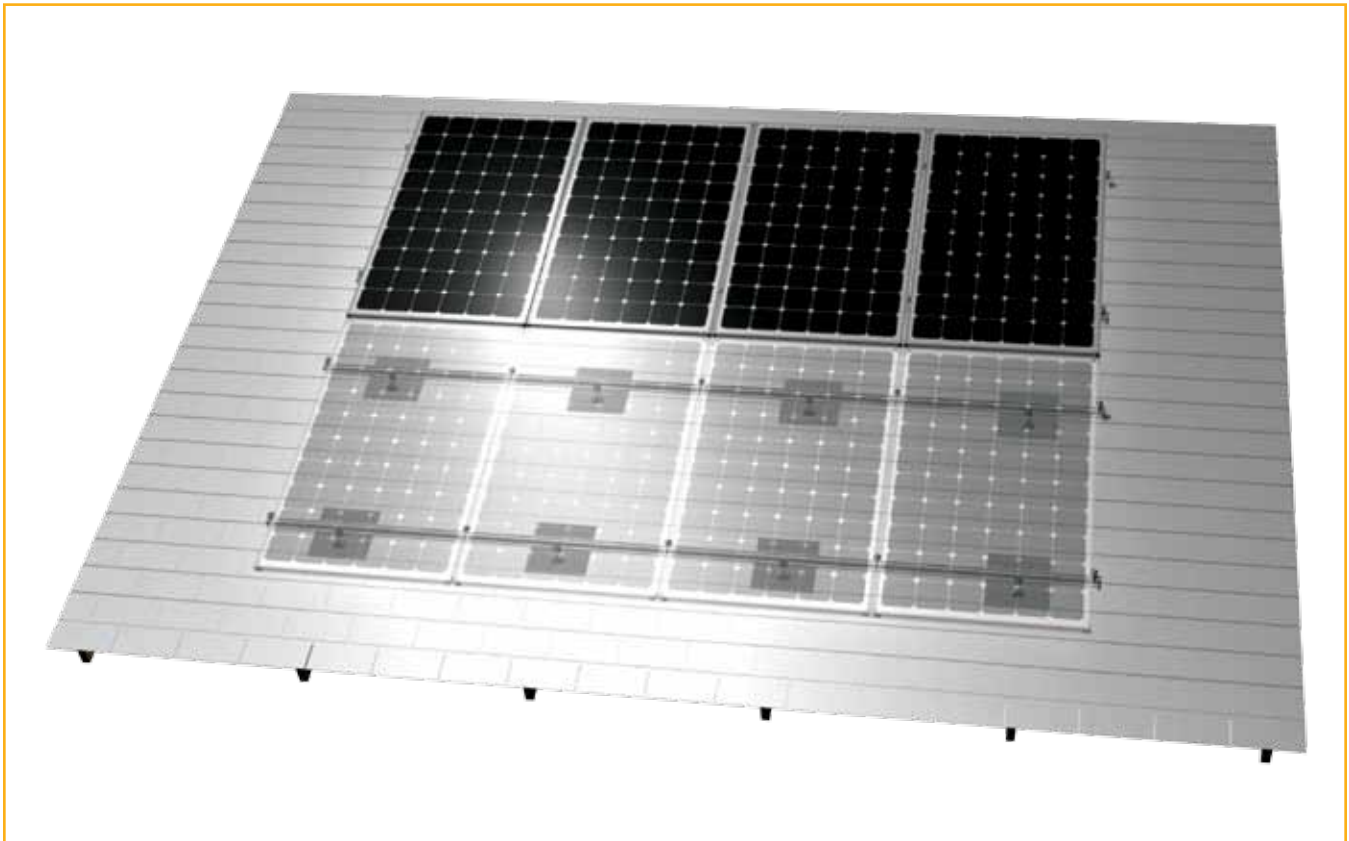
## Module installation

The modules are fastened to the support rails using the top clamps. A torque wrench is required to ensure the correct pressure of the clamp against the module frame. Remember to plug the modules together in series during mechanical installation. **Warning:** modules connected in series may result in dangerously high voltages! Wear insulating gloves when handling module interconnect cables.

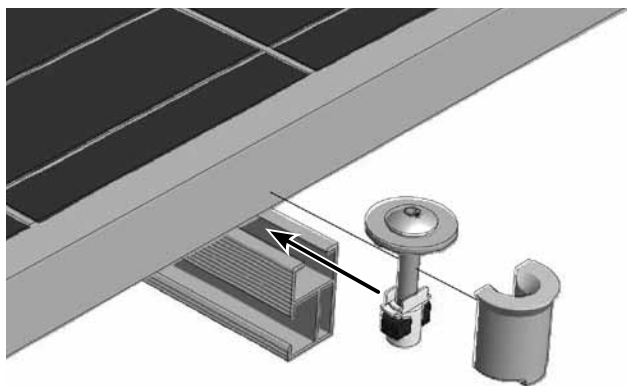
- Wire the modules using the approved electrical diagram.
- Make sure to strictly observe the wiring diagram instructions (string size, AC/DC disconnects, wire size, etc.). Incorrect wiring may cause damage to or even destroy the grid connected inverter and/or modules.
- In order to keep inductive coupling as low as possible in case of lightning strike, the home run cables (+/-) of the string shall be laid as closely to each other as possible (avoid loops).
- The minimum bend radius of cables (5x cable diameter) must be observed in all situations.
- Keep all plugs and sockets dry during installation.
- Attach the cable to the rails using UV-resistant cable ties.

**Note:** in some cases tightly fastened stainless steel screws cannot be unscrewed without causing damage due to galling. Therefore, SolarWorld recommends the following steps to minimize these problems:

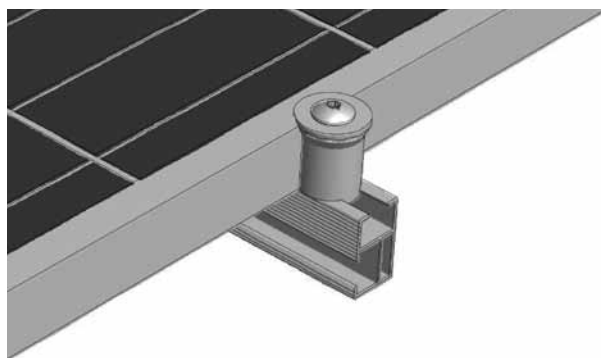
- Keep the stainless hardware shaded, especially on hot days.
- Use an anti-seize product.
- Use lower speed settings on installation tools to reduce the applied heat.
- Tighten all fasteners with a torque wrench to the recommended setting.



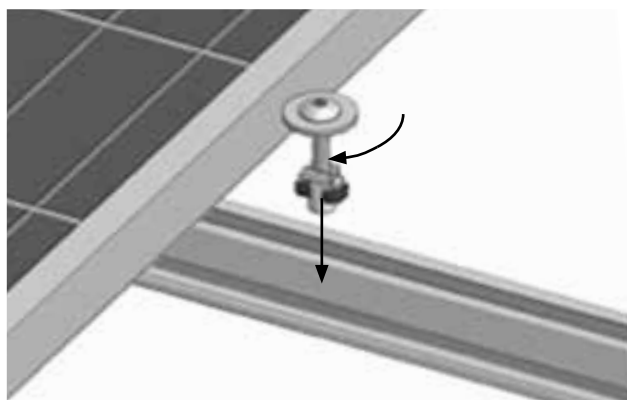
## Mechanical Assembly



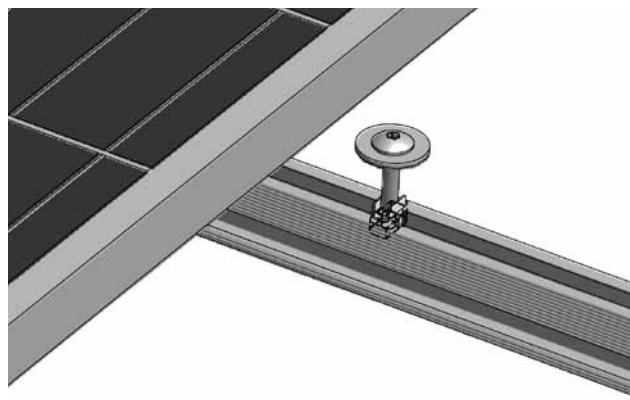
**Step 1.** Start at end, insert top clamp-bolt assembly into rail, add spacer.



