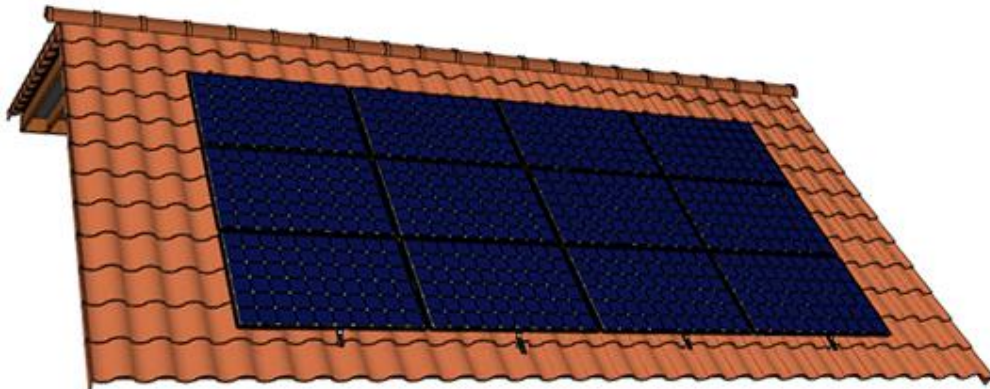
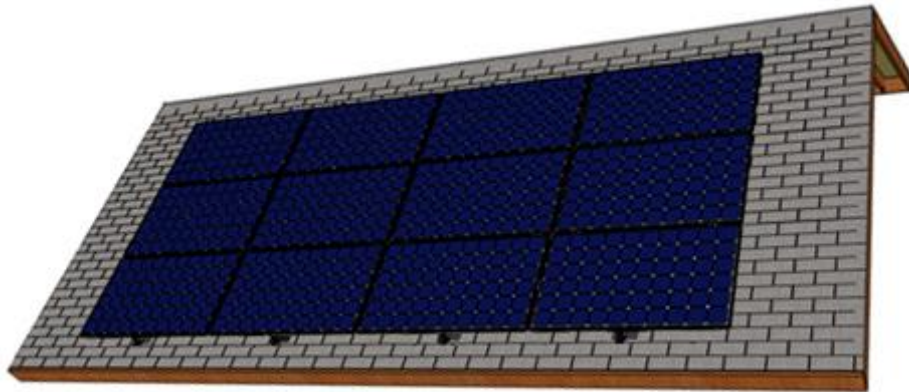




**MageMount  
Rail-less Solar Mounting System  
Installation Manual**



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# 1 Overview

MageMount Rail-less Solar Mounting System is a solar mounting solution that doesn't require rails or clamps. It is designed by Magerack Corporation with focus on easing installation and reducing installation time and cost. Solar module discussed in this manual must have module frame compatible with MageFrame. MageFrame is a proprietary module frame designed by Magerack Corporation. It has a slot on the vertical outside of the module frame, through which module connectors, roof attachments, grounding lugs, mounting brackets and other mounting components can be attached to the module. The assembly is to be mounted over a fire resistant roof covering rated for the application. This mounting system may be used to ground and mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and mounting in compliance with the included instructions.

## **UL Certified with All Components Bonded**

The system is tested and certified to be in compliance with UL 2703 and Class 'A' fire rating for type one solar modules with MageFrame. The system is fully bonded and the bonding pins on module connectors and bonding blades on MageBolt are for multiple uses. Installation doesn't require specific tools. All fasteners are one size and they are all hex 5/16" MageBolts, flange bolts, carriage bolts or flange nuts.

## **Separate Module Connectors and Roof Attachments**

Unlike other rail-less mounting products, MageMount Rail-less Solar Mounting System separates roof attachments from module connecting components. Roof attachments are only used to attach solar modules to the roof and are installed wherever necessary to reduce the number of roof penetrations. Module connectors are only used to structurally connect adjacent modules and additional module connectors can be used to further enforce the connection of two adjacent modules in a row, two modules between adjacent rows or any combination of both. With such flexibility, the array layout can be any combination of module orientations to maximize the number of solar modules on a roof, comply with fire code and other design requirements and achieve the maximal utilization of a roof.

## **Complete Solutions for All Roof Types**

Roof attachments have been designed to accommodate all roof types. The system provides complete roof attachment for composition shingle roof, tile roof, stone-coated steel roof, shake roof, etc. For other types of roofs such as standing seam metal roof, installers can acquire metal clamps from other manufacturers and attach them to the metal seam, and then attach Magerack's L brackets to the metal clamps. The rest of the installation is the same as the installation on composition shingle roof discussed in this manual.

## 2 Components and Assembly

MageMount Rail-less Solar Mounting System is a solar mounting solution that doesn't require rails or clamps. It utilizes solar module that comes with MageFrame designed by Magerack Corporation. It is designed with focus on easing installation and reducing installation time and cost. The mounting system works with solar modules compatible with MageFrame only.

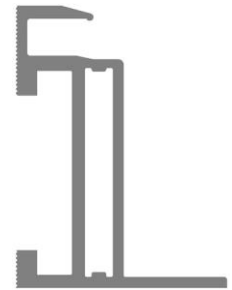
### 2.1 Components

#### 2.1.1 Solar Module with MageFrame

Solar module must have frame that is compatible with MageFrame. MageFrame is a proprietary module frame designed by Magerack Corporation. It has a slot on the vertical outside of the module frame, through which module connectors, roof attachments, grounding lugs, accessory mounting brackets and other mounting components can be attached to the module.



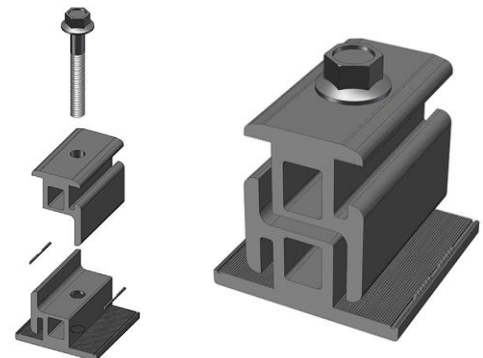
Solar Module with MageFrame



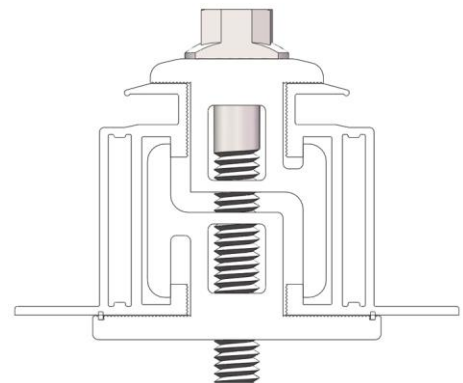
MageFrame Section View

#### 2.1.2 Module Connectors

A module connector connects two adjacent modules structurally. A module connector has top and bottom parts. One part slides into the slot of one module and other part into the slot of the other module. The two parts are connected with a bolt, thus it connects two adjacent modules. The module connector has integrated multiple-use bonding pins. Once module connector is tightened, the two adjacent modules are bonded through the bonding pins on module connector. The binding pins on module connector can be used multiple times. However, before module connector is inserted into module, verify and make sure the bonding pins are intact, especially when module connector is used again after being used first time. If bonding pins are missing, the module connector cannot be used and should be discarded.



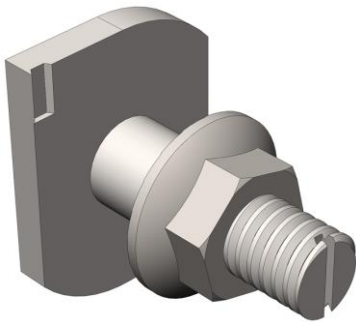
Module Connector with Bonding Pins



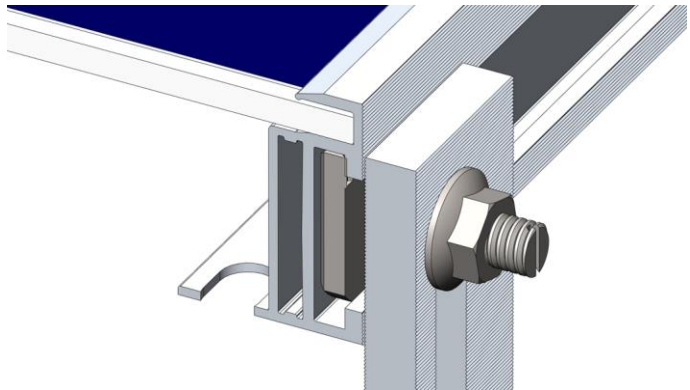
Two MageFrame Modules Bonded by Module Connector through Bonding Pins

### 2.1.3 Roof Attachemnts

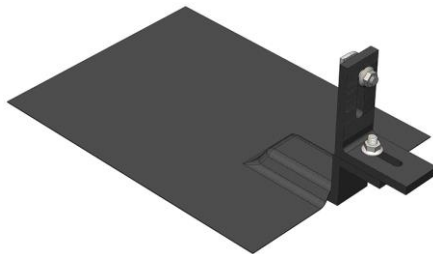
All roof attachments are attached to module through MageBolt. MageBolt has built-in bonding blades that pierce into module frame inside the slot and create bonding between MageBolt and module frame when it is tightened. MageBolt is bonded with rest of roof attachment. Therefore, roof attachment is bonded to the module frame once MageBolt is tightened. The bonding blades on MageBolt can be used multiple times.



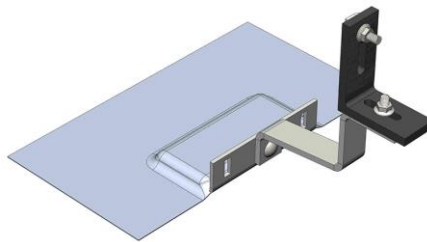
MageBolt with Bonding Blades



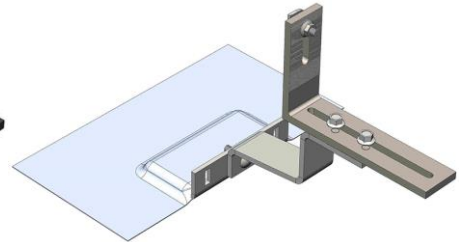
Roof Attachment Bonded with MageFrame  
Module through MageBolt Bonding Blades



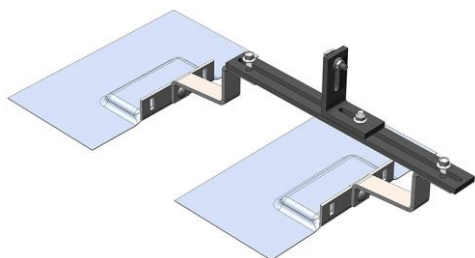
Comp Foot



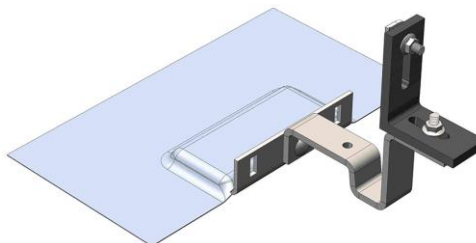
Tile Foot



Long Tile Foot



Double Tile Feet



Steel-Roof Tile Foot



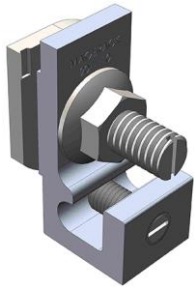
Standoff



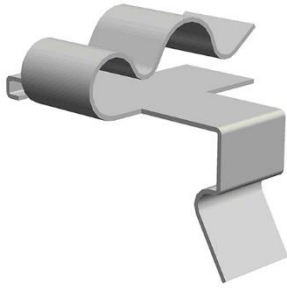
L Bracket

## 2.1.4 Other Components

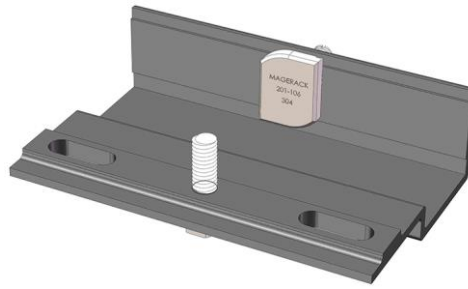
Various components have been designed to utilize the MageFrame to install or connect additional system components. Grounding lug utilizes MageBolt and MageFrame so you can install grounding lug without drilling. Cable clips can be attached to MageFrame to manage cables and accessory mounting bracket can be used to mount microinverter, optimizer and other system components on the back side of modules.



