



MageMount II
Rail-less Solar Mounting System
Installation Manual

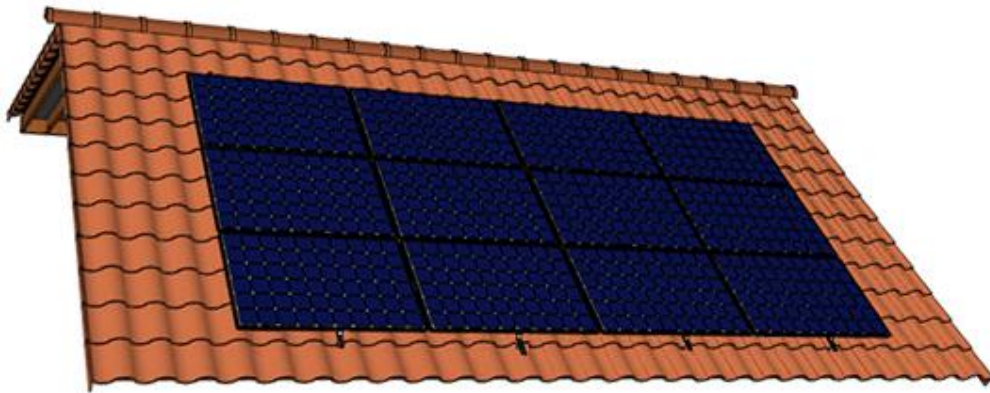
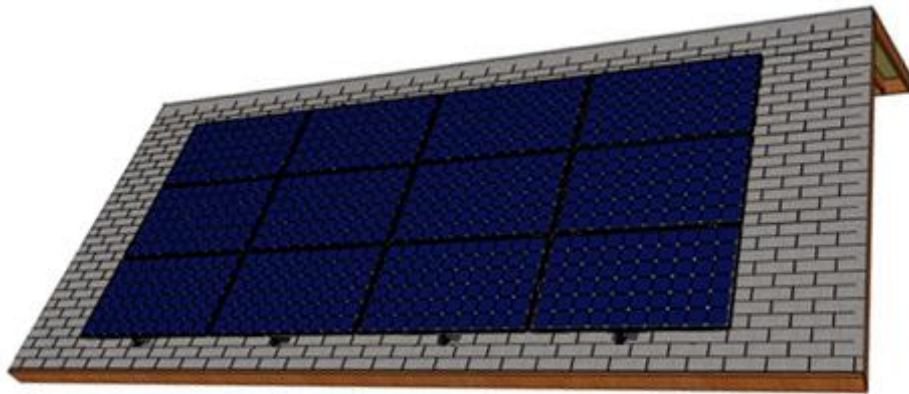


Table of Contents

1	OVERVIEW	2
2	COMPONENTS AND ASSEMBLY	3
2.1	COMPONENTS	3
2.1.1	Module Bracket	3
2.1.2	Module Connectors	3
2.1.3	Roof Attachemnts	4
2.1.4	Other Components	4
2.2	ASSEMBLY.....	5
2.2.1	Module Bracket	5
2.2.2	Module Connectors	5
2.2.3	Roof Attachments	6
2.2.4	Other Components	7
3	ARRAY LAYOUT AND PLANNING.....	9
3.1	ARRAY LAYOUT	9
3.2	ARRAY PLANNING.....	9
3.3	MINIMUM REQUIREMENTS OF ROOF ATTACHMENTS AND MODULE CONNECTORS.....	12
3.3.1	Roof Attachments	12
3.3.2	Module Connectors	12
4	INSTALL ROOF ATTACHMENTS	14
4.1	INSTALL COMP FOOT ON COMPOSITION SHINGLE ROOF.....	14
4.2	INSTALL TILE FOOT, LONG TILE FOOT AND DOUBLE TILE FEET ON TILE ROOF.....	18
4.2.1	Install Tile Foot.....	18
4.2.2	Install Long Tile Foot	21
4.2.3	Install Double Tile Feet.....	22
4.3	INSTALL STEEL-ROOF TILE FOOT ON STONE-COATED STEEL ROOF	22
4.4	INSTALL L BRACKET ON OTHER TYPES OF ROOFS OR STRUCTURES.....	23
5	INSTALL SOLAR MODULES WITH MODULE CONNECTORS.....	24
5.1	INSTALL SOLAR MODULE WITH MODULE CONNECTORS	24
5.1.1	Install First Solar module.....	24
5.1.2	Install Solar Modules on First Row	26
5.1.3	Install Solar Modules on Subsequent Rows.....	28
6	INSTALL OTHER COMPONENTS.....	30
6.1	GROUNDING LUG	30
6.2	CABLE CLIP	30
6.3	ACCESSORY BRACKET	31
6.4	SKIRT	32
7	OTHER CONSIDERATIONS	33
7.1	REMOVAL OF SOLAR MODULES.....	33



7.2	THERMAL EXPANSION.....	33
7.3	SYSTEM MAINTENANCE.....	33
8	SPECIFICATIONS	34
	LIMITED PRODUCT WARRANTY	35

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1 Overview

MageMount II Rail-less Solar Mounting System is a solar mounting solution that doesn't require rails or clamps. It is designed by Magerack with focus on easing installation and reducing installation time and cost. The system discussed in this manual can be installed on most solar modules. 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 PV 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. The system is fully bonded and the bonding pins on module connectors and module brackets are for multiple uses. Installation doesn't require specific tools. All fasteners including flange bolts, carriage bolts and flange nuts are all one size of hex 5/16".

Separate Module Connectors and Roof Attachments

Unlike other rail-less mounting products, MageMount II 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 solar modules and additional module connectors can be used to further enforce the connection of two adjacent solar modules in a row, two solar modules between adjacent rows or any combination of both. With such flexibility, the array layout can be any combination of solar 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 attachments for composition shingle roof, tile roof, stone-coated steel roof, etc. For other types of roofs such as standing seam metal roof, installers can use metal clamps from Magerack or other manufacturers and attach them to the metal seam, and then attach the 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.

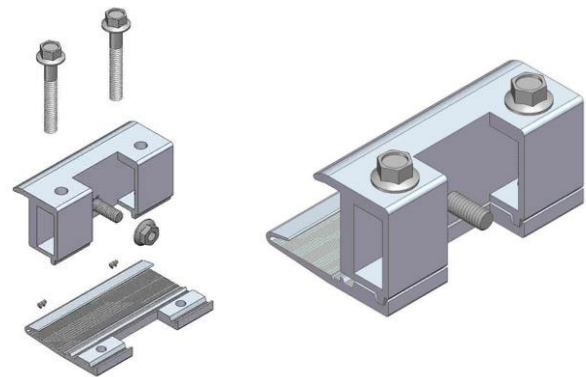
2 Components and Assembly

MageMount II Rail-less Solar Mounting System is a solar mounting solution that doesn't require rails or clamps. It utilizes module connectors and module brackets to connect solar modules together and attach solar modules to a roof. It is designed with focus on easing installation and reducing installation time and cost. The mounting system works with most solar modules.

2.1 Components

2.1.1 Module Bracket

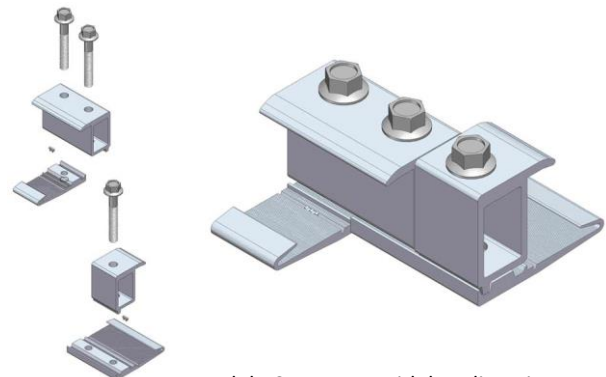
Module bracket can be attached to solar module frame of most common solar module. It has a top component and a bottom component. The top component has top flange that is slightly tilted lower at the tip and also has two bolts. The bottom component has hook-shaped end that can slide and enclose the inner side of the solar module frame bottom. When the two components are tightened with two bolts, the module bracket is secured to the solar module frame. Through an embedded bolt, roof attachment and other mounting component can be attached to the solar module.



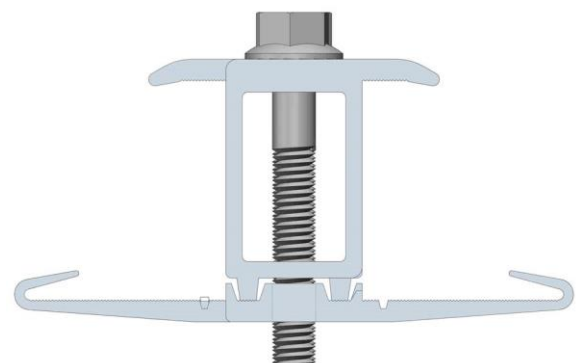
Module Bracket with bonding pins before and after assembly

2.1.2 Module Connectors

A module connector connects two adjacent solar modules. A module connector has a top part and a bottom part that connect two solar modules. The top part has a wider top component and can be attached to a solar module and the bottom part has a wider bottom component and can be attached to another solar module. This allows two adjacent solar modules to be connected with a bolt through the top part and the bottom part. Each part of a module connector has integrated multiple-use bonding pins. Once each part of a module connector is tightened and attached to each solar module, it is bonded with the solar module through the bonding pins on module connector. Once the two solar modules are connected through the tightened two parts, the two solar modules are bonded through the bolt connecting the two parts. The binding pins on module connector can be used multiple times. However, before a module connector is attached to a solar 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



Module Connector with bonding pins before and after assembly

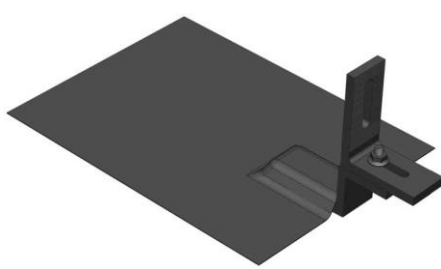


Module Connector section view

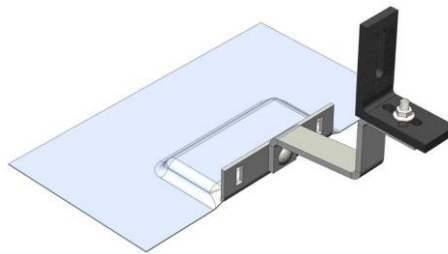
missing, the module connector cannot be used and should be discarded.

2.1.3 Roof Attachemnts

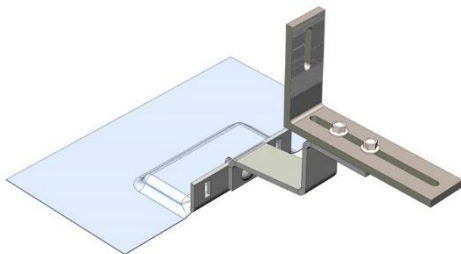
All roof attachments are attached to solar module through module brackets. Module bracket has built-in bonding pins that pierce into solar module frame and create bonding between module bracket and solar module frame when it is tightened. Module bracket is bonded with rest of a roof attachment through embedded bolt and flange nut. Therefore, roof attachment is bonded to the solar module frame once module bracket is tightened with solar module and roof attachment. The bonding pins on module bracket can be used multiple times. Various roof attachments can be attached to solar module through module bracket. They are for composition shingle roof, tile roof, stone-coated steel roof, metal roof and any roof structure through the L bracket of a roof attachment.