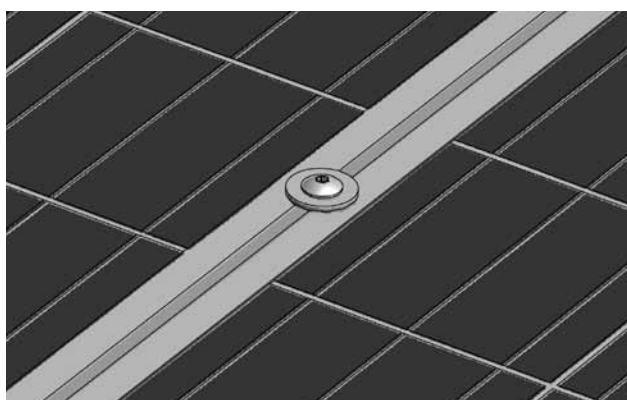
**Step 2.** Position bolt end-spacer against **first** module frame, tighten end-clamp bolt to 15 ft-lbs torque.



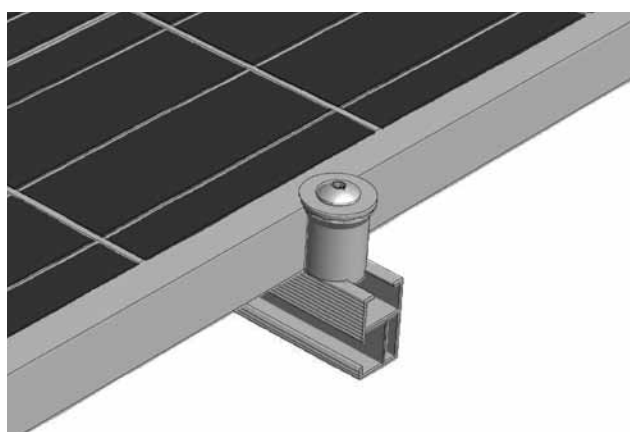
**Step 3.** Insert mid-clamp bolt(s) into rail(s) then 1/4 turn CW to lock the 'channel-nut'.



**Step 4.** Slide bolt firmly into position against module frame so that the plastic retainer touches.



**Step 5.** Place adjacent module firmly against bolt; torque all mid-clamp bolts to 15 ft-lbs (12 ft-lbs with WEEB-DPFs).



**Step 6.** Position bolt end-spacer against **last** module frame, tighten end-bolt to 15 ft-lbs torque.

Routinely check the bolt and connecting parts to make sure they do not become loose. SolarWorld recommends checking a minimum of every two years, to ensure that the required torque is maintained.



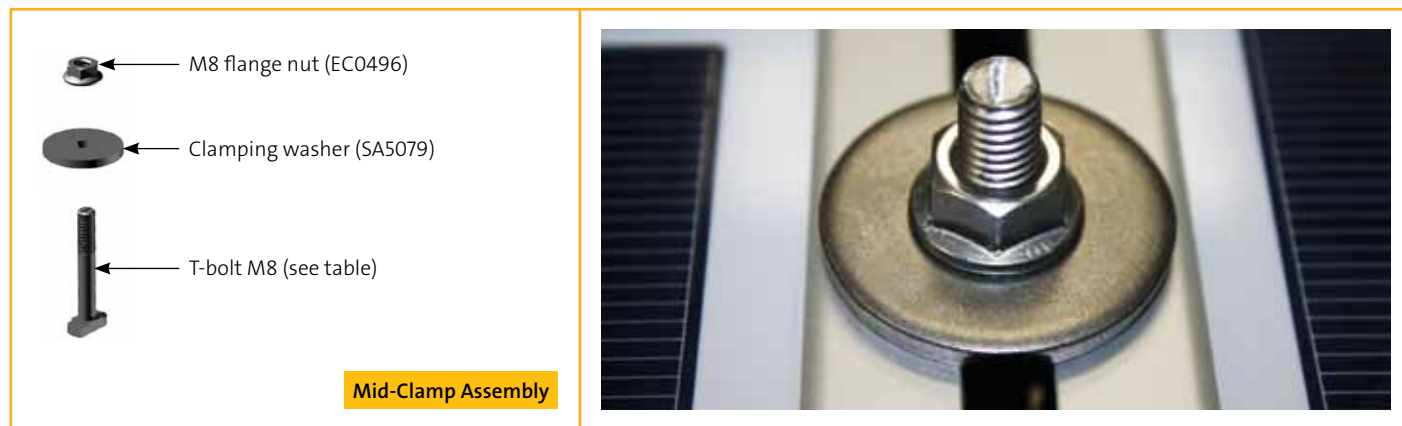
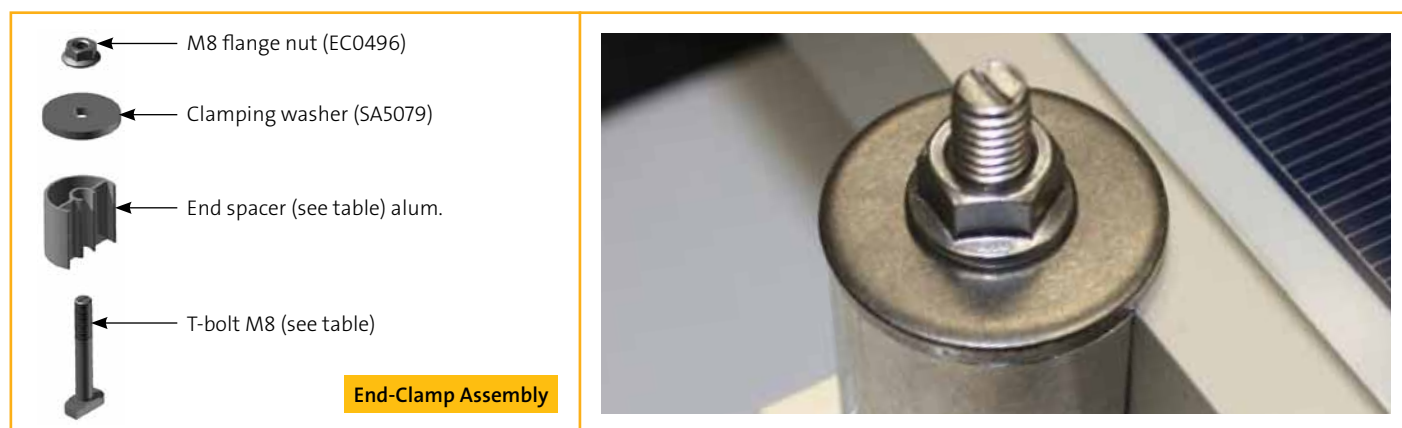
## Sunfix® Plus 2 Top Clamp Selector Guide for Other Modules

The following top clamps for the Sunfix Plus2 roof mounting system are compatible with other PV modules with a frame thickness of 40, 42, 45, 46 and 50 mm.

Make every solar installation the best it can be by starting with the right hardware. The Sunfix Plus 2 Top Clamp hardware for 'end-clamp' and 'mid-clamp' bolt assemblies is illustrated below. Determine the M8 T-Bolt (length) and End Spacer (height) requirements by selecting the appropriate item numbers, based on PV frame height, in the Top Clamp Selection table. The M8 Flange Nut and Clamping Washer are universal fits every top clamp bolt assembly, and are listed separately in the Common Parts table. All Sunfix Plus 2 Top Clamp hardware components are ordered as individual items in package increments of 100 pieces.