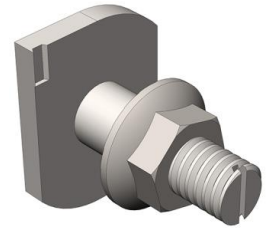
Grounding Lug



Cable Clip



Accessory Mounting Bracket



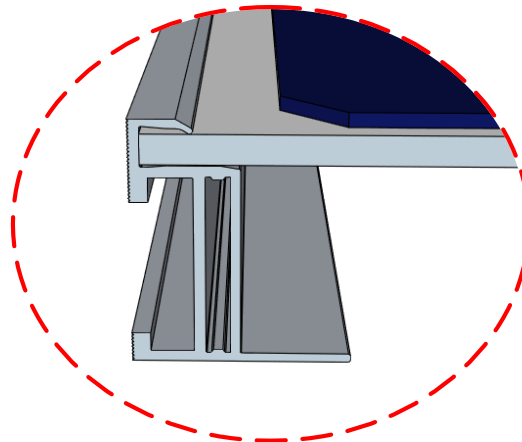
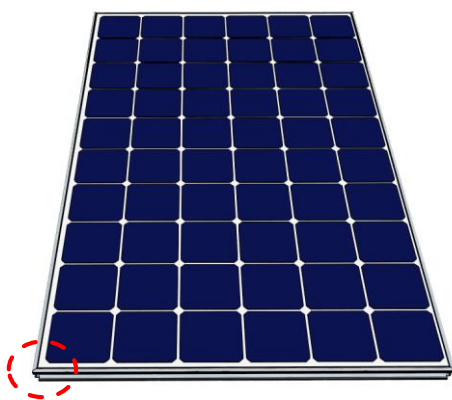
MageBolt

## 2.2 Assembly

### 2.2.1 Solar Module with MageFrame

Solar module with MageFrame is similar to conventional solar module but the vertical outside frame has slot through which module connectors, roof attachments, grounding lugs, accessory mounting brackets and other mounting components can be attached to the module.

Nonetheless, the solar module with MageFrame is compatible with conventional solar module and also certified to be installed using conventional rail-based mounting methods.

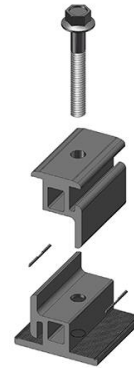




## 2.2.2 Module Connectors

### Module Connector

1. 5/16"-18 flange bolt
2. Connector top
3. Connector bottom
4. Bonding pins



## 2.2.3 Roof Attachments

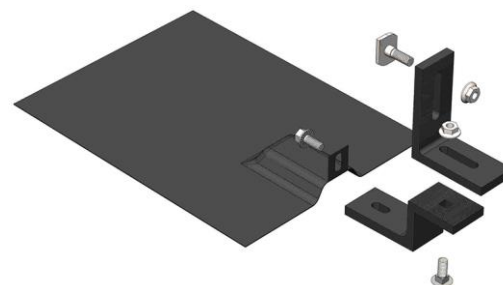
### L Bracket

1. 5/16"-18 MageBolt
2. L bracket
3. 5/16"-18 flange nut



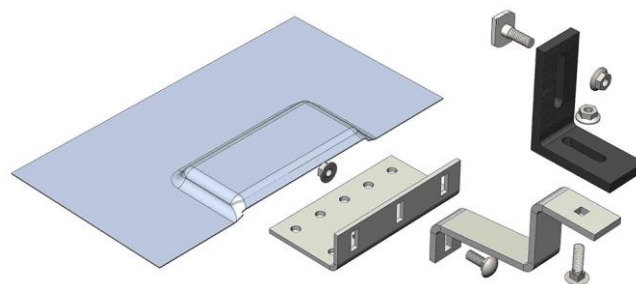
### Comp Foot with Flashing for Composition Shingle Roof

1. 5/16"-18 MageBolt
2. L bracket
3. 5/16"-18 flange nuts
4. 5/16"-18 flange bolt
5. 5/16"-18 carriage bolt
6. Comp foot base
7. Comp foot flashing



### Tile Foot with Flashing for Tile Roof

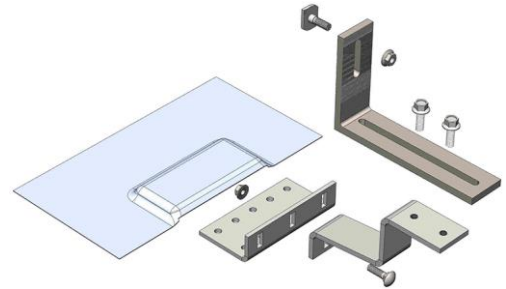
1. 5/16"-18 MageBolt
2. 5/16"-18 flange nuts
3. 5/16"-18 carriage bolts
4. L bracket
5. Tile foot arm
6. Tile foot base
7. Tile foot flashing





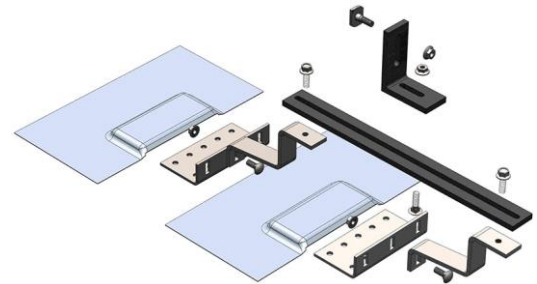
### Long Tile Foot with Flashing for Tile Roof

1. 5/16"-18 MageBolt
2. 5/16"-18 flange nuts
3. 5/16"-18 flange bolts
4. Long L bracket
5. Tile foot arm
6. 5/16"-18 carriage bolt
7. Tile foot base
8. Tile foot flashing



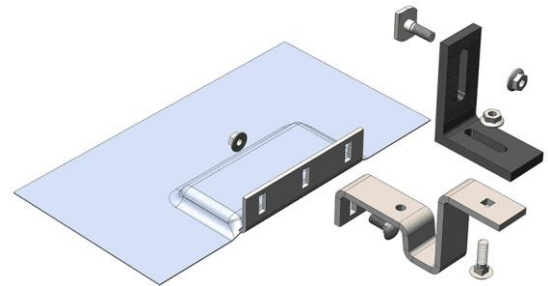
### Double Tile Feet with Flashing for Tile Roof

1. 5/16"-18 MageBolt
2. L Bracket
3. 5/16"-18 flange nuts
4. 5/16"-18 flange bolts
5. 5/16"-18 carriage bolts
6. Double tile feet bridge
7. Tile foot arms
8. Tile foot bases
9. Tile foot flashings



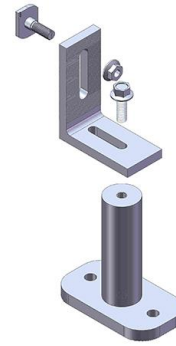
### Steel-Roof Tile Foot with Flashing for Stone-Coated Steel Roof

1. 5/16"-18 MageBolt
2. 5/16"-18 flange nuts
3. 5/16"-18 carriage bolts
4. L bracket
5. Tile foot arm
6. Tile foot base
7. Tile foot flashing



## Standoff

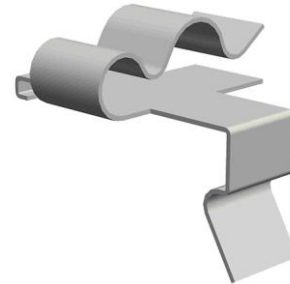
1. 5/16"-18 MageBolt
2. 5/16"-18 flange nut
3. 5/16"-18 flange bolt
4. L bracket
5. Standoff post
6. Standoff base



## 2.2.4 Accessories

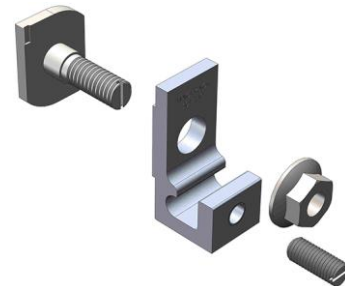
### Cable Clip

Cable Clip



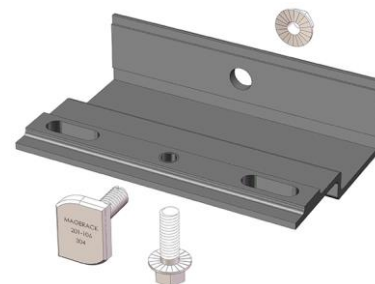
### Grounding Lug

1. 5/16"-18 MageBolt
2. 5/16"-18 flange nut
3. Grounding lug
4. 1/4"-28 set screw



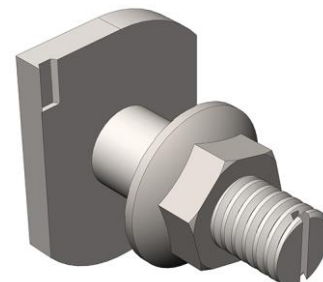
### Accessory Mounting Bracket

1. 5/16"-18 MageBolt
2. 5/16"-18 flange nut
3. Accessory mounting bracket



### MageBolt

1. 5/16"-18 MageBolt
2. 5/16"-18 flange nut

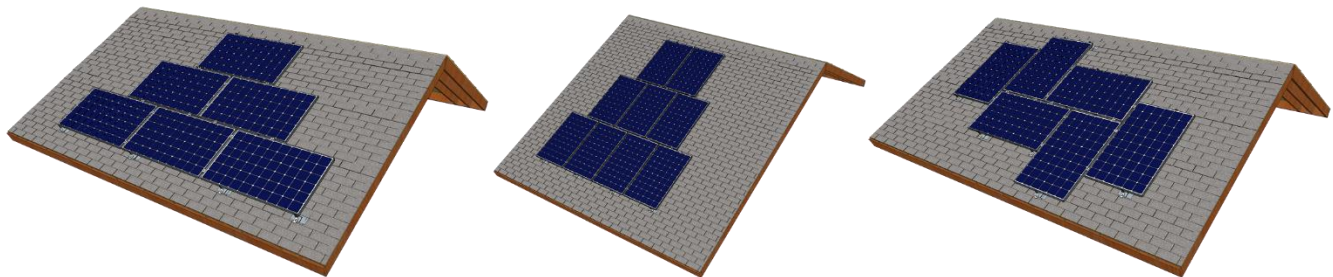


## 3 Array Layout and Planning

### 3.1 Array Layout

Unlike other rail-less mounting products, MageMount Rail-less Solar Mounting System separates roof attachments from module connecting components. Therefore, the roof attachments can be installed only wherever necessary to reduce the number of roof penetrations. Module connectors can be installed wherever needed and additional module connectors can be used to further strengthen the connection of two adjacent modules in a row, two modules between adjacent rows or combination of both. With such flexibility, the array layout can be any combination of module orientation to maximize the number of solar modules on a roof, which still complies with fire code and other design requirements but achieves maximal utilization of a roof.

The modules in an array can be in portrait, landscape or mixed orientations.



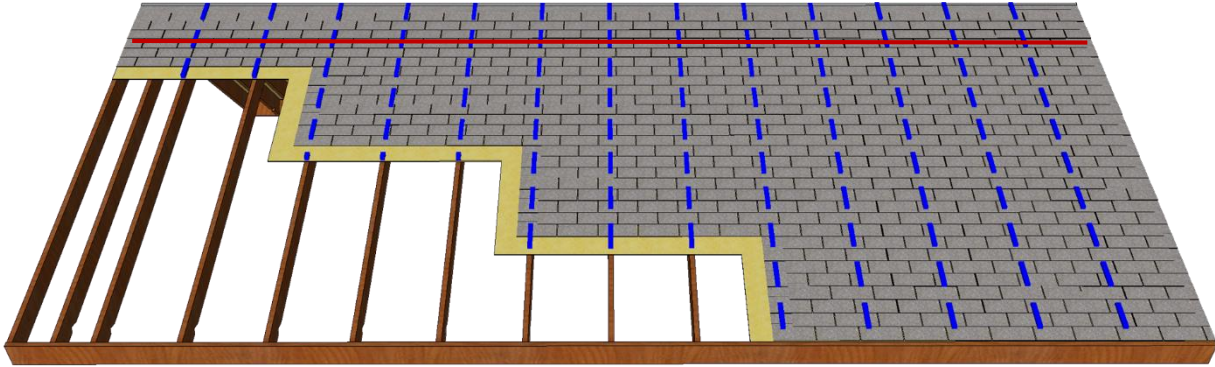
Roof attachment spacings depend on various conditions, such as roof pitch, snow load, wind speed, etc. In general roof attachment spacing can be 72" for landscape orientation, 48" for portrait orientation and 48" for mixed orientations. Consult with local building department to make sure it meets building code and local jurisdiction requirement.

### 3.2 Array Planning

The order and direction of installing modules are also flexible and can be from ridge down to eaves or from eaves up to ridge. The modules in first row will have roof attachments on both top and bottom edges of modules. For the subsequent rows, the top edges of the modules are connected to the bottom edges of modules on previous row with module connectors and the bottom edges of the modules are attached to roof attachments. The adjacent modules on each row are connected with module connectors. In general, there should be at least one module connector on long sides of two adjacent modules and at least one module connector on short sides of two adjacent modules. In addition, installers can install additional module connectors to further strengthen the connections between adjacent modules in an array when necessary.