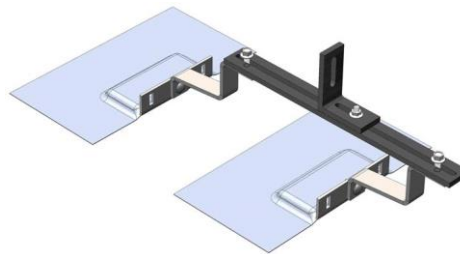
Comp Foot



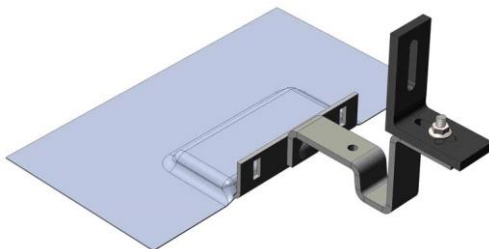
Tile Foot



Long Tile Foot



Double Tile Feet



Steel-Roof Tile Foot



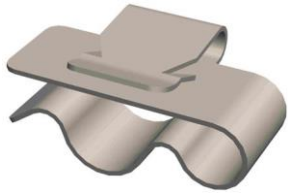
L Bracket

2.1.4 Other Components

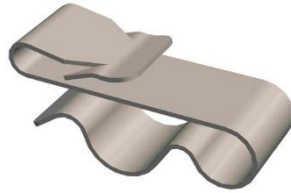
Accessory bracket can be installed to the backside of a solar module frame to mount microinverter, optimizer and other system components. Front-row skirt can be installed for aesthetical looking. In addition, Magerack



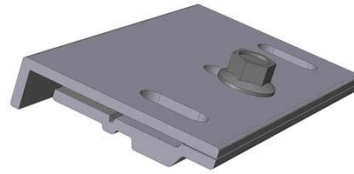
grounding lug or grounding lugs from other manufacturers can be installed to solar module frame. Magerack cable clips or cable clips from other manufacturers can be attached to solar module frames to manage cables.



Cable Clip



Cable Clip



Accessory Bracket



Skirt and Skirt End Caps



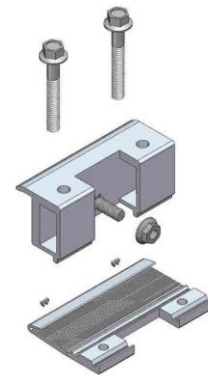
Grounding lug

2.2 Assembly

2.2.1 Module Bracket

Module Bracket

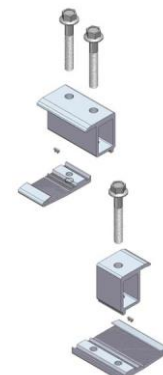
1. 5/16"-18 flange bolts
2. Bracket top with embedded bolt
3. Bracket bottom
4. 5/16"-18 flange nut
5. Bonding pins



2.2.2 Module Connectors

Module Connector

1. 5/16"-18 flange bolts
2. Connector tops
3. Connector bottoms
4. Bonding pins



2.2.3 Roof Attachments

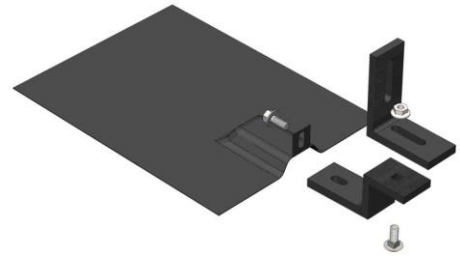
L Bracket

1. L bracket



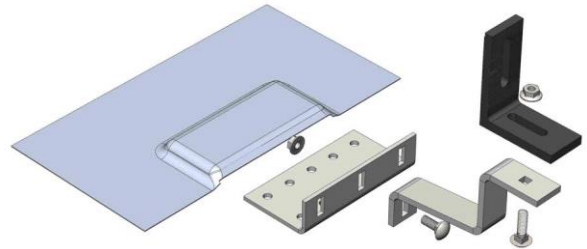
Comp Foot with Flashing for Composition Shingle Roof

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



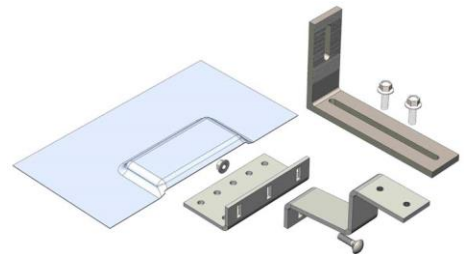
Tile Foot with Flashing for Tile Roof

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



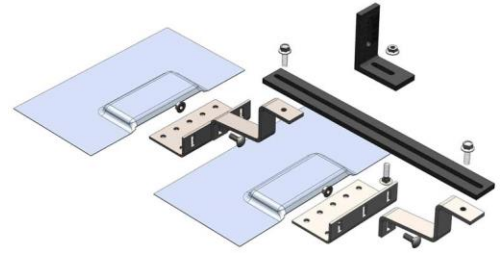
Long Tile Foot with Flashing for Tile Roof

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



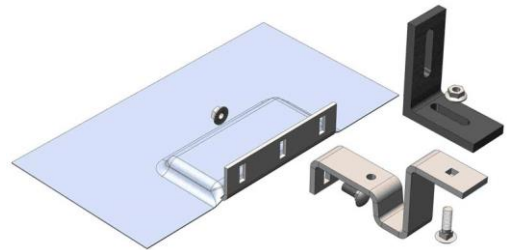
Double Tile Feet with Flashing for Tile Roof

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



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

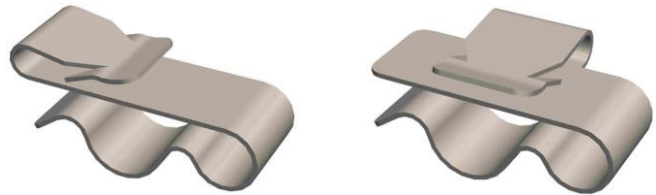
1. L bracket
2. 5/16"-18 flange nuts
3. 5/16"-18 carriage bolts
4. Tile foot arm
5. Tile foot base
6. Tile foot flashing



2.2.4 Other Components

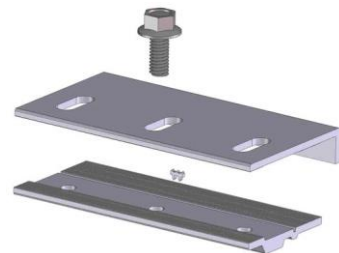
Cable Clip

Cable Clip



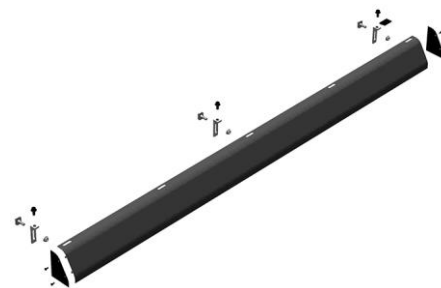
Accessory Bracket

1. 5/16"-18 flange bolt
2. Accessory bracket
3. Bonding pins



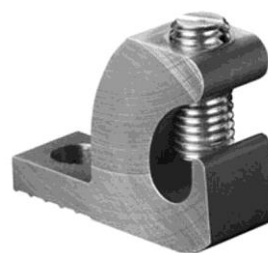
Skirt and Skirt End Caps

1. Skirt
2. Skirt fasteners
3. Skirt end caps with screws



Grounding lug

Grounding lug

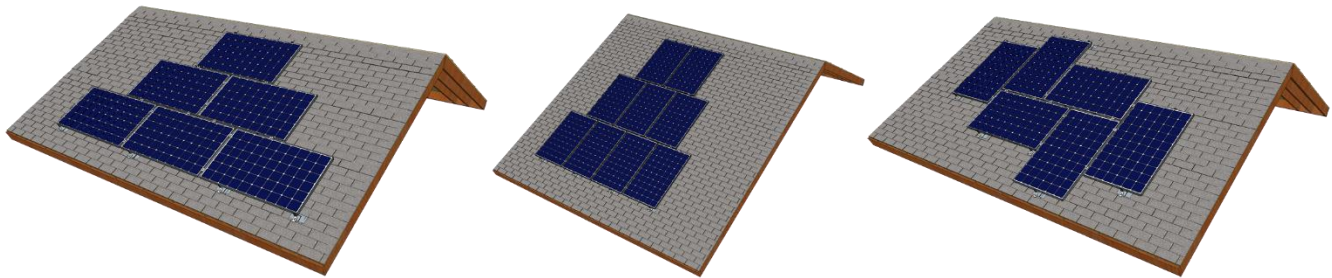


3 Array Layout and Planning

3.1 Array Layout

Unlike other rail-less mounting products, MageMount II Rail-less Solar Mounting System separates roof attachments from solar 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 solar modules in a row, two solar modules between adjacent rows or combination of both. With such flexibility, the array layout can be any combination of solar 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 solar modules in an array can be in portrait, landscape or mixed orientations.



Roof attachment spacing depends 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.

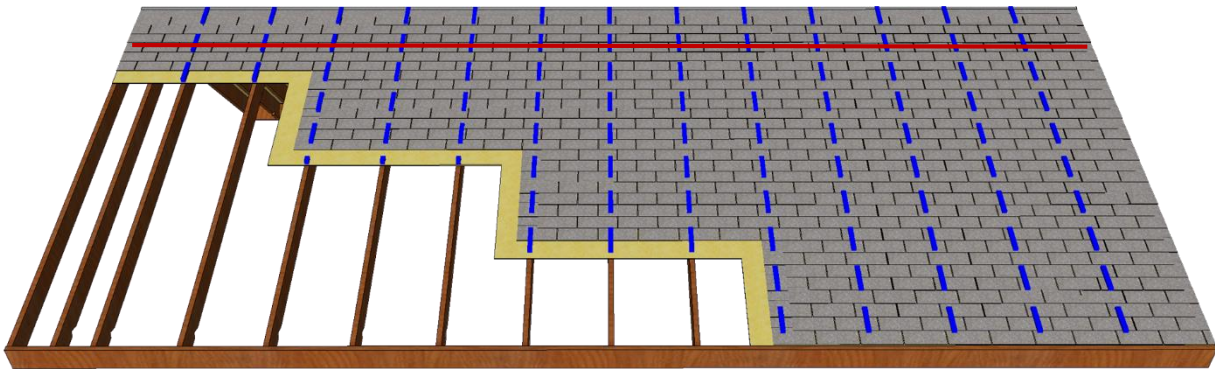
3.2 Array Planning

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

Step 1

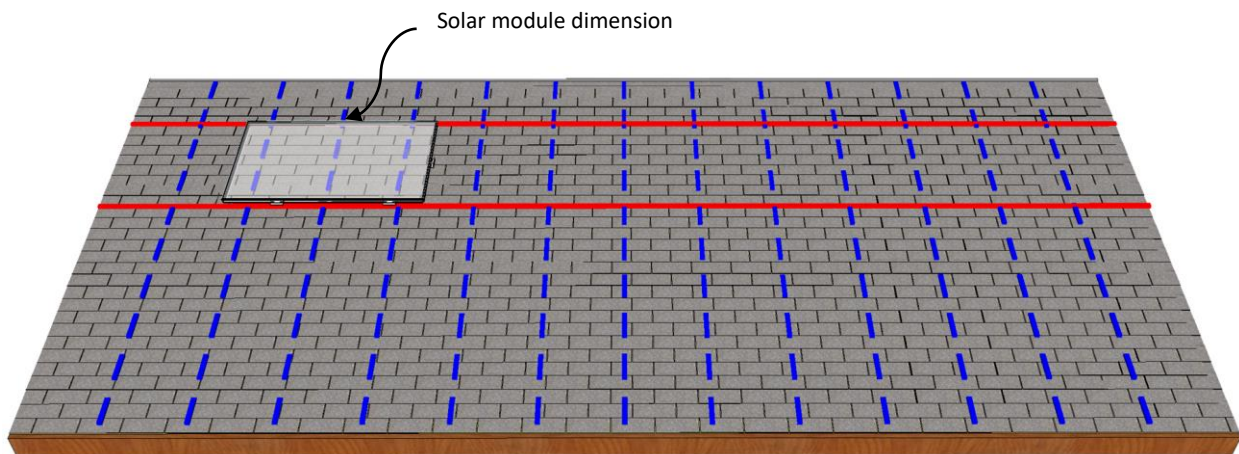
Locate rafters on the roof based on structural drawings, experience and other references, and identify the placement of the first row of roof attachment. Take roof attachments size and direction into consideration when

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.