For installation compatibility, PV modules should be listed to UL1703 and conform to the following criteria:

- Weight not to exceed 46.7 lbs (21.2 kg)
- Dimensions not to exceed 39.41" W x 65.94" L
- Clamping surface not to exceed 1.38" width
- Module area not to exceed 18 ft<sup>2</sup>



### Sunfix Plus 2 Top Clamp Selection

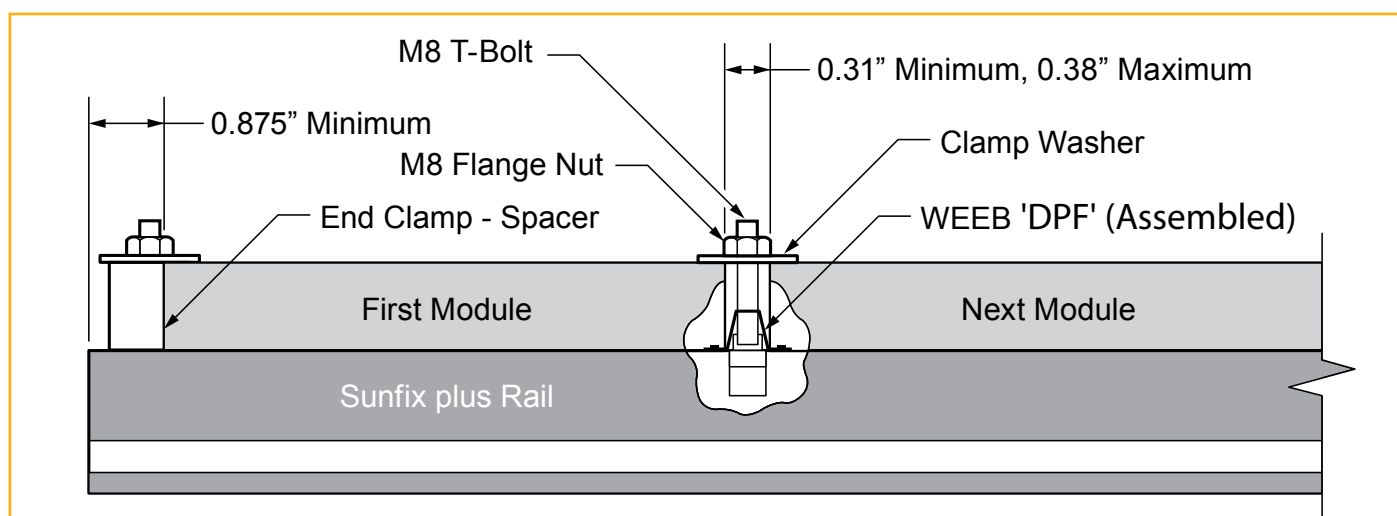
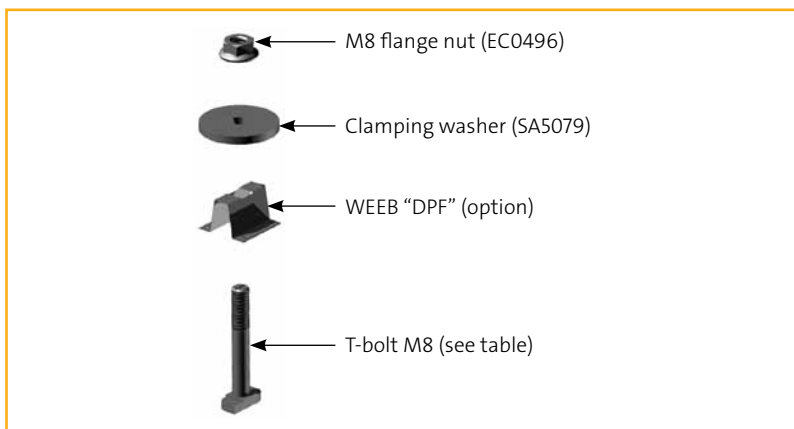
PV Frame	Top Clamp T-Bolt M8		End Clamp - Spacer	
Height (mm) *	Item no.	Description	Item no.	Description
40.00	SH0015	M8 x 60 mm	SA5190	Spacer - 39.5 mm
42.00	SH0005	M8 x 65 mm	SA5099	Spacer - 41.5 mm
45.00	SH0005	M8 x 65 mm	SA5104	Spacer - 44.5 mm
46.00	SH0005	M8 x 65 mm	SK5115	Spacer - 45.5 mm
50.00	SH0006	M8 x 70 mm	SK5222	Spacer - 49.5 mm

\* Standard tolerance on PV frame height not to exceed +/- 0.25 mm.



## Sunfix® Plus 2 Top Clamp Selector Guide for Other Modules

Accessory PV module grounding, as shown as the WEEB-‘DPF’ option below, is available for PV module frames that fit within the dimensional guidelines of acceptable frame cross-sections listed by (Wiley) Burndy Corp. Please review the particular PV module MFR’s installation instructions for any restrictions pertaining to allowable grounding devices or minimum top clamping surface area requirements. Refer to the Sunfix Plus 2 installation instructions for WEEB placement locations for even or odd numbers of PV modules in a row.



### Common Parts

Item no.	Description
EC0496	M8 flange nut
SA5079	Clamping washer

### Accessory Items

Item no.	Description
EC0534	WEEB DPF

### Top Clamp Hardware Quantity Estimator

Array total qty of PV modules	T-bolt clamp assembly		End clamp spacer	
	PV-one row	PV-two rows	PV-one row	PV-two rows
8	18	20	4	8
10	22	24	4	8
12	26	28	4	8
14	30	32	4	8
16	34	36	4	8
18	38	40	4	8
20	42	44	4	8
22	46	48	4	8
24	50	52	4	8

### NOTE:

- >> Fasteners are grade A2 stainless steel.
- >> Top clamps require 15 ft-lbs (20 nm) applied torque. If used with WEEB-DPF, recommend 12-ft-lbs.
- >> T-bolts feature a directional slot indicating proper installation when slot is parallel to module frame.



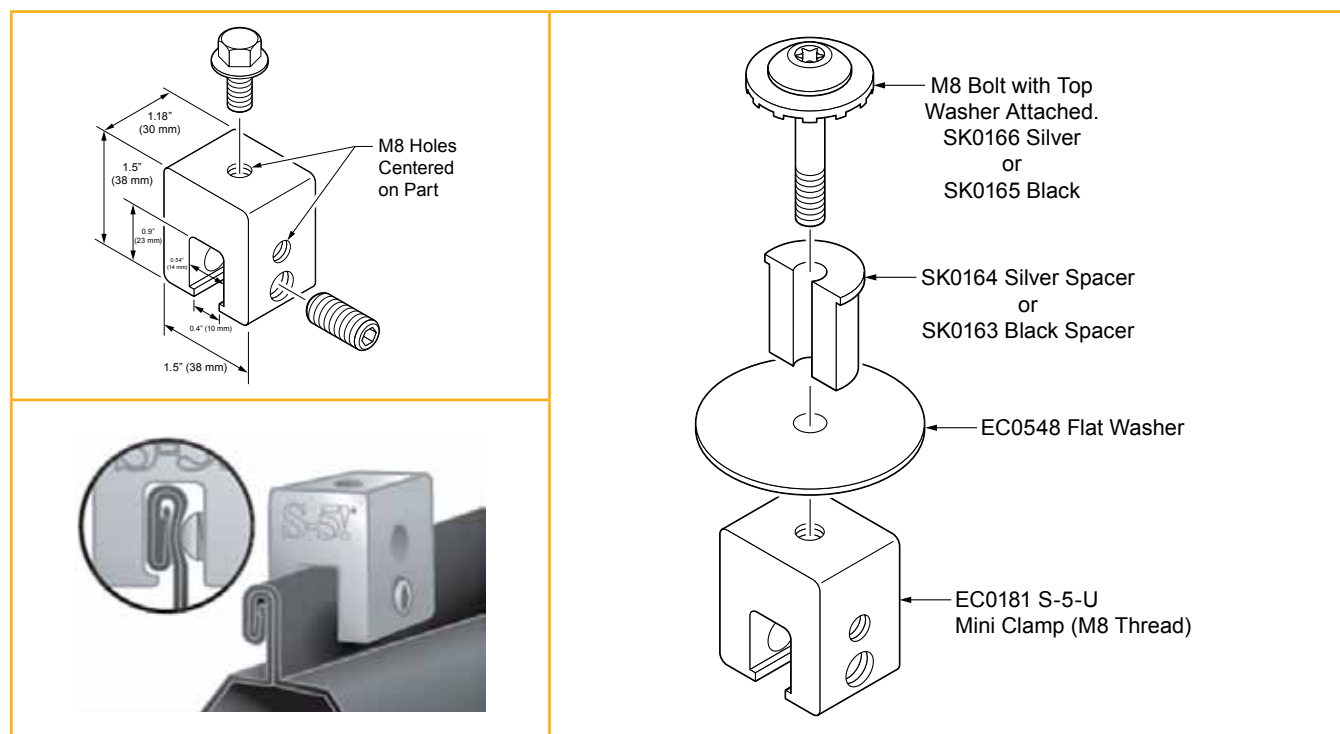
## Standing seam metal roof installation

For metal standing seam roofs, the Sunfix plus rails, L-foot brackets and roof flashings are replaced with an S-5-U Mini clamp solution incorporating the Sunfix top clamp bolt as shown below. The top clamp spacer is only needed on the ends of rows. Module ground-bonding can be accomplished as described in the previous section with lay-in lugs. Grounding of the metal roof will be as governed by the local AHJ.