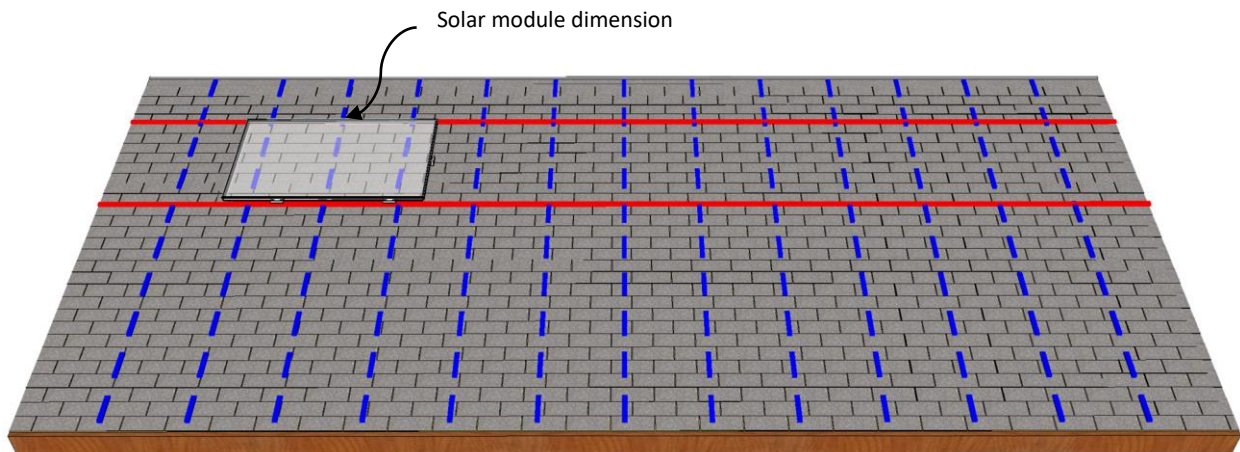
#### Step 1

Locate rafters on the roof based on structural drawings, experience and other references, and identify the placement of the first row of roof attachment. Take roof attachments size and direction into consideration when planning. In the following illustrations, the first row starts at the top left on the roof. However, you may start from right to left or bottom to top depending on your preference and project convenience. Mark the first row.



## Step 2

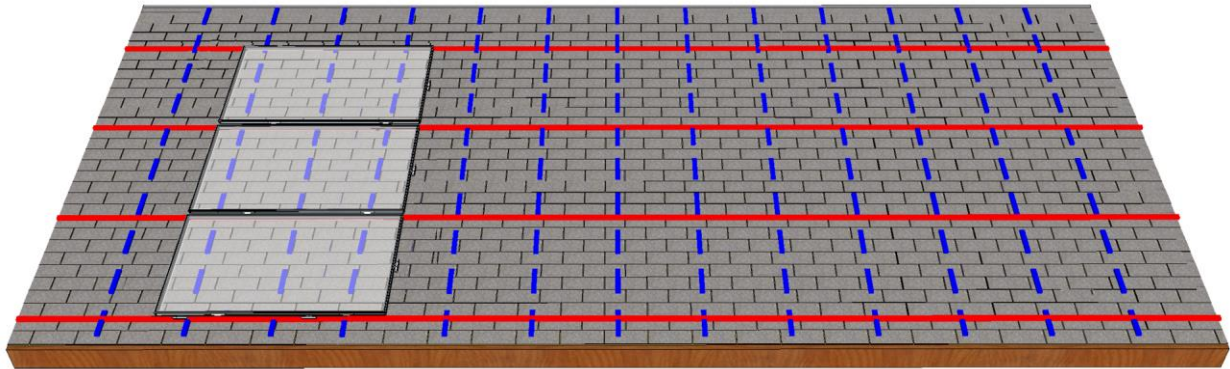
To determine the next row of roof attachments, measure the length of long side (for portrait position) or the width of short side (for landscape position) of module frame **plus 1"** for the module connector spacing. This is the distance for the roof attachments from the first row to second row. Mark the crossing point between rafters and the second row.





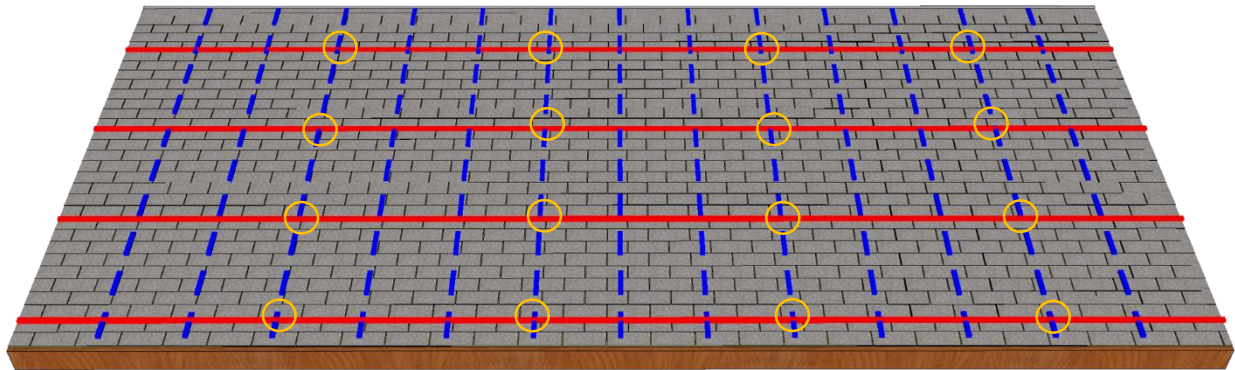
### Step 3

The marked crossing points are the possible penetration points for roof attachments.



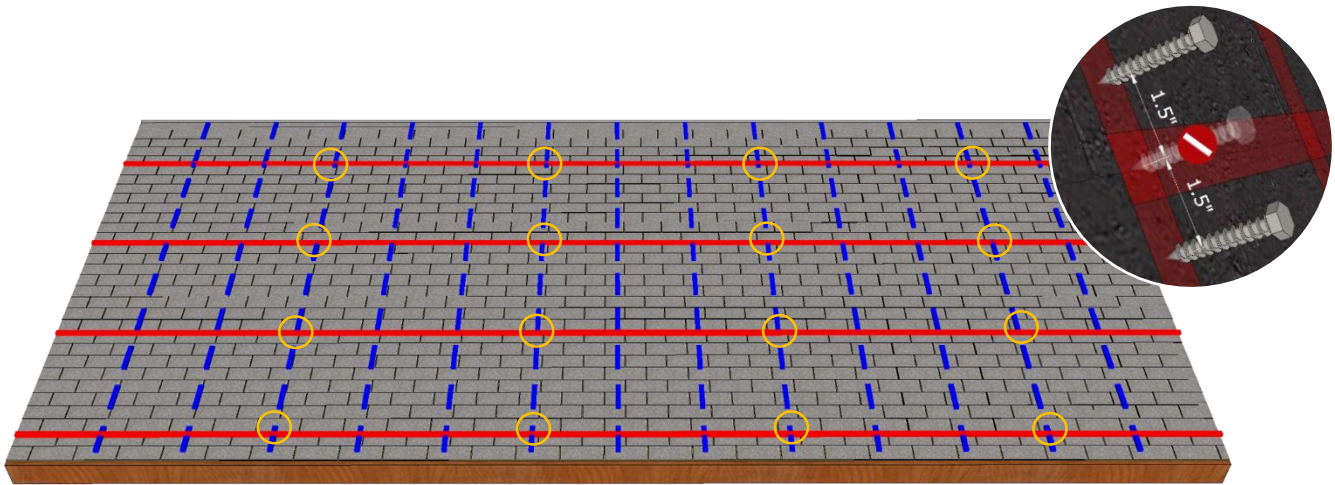
### Step 4

Based on solar module layout of a specific project, determine the actual penetration points for roof attachments. If the penetration point is not ideal, you may move this penetration point up or down along the rafter no more than 1.5" to locate the best position. Yellow spots are selected for possible roof attachment positions.



### Installation Tips:

1. Pre-position the roof attachment before penetration to confirm the distance.
2. In case of impenetrable situation, move the penetration point up or down along the rafter no more than 1.5 inch to locate the best position.
3. If it is necessary to distribute the system weight on as many rafters as possible, it is also possible to mark the roof attachments in staggered pattern. Make sure cantilever, overhang and roof attachment spacing meet the requirement.



### 3.3 Minimum Requirements of Roof Attachments and Module Connectors

#### 3.3.1 Roof Attachments

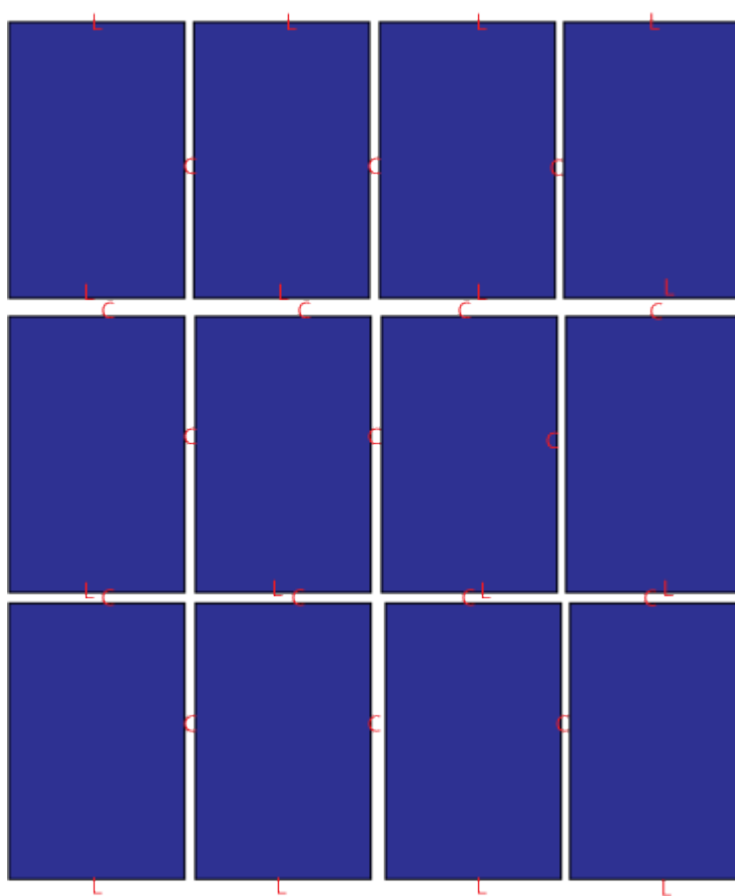
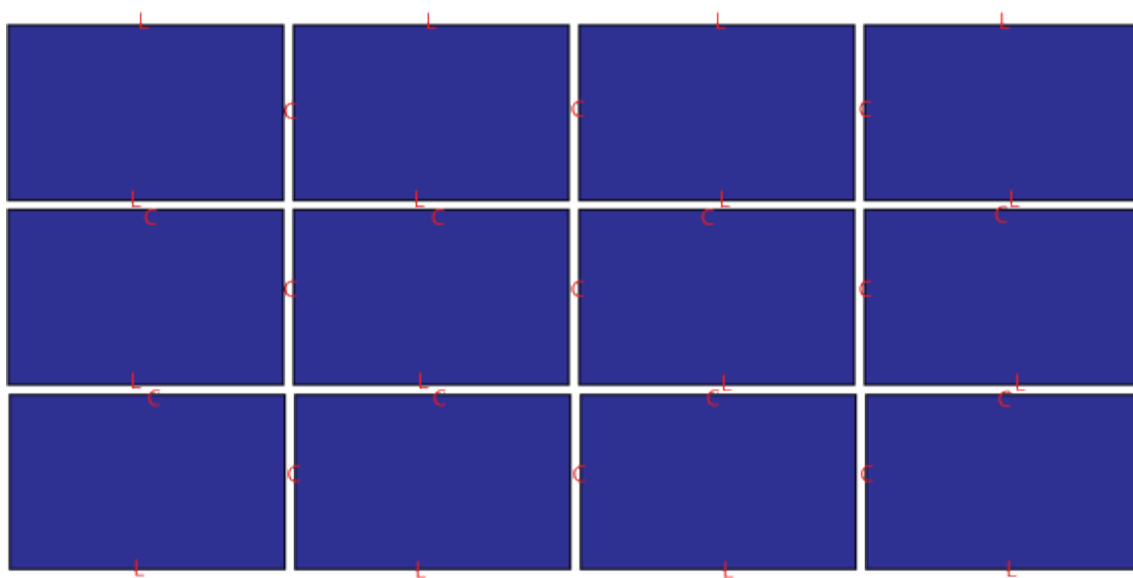
When first row of modules are installed, roof attachments are installed to both top and bottom frames of the modules. There are at least one roof attachment on top or bottom frame of each module. When necessary, more than one roof attachment may be installed on each frame of module, especially on the leftmost and rightmost modules on each row.