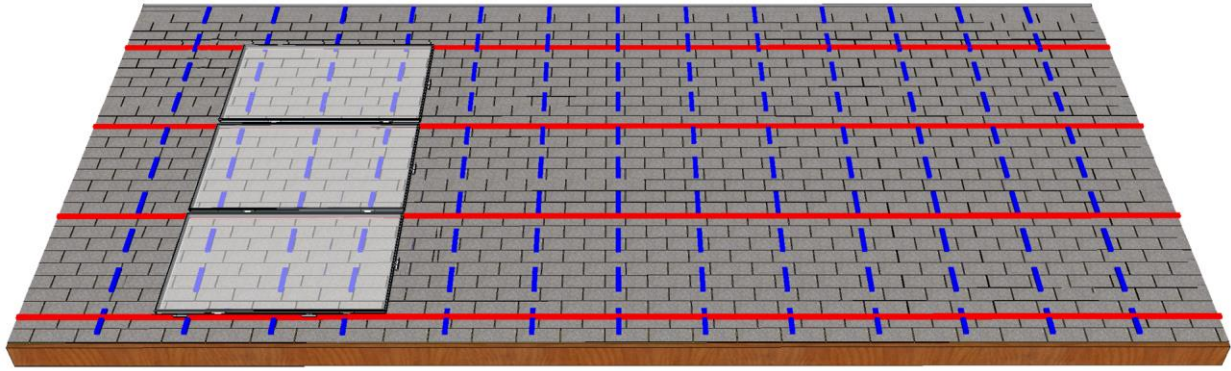
Step 2

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 solar 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.



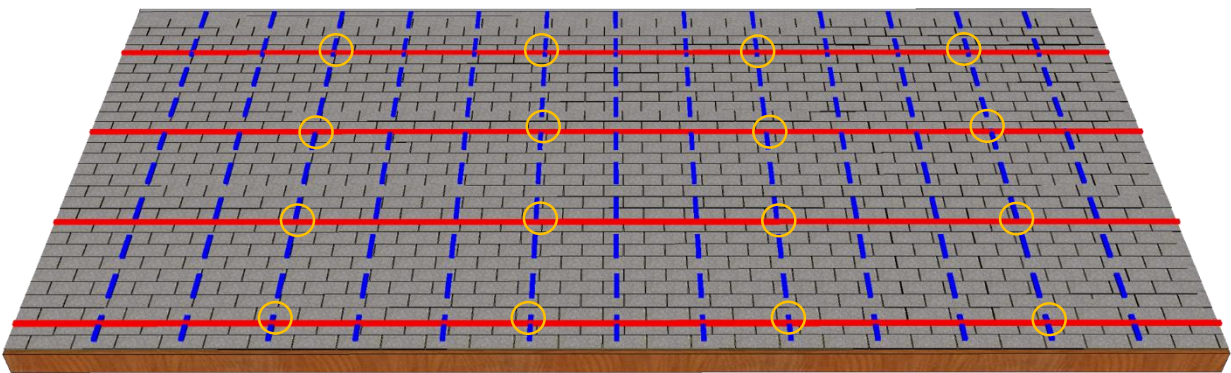
Step 3

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



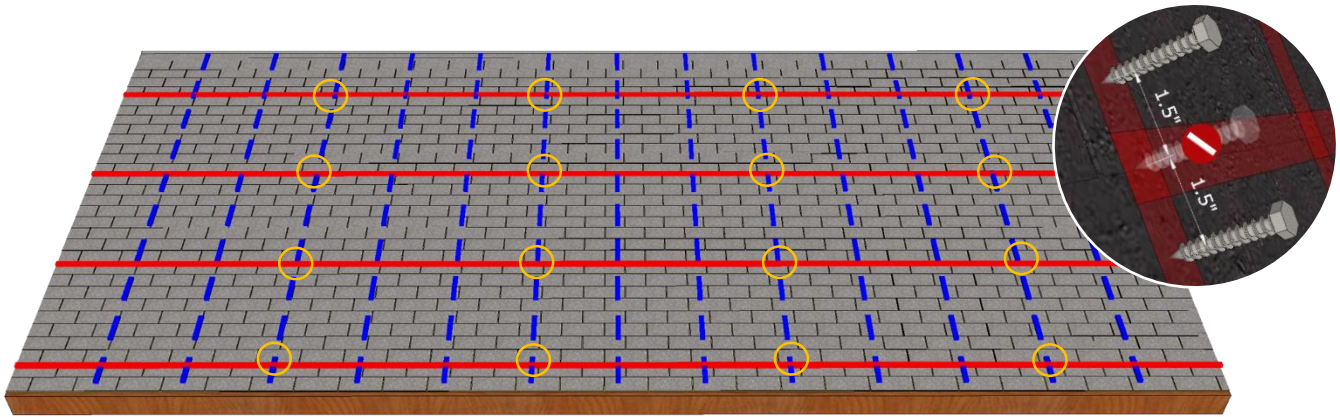
Step 4

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

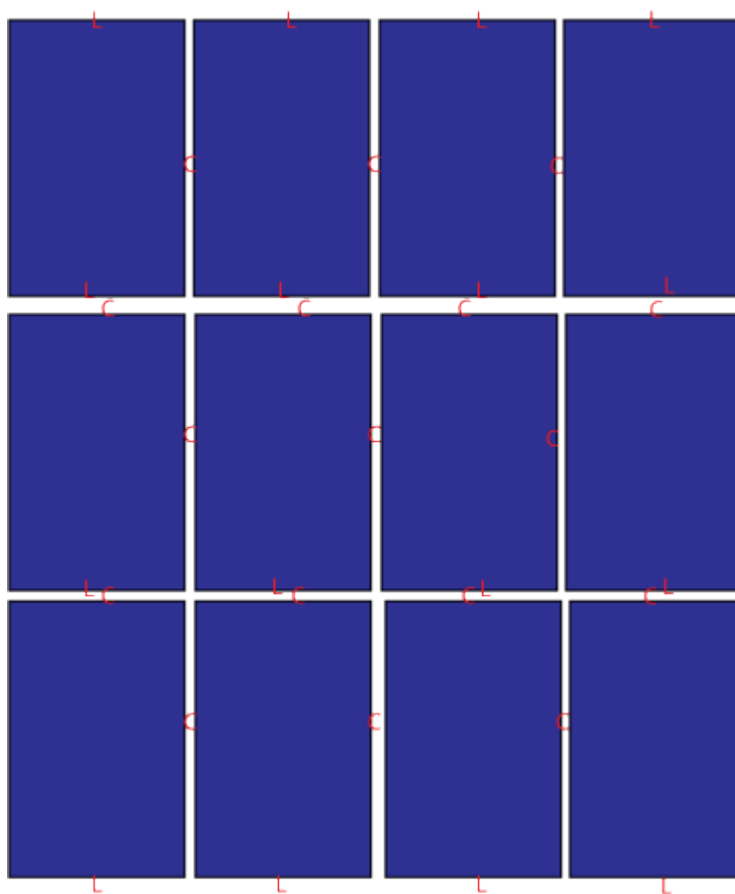
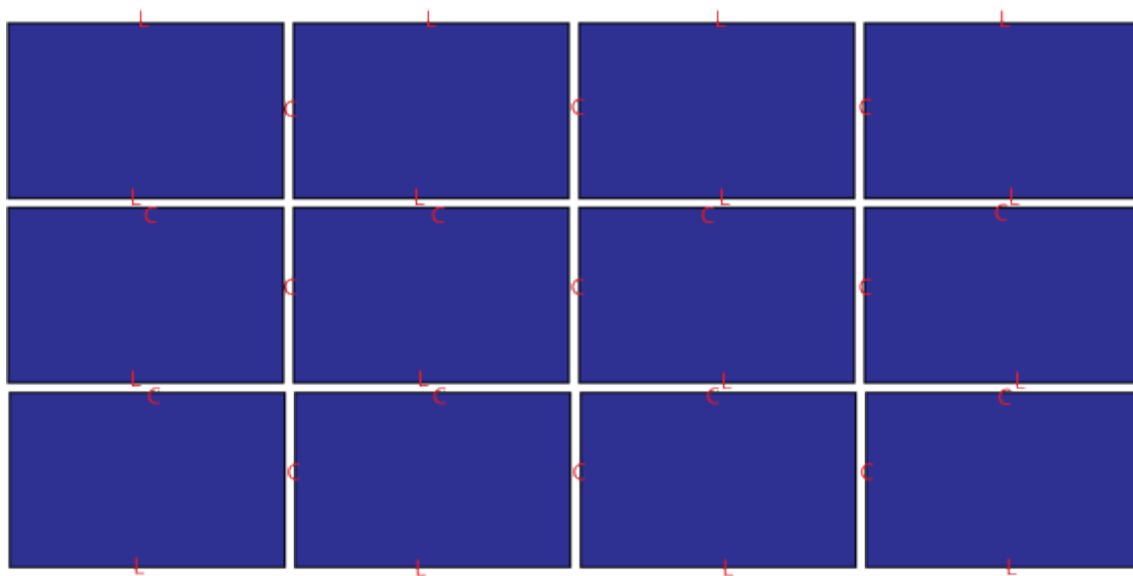
When first row of solar modules are installed, roof attachments are installed to both top and bottom frames of the solar modules. There are at least one roof attachment on top or bottom frame of each solar module. When necessary, more than one roof attachment may be installed on top or bottom frame of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

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

Roof attachments are usually installed near the center of a solar module frame if there is only one roof attachment. For the first and last solar module on each row, the roof attachment should be installed within 6 inches from the center of solar module frame if there is only one roof attachment. For additional stability and security, two roof attachments may be installed on one solar module frame if necessary. If there are two roof attachments installed to one solar 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 solar modules. There are at least one module connector on the frames of two adjacent solar modules. Module connectors are usually at the center of solar modules. When necessary, more than one module connector can be used for two adjacent solar modules and they can be installed evenly along solar module frames.