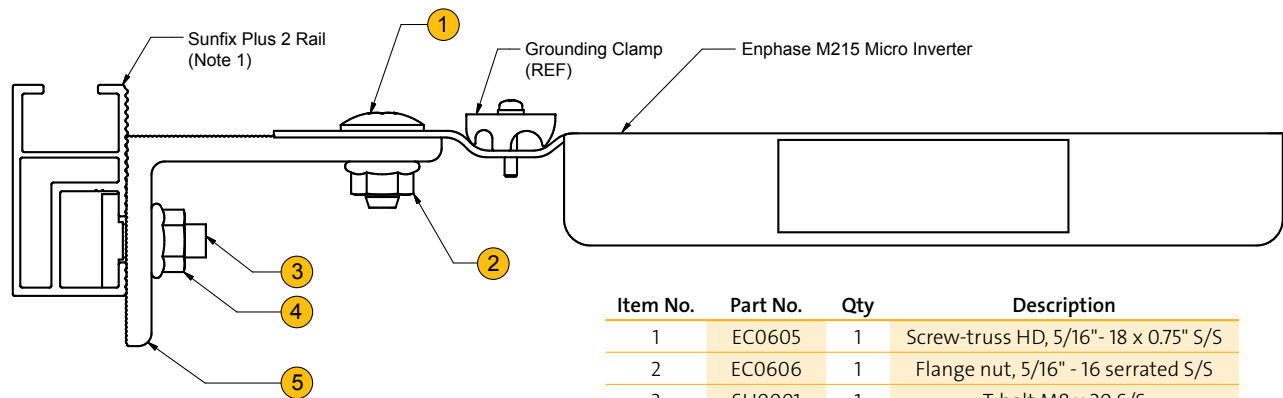
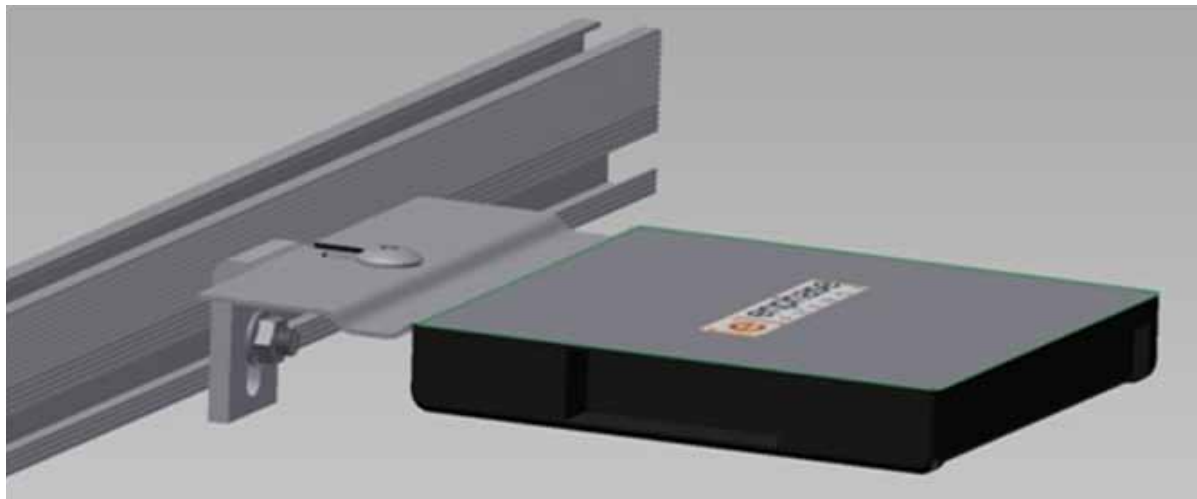
The S-5-U Mini is a medium-duty, non-penetrating seam clamp. Installation is as simple as placing the clamp on the seam and tightening the patented round-point setscrew to the specified tension. Then, affix ancillary items using the bolt provided. S-5!® clamps do not pierce metal roof paneling, thereby protecting roof coatings and preventing water intrusion.

A structural aluminum attachment clamp, the S-5-U Mini is compatible with most common metal roofing materials excluding copper. All included hardware is stainless steel. S-5-U Mini clamps are furnished with set screws, and a bit tip for tightening using an electric screw gun.



# Micro-inverter installation

Incorporate the following method for Sunfix plus rail mounting of micro-inverters. Install the hardware and L-bracket shown below to facilitate mounting from the side of the rail profile using the M8 T-bolt. This location does not provide sufficient clearance between the back of the Sunmodule frame and inverter mounting hardware when exposed to heavy ice/snow loads.



Item No.	Part No.	Qty	Description
1	EC0605	1	Screw-truss HD, 5/16" - 18 x 0.75" S/S
2	EC0606	1	Flange nut, 5/16" - 16 serrated S/S
3	SH0001	1	T-bolt M8 x 20 S/S
4	EC0496	1	Flange nut M8 serrated S/S
5	EC0058	1	L-bracket, clear anodized

## Notes:

1. Do not attach any hardware on top of rail directly under the solar module. Doing so may void module warranty.
2. Install Enphase inverter with 5/16" hardware as shown. Torque M8 and 5/16" bolts to a minimum of 10 ft-lbs.
3. Use M8 T-bolt and nut to attach the L-bracket to the rail as shown.
4. Micro-inverters or other components should not be installed onto the Sunmodule 2.5 frame without prior written consent from SolarWorld.

# Maintenance and cleaning

---

## Maintenance – annual

- Electrical connections at pressure terminals set to proper torque.
- Wiring conductors are properly & securely dressed with cable clips/ties to support structure, not dangling near roof surface or trapping debris.
- Wiring conductors not damaged or rubbing against sharp metal edges which may cause removal or penetration of insulation.
- Visually inspect solar modules for signs of damage to front glass surface or metal framework.
- Visually check all hardware connection points for signs of loose or missing parts.
- Mechanically check fasteners at connection points, insuring torque values are per manufacturer's recommendations.
- Visually inspect the solar array for signs of modules shifting.

## Cleaning – semi annual

- Cleaning schedules are dependent upon your system location, tilt angle, and weather patterns.
- In general, the greater the roof inclination and yearly rainfall, the less cleaning a system will require.
- It is advisable to clean your system with water (no cleaning agents) two times per year after initial installation, and then subsequently as needed.
- In cases of heavy dirt and/or debris, more frequent cleanings and the use of an appropriate microfiber brush or sponge may be required.
- Dirt must never be scraped or rubbed away when the modules are dry as this may cause micro-scratches, which have a negative effect on the module performance.
- The condition of the PV array connections and plugs should be visually inspected at regular intervals.

# Warranty

---

SolarWorld Americas LLC ("SolarWorld") warrants to the original buyer ("Buyer") at the original installation site, that any of the – 'Sunfix plus®' components (the "Product") purchased from SolarWorld shall be free from defects in materials and workmanship for a period of ten (10) years from the date of shipment, except for the anodized finish which finish shall be free from visible peeling, or cracking or chalking under normal atmospheric conditions for a period of five (5) years from the date of shipment (each, as appropriate, the "Warranty Period"). The warranty for the anodized Finish does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. Buyer may transfer this Warranty to subsequent owners, or if Buyer is a contractor to the property owner, any subsequent transferee of which SolarWorld has advance notice, proof of purchase is required.