For the subsequent row, if array is installed from top to bottom, the top frames of modules are connected to the previous row with module connectors and roof attachments are installed only to the bottom frames of the modules; similarly, if array is installed from bottom to top, the bottom frames of modules are connected to the previous row with module connectors and roof attachments are installed only to the top frames of the modules.

Roof attachments are usually installed near the center of each frame if there is only one roof attachment. For the first and last module on each row, the roof attachment should be installed within 6 inches from the center of module frame if there is only one roof attachment. For additional stability and security, two roof attachments may be installed on one module frame if necessary. If there are two roof attachments installed to one module frame, the two roof attachments should be installed within the range of  $1/4$  to  $1/3$  of the frame from each end if possible.

#### 3.3.2 Module Connectors

Module connectors are installed whenever there are two adjacent modules. There are at least one module connector on frames of two adjacent modules. Module connectors are usually at the center of modules. When necessary, more than one module connector can be used for two adjacent modules and they can be installed evenly along module frame.



**L:** Roof Attachment

**C:** Module Connector



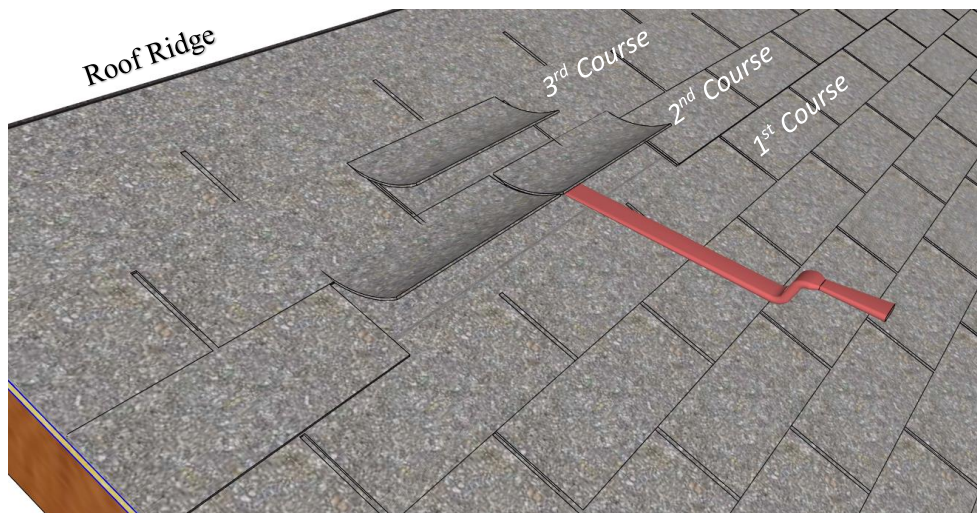
## 4 Install Roof Attachments

Roof attachments are attached to module through MageBolt and flange nut. When MageBolt is tightened with flange nut, tighten flange nut to torque 16 ft-lbs.

### 4.1 Install Comp Foot on Composition Shingle Roof

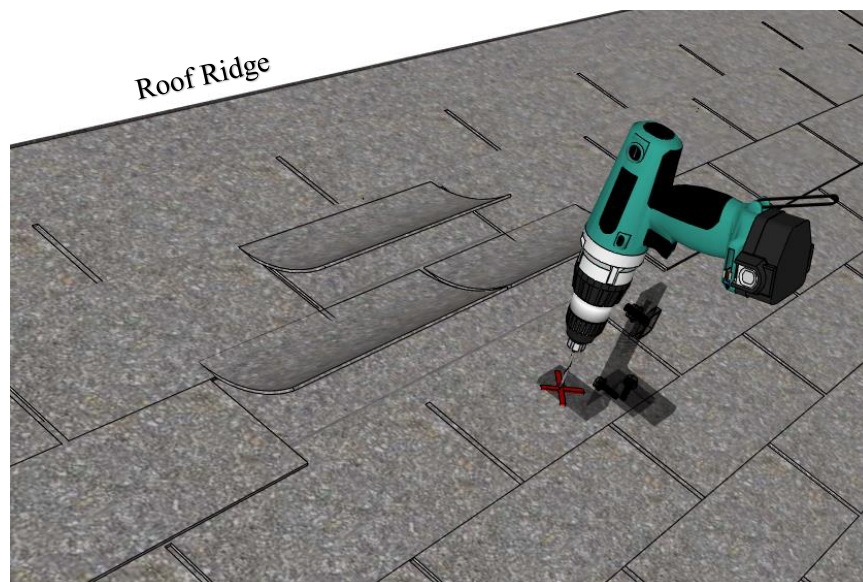
#### Step 1

Remove sealant and nails between first and second courses, and second and third courses. Make sure to remove all nails where the flashing slide into. It is required to have flashing reach the 3rd course.



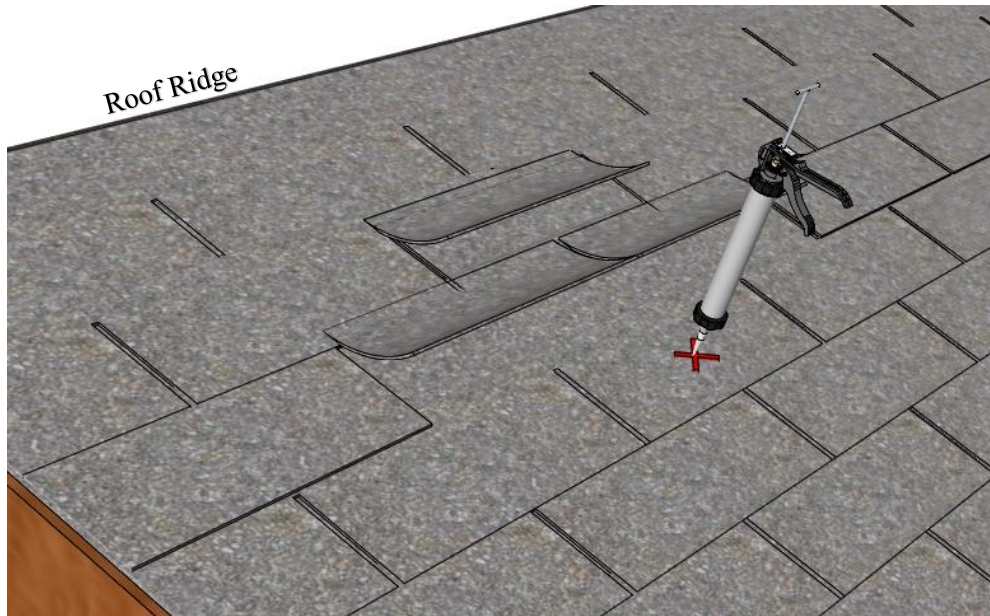
#### Step 2

Use 1/8" aircraft extension bit and drill 2" to 3" deep pilot hole into center of rafter at marked penetration point.



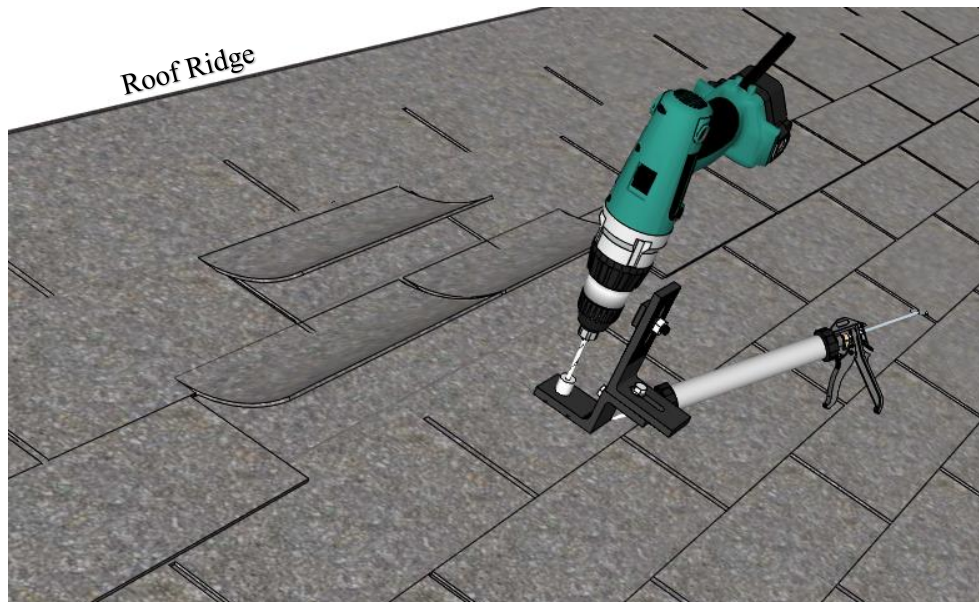
### Step 3

Seal the hole with appropriate sealant.



### Step 4

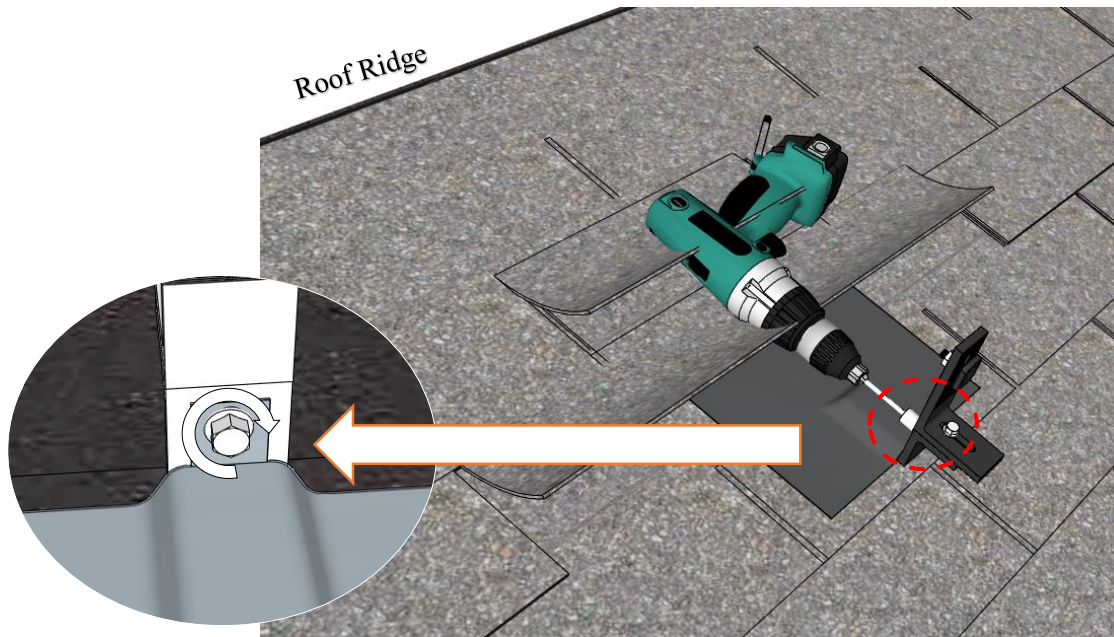
Attach a Magerack comp foot to roof with a 5/16" lag screw through the pilot hole. Make sure comp foot base is aligned along the rafter and perpendicular to roof ridge. The flashing side of base should point upwards to the ridge. The length of lag screw should be decided by system designer or installer to make sure the lag screw could be penetrated deep enough into the rafter through the comp foot base. If necessary, apply some sealant to the underside of comp foot base and into the bolt hole then tighten the lag screw.





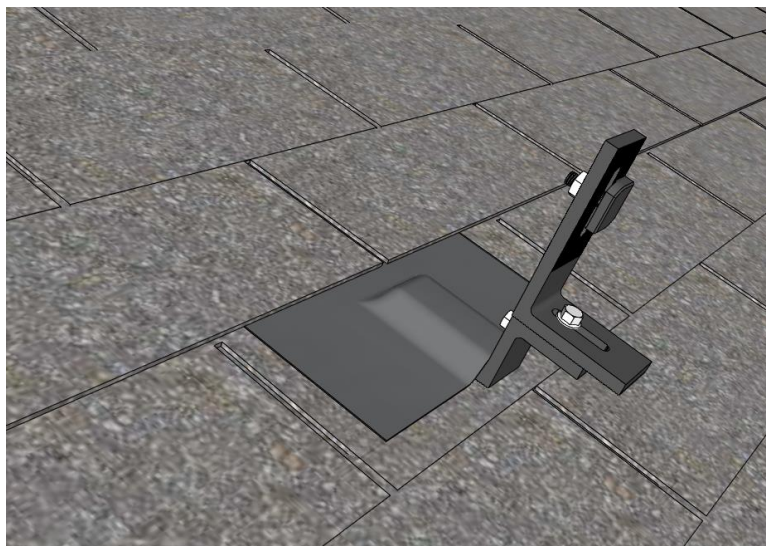
### Step 5

For waterproofing purpose, the comp foot flashing must be installed. Slide the top of flashing under the second course all the way up until the bottom of flashing is right above the comp foot base. Make adjustment so that the flashing is centered horizontally above comp foot base. If necessary, apply some sealant on the undersides of shingle on second and third courses and also the underside of flashing. Attach flashing to the comp foot base with provided flange bolt.