L: Roof Attachment

C: Module Connector

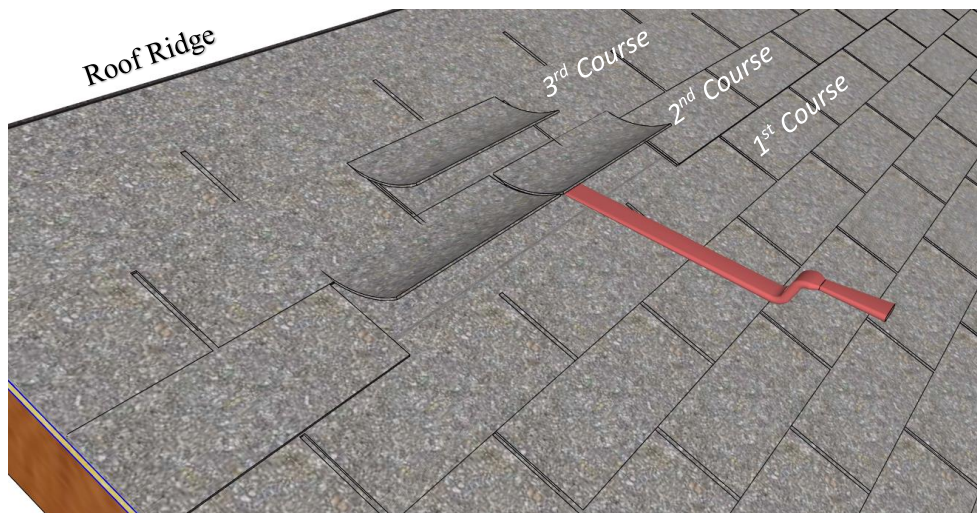
4 Install Roof Attachments

Roof attachments are attached to solar module through embedded bolt on module bracket with flange nut. When module bracket is tightened to roof attachment with flange nut, tighten flange nut to torque 16 ft-lbs.

4.1 Install Comp Foot on Composition Shingle Roof

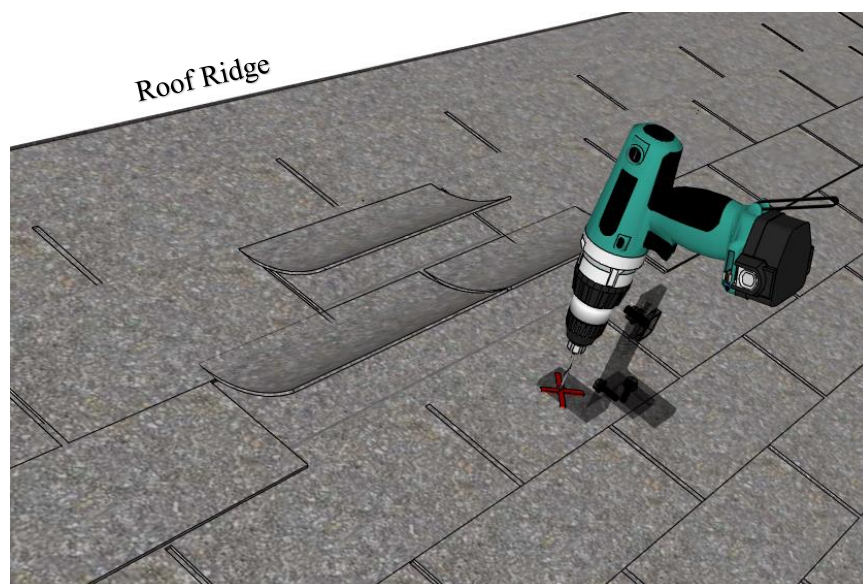
Step 1

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



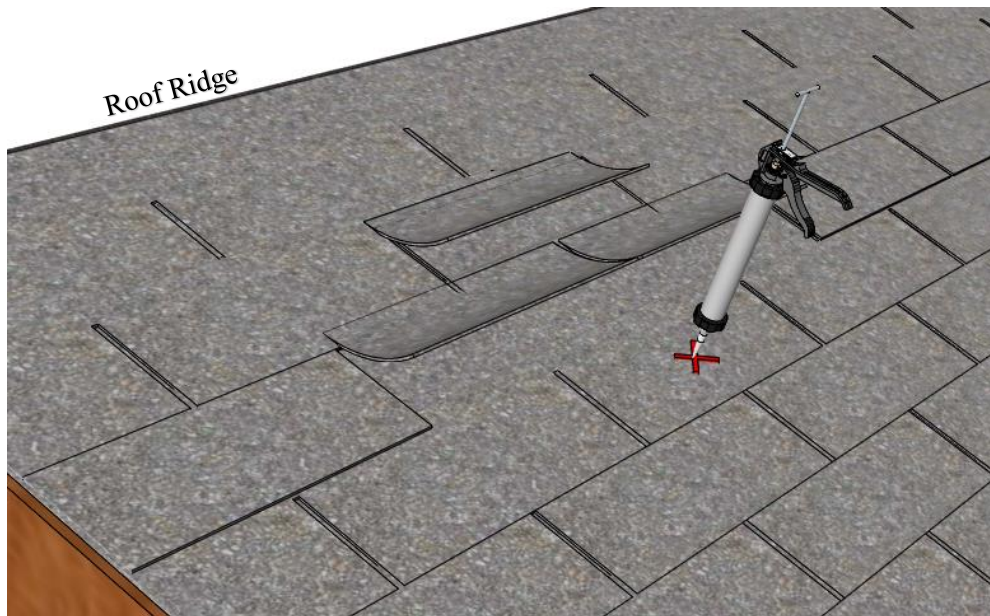
Step 2

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



Step 3

Seal the hole with appropriate sealant.



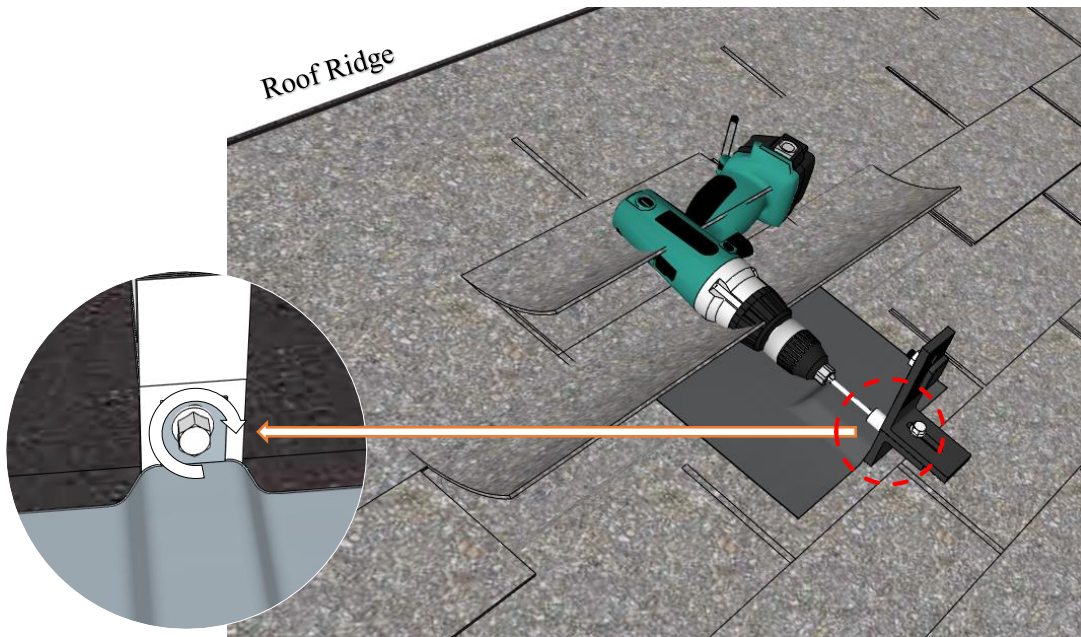
Step 4

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.



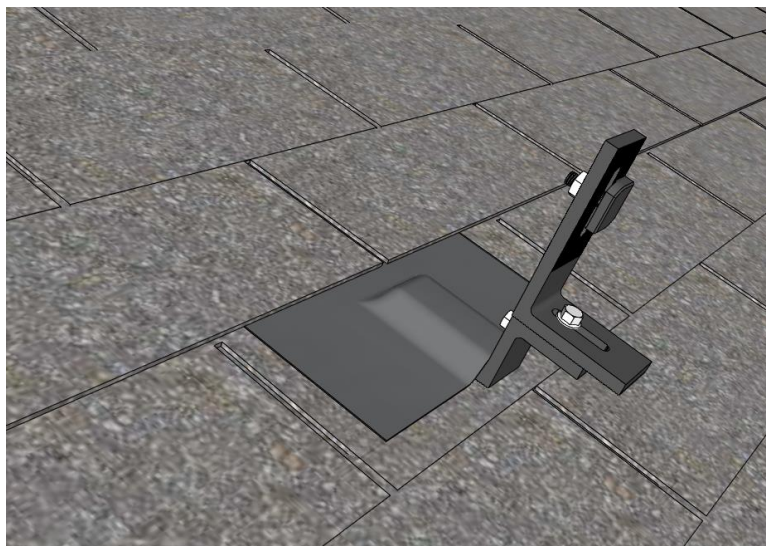
Step 5

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.



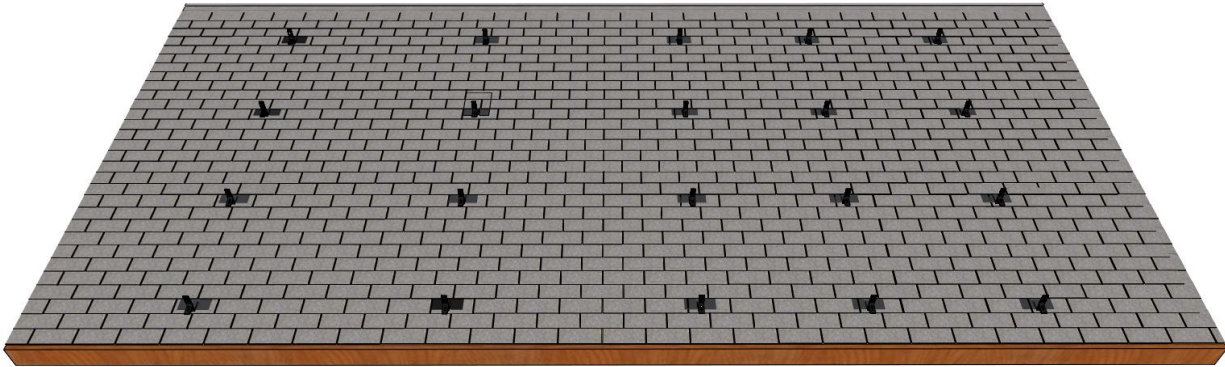
Step 6

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



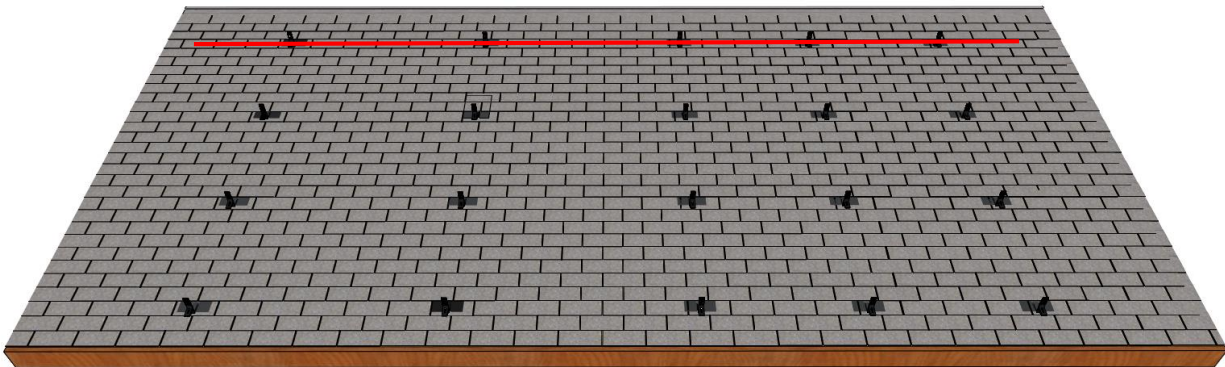
Step 7

Repeat steps 1-6 to install all roof attachments.