This Warranty covers only the Product, and not photovoltaic or PV modules, electrical components or wiring used in connection with the Product, or other products of SolarWorld. This Warranty shall be void if A) installation of the Product is not performed in accordance with the SolarWorld Product information, B) the Product has been modified, repaired, or reworked in a manner not previously authorized by SolarWorld in writing, or C) the Product is installed in an environment for which it was not designed, each as determined in SolarWorld's sole discretion.

If, within the Warranty Period, the Product shall be proven in SolarWorld's sole discretion to be defective, then Buyer's sole and exclusive remedy, and SolarWorld's only obligation for breach of warranty for Products hereunder, shall be, at SolarWorld's option in its sole discretion, to either repair or replace the defective Product, or any part thereof. Any such repair or replacement does not constitute a new Warranty Period, nor shall the Warranty Period of this Limited Warranty be extended by any such repair or replacement. Buyer shall bear all costs of shipment or transportation related to the repair or replacement of the defective Product. Such repair or replacement shall be Buyer's sole remedy under this Limited Warranty, and does not include on-site physical installation of repaired or replaced product and shall fulfill SolarWorld's obligations with respect to this Limited Warranty. The provision of the above remedy shall be conditioned upon notification and substantiation as may be required by SolarWorld.

**Warranty Limitations.** The warranties and remedies for breach of warranty provided for herein extend only to use of Products at their site of original end user installation and do not cover, and SolarWorld shall not be liable for, (i) damage to the Product that occurs during its shipment, storage, and installation, (ii) any product, component, accessory or part not supplied by SolarWorld, (iii) abnormal wear and tear or damage, (iv) any cause beyond or not contemplated by the warranty and outside the reasonable control of SolarWorld, including conditions caused by movement, settlement or structural defects of the environment or other components in which the Products are installed, any conditions proximately caused by intentional misconduct of others, improper use or third party negligence, or (v) damage proximately caused by anyone except SolarWorld employees, contractors or agents. If any provision of this Limited Warranty is held unenforceable or illegal by a court or other body of competent jurisdiction, such provisions shall be modified to the minimum extent required such that the rest of this Limited Warranty will continue in full force and effect.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES ARISING BY OPERATION OF LAW, TRADE OR COURSE OF DEALING INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OR CONDITIONS OF TITLE, NON-INFRINGEMENT, MERCHANTABILITY, FITNESS OR SUITABILITY FOR A PARTICULAR PURPOSE, USE OR APPLICATION. SOLARWORLD SHALL HAVE NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR DAMAGE OR INJURY TO PERSONS OR PROPERTY OR FOR OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR RELATED TO THE PRODUCT, INCLUDING, WITHOUT LIMITATION, ANY DEFECTS IN PRODUCT, OR FROM USE OR INSTALLATION. SOLARWORLD'S TOTAL LIABILITY TO BUYER (REGARDLESS OF THE NATURE OF THE CLAIM) SHALL BE LIMITED TO THE TOTAL PURCHASE PRICE OF THE PRODUCTS PURCHASED FROM SOLARWORLD BY BUYER. UNDER NO CIRCUMSTANCES SHALL SOLARWORLD BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY TYPE, INCLUDING WITHOUT LIMITATION RELATING TO LOSS OF USE, LOSS OF PROFITS, LOSS OF PRODUCTION OR LOSS OF REVENUES.

# Appendix

---

## Sunfix plus racking system – sample layouts

---

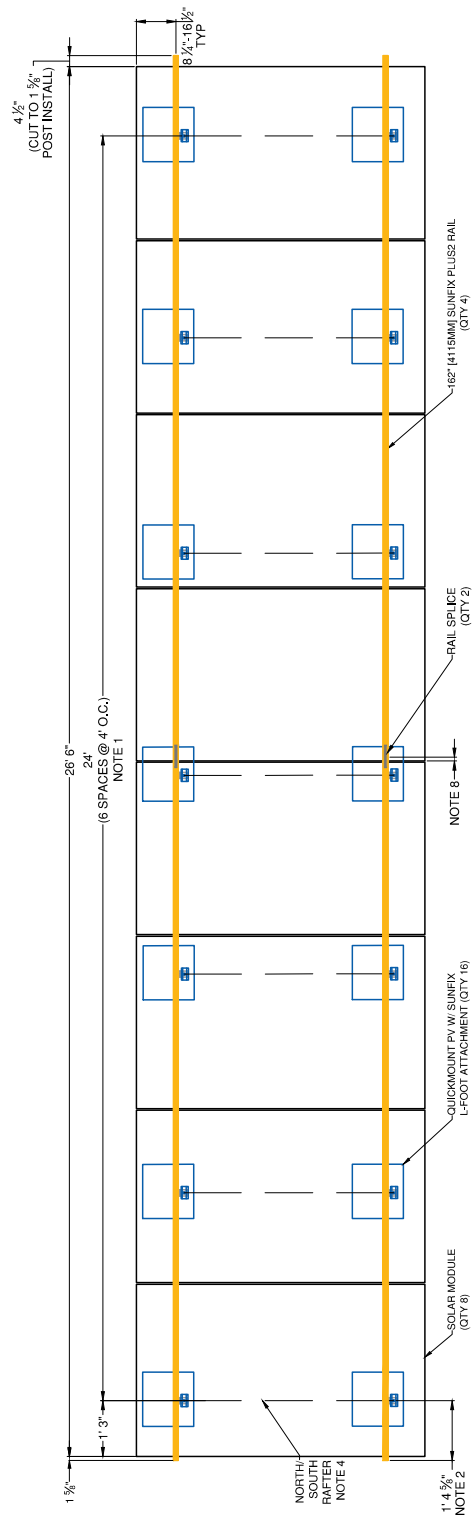
### **Recommended module layouts**

The following drawings illustrate typical racking layout plans with SolarWorld ‘Sunmodules’. These layout drawings identify:

- Where to start the first module
- Approximate length of assembled rows
- How much rail overhang is expected
- Approximate location of rail splice connectors
- Quantity of roof attachments recommended
- How much rail cut-off may be needed-post install

The following module layouts are:

- Sunfix plus2 Sample Layout 8 Modules, 1 Row of 8, 030025-A
- Sunfix plus2 Sample Layout 8 Modules, 2 Rows of 4, 030026-A
- Sunfix plus2 Sample Layout 10 Modules, 1 Row of 10, 030027-A
- Sunfix plus2 Sample Layout 10 Modules, 2 Rows of 5, 030028-A
- Sunfix plus2 Sample Layout 12 Modules, 2 Rows of 6, 030029-A
- Sunfix plus2 Sample Layout 18 Modules, 2 Rows of 9, 030030-A
- Sunfix plus2 Sample Layout 18 Modules, 3 Rows of 6, 030031-A
- Sunfix plus2 Sample Layout 24 Module, 2 Rows of 12, 030032-A