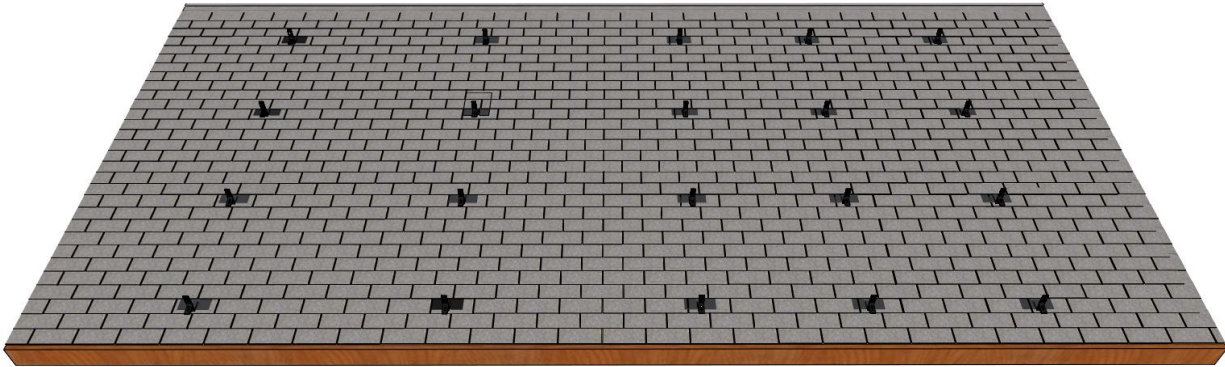
### Step 6

Once the comp foot base and flashing are secured, move shingles back to original position and make sure flashing is under roofing materials.



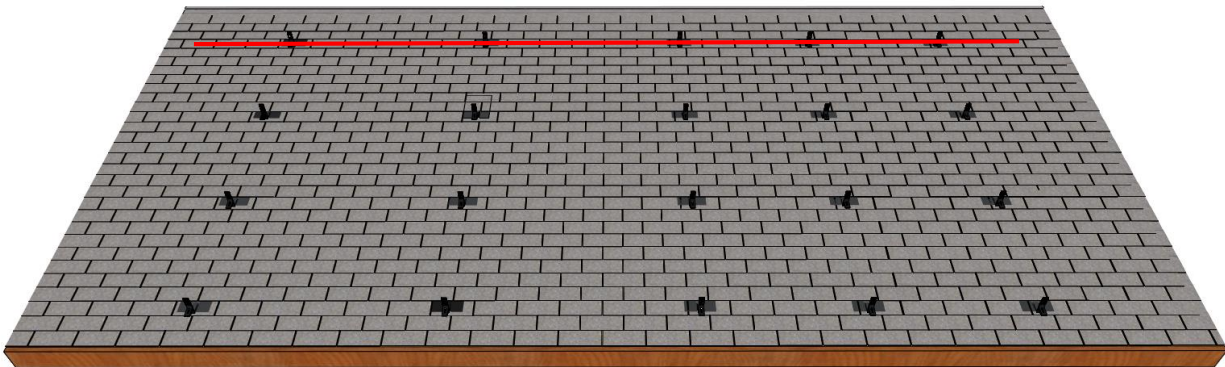
## Step 7

Repeat steps 1-6 to install all roof attachments.



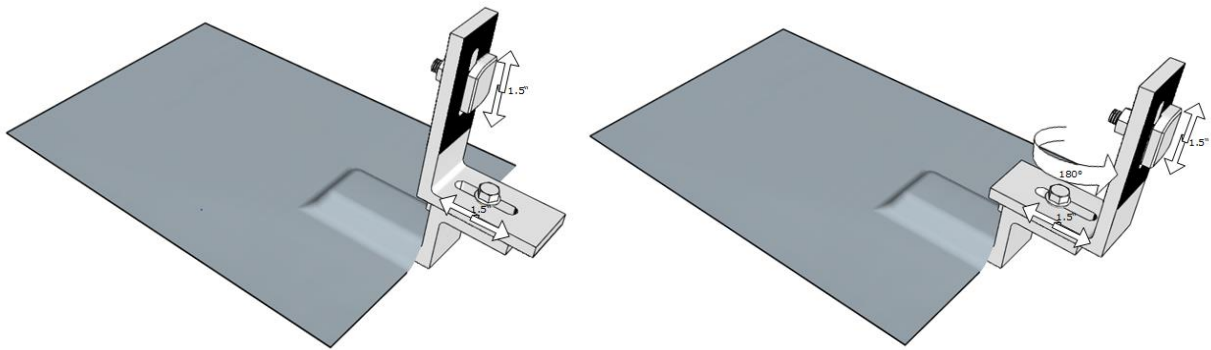
## Step 8

Adjust the L brackets on comp foot base to make sure all L brackets on each row are aligned horizontally. For the first row, tighten the flange bolts between L brackets and comp foot bases. For the rest rows, do not fully tighten the flange bolts between L brackets and comp foot bases yet.



## Installation Tips:

1. Comp foot is adjustable within 1.5" span moving along the rafter direction. Depending on your project, you may rotate the L bracket 180° which gives you another 1.5" span. But it may be difficult to tighten L bracket to comp foot base because the flange bolt may be under solar module if L bracket points to the module. It is highly recommended to make a plan for the direction of L brackets before attaching comp foot bases to the roof so that you can have the enough space for your hands and tool to tighten bolts after the solar modules are installed.
2. For aesthetic looking and saving space, the direction of L brackets on the outside edge of first row in an array can be adjusted in a way, once attached and tightened to the comp foot bases, that the bottom of the L brackets and comp foot bases are hidden under modules. If you plan to install in such way, make sure you measure the distance between the L brackets with correct L bracket directions when planning and installing roof attachments between first and second rows.

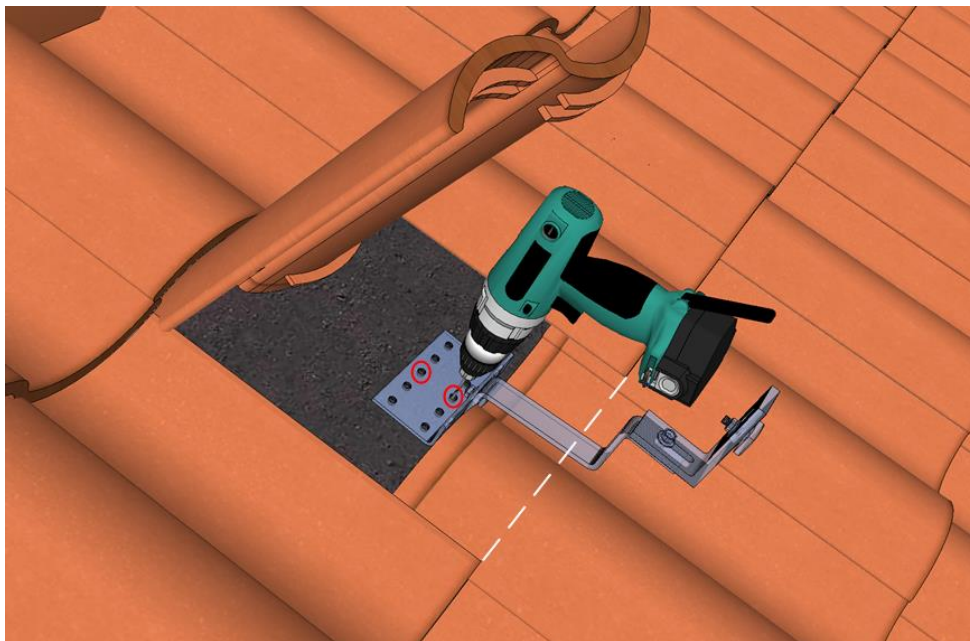


## 4.2 Install Tile Foot, Long Tile Foot and Double Tile Feet on Tile Roof

### 4.2.1 Install Tile Foot

#### Step 1

Remove the tile and locate the penetration point. Use tile foot as reference, make sure the vertical portion of the tile foot arm is behind headlap area (white dash line) and tile foot arm sits on center of lower curve of the first course of tile if possible. Drill two 2" to 3" deep pilot holes through the base holes into rafter.



#### Step 2

Seal the two holes with appropriate sealant.





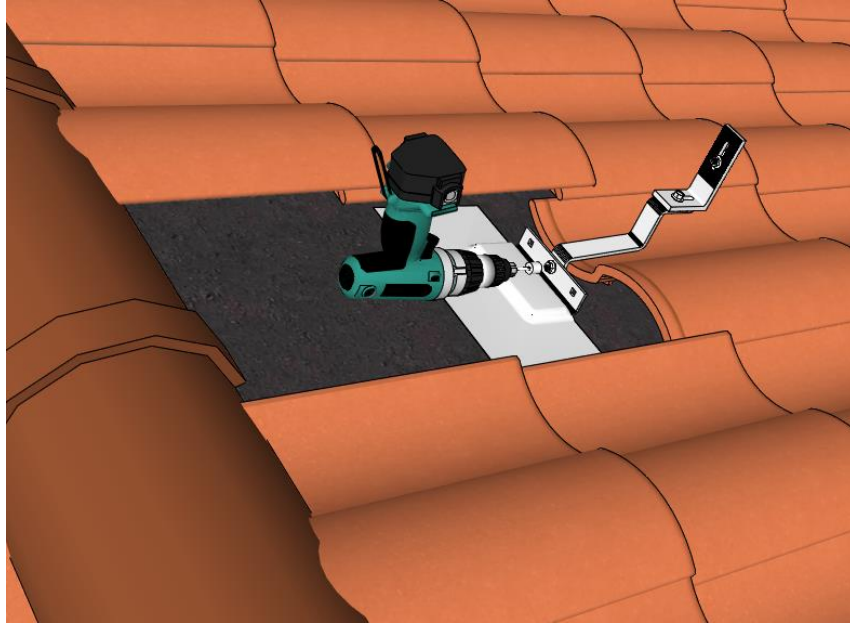
### Step 3

Secure tile foot base to roof with two 5/16" lag screws through the pilot holes. Make sure tile foot base is vertical to roof ridge along the rafter. The base should point to the ridge direction. Decide the length of lag screw and make sure the lag screw could be penetrated deep enough into the rafter through the tile foot base. If necessary, apply some sealant to the underside of tile foot base and into the bolt holes and then tighten the lag screws.



#### Step 4

Adjust the tile foot arm height and tighten it to the tile foot base. For waterproofing purpose, you may install the tile foot flashing. Simply apply sealant on the underside of flashing, and cover the tile foot base. Make sure the top edge of the flashing is inserted under roof underlayment or covered with sealant.



#### Step 5

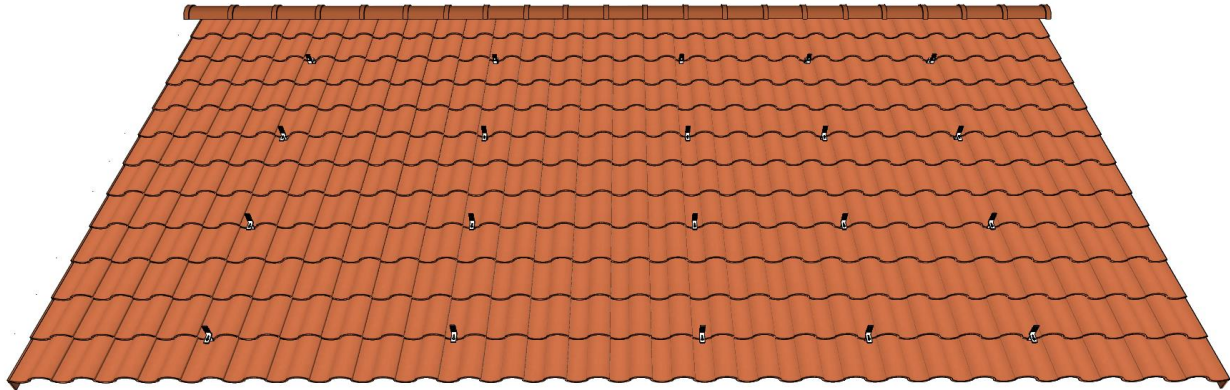
Re-install the tile back to its original place.