Step 8

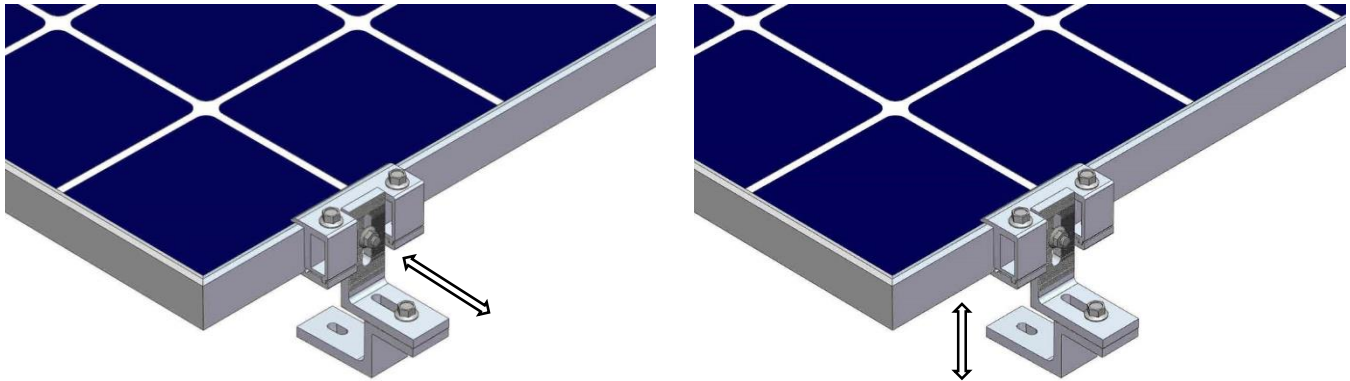
Adjust the L brackets on comp foot base to make sure all L brackets on each row are aligned horizontally. For the first row, tighten the flange bolts between L brackets and comp foot bases. For the rest rows, do not fully tighten the flange bolts between L brackets and comp foot bases yet.



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 solar 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 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 frame 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 solar modules. If you plan to install in such way, make sure you measure the distance between the L brackets with correct L bracket direction when planning and installing roof attachments between first and second rows.

3. Solar module lateral position can be adjusted through L bracket horizontal slot and solar module height can be adjusted through L bracket vertical slot.

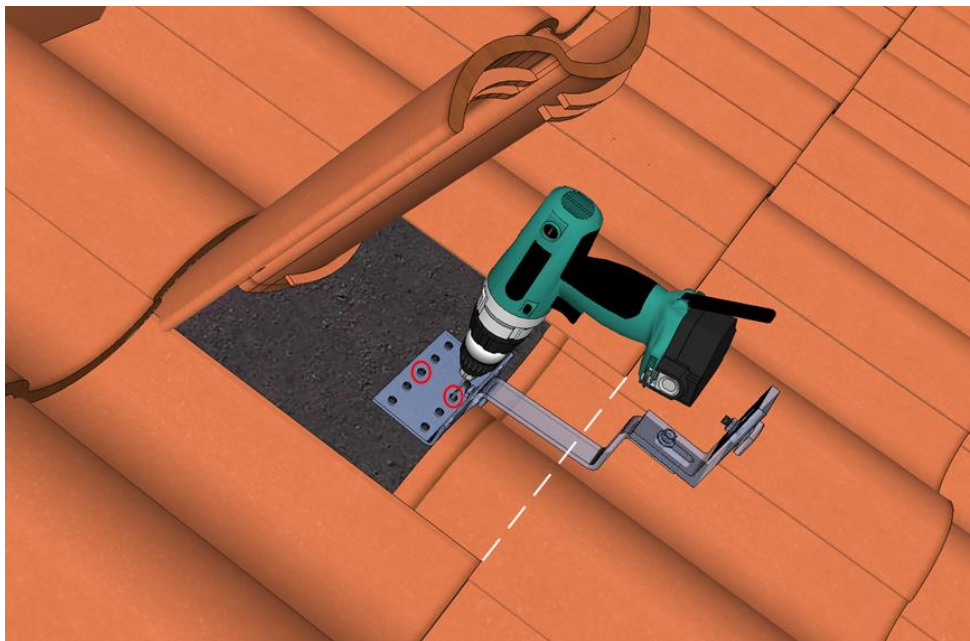


4.2 Install Tile Foot, Long Tile Foot and Double Tile Feet on Tile Roof

4.2.1 Install Tile Foot

Step 1

Remove tiles 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.



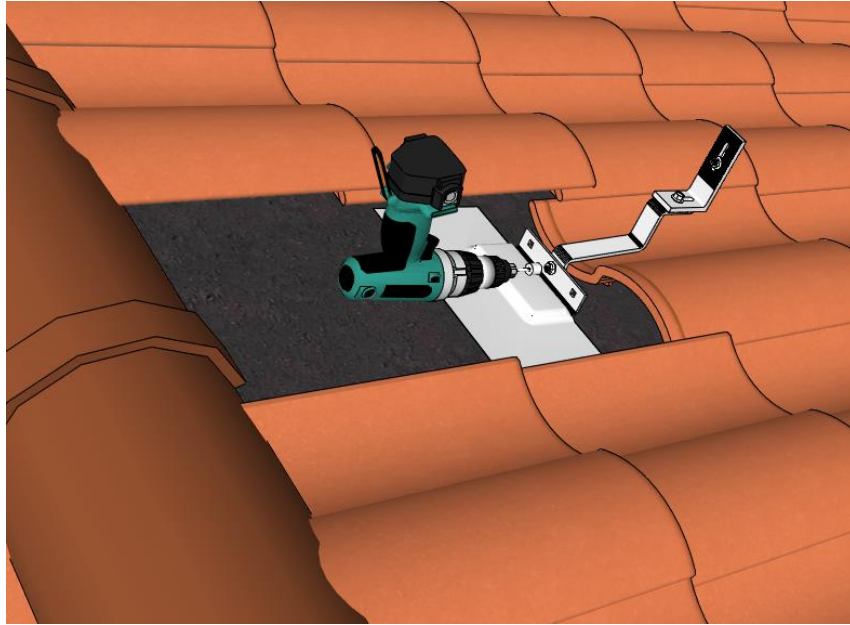
Step 3

Secure tile foot base to roof with two 5/16" lag screws through the pilot holes. Make sure tile foot base is perpendicular 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 can 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 the flashing to cover the tile foot base. Make sure the top frame of the flashing is inserted under roof underlayment or covered with sealant.



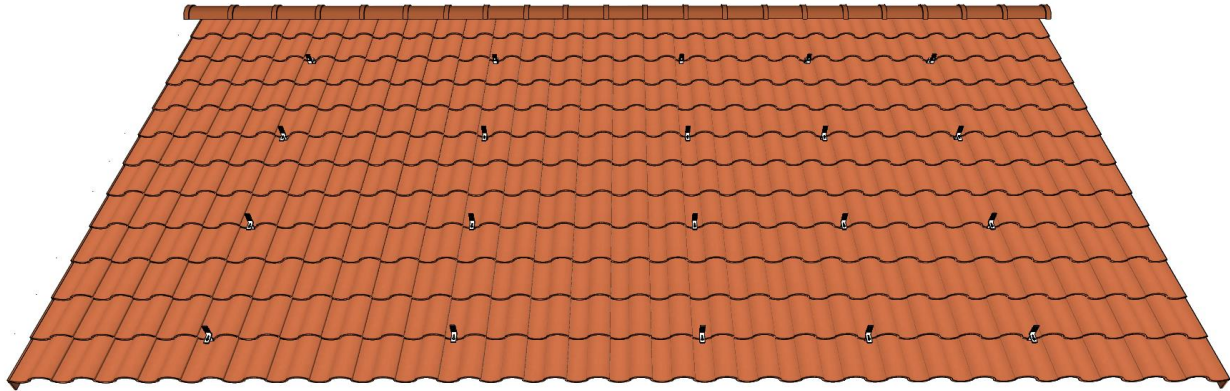
Step 5

Re-install the tile back to its original place.



Step 6

Repeat steps 1-6 to install all tile roof attachments.



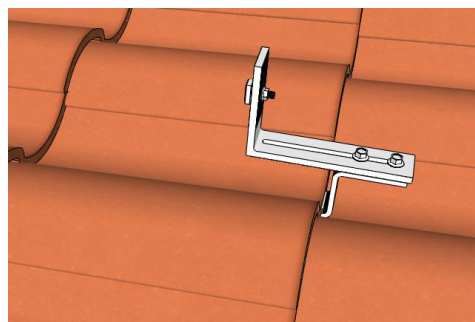
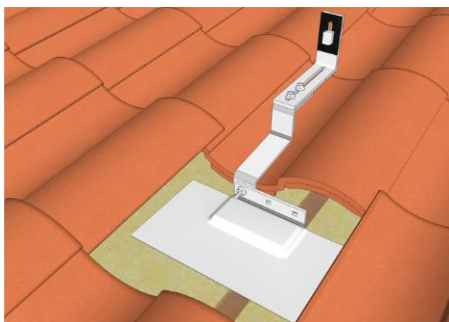
Installation Tips: It is recommended to pre-position the roof attachments and confirm the distance before penetrations. The measurement should be between L brackets among two rows. In the case that L bracket is not in position where the solar module frame is located, long tile foot or double feet can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

4.2.2 Install Long Tile Foot

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

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



Install first foot



Install second foot



Return tiles to original location



Install double tile feet bridge



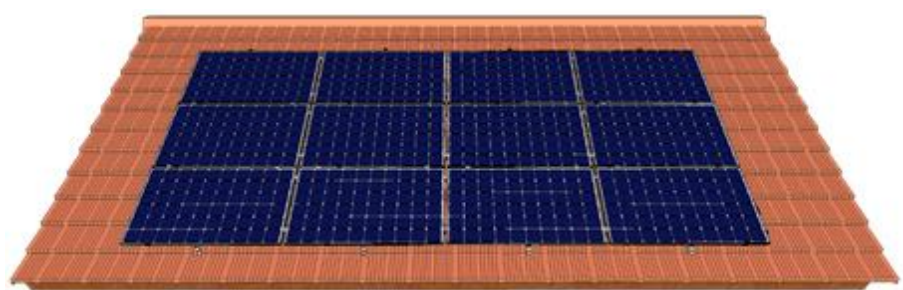
Install L bracket

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 Install Tile Foot** above for installation.