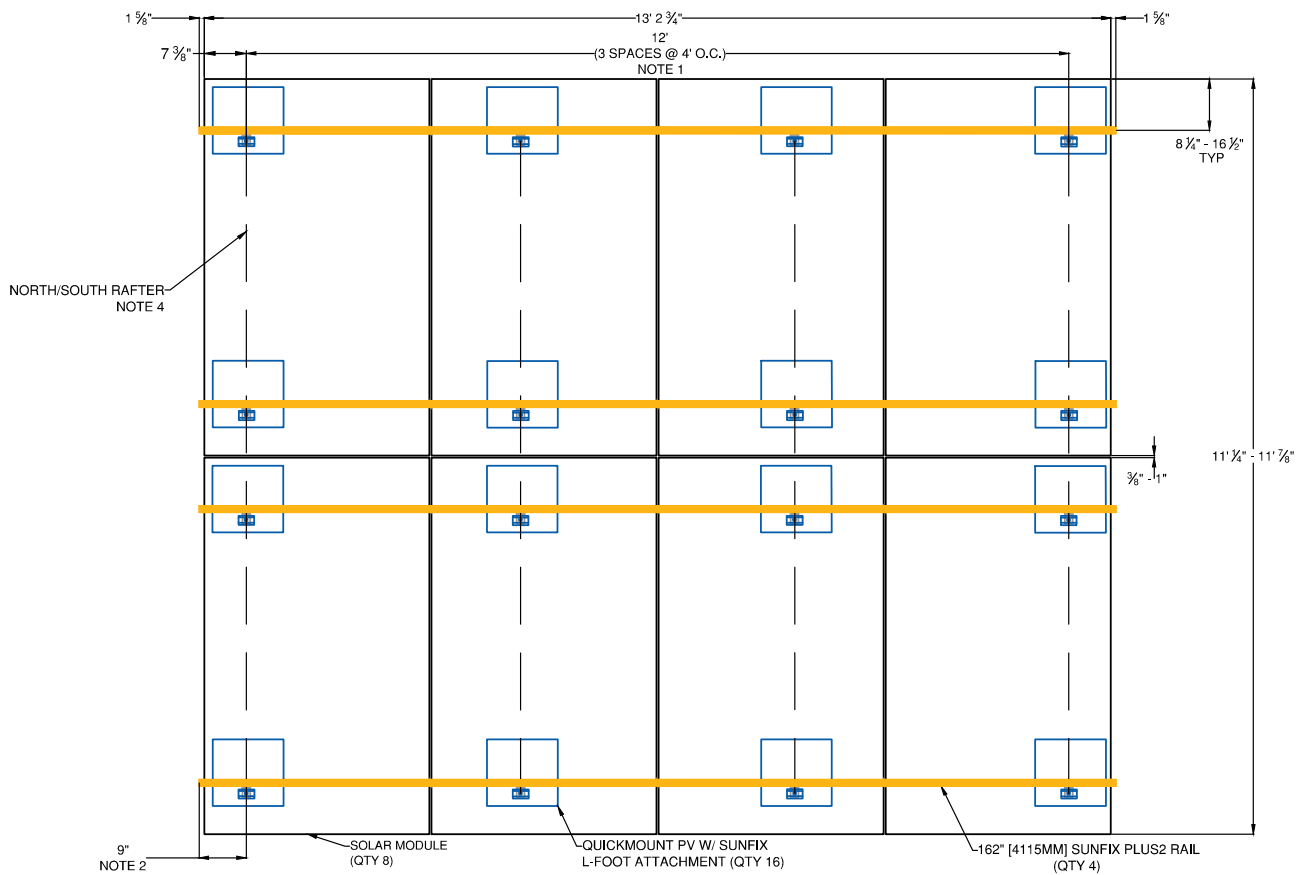


#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4 FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED. ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" x 4".
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

Sunfix plus2 Sample Layout 8 Modules, 1 Row of 8, 030025-A.

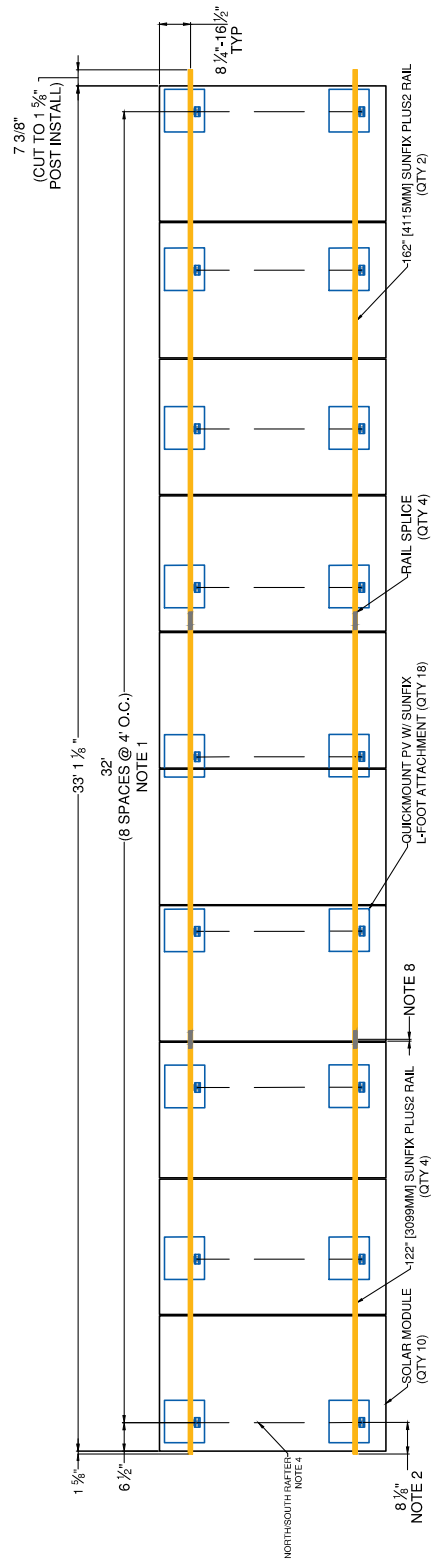




#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED, ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" X 4".
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

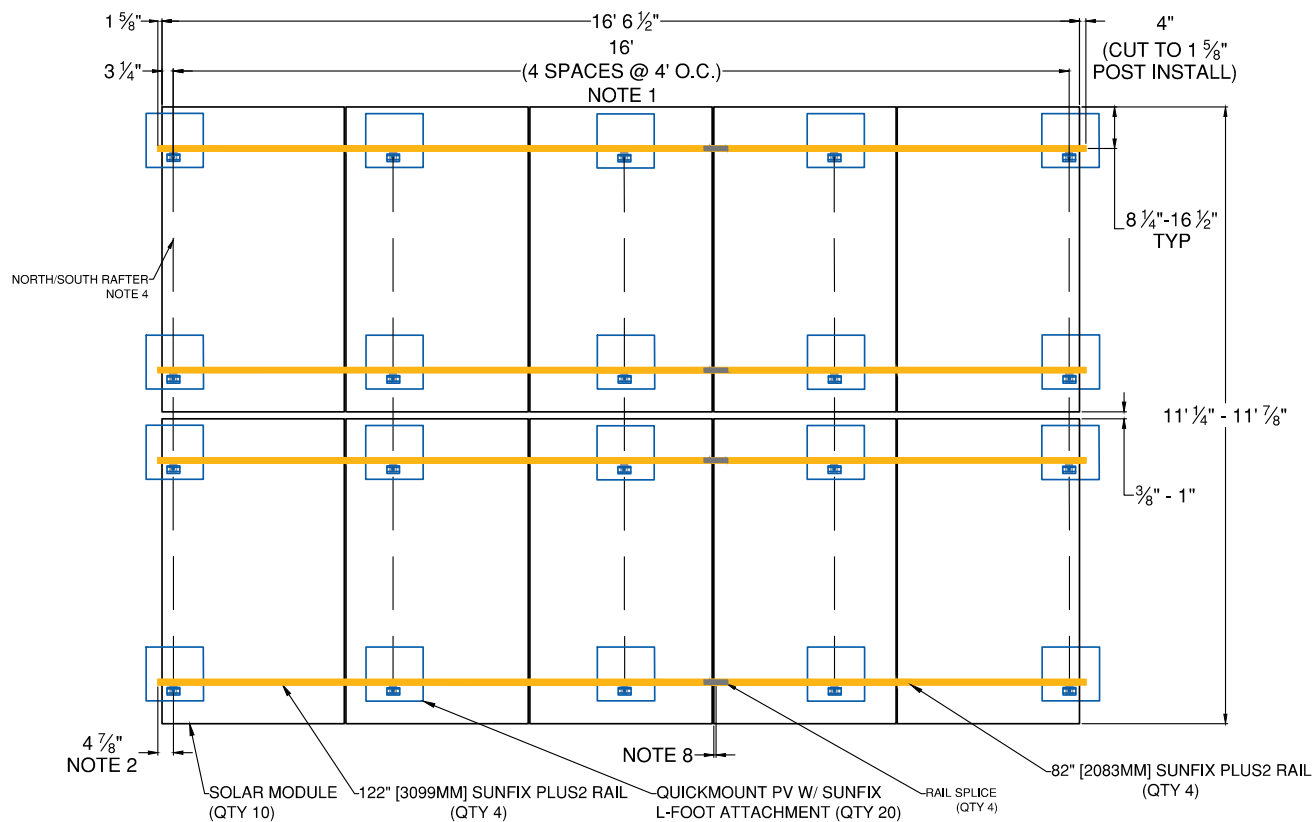
Sunfix plus2 Sample Layout 8 Modules, 2 Rows of 4, 030026-A.