## Step 6

Repeat steps 1-6 to install all roof attachments.



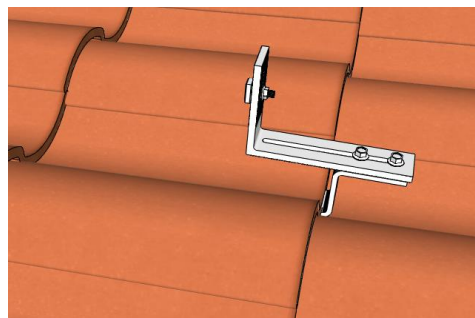
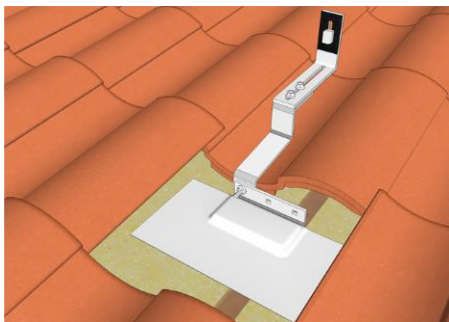
**Installation Tips:** It is recommended to pre-position the roof attachments and confirm the distance before penetrations. The measurement should be between L brackets between two rows. In the case that L bracket is not in position where the module frame is located, long tile foot or double feet can be used.

### 4.2.2 Install Long Tile Foot

Due to the length of a roof tile, sometimes the module frame may be short of where the L bracket mounting position is, so it is not possible to attach L bracket to the module frame. Long Tile Foot may be used to extend L bracket to the module frame.

The Long tile foot is specially designed to complement regular tile foot for tile roof projects. The L bracket is extended and spans up to 10”.

The installation procedure is the same as **4.2.1 Install Tile Foot** above.



### 4.2.3 Install Double Tile Feet

Due to the length of a roof tile, sometimes the module frame may be short of where the L bracket mounting position is, so it is not possible to attach L bracket to the module frame with Tile Foot or even Long Tile Foot. Double Tile Feet may be used to extend L bracket to the module frame.

Double Tile Feet is to provide mounting position for L bracket at any location of a tile by using two tile feet with a bridge. L bracket is attached to the bridge. It provides the final solution for such difficult situation.

The installation procedure is similar to **4.2.1 Installing Tile Foot** above.



Install first foot



Install second foot



Return tiles to original location



Install double tile foot bridge



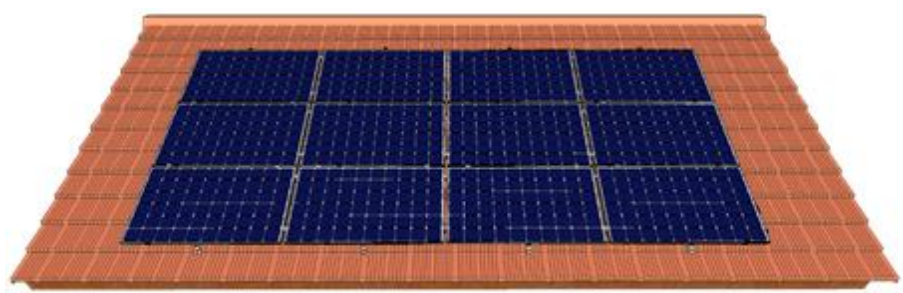
Install L bracket

### 4.3 Install Steel-Roof Tile Foot on Stone-Coated Steel Roof

The procedure to install Steel-Roof Tile Foot on stone-coated steel roof is very similar to install tile foot on tile roof. See **4.2.1 Installing Tile Foot** above for installation.



Install steel-roof tile foot  
on stone-coated steel roof



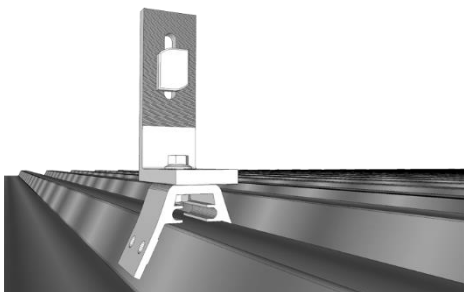
Modules installed on stone-coated steel roof

### 4.4 Install L bracket on Other Types of Roofs or Structures

MageMount Rail-less Solar Mounting System can also be used on other types of roofs or structures, such as metal roof as long as the L bracket can be attached to a roof attachment. For example, for standing seam metal roof, you can purchase seam clamps and install seam metal clamps on the metal roof. Magerack L Bracket can be attached to the metal clamp with MageBolt, then the rest of installation steps is similar to installing comp



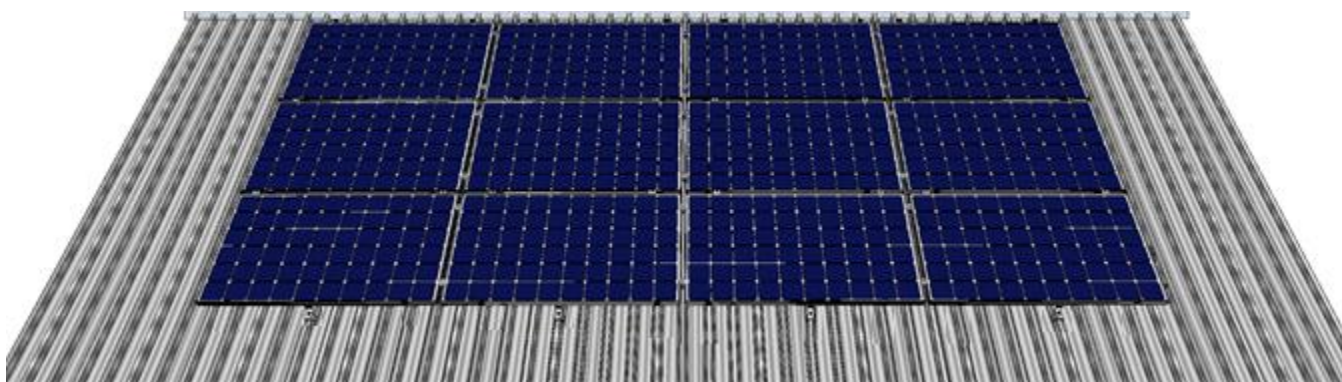
foot on comp shingle roof. Follow the steps of **4.1 Install Comp Foot on Composition Shingle Roof** to finish the installation.



Attach L bracket to metal roof clamp



Install module on metal roof with L bracket



Modules installed on metal roof

## 5 Install Solar Modules with Module Connectors

Module connector has two parts, top and bottom parts that connect two modules. Each part is connected to one module with its one end sliding inside module slot. The top part of the module connector has clamping flanges at the top pressing down the top edges of two modules. The bottom part of the module connector has clamping flanges at bottom with bonding pins holding the bottom edges of two modules. The top and bottom parts are connected with a bolt. Once the bolt is tightened through top and bottom parts, the two modules are tightened and pressed together vertically and the tightened top and bottom parts of the module connector also prevent two modules from pulling away horizontally. Therefore, the two modules are connected structurally and also bonded electrically.

### 5.1 Install Solar Module with Module Connectors

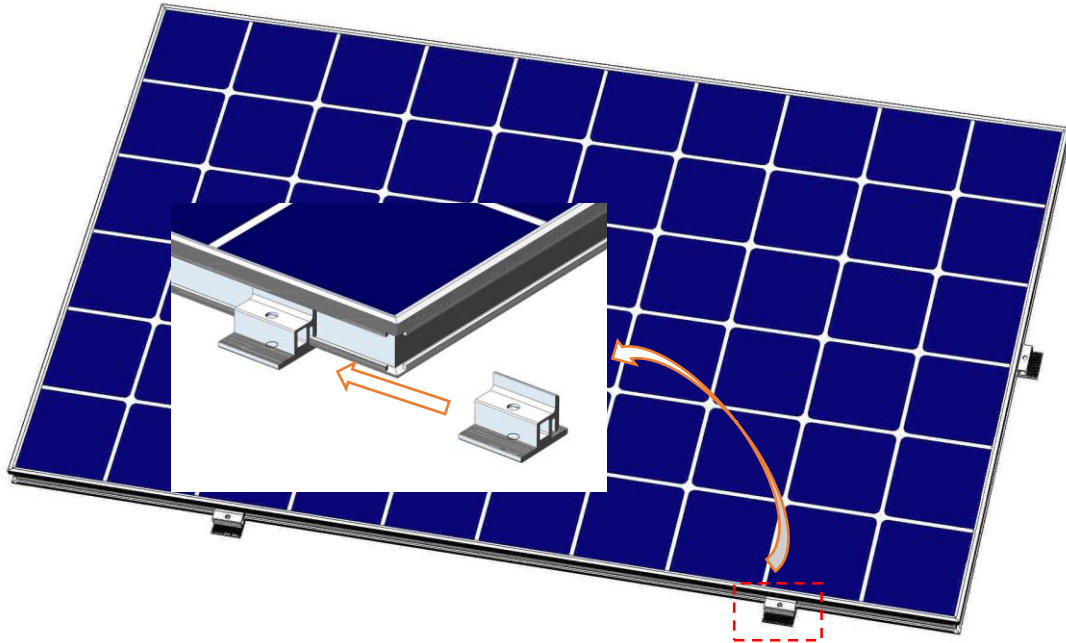
The modules in first row have roof attachments on both top and bottom edges of modules. For the subsequent rows, the top edges of the modules are connected to the bottom edges of modules on previous row with module connectors and the bottom edges of the modules are attached to roof attachments. The adjacent modules on each row are connected with module connectors. In general, there should be at least one module connector on long sides of two adjacent modules and at least one module connector on short sides of two adjacent modules. In addition, installers can install additional module connectors to further strengthen the connections between modules in the array when necessary.

#### 5.1.1 Install First Module

##### **Step 1:**

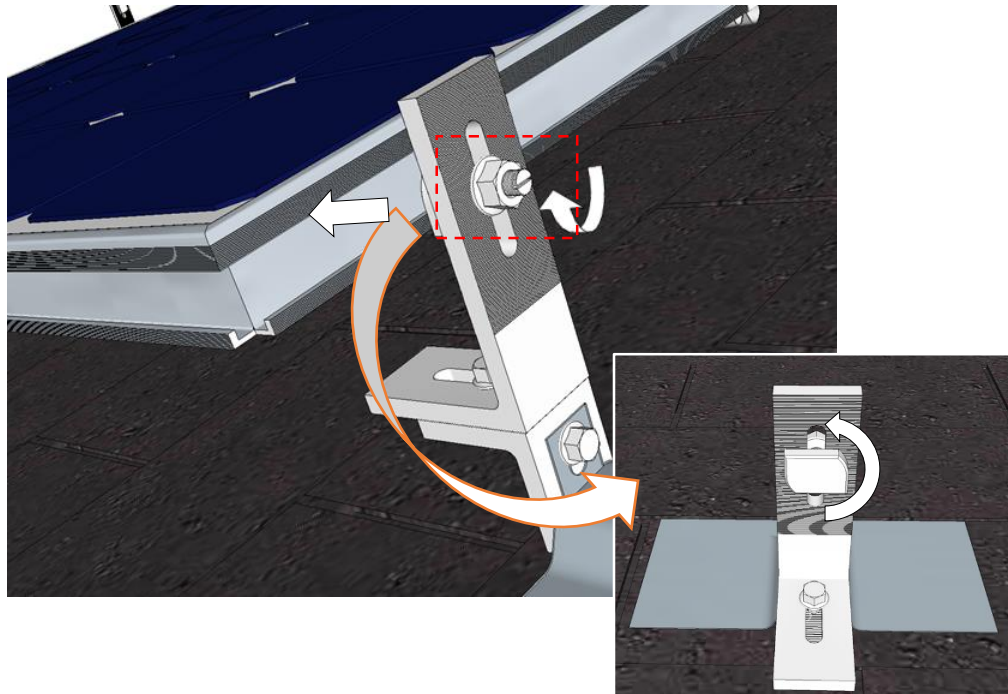
Slide the bottom part of a module connector into the slot on the right edge and another module connector on the bottom edge of the solar module. The easiest way is to always slide the bottom parts of the module connectors in the slot of module that is already installed, and slide the top parts of the module connectors in the slot of module that is to be installed. Module connectors can only slide in the slots, so make sure module connectors are already in place before module is attached to roof attachments. Therefore, it is highly recommended to prepare array planning carefully and decide all the connecting positions before installation.