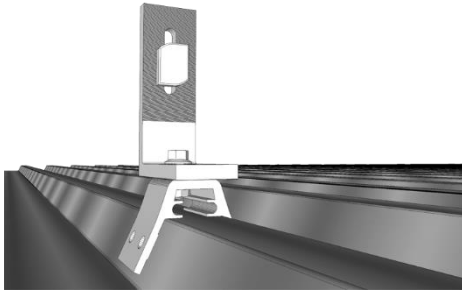
Install steel-roof tile foot
on stone-coated steel roof



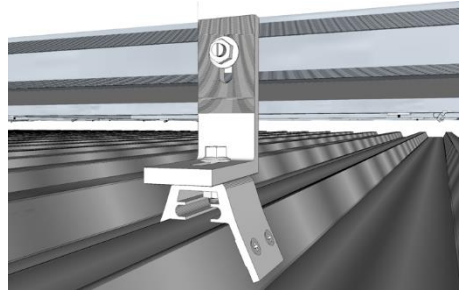
Modules installed on stone-coated steel roof

4.4 Install L bracket on Other Types of Roofs or Structures

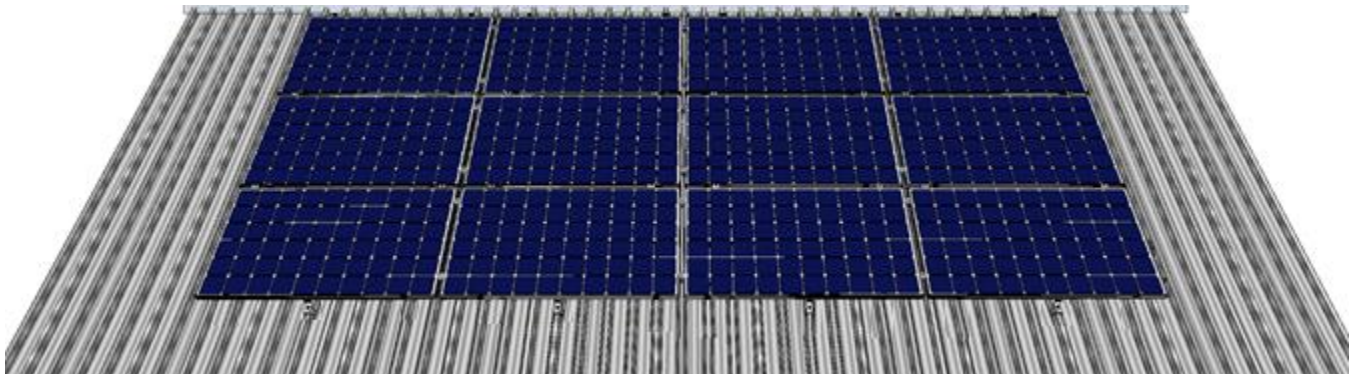
MageMount II Rail-less Solar Mounting System can also be used on other types of roofs or structures, such as metal roof as long as the L bracket can be attached to a roof attachment. For example, for standing seam metal roof, you can use Magerack metal roof clamps or clamps from other manufacturers and install them on the metal roof. Magerack L Brackets can be secured to the metal clamps and attached to solar module frames with module brackets. The installation steps are similar to installing comp foot on composition 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 solar module on metal roof with L bracket and module bracket



Solar modules installed on metal roof

5 Install Solar Modules with Module Connectors

A module connector connects two adjacent solar modules. A module connector has a top part and a bottom part that connect two solar modules. The top part has a wider top component and can be attached to a solar module; the bottom part has a wider bottom component and can be attached to another solar module. This allows two adjacent solar modules to be connected with a bolt through the top part and the bottom part of the module connector. Each part of a module connector has integrated multiple-use bonding pins. Once each part of a module connector is tightened and attached to each solar module, it is bonded with the solar module through the bonding pins on module connector. Once the two solar modules are connected through the tightened two parts, the two solar modules are bonded through the bolt connecting the two parts. The binding pins on module connector can be used multiple times. However, before a module connector is attached to a solar 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.

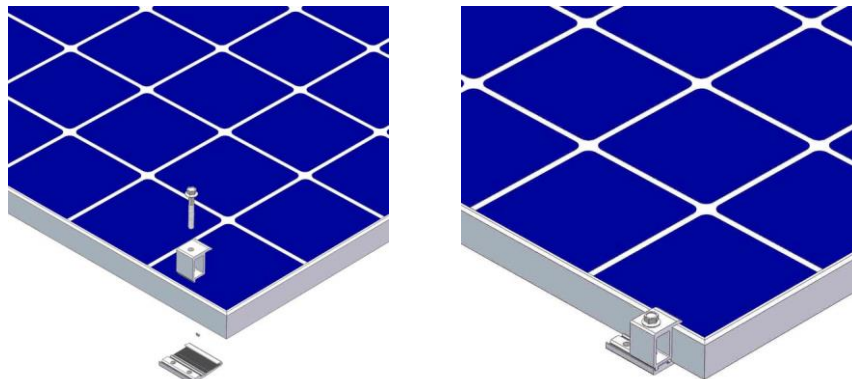
5.1 Install Solar Module with Module Connectors

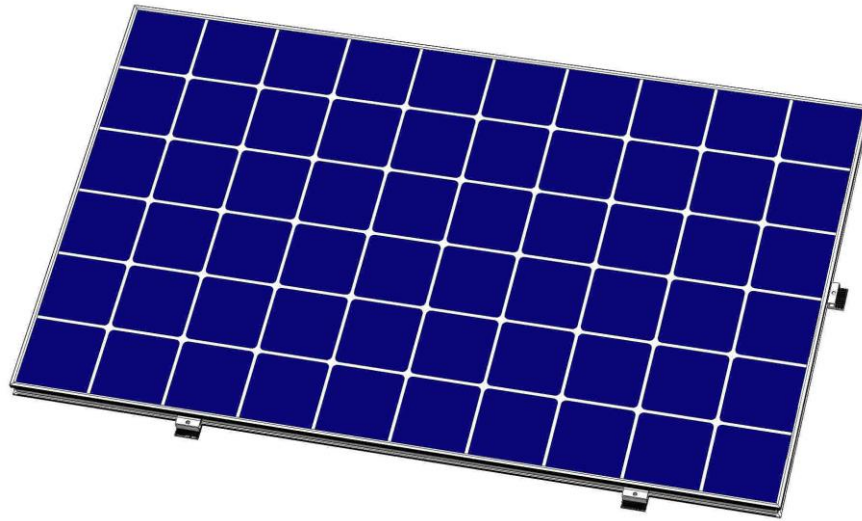
The solar modules in first row have roof attachments on both top and bottom frames of solar modules. For the subsequent rows with top-to-bottom installation, the top frames of the solar modules are connected to the bottom frames of solar modules on previous row with module connectors and the bottom frames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

5.1.1 Install First Solar module

Step 1:

A module connector has two parts, top part with a wider top component and bottom part with a wider bottom component. Attach bottom part to the first solar module and tighten the bolt to the extent that the bottom part cannot be pulled off the solar module frame but can still slide along solar module frame freely. Attach bottom parts of module connectors as many as planned and needed.



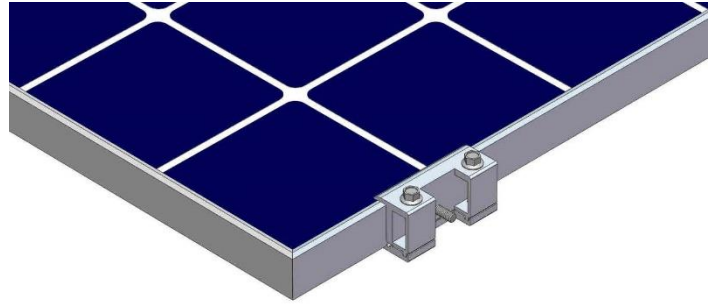


Step 2:

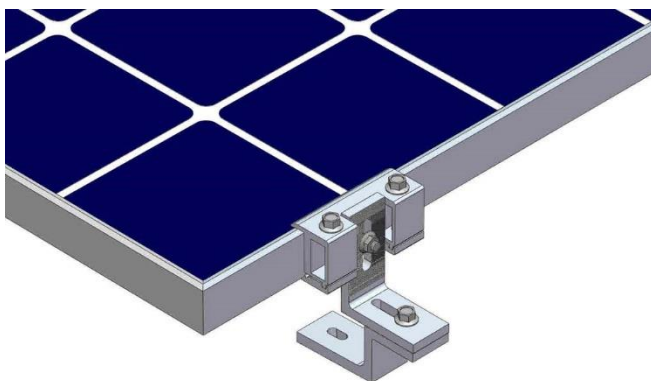
Attach module bracket to the solar module frame and tighten it with two bolts to the extent that module bracket cannot be pulled off the solar module frame but can still slide along solar module frame freely. Place solar module in position. Use module blocks to stabilize the solar module in position. Attach module bracket to the L bracket on a roof attachment through the embedded bolt and secure it with a flange nut. Level solar module at appropriate level and then tightened the flange nut to secure solar module.



Module bracket before being mouted to a solar module



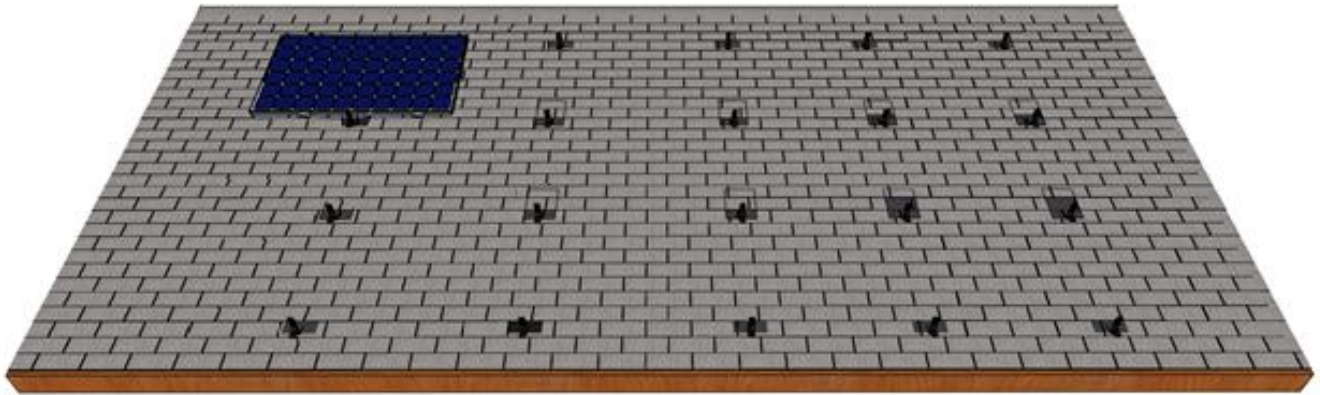
Module bracket after being mouted to a solar module



Roof attachment is mounted to module bracket

Step 3:

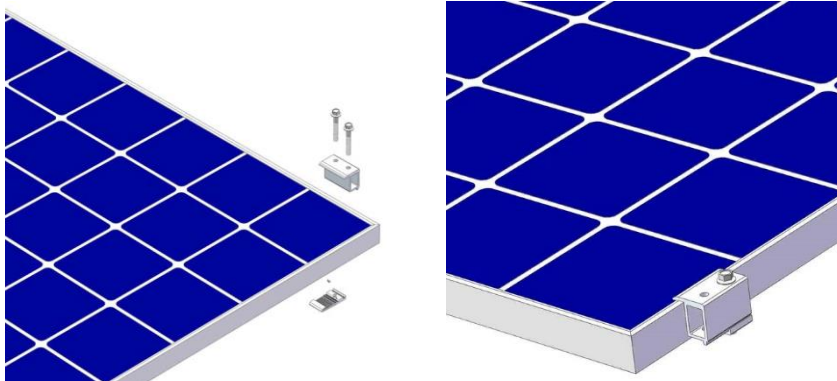
Repeat Step 2 and complete the installation of first solar module with all roof attachments. Once solar module is leveled and positioned, tighten the flange nut between module bracket and L bracket, and tighten the flange bolts on module bracket and roof attachment. Tighten all flange bolts and nuts to torque 16 ft-lbs.