#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4 FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED, ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" X 4".
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

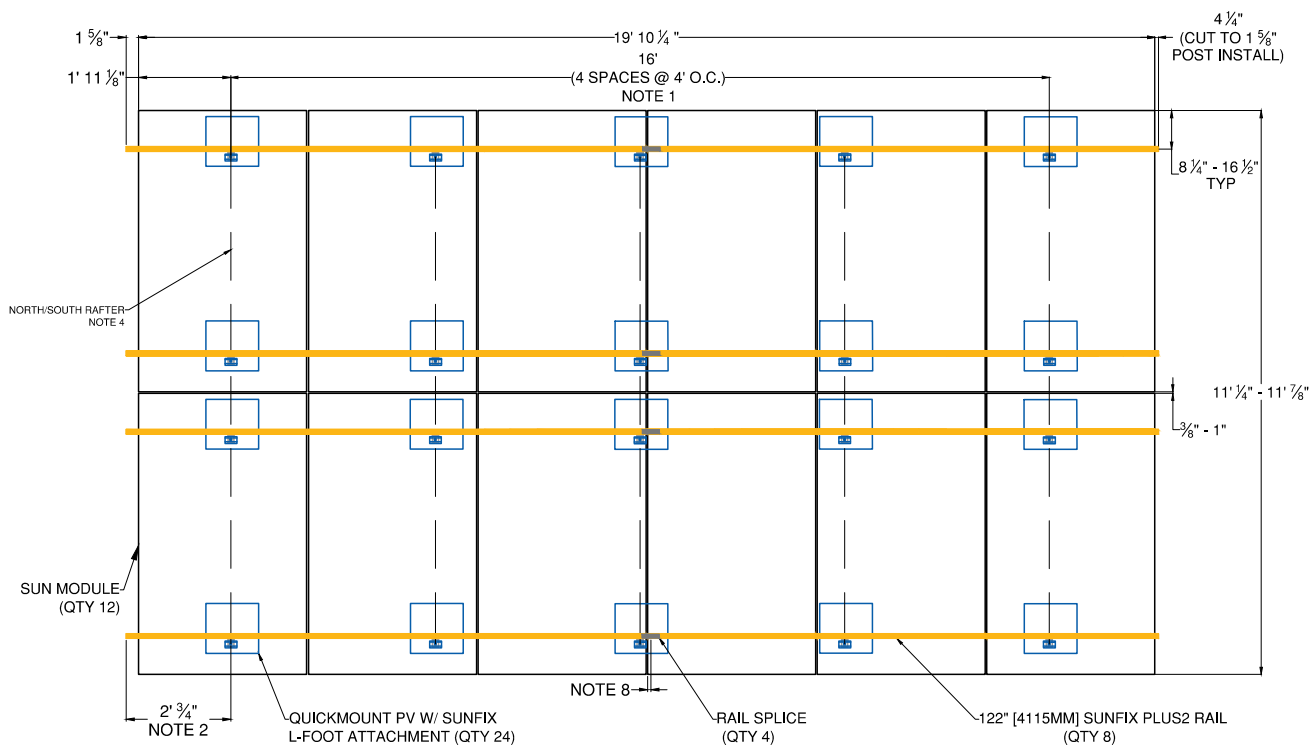
Sunfix plus2 Sample Layout 10 Modules, 1 Row of 10, 030027-A.



#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED, ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" X 4".
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

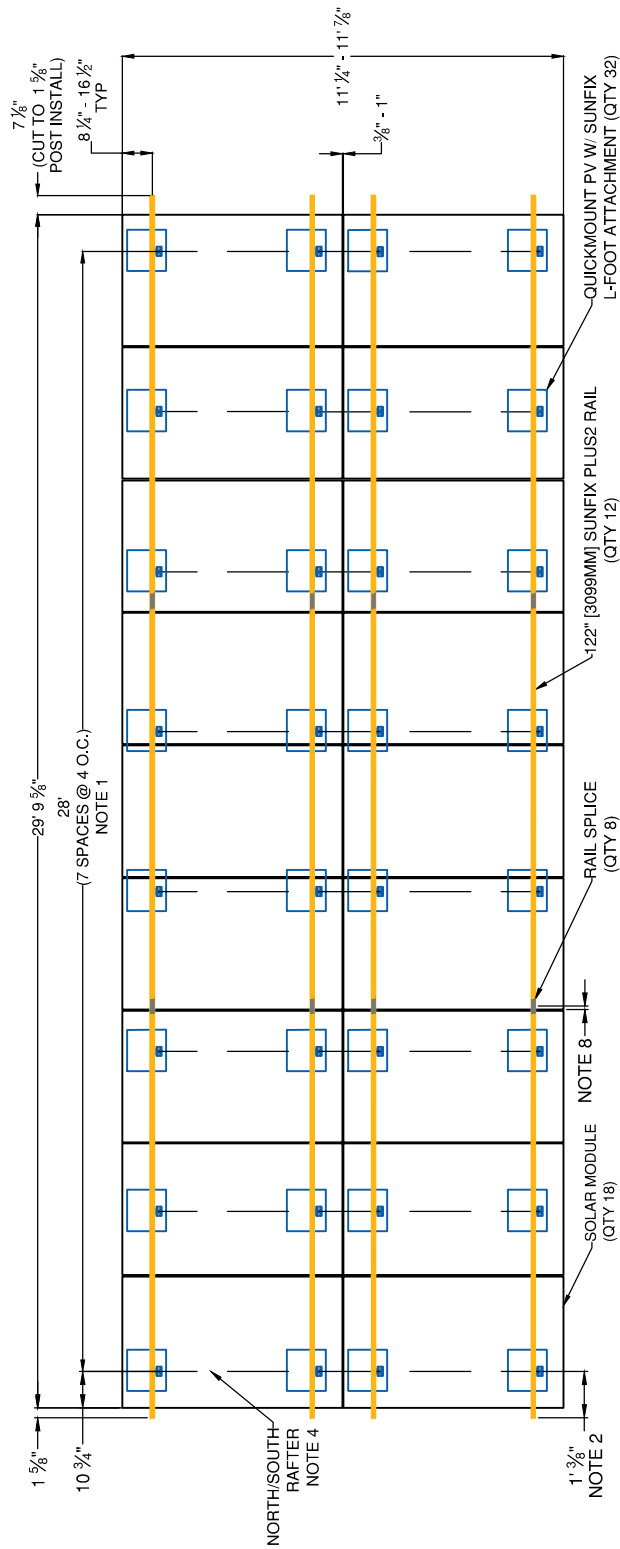
Sunfix plus2 Sample Layout 10 Modules, 2 Rows of 5, 030028-A.