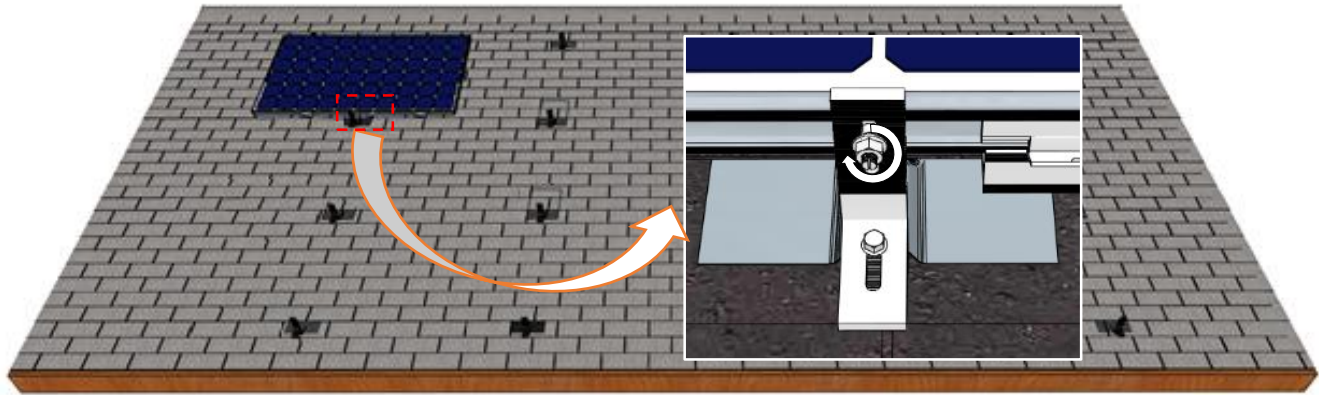
## Step 2:

Place module in position. Use module blocks to stabilize the module in position. Rotate MageBolt on comp foot to horizontal position and snap MageBolt head inside the slot on module frame. Then turn MageBolt clockwise 90° and tighten flange nut a bit. Level module at appropriate level and then tightened the flange nut to secure module. In case MageBolt is not rotated 90° to full position, use screw driver to turn clockwise at the tip of MageBolt to make sure it is fully rotated.



### Step 3:

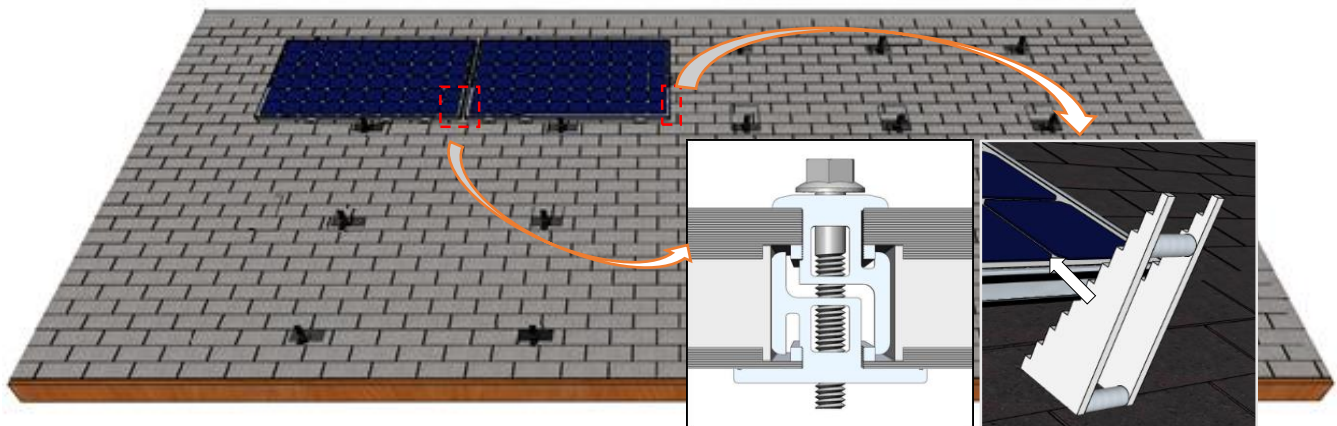
Repeat Step 2 and complete the installation of first module with all roof attachments. Once module is leveled and positioned, tighten the flange bolts between L brackets and comp foot bases. Tighten all flange bolts and nuts to torque 16 ft-lbs.



## 5.1.2 Install Modules on First Row

### Step 4:

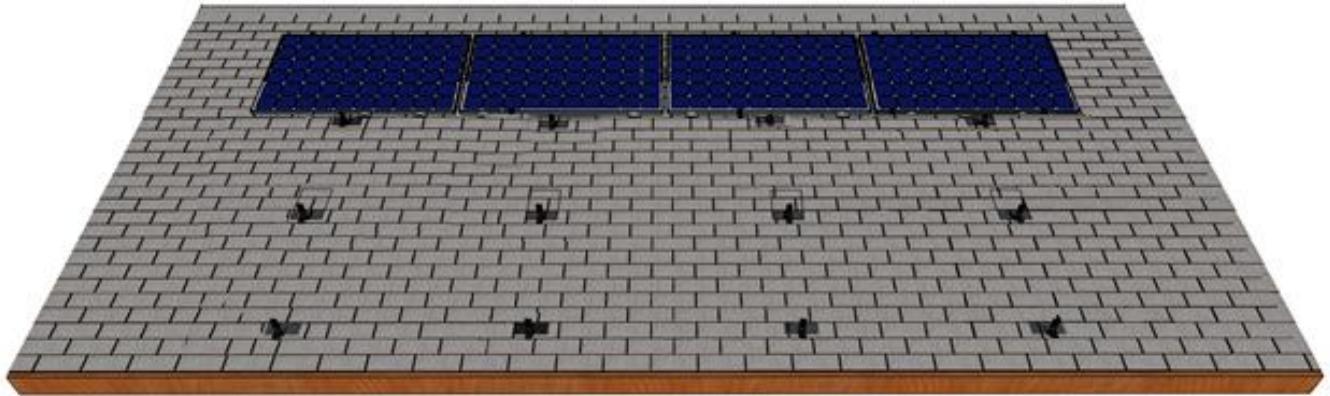
Slide the top parts of module connectors in the slot on the left edge of second module to be installed. Make sure the bottom parts of module connectors are already in the slot of the first module that is already installed. Place the second solar module next to the first module. Use module blocks to stabilize the module. Make sure the top part of the module connectors is aligned to the bottom parts of the module connectors. Insert the flange bolt through the top part and into the bottom part and tighten the flange bolt slightly. Make sure module is properly leveled, then tighten the flange bolts on module connectors to torque 16 ft-lbs.



### Step 5:

Follow Step 2 and 3 to attach all roof attachments to the modules. Adjust L bracket position to make sure they are properly positioned with modules. Fully tighten all MageBolts to torque 16 ft-lbs.

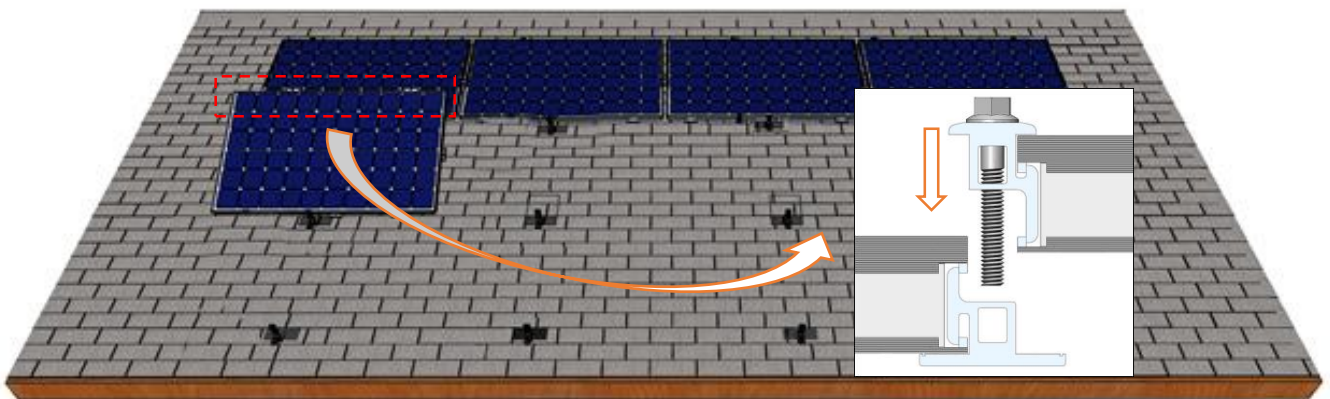
Repeat Step 5 to install subsequent modules and complete the first row.



## 5.1.3 Install Modules on Subsequent Rows

### Step 6:

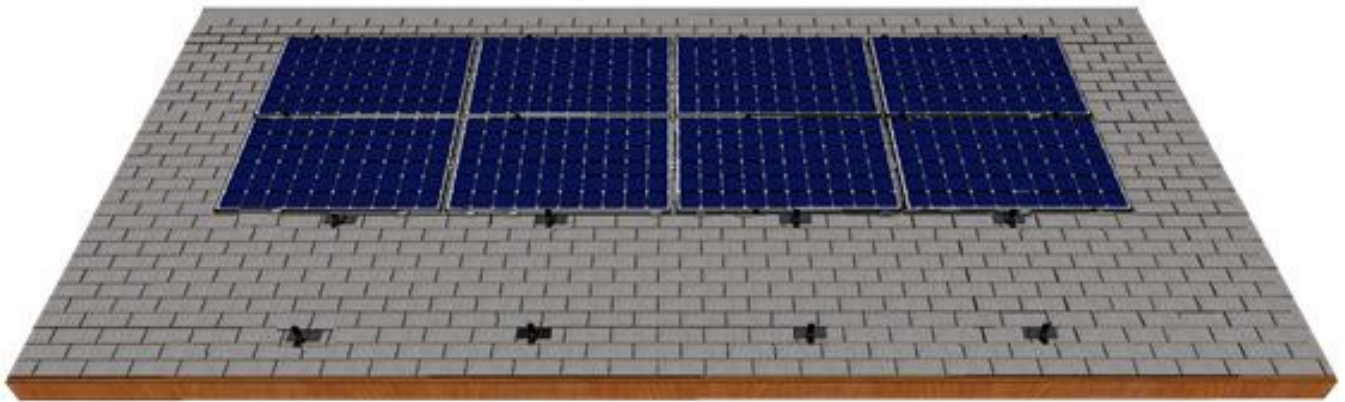
Slide the top parts of module connectors in the slot on the top edge of first module on second row to be installed. Make sure the bottom parts of module connectors are already in the slot on the bottom edge of the first module on previous row that is already installed. Place the first solar module on the second row next to the first module on first row. Use module blocks to stabilize the module. Make sure the top part of the module connectors is aligned to the bottom parts of the module connectors. Insert the flange bolt through the top part and into the bottom part and tighten the flange bolt slightly. Make sure module is properly leveled, then tighten the flange bolts on module connectors to torque 16 ft-lbs.



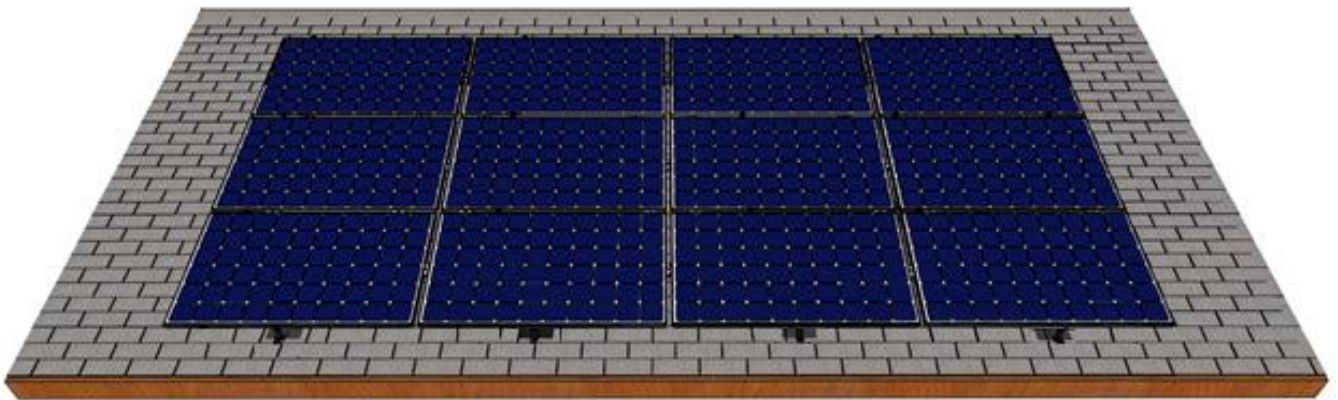


**Step 7:**

Slide the top parts of module connectors in the slot on the top and left edges of second module on second row to be installed. Make sure the bottom parts of module connectors are already in the slot on the bottom edge of the second module on previous row and right edge of first module on second row that are already installed. Place the second solar module on the second row next to the second module on first row and first module on second row. Use module blocks to stabilize the module. Make sure the top parts of the module connectors are aligned to the bottom parts of the module connectors. Insert the flange bolts through the top part and into the bottom part and tighten the flange bolts slightly. Make sure module is properly leveled, then tighten the flange bolts on module connectors to torque 16 ft-lbs.