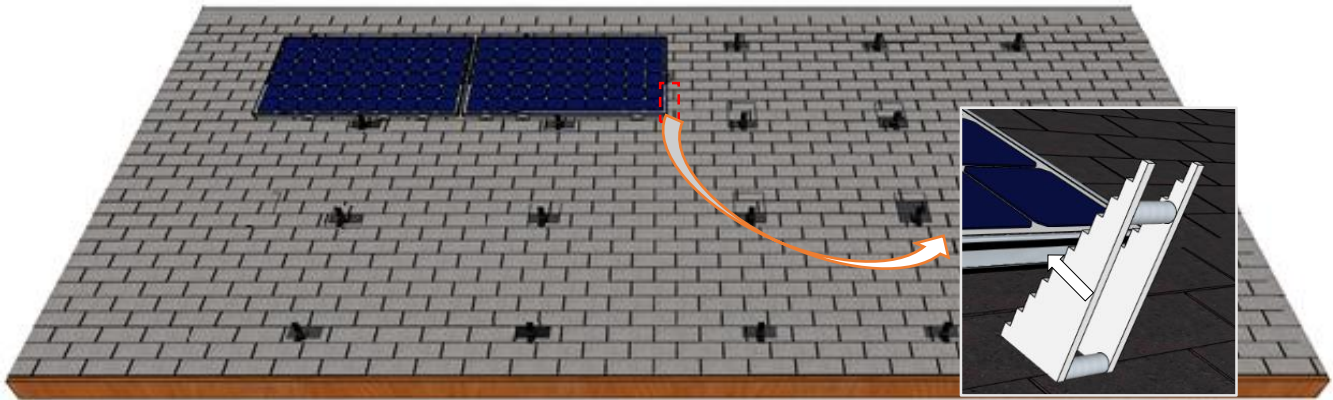
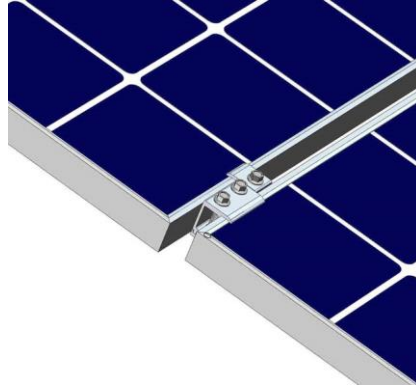
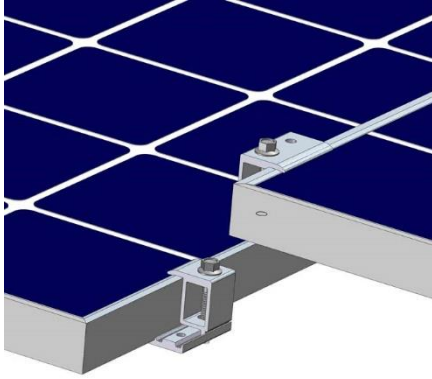


5.1.2 Install Solar Modules on First Row

Step 4:

Attach the top part of a module connector to the second solar module to be installed and tighten the bolt to the extent that the component cannot be pulled off the solar module frame but can still slide along solar module frame freely. Attach top parts of module connectors as many as planned and needed. Make sure the bottom parts of module connectors are already attached to the first solar module that is already installed. Place the second solar module next to the first solar module. Use module blocks to stabilize the solar module. Make sure the top parts of the module connectors are aligned right next 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. Connect all module connectors with flange bolts. Make sure solar module is properly leveled, then tighten the flange bolts on module connectors to torque 16 ft-lbs.

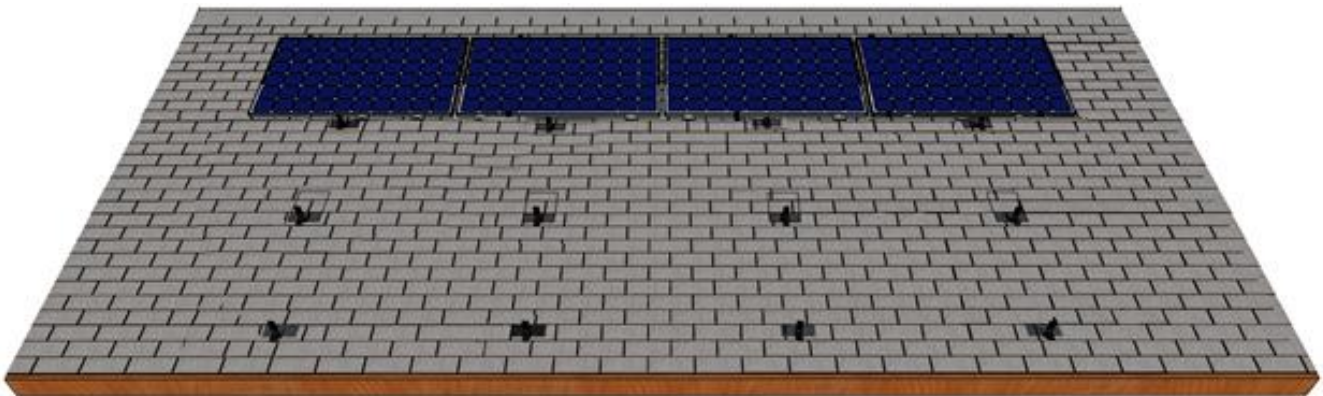




Step 5:

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

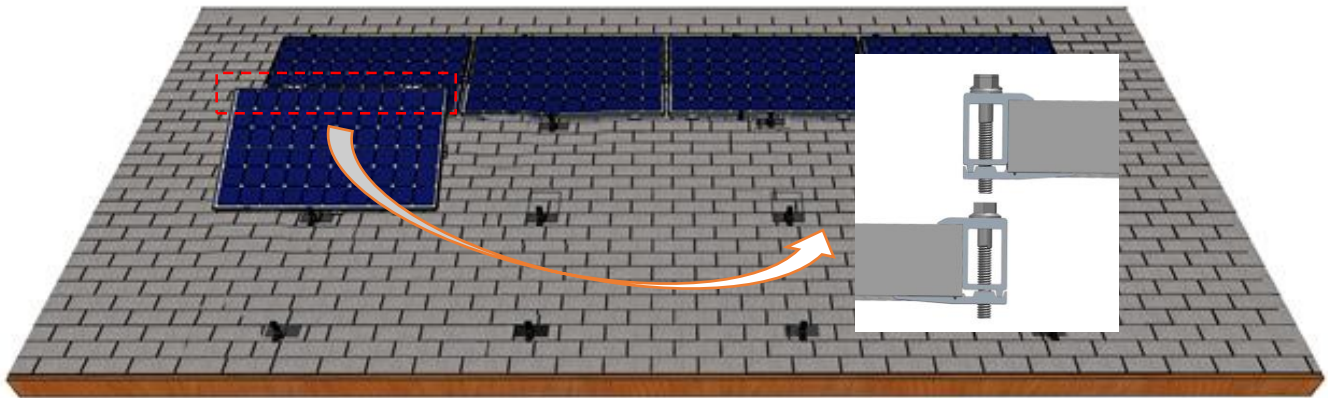
Repeat Step 5 to install subsequent solar modules and complete the first row.



5.1.3 Install Solar Modules on Subsequent Rows

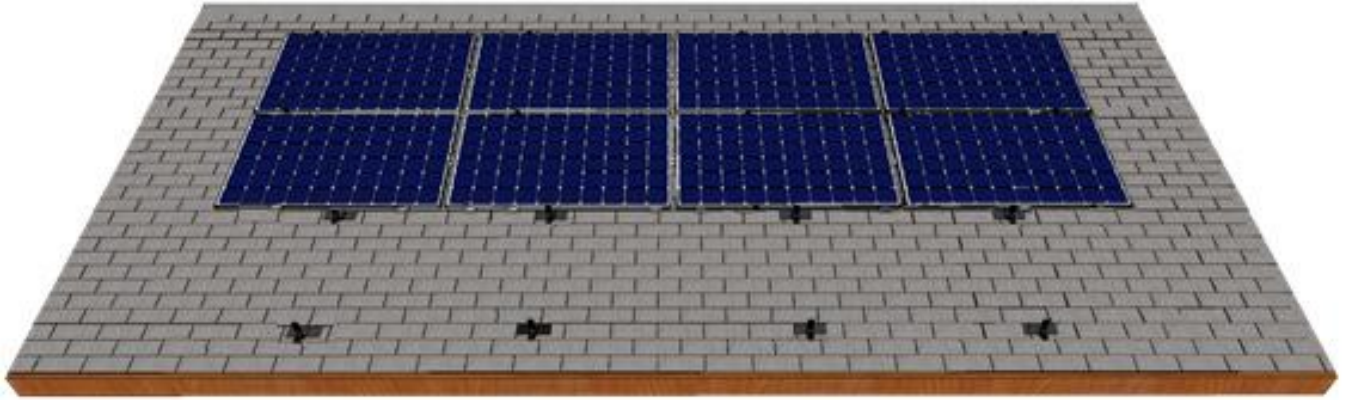
Step 6:

Attach the top part of a module connector to the top frame of first solar module on second row to be installed and tighten the bolt to the extent that the component cannot be pulled off the solar module frame but can still slide along solar module frame freely. Make sure the bottom parts of module connectors are already attached to the bottom frame of the first solar module on previous row that is already installed. Place the first solar module on the second row next to the first solar module on first row. Use module blocks to stabilize the solar module. Make sure the top parts of the module connectors are aligned next 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. Connect all module connectors with flange bolts. Make sure solar module is properly leveled, then tighten the flange bolts on module connectors to torque 16 ft-lbs.