#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED, ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" X 4".
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

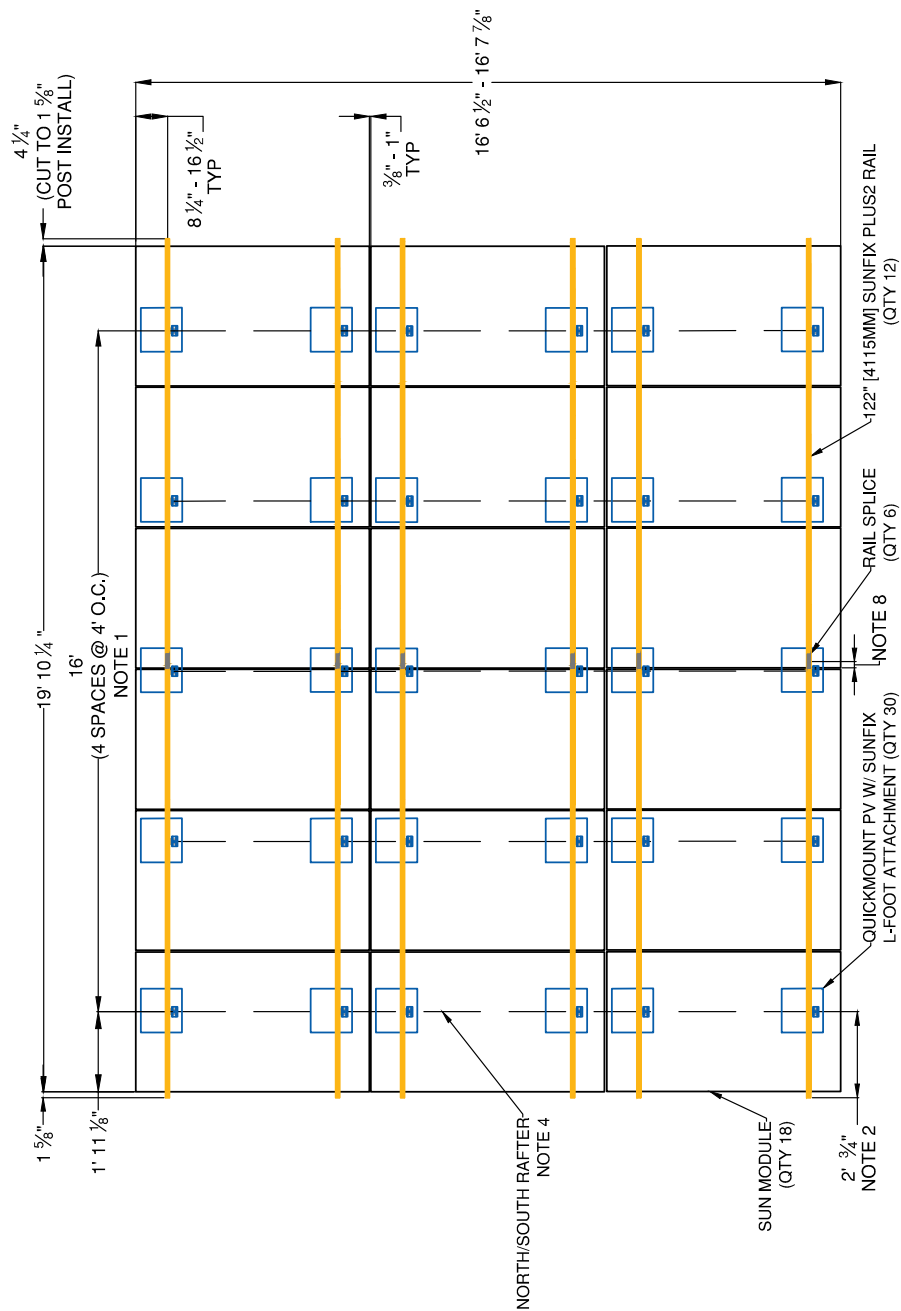
Sunfix plus2 Sample Layout 12 Modules, 2 Rows of 6, 030029-A.



#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED, ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" X 4"
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

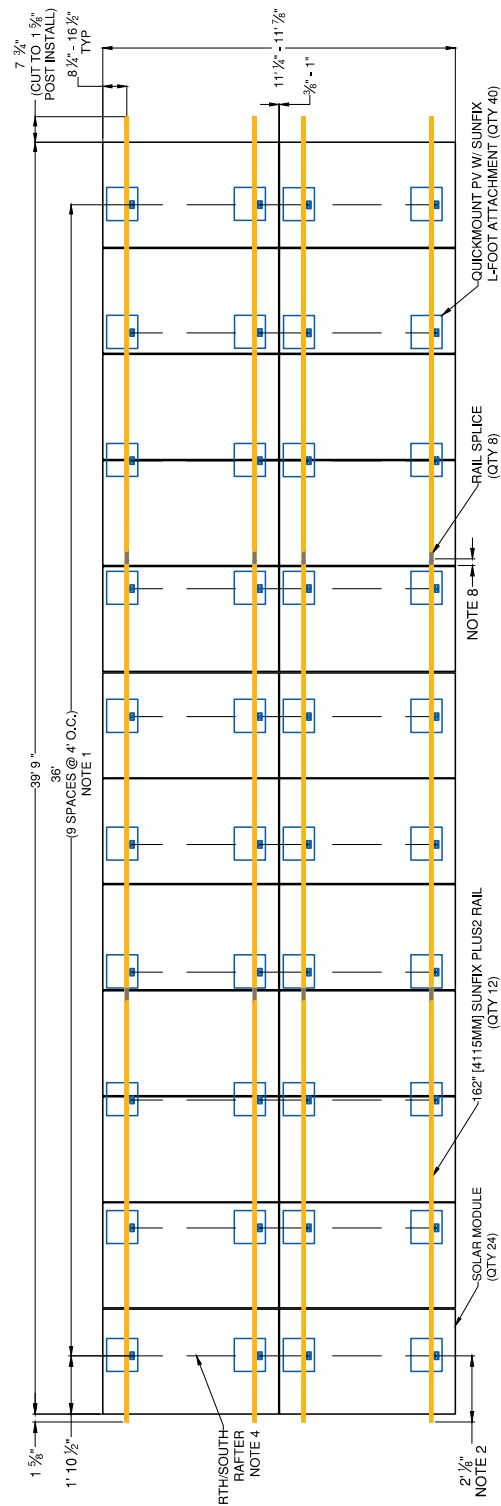
Sunfix plus2 Sample Layout 18 Modules, 2 Rows of 9, 030030-A.



#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-S RAFTERS MIN 2" X 4"
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ONTO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

Sunfix plus2 Sample Layout 18 Modules, 3 Rows of 6, 030031-A.



#### MECHANICAL NOTES:

1. TYPICAL ATTACHMENT SPANS AT 4 FT ON CENTER. REFER TO SPAN TABLES IN THIS INSTALLATION GUIDE TO EXCEED 4 FT.
2. DO NOT EXCEED CANTILEVER VALUES LISTED IN SPAN TABLES. ADDITIONAL FLASHINGS MAY BE NEEDED. ADJUSTMENTS MAY BE REQUIRED.
3. MAX MODULE DIMENSIONS: 65.94" x 39.41"
4. ROOF MEMBER N-5 RAFTERS MIN 2" X 4"
5. TOTAL RACKING SYSTEM LOAD W/O MODULES BUT INCLUDING FLASHING, TOP CLAMPS, AND GROUNDINGS: 0.40 PSF
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS WHEN PREPARING ROOF FOR ANCHOR POINT LOCATIONS. BUILDING STRUCTURE INTEGRITY IS THE RESPONSIBILITY OF THE INSTALLER.
7. LAYOUT BASED ON INSTALLING MODULES ON TO RAIL FROM LEFT TO RIGHT.
8. ENSURE INTERSECTION OF ADJACENT MODULES IS AT LEAST 1" AWAY FROM THE END OF THE RAIL AT THE SPLICE JOINT (SEE TOP OF PAGE 31 IN THE INSTALLATION GUIDE).

Sunfix plus2 Sample Layout 24 Module, 2 Rows of 12, 030032-A.



This page intentionally left blank.

# Production and sales locations of the SolarWorld group



## SolarWorld Ibérica, S.L.

C/La Granja 15,  
Bloque B-1ºB  
28108 Alcobendas, Madrid  
Spain

## SolarWorld Americas LLC

4650 Adohr Lane  
Camarillo, CA 93012  
USA  
customerservice@solarworldusa.com  
solarworld.com

## SolarWorld AG

Martin-Luther-King-Str. 24  
53175 Bonn  
Germany  
Phone: +49 228 55920 0  
Fax: +49 228 55920 99  
service@solarworld-global.com  
solarworld.de

## SolarWorld France SAS

Hôtel de l'Entreprise, Petite Halle, Bouchayer-Viallet  
31, rue Gustave Eiffel  
38000 Grenoble  
France

## SolarWorld Africa Pty. Ltd.

20th Floor  
1 Thibault Square  
Kapstadt, 8001  
South Africa  
g.kuepper@solarworld-africa.co.za  
solarworld-africa.co.za

## SolarWorld Asia Pacific Pte. Ltd.

72 Bendemeer Road  
#07-01, Luzerne  
Singapore 339941  
Singapore



solarworld.com