**Step 8**

Follow Step 6 and 7 to install modules on rest of the array and complete the module installation.

**Installation Tips:**

1. In the illustration above, the array is installed from left to right and top to down. But depending on your project convenience, you may start from any location and in any directions.



2. In the illustration above, the solar modules are in landscape orientation, but you may arrange them in portrait, or mixed orientations.
3. In the illustration above, the modules are aligned perfectly, but it is not necessarily aligned row by row or column by column perfectly as shown. As long as the modules are well supported by roof attachments properly and connected by module connectors, you may shift any row from left to right or from top to bottom as needed in staggered layout.

## 6 Install Other Components

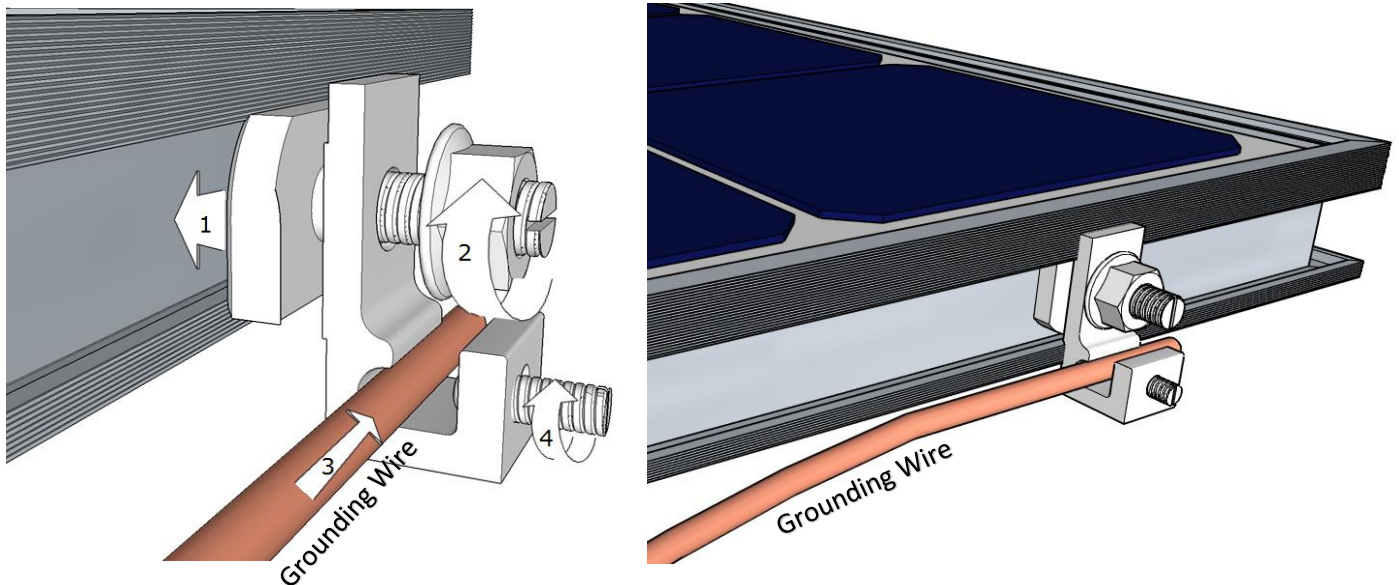
### 6.1 Grounding Lug

To comply with code, it is required to have at least one grounding lug installed for each system. To install the grounding lug, simply follow the following steps:

1. Insert MageBolt on the grounding lug inside the slot on module frame.
2. Position the grounding lug and tighten the flange nut to torque 16 ft-lbs.
3. Place grounding wire in lay-in channel.
4. Tighten the set screw to specified torque.

Magerack Mounting System is evaluated assuming a 15 Amp maximum series fuse size. Installers should install grounding lug in compliance with National Electrical Code, ANSI/NFPA 70. The equipment ground conductor wire size, type, set screw torque and temperature rating are as follows,

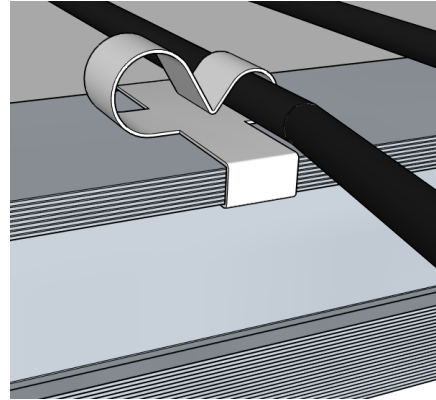
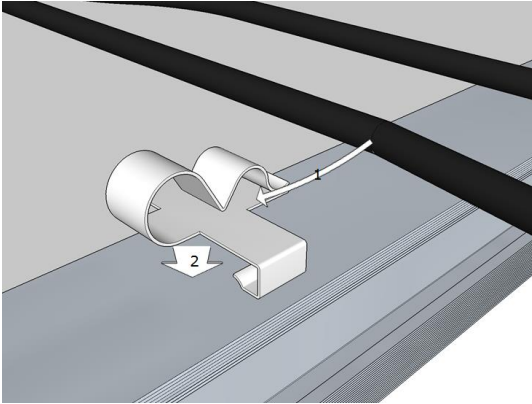
Wire Range, AWG	Wire Type	Torque in-lbs	Temperature rating
14 - 4	Solid	20	90° C



### 6.2 Cable Clip

Cable clips are used to help manage cables under modules. It has two rings, one for PV wire, and the other for trunk or AC cable.

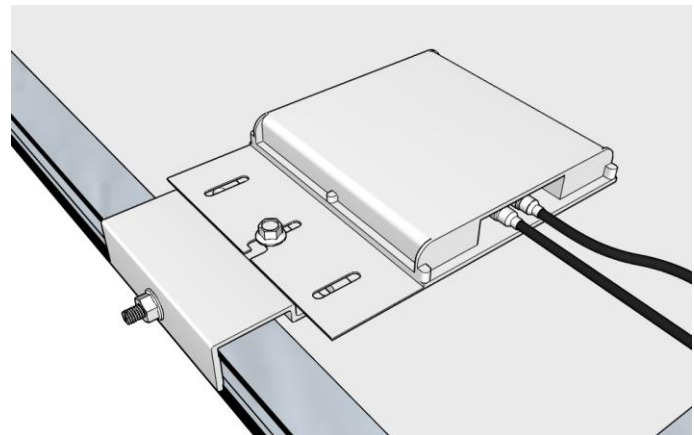
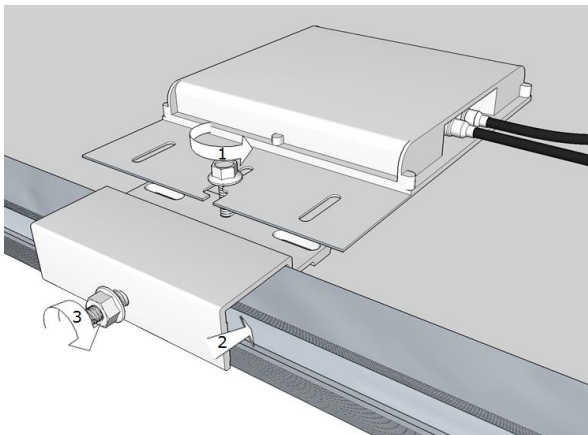
1. Snap the wire clip onto the back side of module frame.
2. Insert cable into the loop on cable clip.
3. Complete wire management module by module and then row by row.



### 6.3 Accessory Mounting Bracket

Accessory mounting bracket can be used to install microinverter, optimizer, etc. on the back of solar modules. Skip this chapter if you do not plan to install microinverter or optimizer. To install the accessory mounting bracket, follow the following steps:

1. Position the accessory mounting bracket on the back side of module frame and insert the MageBolt into the slot on module frame.
2. Tighten the MageBolt nut to torque 16 ft-lbs. The accessory mounting bracket is now attached and bonded to module frame through MageBolt.
3. Install the microinverter or optimizer on the bracket and tighten the provided flange bolt to torque 16 ft-lbs.



## 7 Other Considerations

### 7.1 Removal of Solar Modules

Magerack Rail-less Solar Mounting System is designed to make module replacement and services easy and hassle-free. A solar module can be removed and replaced by removing only one solar module. In the worst scenario when the module to be removed and replaced is surrounded by solar modules along all four sides, such module can also be removed without removing the surrounding modules. Follow the steps below to remove a module:

1. Loosen and remove all flange bolts on module connectors attached to the module.
2. Slide the top part of the clamping module connector in any direction so that the top part and the bottom part are not overlapping each other anymore.
3. Use wrench to loosen the flange nut on MageBolt of roof attachment, turn the MageBolt counterclockwise and pull it out of the slot by pushing module in opposite direction. Do the same for all roof attachments attached to the module.
4. Disconnect all the cable underneath and remove the module.

When install a module back, follow the same steps above in reverse order.

### 7.2 Thermal expansion

To accommodate thermal expansion, maximum 30 modules in portrait and 20 modules in landscape are allowed in each consecutive row. When there are more than maximum number of modules in one row, a gap must be retained, the adjacent modules are not connected and the two modules are considered as end of a row and beginning of another row. Roof attachments to the two modules should also be installed as end of a row and beginning of another row. Bonding must be considered to make sure the two portion between the gap is bonded, otherwise separate grounding lugs must be installed across the gap.

### 7.3 System Maintenance

To maximize system output, module should be kept clean and clear of dirt and other debris. To ensure system safety, periodic re-inspection of the installation needs to be conducted for loose components, loose fasteners and any corrosion, such that if found, the affected components are to be immediately replaced.

## 8 Specifications

<b>Grounding/Bonding Certification</b>	UL 2703 Certified
<b>Mechanical Load Certification</b>	UL 2703 Certified, tested for design load rating, up: 30 psf, down: 30 psf, down-slope: 5 psf
<b>Module Tested for UL Certification</b>	Boviet BVM6610P-xxx (xxx=225-275), BVM6610M-xxx (xxx=235-280)
<b>Fire Resistance</b>	Class 'A' Fire Rating for type one module
<b>Components Materials</b>	Aluminum alloy 6061-T6 or 6063-T5 in mill finish, clear anodized or black anodized; 304 stainless steel
<b>Flashing Materials</b>	Aluminum in mill finish or black anodized
<b>Modules Per Grounding Lug</b>	Maximum 100
<b>Grounding Lug Wire Range</b>	14-4 AWG
<b>Grounding Lug Wire Type</b>	Solid
<b>Grounding Lug Torque</b>	20 lbs-in
<b>Maximum Roof Attachment Spacing</b>	48" in portrait orientation and 72" in landscape orientation
<b>Minimum Module Connector</b>	At least one module connector on connecting side of two adjacent modules
<b>Module Clearance</b>	3.5" to 5" between bottom of module frame and roof
<b>Warranty</b>	25-year Limited Product Warranty





## Limited Product Warranty

Magerack warrants to the original end-user (“Purchaser”) of Magerack Solar Mounting System that Magerack manufactures (“Product”) at the original installation site that the Product shall be free from defects in material and workmanship for a period of twenty-five (25) years from the date the installation of the Product is completed or 30 days after the purchase of the Product by the original Purchaser, whichever comes earlier.

This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation. This Warranty does not apply to installation that is not performed in accordance with Magerack’s written installation instructions and design specifications, or installation of which the Product has been altered, modified or repaired in a manner not authorized by Magerack in writing, or installation that the Product is installed in an environment for which it was not designed. The Warranty does not apply to any installations in corrosive atmospheric conditions.

Under no circumstances shall Magerack be liable for consequential, contingent, incidental or punitive damages arising due to the use of the Product by Purchaser under any circumstances. When the Product is determined to be defective within Warranty period, Magerack shall repair or replace the defective Product under Limited Warranty in Magerack’s sole discretion and Magerack shall not be responsible for the cost of any labor and any cost associated with the repair, removal, installation and shipping or transportation of the Product. Such repair or replacement shall discharge all of Magerack’s liability with respect to this limited Warranty completely. Magerack’s maximum liability is limited to the original purchase price of the Product due to any manufacturing or design defects or under any theory of liability, whether expressed, implied or statutory.

For other components of the solar PV system, such as solar modules, inverters, electrical components and flashings, respective Manufacturers may provide written warranties of their own. Magerack’s Limited Warranty covers only its Product, and is not responsible for any other components of the solar PV system.