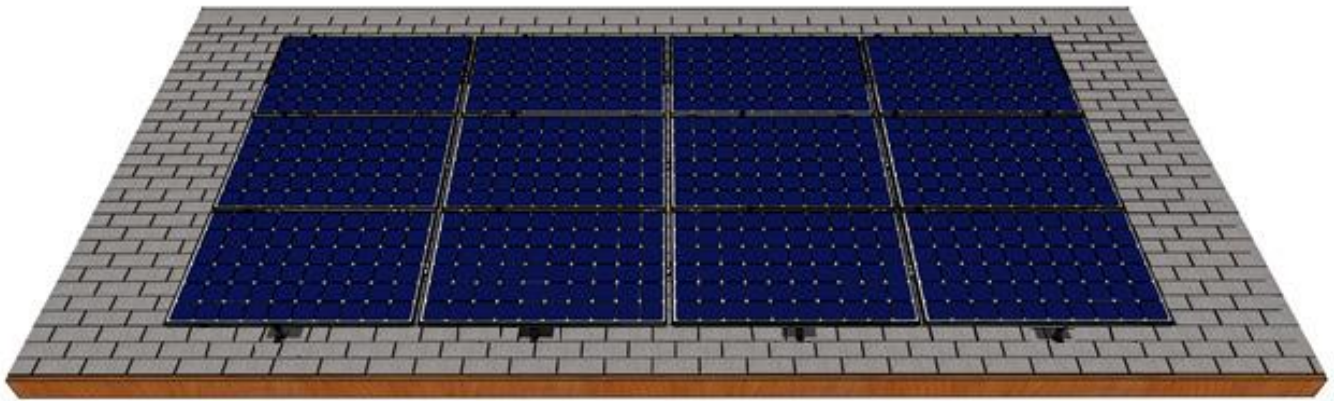
Step 7:

Attach the top part of a module connector to the top frame of second solar module on second row to be installed and tighten the bolt to the extent that the component cannot be pulled off the solar module frame but can still slide along solar module frame freely. Make sure the bottom parts of module connectors are already attached to the bottom frame of second solar module on previous row and right frame of first solar module on second row that are already installed. Place the second solar module on the second row next to the first solar module on second row. Use module blocks to stabilize the solar module. Make sure the top parts of the module connectors are aligned next 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. Connect all module connectors with flange bolts. Make sure solar 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 solar modules on rest of the array and complete the solar 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 direction.
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 solar modules are aligned perfectly, but it is not necessarily aligned row by row or column by column perfectly as shown. As long as the solar 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

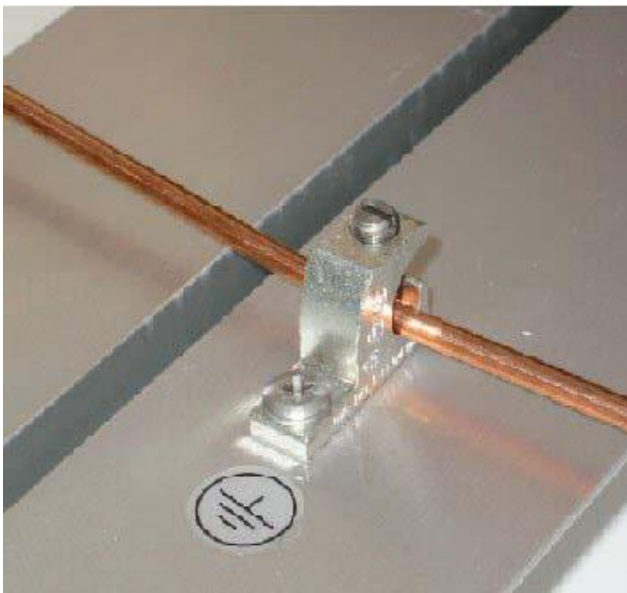
6.1 Grounding Lug

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. Attach the grounding lug to the back side of solar module frame and tighten the provided bolt to torque 16 ft-lbs. If the grounding lug hole on solar module frame is too large, use a nut to secure the bolt to the solar module frame and use proper washer to be bonded properly.
2. Place grounding wire in lay-in channel.
3. Tighten the set screw to specified torque.

MageMount II Rail-less Solar 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

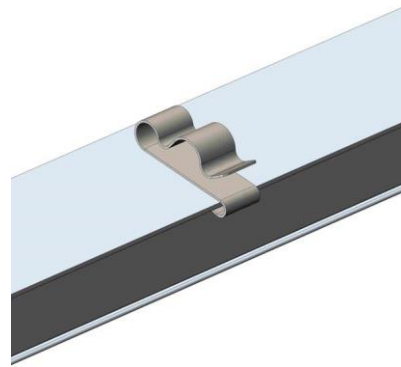
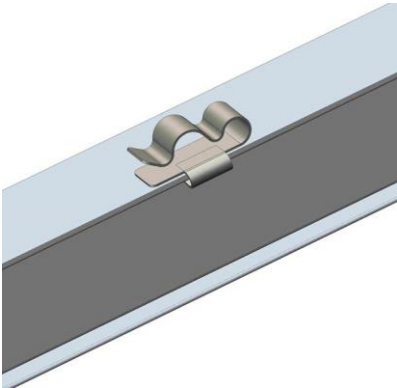


6.2 Cable Clip

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

1. Snap the cable clip to the back side of solar module frame.
2. Insert cable into the loop on cable clip.

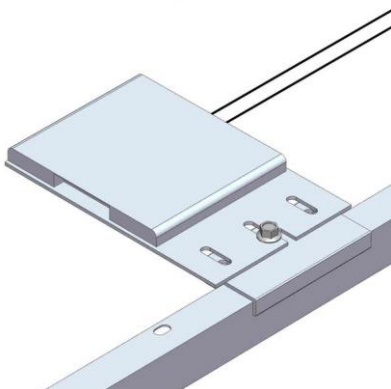
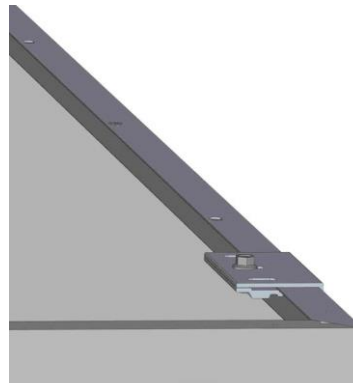
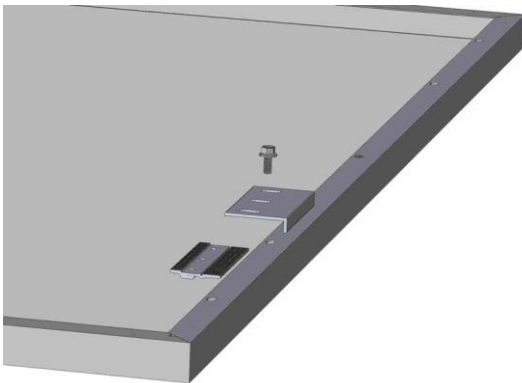
3. Complete wire management on each solar module and then on each row.



6.3 Accessory Bracket

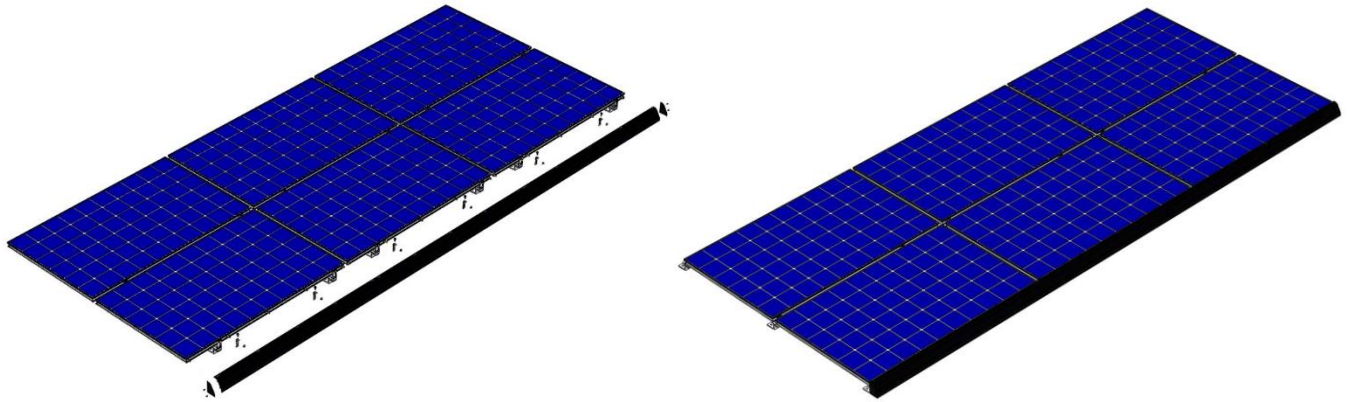
Accessory bracket can be used to install microinverter, optimizer, etc. on the back of solar module frame. Skip this chapter if you do not plan to install microinverter or optimizer. To install the accessory bracket, follow the following steps:

1. Position the accessory bracket on the back side of solar module frame and insert the flange bolt to secure accessory bracket to solar module frame but do not tighten it yet.
2. Slide the microinverter or optimizer into the loosely tightened flange bolt and tighten the flange bolt to torque 16 ft-lbs. The accessory bracket is now attached and bonded to solar module frame.



6.4 Skirt

Skirt can be used to install to the first row of solar modules for aesthetical looking. Each section of skirt comes with two fasteners. Attach two fasteners to the frame of first row of solar modules and attach skirt to the two fasteners with provided bolts. The adjacent skirts can be attached together with provided skirt clippers. The two end caps are attached to the ends of the skirts.



7 Other Considerations

7.1 Removal of Solar Modules

MageMount II Rail-less Solar Mounting System is designed to make solar 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 solar module to be removed and replaced is surrounded by solar modules along all four sides, such solar module can also be removed without removing the surrounding solar modules. Follow the steps below to remove a solar module:

1. Loosen all three flange bolts on a module connector attached to two adjacent solar modules and remove only the middle flange bolt.
2. Slide the top part of the module connector in one direction so that the top part and the bottom part are not overlapping each other anymore.
3. Use wrench to loosen and remove the flange nut on the embedded bolt through which the L bracket of a roof attachment is secured to the module bracket and separate L bracket from module bracket.
4. Do the same for all module connectors and roof attachments attached to the solar module to be removed.
5. Lift the solar module, disconnect all the cable underneath and remove the solar module.

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

7.2 Thermal expansion

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

7.3 System Maintenance

To maximize system output, solar 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

Grounding/Bonding Certification	UL 2703 Certified
Mechanical Load Certification	UL 2703 Certified, tested for design load rating, up: 30 psf, down: 30 psf, down-slope: 5 psf
Solar Module Tested for UL Certification	Jinko Solar JKMxxxM-60 (xxx=290-300)
Fire Resistance	Class 'A' Fire Rating for type one solar module
Components Materials	Aluminum alloy 6061-T6 or 6063-T5 in mill finish, clear anodized finish or black anodized finish; 304 stainless steel
Flashing Materials	Aluminum in mill, clear anodized or black anodized finish
Solar Modules Per Grounding Lug	Maximum 100
Grounding Lug Wire Range	14-4 AWG
Grounding Lug Wire Type	Solid
Grounding Lug Torque	20 lbs-in
Maximum Roof Attachment Spacing	48" in portrait orientation and 72" in landscape orientation
Minimum Module Connector	At least one module connector on connecting side of two adjacent solar modules
Solar Module Clearance	3.5" to 5" between bottom of solar module frame and roof
Warranty	25-year Limited Product Warranty



Limited Product Warranty

Magerack warrants to the original end-user (“Purchaser”) of MageMount II Rail-less 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.